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THURSDAY, MAY 14, 1874

THE SCIENCE COMMISSION

IT would be difficult, we think, to overestimate the value of the evidence brought together in the second volume published by the Science Commission. The first volume dealt mainly with the diffusion of knowledge; the second is concerned mainly with the advancement of Science. The Commission has done good service in bringing before Parliament and the country the carefully weighed opinions of men of the highest mark in all departments of Science on subjects of the first importance, not only in their bearing on the advancement of Science but also on some of the best interests of this country. We propose to show the general bearing of the evidence contained in the volume on some of the questions on which the Commission sought information, omitting all opinions of our own.

The unanimity of opinion among the witnesses examined—and their number is large—as to the duty of the State in the matter of Abstract Science is striking; without exception, so far as we have been able to examine the evidence, the opinion is unanimous that it is the duty of the State to encourage original research in Abstract Science. As might naturally be expected opinions vary as to the method which the State should adopt in carrying out this duty, but that some action ought to be taken by the State in this direction is the all but unanimous conviction of the best men in all departments of Science. We need only mention in this connection such names as those of Lord Derby, Lord Salisbury, Sir Stafford Northcote, as statesmen, Sir Wm. Thomson, Dr. Joule, Dr. Sanderson, Col. Strange, Mr. George Gore, Dr. Carpenter, Mr. T. H. Farrer, Prof. A. W. Williamson, Dr. Frankland, Mr. E. J. Reed, General Sir Edward Sabine, Prof. Balfour Stewart, Prof. Owen, Admiral Richards, Dr. C. W. Siemens, Mr. P. L. Sclater, Dr. Hooker, Dr. De la Rue, &c., to show the weight and comprehensiveness of opinion on this point, and that it is held not only by men concerned solely with Abstract Science but also by those concerned with some of the most important practical applications of Science.

Of course the principal way in which the State can aid scientific research is by granting money for the purpose; as to how such a grant ought to be applied various opinions are offered by the witnesses, each witness, as a rule, naturally looking at the matter from the point of view of his own branch of Science, but all are decidedly of opinion that a very large sum should be put on the estimates annually for the promotion of Science. Nearly all the witnesses who have been examined on this point are of opinion that Government, under judicious advice, ought to make grants to existing scientific institutions, to university laboratories, and to private individuals, to enable them to carry on research that is likely to lead to valuable scientific results. In addition to this, however, such men as Sir Wm. Thomson, Dr. Frankland, General Strachey, Prof. Owen, Dr. Joule, Dr. De la Rue, Dr. Carpenter, Col. Strange, Mr. Gore, and others, express a most decided conviction that one of the most efficient methods by which Government could further research in this country is by the establishment of public laboratories for the pursuit of scientific research in connection with the various and ever-multiplying departments of Physics, Chemistry, and Biology, adequate research in connection with which is admittedly quite beyond the means of private individuals. The evidence in favour of institutions of this kind is very strong indeed whether we consider the number and position of the witnesses or the earnestness and decision with which they express their convictions. It is clearly stated that in this country we are very far behind continental states and America in this respect, and that not only is Science a loser from want of assistance from the State, but the general welfare of the country is seriously impeded. The evidence in favour of the establishment of State institutions for the prosecution of scientific research is so voluminous and strong that it is difficult to select any particular part for quotation. As an example of its nature, however, we may quote what Dr. De la Rue says on the subject of chemical laboratories :—

"I hold it to be so important that chemistry should be extensively cultivated in England, that I would strongly advocate that there should be a State laboratory. That State laboratory should undertake all the chemical work which the Government might require; but at the same time, according to the views which I hold, it ought to be such an establishment as could afford facilities to men who have completed their scientific education, and who might be desirous of continuing original investigations, in which space for working and instruments should be afforded them, and, moreover, if men were not in a position of fortune to continue their researches, in some cases materials and even money might be granted to them on the recommendation of the Council. I may state that of my own knowledge I know that chemical science at present is not progressing in England in a satisfactory manner, that we do not make so many original researches as our continental neighbours, particularly the Germans, do. In Germany very great patronage is given to Science, magnificent laboratories have been built, and the students, who after they are sufficiently advanced are encouraged to make original investigations, contribute at present most largely to scientific chemistry."

On the question of establishing a Public Physical Laboratory, Col. Strange says :—

"I think it is an absolute necessity on the ground of my second postulate, in which I say that all science should be cultivated, even branches of Science which do not appear to promise immediate advantage. It is one of the most important parts of Science, and cannot be omitted without detriment to all the other parts. Investigations connected with almost the whole of our material economy are required. There is no question connected with sanitary improvement, with water supply, or sewage, or telegraphy, or the enormous number of the requirements of the army and navy, which would not derive advantage more or less from investigations of a physical nature such as would be conducted in a physical laboratory. I think that the whole of our naval and military and social economy is dependent upon investigations such as would be carried on in a physical laboratory."

A similar tone pervades the evidence of the witnesses who were questioned on the subjects of physiological and biological laboratories, metallurgical laboratories, botanical laboratories, and observatories for astronomical physics. Of those in favour of an observatory of the last-mentioned kind, we might mention the names of Lord

Salisbury, Lord Derby, Sir William Thomson, Prof. Balfour-Stewart, Admiral Richards, Dr. Siemens, Dr. Joule, General Strachey, Dr. Frankland, besides many others.

This may suffice to show the nature of the evidence as regards the duty of the State in the matter of Abstract Science and the method by which this duty should be performed. In minor details, of course, there are differences of opinion, but the weight of evidence is without doubt in favour of the establishment of scientific laboratories by the State, in addition to the encouragement of suitable private individuals and the subsidising of existing institutions. Most seem to be of opinion that at first central laboratories should be established in London only, to be afterwards extended to the provinces, and most of those examined on the subject expressed their decided conviction that the men who gave up their time to the service of Science and the State in these laboratories or elsewhere should be adequately remunerated, indeed be regarded as a superior class of Civil servants. For example, Lord Salisbury, on the question of income, suggests that men who might be appointed to pursue original research by the State ought to have an income of about 1,000*l.* or 1,500*l.*, with a provision for retirement. Other witnesses who spoke in favour of paying public researchers were Lord Derby, Dr. Joule, Sir William Thomson, Sir E. Sabine, Sir Stafford Northcote, Dr. Siemens, Mr. Gore, the late Prof. Rankine, &c.

In order that the State may look after the interests of Science and the scientific interests of the country, it would of course be necessary that some well-organised system should be adopted by which the intentions of the State should be carried out. The great majority of those examined on this point agree that this would be best accomplished by the establishment of a State Council of Science presided over by a Minister of Science, who, however, some are of opinion might also be Minister of Education. But that a special department, or at the least, a sub-department of the State should take the promotion of Abstract Science and Science in its practical bearings on the interests of the country under its wing, seems to be the opinion of the great majority of those whose opinion was asked by the Commission on this question; and they include many of the men most eminent in Abstract as well as Applied Science. This State Council of Science, as we have indicated, is not meant solely to look after the interests of abstract scientific research in the country; its time would be much, if not a great deal more, occupied in bringing to a scientific test and advising Government upon all Government projects in which scientific principles are more or less involved. All are agreed that the cost to the country of such a Council would be nothing compared to the losses which are being continually sustained through the haphazard projection and carrying out of schemes that fail wholly or partially from not being founded on strictly scientific principles. Several of the witnesses, for example, refer to the unfortunate *Captain*, whose blundering construction would have been impossible had the Government had such a Council to consult. As to the size and composition of such a Council, opinions of course differ, though many of the witnesses referred with more or less approval to the long-thought-over and well-matured scheme of Col. Strange.

As to some of the duties which would devolve upon such a Council, we cannot do better than quote from Sir William Thomson's evidence, merely reminding the reader that his statement is typical of the opinions held by most of the other witnesses who spoke to the question:—

"The main object of such a Council would, in my opinion, be to advise the Government on all scientific questions which might come under the attention of the Government, and on all scientific works actually undertaken. With a vast amount of mechanical work which is necessarily undertaken by the Government, and which is continually in hand, questions involving scientific difficulties of a novel character frequently occur: questions requiring accurate knowledge of scientific truth hitherto undeveloped are occurring every day. In both respects Government is at present insufficiently advised, and the result is undoubtedly that mechanical works are sometimes not done as well as they might be done, that great mistakes are sometimes made: and, again, a very serious and perhaps even a more serious evil of the present system, in which there is not sufficient scientific advice for the Government, is the undertaking of works which ought never to be undertaken. . . One great mistake undoubtedly was the construction of the *Captain*, and I believe that a permanent scientific Council advising the Government would have made it impossible to commit such a mistake. They would, in the very beginning, have relieved the Government from all that pressure of ignorant public opinion which the Government could not possibly, in the present state of things, withstand."

On the question as to whether such a Council would command sufficient public confidence among men of Science, the answer of Mr. P. L. Sclater, F.R.S., may be taken as embodying the opinion of most of the other witnesses. He says:—"I have no misgivings at all upon that subject. I should say that they would meet with general support from men of Science. Most men of Science, I think, see that something of the sort is imperatively required. All lament the piecemeal way in which scientific subjects are dealt with by Government, in consequence of their being subdivided amongst all these different offices, and of there being nobody to appeal to upon a question of Science, and, therefore, I think the proposal to establish such a Council would meet with universal acceptation amongst scientific men."

Into the questions of the size of the Council, whether the members should or should not be appointed for life, &c., we need not enter here; the great point is that the mass of evidence is in favour of establishing such a Council, presided over by a Minister of Science.

The question of the institution of a State Minister of Science has been so often discussed in these pages that we need not go into the voluminous evidence in its behalf which is published by the Commission. While some of the witnesses think that such a Minister's functions ought also to include the department of Education, most of them point out that Britain is the only country in which the interests of Science have no representative in the Government of the country.

It will thus be seen that the Commission has been the means of eliciting from the various eminent men who have come before it a complete and comprehensive scheme for the promotion of Science by the State, and for giving Government the means of obtaining trustworthy counsel in all matters in which scientific principles are in any way in-

volved. In the main features of the scheme nearly all the witnesses who were examined on the subject are at one; many of the details in which they differ are of such a nature as can be settled only by actual trial.

On the many other subjects touched upon in the volume we cannot enter here. Much of the evidence bearing on the Universities tends to prove that the interests of Science are inadequately attended to in these institutions, and that the scientific teachers in some of them have to contend with very great difficulties. With respect to what Universities should do to advance the interests of Science, not to speak of the utilisation of the enormous funds at the disposal of Oxford and Cambridge, such men as Dr. Siemens, Dr Frankland, Dr. Sanderson, and others are of opinion that for the highest degrees in Science original research should be required; Prof. Balfour-Stewart thinks that Universities ought to afford facility for the prosecution of original research, and Dr. Carpenter that University Fellowships should be given to men employed in original research.

Many of the most eminent witnesses—as Sir B. Brodie, Lord Salisbury, Dr. Frankland, Prof. Williamson, Colonel Strange, Sir William Thomson, &c.—are of opinion that research ought to be endowed quite apart from teaching in the ordinary acceptation of the term.

Most of the witnesses who spoke to the condition of Science in this country contrasted it with the great encouragement given to research in nearly every other European country, and in America. In this relation we cannot help quoting a very striking statement made by Sir William Thomson in respect to France, in answer to the question as to how many institutions for research he would recommend.

"There should be five," he says. "One at present exists, namely, the Royal Observatory at Greenwich. Another in my opinion is very much wanted, an observatory for astronomical physics; then again a physical laboratory, and a laboratory for chemical research, and a physiological laboratory are necessary. In respect of such institutions, I believe, we might with great advantage obtain information, with a view to following example, in Paris. The strong feeling of the necessity to promote scientific research which was evinced shortly after the recent sad disasters which came upon France illustrates very strongly the national value of such institutions. In the depths of their misfortunes, one of the first strong feelings shown by the most intelligent part of the French nation was the want of rigorous and accurate scientific research. Competitive examinations seemed in France to have swallowed up scientific energy, and there was a strong feeling of the insufficiency of the national institutions for promoting the advancement of Science."

In conclusion, we cannot do better than quote the forcible and noble language of Sir William Thomson, on the much-discussed question of the "utility" of abstract scientific research. To the question as to some of the objects to be gained by the establishment of a Council of Science, Sir William Thomson replies:—

"The immediate utility of the work is undoubtedly a very important object, and perhaps may be considered to be the first duty of the Government; but yet there is another duty which, although we cannot call it the first duty, is certainly not an inferior duty, and that is, to promote the honour of this country. There can be no doubt but that the inhabitants of this country do get benefit from the feeling of satisfaction that naturally results from any great scientific discoveries or great advances in Science made by their own countrymen, and especially by the assistance of their own Government. The Royal Observatory at Greenwich is an honour and a glory to this country, and I am quite sure that the money paid for it is very well spent, in the satisfaction that the country feels in the honour of having one of the greatest and best, if not *the* greatest and best, of scientific astronomical observatories in the world. This country undoubtedly has a great permanent possession in the name of Newton and in the name of Faraday. The promotion of scientific research in a regular way cannot make Newtons and Faradays, but it can obtain great scientific results by systematic business-like action, carried out through well-instructed and able men. It seems to me to be a duty of the Government to make the national honour in scientific investigation a subject of its solicitude and an occasion (with due safeguards against abuse) for spending the public money."

J. S. K.

OUR BOOK SHELF

Proceedings of the London Mathematical Society, vol. iv. Nos. 41-66. (Messrs. Hodgson, Gough Square.)

THE volume before us contains the papers which have been read during the eighth and ninth sessions of the Society. We notice a favourable sign in the much greater number of contributions which have been made in the later session—36 against 15. A large number of the members have been led to take an interest in the meetings, and the papers without losing their former high character are in some cases less "caviare to the general" than in previous volumes. The Society's first president himself thus wrote, "Not a drop of liquor is seen at our meetings, except a decanter of water; all our 'heavy' is a fermentation of symbols, and we do not draw it mild. There is no penny fine for reticence or occult science; and as to a song! not the ghost of a chance." The Society, however, as we see, has reached its tenth year; and though some of the members drop off for reasons which perhaps may be gathered from our quotation, yet the number of members recorded in this volume is fairly satisfactory: the present number of members of the Mathematical Society is about 117. In Paris the new Society (la société mathématique de France) started with almost double this number of members. So far as we have seen, however, the papers of the volume under notice and of previous volumes will not lose by a comparison with the opening numbers of the younger society's *Bulletin*. Of course no volume would fairly represent English mathematics without having contributions from Prof. Cayley's fertile pen; here we have no less than ten papers, some of considerable length, principally on curves and surfaces, and constructions for mechanically describing the former.—Dr. Sylvester furnishes only short notes on the properties of numbers.—Prof. H. J. S. Smith contributes an arithmetical demonstration of a theorem in the integral calculus, and two other papers bearing upon linear congruences and determinants.—Prof. W. K. Clifford writes, among other things, upon geometry, on an ellipsoid, and a new form of Biquaternion.—Mr. Samuel Roberts rivals Prof. Cayley in the extent and nature of his communications upon parallel surfaces, and also upon epi- and hypo-trochoids.—Prof. Clerk-Maxwell takes us to another sphere, and treats of the transformation of solids, of the equations of motion, of a system of electrified conductors, and of the focal lines of a refracted [illegible]. Lord Rayleigh too takes us into the domain of physical science, in his vibrations in a sphere, the investigation of the disturbance produced by a spherical obstacle on the waves of sound, general theorems relating to vibrations.—A presidential address by Mr. Spottiswoode treats of some recent generalisations of algebra.—Mr. J. W. L. Glaisher writes on

Bernoulli's numbers, and on points connected with definite integrals.—Prof. Wolstenholme's papers are concerned with series and loci, and treat also of epicycloids and hypocloids.—Mr. T. Cotterill gives a short paper on an algebraical form and the geometry of its dual connection with a polygon, plane or spherical.—An analogous theorem relating to polyhedra is discussed by Prof. Clifford in this same volume.—M. Hermite contributes two short notes, one on circular functions, the other on unicursal curves.—Mr. J. J. Walker writes on the invariant conditions of multiple-concurrence of two conics, and Mr. R. B. Hayward on an extension of the term *Area* to any closed circuit in space.—From this analysis it will be seen that there is considerable variety in the contents of the volume. It is not necessary here to give any detailed account of the papers, as notices of them have appeared from time to time in our columns.

LETTERS TO THE EDITOR

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

Flowers of the Primrose destroyed by Birds

I HOPE that you will permit me to make a few final remarks on the destruction of primrose flowers by birds. But first I must return my best thanks to your correspondents, as well as to some gentlemen who have written direct to me, and to whom I have not had time to send separate answers. Secondly, I must plead guilty to the high crime of inaccuracy. As the stalks from which the flowers had been cut were shrivelled, I mistook, in a manner now inexplicable to me, the base of the ruptured or removed ovarium for the summit; a remnant of the shrivelled placenta being mistaken for the base of the pistil. I have now looked more carefully, and find that on twelve stalks only three had any remnant of the ovarium left. I have also examined sixteen bits of the calyx which had been cut off by a caged bullfinch, presently to be noticed, and in fifteen of these not only had the ovarium been torn into fragments or quite destroyed, but all the ovules had been devoured, excepting sometimes one or two. In several cases the calyx had been split open longitudinally. The ovarium was in the same state in thirteen small portions of the calyx lying on the ground near a wild cowslip plant. It is therefore clear that the ovules are the chief attraction; but the birds in removing by pressure the ovules could not fail to squeeze out the nectar at the open end, as occurred when I squeezed similar bits between my fingers. The birds thus get a dainty morsel, namely, young ovules with sweet sauce. I still think that the nectar is, in part, the attraction, as caged bullfinches and canary birds much like sugar; but more especially because Mr. C. J. Monro has sent me some flowers from a cherry-tree near Barnet, which during several years has been attacked; and he finds many of the flowers, both those on the tree and on the ground, with rather large ragged holes in the calyx, like, but much larger than, those often made by humble bees when they rob flowers in an illegitimate manner. Now the inside of the flower of the cherry, round the ovarium, is bedewed (if protected from the visits of insects) with drops of nectar, which sometimes collect so as almost to fill up the bottom of the flower. In the case of the cherry I cannot doubt that this is the attraction, for I examined the ovarium of ten flowers, and although they had all been scored by the bird's beak, and in four instances punctured, the ovule had in no case been devoured.

To return to the primroses: from the accounts received, it seems that the flowers are cut off in the manner described by me, near Preston in Lancashire, in North Hampshire, Devonshire, and Ireland, as well as in Kent. In several other places, not worth specifying, where primroses are abundant, they have not been thus attacked; and this may possibly be due to the proper enemy, namely, as I now suspect, the bullfinch, not being a common bird. In my former letter I remarked that if the habit of cutting off the flowers proved to be a widely extended one, we should have to consider it as inherited or instinctive; as it is not likely that each bird should discover during its individual lifetime the exact spot where the nectar, and, as I must now add, the ovules, lie concealed, or should learn to bite off the flower so skilfully at the proper point. That the habit is instinctive, Prof. Frankland has given me interesting evidence. When he read my letter he happened to have in the room a bunch of cowslip flowers and a caged bullfinch, to whom he immediately gave some of the flowers, and afterwards many primrose flowers. The latter were cut off in exactly the same manner, and quite as neatly, as by the wild birds near here. I know that this is the case by having examined the cut-off portions. The bird worked so quickly that he easily destroyed twenty flowers in three minutes; a single wild pair would therefore cause great havoc. Prof. Frankland informs me that his bird pressed the cut-off portions of the calyx in its beak, and gradually worked them out on one side, and then dropped them. Thus the ovules were removed, and the nectar necessarily squeezed out. A canary bird to whom some cowslip and primrose flowers were given attacked all parts indiscriminately, and ate up the corolla, calyx, and stalks. A lady also informs me that her canary and siskin always attack primrose and cowslip flowers, if kept in the same room. They generally first make a ragged hole through the calyx opposite the ovarium, and remove the ovules, as I found to be the case with flowers which were sent to me; but the ovules had not been so well removed as by the bullfinch, and the nectar could not be obtained by this method of attack.

But now comes the interesting point: the caged bullfinch just referred to was caught in 1872 near Ventnor, in the Isle of Wight, soon after it had left the nest, by which time the primroses would have been out of flower, and since then, as I hear from Prof. Frankland, it had never seen a primrose or cowslip flower. Nevertheless, as soon as this bird, now nearly two years old, saw these flowers, some machinery in its brain was set into action, which instantly told it in an unerring manner how and where to bite off and press the flowers, so as to gain the hidden prize. We are reminded by this little fact of Mr. Spalding's admirable observations on the instinctive actions of chickens when their eyes were uncovered, after having been blind-folded from the moment of being hatched.

Prof. Frankland seems to have been much struck with the behaviour of his bullfinch, and remarks in his letter that "it had all the precision of a chemical reaction; the result of putting a primrose within its reach can be almost as certainly predicted as that of putting a plate of iron into a solution of sulphate of copper."

CHARLES DARWIN

Down, Beckenham, Kent, May 7

P.S.—This letter was printed before I saw your last number, and I am glad to find that some of my statements are confirmed, more especially with respect to bullfinches. During the last fortnight not one primrose has been attacked in the little wood where shortly before there was such havoc. I imagined that the pair of bullfinches, which I saw there earlier in the season, had wandered away; but yesterday evening (May 10) it occurred to me that the flowers produced late in the season might fail to secrete nectar, or that the recent cold weather might have produced this effect. Accordingly, in the afternoon I gathered fifteen flowers from as many distinct plants, and kept them in water in my room for seventeen hours. Earlier in the season I treated some flowers in this same manner, and found the tube of the corolla full of nectar; but now only one of the flowers contained a very small quantity of nectar, another showing a

mere trace of it. And the flowers being no longer cut off by the birds supports my belief that the nectar is one chief attraction to them; the ovules without the sauce not being worth the gathering. I may add that as the primrose is a dimorphic plant, these non-nectariferous flowers would be sterile, for they would not be visited by insects.—C. D.

Mr. Spencer and *à priori* Axioms

I QUITE agree with Mr. Spencer that argument between us will not be to much purpose; but it should be noted that my principal "exemplification of unconsciously-formed preconceptions" was of Mr. Spencer's own choosing, namely, Newton's "Second Law of Motion," which, if I understand him aright, may now be described as "a consciously-formed hypothesis concerning the relation between weight (force?) and motion." Only demurring to the word "hypothesis," and leaving it to Mr. Spencer to reconcile this with his former declaration that the law in question is an "immediate corollary" of one of these unconsciously-formed preconceptions, it seems to me there is little left to argue about.

Harrow, May 8 ROBT. B. HAYWARD

MR. SPENCER does not state his arithmetical illustration very exactly. He implies that there is a certain truth which the savage is incapable of understanding concerning which the schoolboy makes a mistake, but that there is present in the civilised adult a consciousness of its logical necessity. It does not appear distinctly what that truth is.

The most obvious interpretation of what is printed is, that Mr. Spencer refers to the local value of figures in the Arabic system of notation: this is probably not what is meant.

Two other interpretations suggest themselves. The sum of seven and five is the same number whatever be the things to which the seven and five refer; or else the more particular statement that the sum of seven and five is the same as the sum of ten and two. It is not apparent that either of these is intended.

To say that seven and five make twelve without implying something about twelve other than the statement that it is seven and five, seems a proposition so purely verbal that it is difficult to see how the recognition or non-recognition of it illustrates the grounds of belief in physical laws.

NOT A METAPHYSICIAN

The Glacial Period

IN the many kind and favourable reviews of my book, "The Naturalist in Nicaragua," exception has been generally taken to my speculations on the extent and effects of the ice of the glacial period. The subject is a large one, and too little of my time can be given to scientific inquiry to allow me to hope that I can deal with it in detail for some years to come; but as it appears that I have not expressed my views with sufficient clearness and have been misunderstood by some of my critics, I shall be glad of an opportunity to state them with distinctness and brevity.

1. At the present sea-level, the ice extended, in the northern hemisphere, from the Pole to lat. 39° in America, to about the valley of the Thames in England, to lat. 50° in central Europe, and to lat. 52° in north-western Asia. Along the high lands of America it reached to the tropics, and in Central America all the land lying over 2,000 ft. above the sea supported glaciers. I do not contend that the present low lands of tropical America were ever covered with ice, and it is on the mountain chains of that continent alone that I believe it nearly reached to the equator.

2. The ice was thickest over the American continent, not because it was coldest there, but because the great evaporating area of the Pacific lay to the south-west of it and the counter trade-wind swept across it and precipitated the moisture with which it was laden. Siberia was equally cold, but the upper moisture-bearing currents of air were intercepted by the Himalayas, the Kuen Lun, and the Altai Mountains. It was thickest in America for the same reason that it is thicker on the summits of the Pyrenees than on similar heights on the Caucasus, and thicker on the southern than on the northern slope of the Himalayas, not because of greater cold, but of greater precipitation.

3. The immense accumulation of ice in the extreme north of America and Europe must have overflown and filled the polar basin even if it had not independently collected there; but the precipitated moisture would not have frozen on the continents if the climate had not been much colder then than now; and the surface of the Arctic Ocean must have been frozen over, and as capable of sustaining accumulations of snow as the solid land itself, even if that ocean was not displaced by the ice flowing into it from the northern extremities of the continents.

4. Probably the ice was not thickest at the Pole, but formed a ridge of varying height at unequal distances from it; for, as we have seen, it would not be thickest where it was coldest, but where there was most precipitation, and the south-west winds would part with their moisture long before they reached the Pole.

5. Whilst we can follow on the land the marks left by the ice of the glacial period, and map out its former boundaries, we can only speculate on its extent over the areas now covered by the sea. We have, however, some evidence. The Hebrides and the extreme north-east of Scotland were overflown by ice that came from the north-west, and the bed of the North Atlantic must have been filled so far at least, or to about lat. 59°; and taking into account the much greater quantity of ice lying on America than on Europe, it is not an extreme supposition that on the western side of the Atlantic the bed of the ocean was occupied by ice to lat. 45°.

6. One of the principal effects of this great advance and accumulation of ice, not yet taken into consideration by geologists, was an interruption to the drainage of all countries whose rivers flowed northwards. The great plain of Siberia was, I believe, occupied by an immense lake caused by the blocking up of the whole of the watershed to the north. In western Europe this interference with the drainage of the land took place, even if we do not accept the theory of an ice-cap, but hold with some geologists that the ice descended only from existing chains of mountains. All the rivers of northern Germany must have been dammed back by the ice descending from the Scandinavian mountains. One of the most important changes was effected in the German Ocean. Its northern half was filled with ice, from the mountains of Norway and Sweden, from Scotland and northern England. As we know that at this time the Straits of Dover did not exist, it is evident that the southern portion of the bed of the German Ocean must have been filled by a great fresh-water lake, varying in extent during the advance and retreat of the ice, into which flowed all the water of the melting ice, and all the rivers that now run into the same area.

7. There is no satisfactory evidence of the intercalation of a warm period between two glacial ones, though doubtless there was more than one retreat of the ice, during which a temperate climate prevailed in regions glaciated before and afterwards. The intermingling of the remains of northern and southern mammalia in the gravels of south-eastern England arose, probably, as explained by Sir Charles Lyell, by a northern and a southern fauna having migrated to the district at different seasons of the year.

When the German Ocean was blocked up to the north by ice, a great river must have run to the south through what are now the Straits of Dover and the English Channel, receiving into one stream the waters of the Rhine, the Thames, the Humber, and the Somme. How far that river ran southward would depend upon the relative heights of the land and the sea. It must have run into a comparatively warm ocean, for the effects of the warm currents of water coming from the tropics, instead of as at the present time entering the polar basin, would be confined to and intensified in more southern latitudes, and they would then, as now, be deflected upon the western coast of Europe. Up this river the hippopotamus and the southern species of rhinoceros and elephant may have come in summer and autumn, whilst the mammoth, the woolly rhinoceros, and the musk ox came from the north in winter.

8. The theory of the damming-up of many rivers throws much light on the difficult question of the formation of the high and low level gravels and the loess. The lake occupying the area of the German Ocean must have stood much higher in spring and early summer than it did later on in the year and in winter; and the levels of the lower parts of the rivers running into it must have been affected by its rise and fall. If we can suppose that the hippopotamus only came up the river when it was low in the latter part of summer, or in the autumn, we can understand how its remains are only found in the low-level gravels of the Thames and the Somme; though it is also possible that they may belong to a later and milder period when the ice had retired so far back that the great lake partly drained to the north around Scotland.

9. The glacial period probably existed in both hemispheres at the same time. First, because we can trace the evidence of the existence of ice along the high lands of America into the northern tropics until it nearly inosculates with that coming down

from the south, and there is no difference in the character or appearance of the moraines left on both sides of the equator. Second, because, excepting on the supposition that the ice extended, at least along some meridians, both from the south and the north nearly to the equator, at the same time, we cannot explain the distribution of those animals and plants that are found in the temperate zones of both hemispheres, separated by the whole width of the tropics, over which they cannot now pass. For example, there are more than forty flowering plants of North America and Europe which are also found in Terra del Fuego. Darwin's theory that these plants were driven to the high lands of the tropics during the glacial period, and followed the retreating ice in its retrocession, must fall to the ground if the ice did not exist in both hemispheres at the same time. (See "Origin of Species," p. 405, &c.)

10. The piling-up of water around the poles in the form of ice could not fail to affect the level of the ocean. Mr. Alfred Tylor has calculated that the accumulation of the ice in the northern hemisphere alone would abstract so much water as to lower the level of the sea 600 feet; and if, as I believe, the glacial period occurred at the same time in both hemispheres, the level of the ocean must have been lowered at least 1,000 feet.

11. The theory of the lowering of the level of the sea during the glacial period is directly opposed to the generally accepted one of a great submergence of part of England and Scotland to a depth of about 2,000 feet, when the marine shells of Moel Tryfaen and Macclesfield were deposited. The facts on which this theory of submergence is based can be otherwise explained. The shells are broken or worn, and generally mixed amongst other transparent materials. They are just where they ought to be found on the supposition that an immense body of ice coming down from northern Ireland, from Scotland, and from Cumberland and Westmoreland, filled the basin of the Irish sea, scooped out the sand with the shells that had lived and died there, and thrust them far up amongst the Welsh hills that opposed its course southward and around the great bight of which Liverpool forms the apex. Excepting some raised beaches around our coast, which were probably formed after the glacial period, and in no case reach more than 100 feet above the present level, I believe there is no evidence of the submergence of Great Britain either during or since the glacial period. THOMAS BELT

Lakes with two Outfalls

THE subject of double outfalls is of some interest, if only as showing the necessity of accurate observation, and the difficulty of ascertaining the truth in matters apparently of simple fact. In NATURE, vol. ix. p. 485, Mr. W. B. Thelwall brings forward two instances of lakes with double outfalls, and states that he has passed two or three more. Now, as regards that upon the Fille Fjeld, which he describes from personal observation, I beg entirely to call in question his accuracy. I passed the locality during each of the two last summers, and my attention was drawn to the position and nature of the watershed, especially during my visit of last summer, when I had carefully inquired into the asserted existence of a natural double outfall at the Lesjeskaagen Vand. (See NATURE, vol. viii. p. 304; also Colonel Greenwood's and Mr. R. B. Hayward's letters, NATURE, vol. viii. p. 382.)

Mr. W. B. Thelwall says:—"Between Nystuen and Skogstad is a chain of lakes crossing the watershed, the highest of which (not the one marked on the Vei-cart over Norge, I think), sends its waters to the west, past Nystuen to the Sogne Fjord, at Lærdalsören, and on the east by the Lille Mjösen, and Aadalen to the Tyrifjord, and so past Drammen to the Christiania Fjord. This lake is a small one, and the double outflow is close to the high road."

Now this statement is inaccurate in all the essential details. The division of the waters is *not* between Nystuen and Skogstad, but on the other side of Nystuen between it and Maristuen. The water which passes Nystuen does *not* flow towards the west to the Sogne Fjord, but to the east towards the Lille Mjösen, as I carefully ascertained when I was staying at Nystuen. This is rendered certain, too, by the fact that the land rises to the west of Nystuen, the actual division of the waters being about 100 or 105 feet, by my aneroid barometer, above Nystuen. Moreover, having scrambled up a steep mountain close behind Nystuen, whence the view on a clear day is of the wildest character, I had a bird's-eye view of the whole district in debate, and examined it carefully with a good field-glass, with a view to detecting any evidence of a double outflow. I came to the conclusion that the division of the waters took place in the boggy bottom of the valley to the west of Nystuen, and that it would be impossible to say exactly where it was. To the westward of this boggy place is indeed another lake, of which the waters flow to the Sogne Fjord; but this lake is several miles to the west of Nystuen, and separated from it by dry land, rising 100 feet or more above the levels of the water in the two lakes.

Whether lakes with two outflows exist or not, it is difficult to avoid feeling that Colonel Greenwood was warranted in his former incredulity upon the subject. W. STANLEY JEVONS

Trees Pierced by other Trees

UNDER this heading your correspondents discuss two distinct questions as if they were the same, namely the piercing of the stem of a tree by the head of another, as supposed by Mr. Murphy, and the growth of the *root* of a plant in or on another tree. Nothing can be more common than this last. Wherever soil aggregates the roots of seeds will grow as a matter of course. More than this, trees will strike roots into soil collected in their own forks, as I can show here, or down the rotten wood of their own trunks. A remarkable case of this may be seen in a yew tree in West Tisted churchyard near here. But nothing can be more opposite than the growth of the root and that of the head. The root grows to darkness; the head to the light.

Alresford, May 11 GEORGE GREENWOOD

[This correspondence must now end.—ED.]

The supposed Antipathy of Spiders to Chesnut Wood

SOME years back, while walking in the cloisters of New College, I remember a resident Fellow (since deceased) telling me that spiders were never known to occur in the woodwork of the roof, and attributing their absence to the chesnut timber, of which it was framed.

It has been asserted that this wood, which was formerly supposed to be that of the chesnut, really belongs to *Quercus sessiliflora*, but I do not know if that is still held to be the case.

The roof of Westminster Hall was at one time considered to have been constructed of chesnut; has any such story been heard of in connection with it? R. A. PRYOR

13 Bury Street, S.W.

*AN EXPERIMENTAL OBSERVATION ON HAY FEVER**

"THE accompanying brief but most interesting paper was received a day or two ago. Believing that it may bring relief to those who during the coming warm weather may be attacked with hay fever, Prof. Tyndall forwards it, with his compliments, to the editor of NATURE."

From what I have observed (says Prof. Binz) of recent English publications on the subject of hay fever, I am led to suppose that English authorities are inaccurately acquainted with the discovery of Prof. Helmholtz, as far back as 1868, of the existence of uncommon low organisms in the nasal secretions in this complaint, and of the possibility of arresting their action by the local employment of quinine. I therefore purpose to republish the letter in which he originally announced these facts to myself, and to add some further observations on this topic. The letter is as follows† :—

"I have suffered, as well as I can remember, since the year 1847, from the peculiar catarrh called by the English 'hay fever,' the speciality of which consists in its attacking its victims regularly in the hay season (myself between May 20 and the end of June), that it ceases in the cooler weather, but on the other hand quickly reaches a great intensity if the patients expose themselves to heat and sunshine. An extraordinarily violent sneezing then sets

* By Prof. Binz, of Bonn.

† Cf. Virchow's *Archiv*, vol. xlvi. p. 100.

in, and a strongly corrosive thin discharge, with which much epithelium is thrown off. This increases, after a few hours, to a painful inflammation of the mucous membrane and of the outside of the nose, and excites fever with severe headache and great depression, if the patient cannot withdraw himself from the heat and the sunshine. In a cool room, however, these symptoms vanish as quickly as they come on, and there then only remains for a few days a lessened discharge and soreness, as if caused by the loss of epithelium. I remark, by the way, that in all my other years I had very little tendency to catarrh or catching cold, while the hay fever has never failed during the twenty-one years of which I have spoken, and has never attacked me earlier or later in the year than the times named. The condition is extremely troublesome, and increases, if one is obliged to be much exposed to the sun, to an excessively severe malady.

"The curious dependence of the disease on the season of the year suggested to me the thought that organisms might be the origin of the mischief. In examining the secretions I regularly found, in the last five years, certain vibrio-like bodies in it, which *at other times I could not observe* in my nasal secretion. They are very small, and can only be recognised with the immersion-lens of a very good Hartnack's microscope. It is characteristic of the common isolated single joints that they contain four nuclei in a row, of which two pairs are more closely united. The length of the joints is 0·004 millimetre. Upon the warm objective-stage they move with moderate activity, partly in mere vibration, partly shooting backwards and forwards in the direction of their long axis; in lower temperatures they are very inactive. Occasionally one finds them arranged in rows upon each other, or in branching series. Observed some days in the moist chamber, they vegetated again, and appeared somewhat larger and more conspicuous than immediately after their excretion. It is to be noted that only that kind of secretion contains them which is expelled by violent sneezings; that which drops slowly does not contain any. They stick tenaciously enough in the lower cavities and recesses of the nose.

"When I saw your first notice respecting the poisonous action of quinine upon infusoria, I determined at once to make an experiment with that substance, thinking that these vibrionic bodies, even if they did not cause the whole illness, still could render it much more unpleasant through their movements and the decompositions caused by them. For that reason I made a neutral solution of sulphate of quinine, which did not contain much of the salt (1·800), but still was effective enough, and caused moderate irritation on the mucous membrane of the nose. I then lay flat on my back, keeping my head very low, and poured with a pipette about four cubic centimetres into both nostrils. Then I turned my head about in order to let the liquid flow in all directions.

"The desired effect was obtained immediately, and remained for some hours; I could expose myself to the sun without fits of sneezing and the other disagreeable symptoms coming on. It was sufficient to repeat the treatment three times a day, even under the most unfavourable circumstances, in order to keep myself quite free.* There were then no such vibrios in the secretion. If I only go out in the evening, it suffices to inject the quinine once a day, just before going. After continuing this treatment for some days the symptoms disappear completely, but if I leave off they return till towards the end of June.

"My first experiments with quinine date from the summer of 1867; this year (1868) I began at once as soon as the first traces of the illness appeared, and I have thus been able to stop its development completely.

"I have hesitated as yet in publishing the matter, because I have found no other patient* on whom I could try the experiment. There is, it seems to me, no doubt considering the extraordinary regularity in the recurrence and course of the illness, that quinine had here a most quick and decided effect. And this again makes my hypothesis very probable, that the vibrios, even if being no specific form but a very frequent one, are at least the cause of the rapid increase of the symptoms in warm air, as heat excites them to lively action."

I should be very glad if the above lines would induce medical men in England—the haunt of hay fever—to test the observation of Helmholtz. To most patients the application with the pipette may be too difficult or impossible; I have therefore already suggested the use of Weber's very simple but effective nose-douche. Also it will be advisable to apply the solution of quinine *tepid*. It can, further, not be repeated often enough that quinine is frequently adulterated, especially with cinchonia, the action of which is much less to be depended upon.

Dr. Frickhöfer, of Schwalbach, has communicated to me a second case in which hay fever was cured by local application of quinine (Cf. Virchow's *Archiv* (1870), vol. li. p. 176). Prof. Busch, of Bonn, authorises me to say that he succeeded in two cases of "catarrhus æstivus" by the same method: a third patient was obliged to abstain from the use of quinine, as it produced an unbearable irritation of the sensible nerves of the nose. In the autumn of 1872 Helmholtz told me that his fever was quite cured, and that in the meantime two other patients had, by his advice, tried this method, and with the same success.

THE COMING TRANSIT OF VENUS †

IV.

IT has already been pointed out how unsatisfactory in some respects were the results of the observations made in 1761. Those of the year 1769 were more successful, but the discrepancies of different observers still threw a doubt on the result. After Encke had discussed with all possible care the observations made upon these two occasions,‡ doubts were still raised as to the correctness of the value thus found for the solar parallax. The reasons of these doubts were manifold. In the first place in order to get any value whatever of the solar parallax, Encke had been forced to assume that enormous errors had been committed by some of the observers; and again, all the other methods of which we have spoken were found to give a tolerably accordant value of the solar parallax, but values that differed considerably from Encke's determination.

It was with no small satisfaction then, that astronomers learnt that M. Powalky in 1864 had deduced a sensibly greater value for the solar parallax, by using more accurate values for the longitudes of the places of observation.

But Mr. C. J. Stone, now her Majesty's astronomer at the Cape of Good Hope, has lately re-discussed these observations. § He finds that when the remarks of the observers are rightly interpreted, all the observations agree without any extravagant errors of observations; and moreover, the value of the solar parallax thus deduced agrees with the values found by other means. Mr. Stone deserves the thanks of the scientific world for having convinced them that this method, which at one time was falling into disrepute, may really be rendered very trustworthy.

The result of Encke's determination was that the mean

* There is no foundation for the objection that syringing the nose could not cure the asthma which accompanies hay fever; for this asthma is only the reflex effect arising from the irritation of the nose.—*B.*

* Helmholtz, now Professor of Physics at the University of Berlin, is although M.D., no medical practitioner.—*B.*

† Continued from p. 14.

‡ *Berlin Abhandlungen*, 1824, pp. 235-310.

§ Monthly Notices of the R.A.S., xxviii. p. 155.

distance of the sun from the earth is about 95 millions of miles. It now appears that the true distance is somewhere about 91½ millions of miles. The annexed table gives the values of the sun's parallax and distance as determined by different methods.

Method.	Parallax.	Dist. of sun in miles.	Computer.
Transit of Venus *	8″91	91,580,000	Stone
Opposition of Mars †	8″943	91,240,000	Stone
Lunar Theory ‡	8″916	91,520,000	Hansen
Lunar Theory §	8″850	92,200,000	Stone
Planetary Theory ‖	8″859	92,110,000	Leverrier
Jupiter's Satellites and velocity of light ¶	8″86	92,100,000	Foucault
Constant of Aberration and velocity of light **	8″86	92,100,000	Cornu

The uncertainty of observation which Mr. Stone aimed at clearing away is one of a very curious optical character. It is found that Venus at the time when she has almost completely entered within the sun's disc does not retain her round aspect, but becomes pear-shaped, or at least connected with the sun's limb by a "black drop" or "ligament." This ligament sometimes appears simply as a fine black thread connecting the planet with the limb of the sun. One observer in 1769 saw a number of black cones shooting out to the sun's edge in a fluctuating manner.

Many of these phenomena were doubtless due to bad definition of the telescope employed, or to the instability of its mounting. But the existence of a "black drop" even under the most favourable circumstances cannot be doubted; it was well observed in the case of a transit of Mercury that occurred in 1868.†† If the planet be entering upon the solar disc, the first phase occurs when the edges of the sun and planet *seem* to be in contact. The second phase occurs at the instant when the "black drop" breaks off and a flood of light sweeps in between the planet and the sun. This occurs very suddenly, and has been supposed to indicate the true time of actual contact.

By referring to the *Philosophical Transactions* of 1769-70, a large number of descriptions of the phenomenon may be read. Some of the appearances are shown in Fig. 14, they are copied from the originals by Bevis, Hirst, Bayley, and Mayer, respectively—Prof. Grant states that the last one bears a resemblance to the appearance of Mercury as seen during its transit in 1868 from the Glasgow Observatory, the sun being near the horizon.

In the case of that transit of Mercury, studied by six experienced observers at Greenwich Observatory, two curious facts appear. Firstly, the times of contact as determined by different observers vary to the extent of 13½ seconds. And secondly, the shape of the planet varied considerably with different observers.

Mr. Stone having noticed a confusion in the language of the astronomers of the last century as to which of the two phases was observed, carefully re-studied their words; and by supposing the two phases to be separated by a constant interval of time, he utilised both kinds of observation. This constant interval of time was deduced from all the observations, and found to be about 17 seconds. In this manner he arrived at the more accurate value of the sun's parallax.

It has been asserted that astronomers claim undue credit for the accuracy of their measurements, since Encke made an error of three or four millions of miles in the calculation of the sun's distance. This is not so. A chemist may be able to weigh many substances with an error of $\frac{1}{100}$ per cent. or less; but if the substance to be weighed be only $\frac{1}{100}$ of a milligramme, he might have a larger percentage error. When we consider how extremely small an angle the solar parallax is, it is astonishing to find so great a concordance between the results of different methods.

As to the cause of the phenomenon of the "black drop," Lalande ascribed it to irradiation. Irradiation is that curious phenomenon in virtue of which a star, or any bright object, appears larger than it really is. If a thin platinum wire be intensely heated by the passage of an electric current, it seems, to a person distant about fifty feet, to be as thick as a pencil. In this way the sun's diameter seems to be increased. The sun's light also encroaches upon the disc of the planet and makes it seem to be smaller than it really is. But when Venus and the sun have their edges almost in contact, as shown by the dotted line in Fig. 15, then there is no light at that point which can encroach; hence we see at this point the "black drop" to which allusion has been made.

Father Hell, one of the observers in 1769, ascribed the phenomenon of the "black drop" to the sensible size which an illuminated surface must have before it can be visible. There is probably some truth in each of these suppositions.

As to the cause of irradiation, it is difficult to speak with certainty. It is probably caused in part by the telescope and in part by the eye. Great confusion has been introduced by persons neglecting to separate two perfectly distinct phenomena. True irradiation is only observed with a powerful light. With less illumination similar results may be seen, but they are of a different nature, and are produced between the formation of an image on the retina and its reception by the brain. In accordance with the customary nomenclature, this error of vision may be called the *mental aberration* of the eye. It is a perfectly definite phenomenon capable of accurate investigation, and M. Plateau has made measurements of the mental aberration of his own and his friends' eyes.* True irradiation may be caused either wholly or in part, by the spherical aberration or the chromatic aberration of the eye, or by diffraction, or by a spreading of the excitement of the nerves of the retina, which gives rise to the sensation of vision over a sensible space. In a telescope it is probably chiefly due to diffraction.

The success or failure of all observations of contact in the coming transit will to a great extent depend upon our knowledge of the nature of this appearance. For this reason numerous experiments have been made with the object of gaining information upon the question. The Russians, Germans, Americans, and English have all mounted artificial transits of Venus for the practice of observers. The arrangement adopted by the Astronomer Royal consists essentially of a metal disc with two arcs of circles drawn upon it to represent the sun's edge with the metal between them cut away. Behind these there passes a glass plate with a circle of metal to represent Venus let into it flush with its surface. The glass plate is moved by clock-work so that the different phenomena are observed in succession exactly as they will be seen in the true transit. As the artificial planet passes in succession the two arcs representing the sun's edge, the phenomena of ingress and egress are successively observed. Before contact takes place, the sun has two cusps at the point of contact where Venus is touching the edge of the sun. The distance between the points of these cusps rapidly diminishes, the space between them being intensely black. They suddenly meet. But between the planet and the sun's edge a light shade is still seen which lasts several seconds before the planet appears completely detached. If instead of watching the meeting of the cusps, the part between them be studied, a sudden diminution of intensity of the blackness is seen

* Nouv. Mém. de l'Acad. Royal de Bruxelles, t. xi. p. 1, &c.

* Monthly Notices, xxviii., 355.
† *Ibid.* xxiii. 183.
‡ *Ibid.* xxiv., 8
§ *Ibid.* xxviii., 271
‖ *Comptes Rendus*, July 22, 1872
¶ *Ibid.* 1862, p. 502.
** *Ibid.* 1874, p. 341
†† Monthly Notices, xxiv., p. 17, &c.

about a second before the meeting of the cusps. The diminution of brightness is very sudden, and this is the phenomenon to be chiefly attended to in the actual observation. It occurs almost exactly at the moment of true contact, though the "black drop" does not disappear until some seconds later. It is of the utmost importance that the nature of these different phenomena should be carefully studied by all the observers. And at the present time experiments are being made with a view of determining the personal equation of each of the observers on the British expeditions.

But the actual observation will be rendered more difficult for various reasons. Firstly, the enormous extent of atmosphere which the rays of light must penetrate before reaching the telescope will destroy the definition to a large extent. Secondly, the existence of an atmosphere around the planet Venus may materially affect the nature of the phenomenon.

In any case there is little doubt that as many of the observers as possible of all countries should describe, as accurately as can be done, the exact appearances which are noticed at successive stages of the ingress and egress respectively. Comparisons being also made between different observers and between different telescopes, it will be possible to reduce the observation of any phase which may chance to be caught in the actual observation to the true time of contact. From observations with the Model Transit of Venus made at Greenwich, the following facts appear :—

1. It requires considerable experience for an observer to appreciate all the definite changes of appearance which occur.

2. When two observers describe a particular phase which they see, and determine to observe this phase together, the times recorded by each are generally accordant within a fraction of a second.

3. The successive phases of an ingress or egress appear to follow each other sometimes rapidly, at other times gradually ; so that in some cases all the phenomena are observed within three seconds, on other occasions the same series of phases is completed in ten seconds.

4. The time at which any particular phase is observed varies very slightly with the aperture of the telescope. When a telescope of good definition is employed, the time of any phase at ingress is earlier than with an instrument of less perfect definition.

In the case of the observations of last century, it is easy to see how observers quite unprepared by previous observations as to the nature of the appearances they were about to witness were sometimes inconsistent with each other. In fact, without preliminary practice, and with bad definition, observers might vary even with a Model Transit of Venus by as much as 15 seconds. But, knowing what they are to observe, they would differ under no circumstances by more than about 2 seconds. Hence it is probable that in the actual transit, if the definition be good, the observation *may* be accurate to within one second ; but if the circumstances be not very favourable, they may differ to an extent of fully three seconds, even after considerable practice with the model. These estimates serve to give us some idea of the accuracy with which we may hope to have the observations made ; and it is probable, from the care which has been taken to multiply the number of observers at each station, that each pair of observations of contact will give us a determination of the parallax of the sun true to about $\frac{1}{8}$ per cent.

In the observations of contact, however, a great deal depends upon the experience of the observer ; and it is fortunate that the idea originally thrown out by M. Janssen, and the mechanical execution of which has since been so ably carried out, will indelibly record the progress of the phenomenon and serve as a check to the observers.

By the aid of this method photographs of particular sun-spots have already been taken with great success at intervals of one second during one minute of time. Each of these sixty photographs is perfect in itself, and would admit of very perfect measurements. Hence there is every reason to believe that in this manner an independent and very valuable observation of the true time of contact will be made at each stationwhere a photo-heliograph is situated.

The observations by means of photography during the progress of the transit have few difficulties to contend with. Their value will be largely increased by the fact that the actual measurements will be made afterwards when the observer cannot be carried away by the excitement of the moment. But even in this class of observation there are difficulties which must be carefully considered. It is found that if a sensitised plate be overexposed, the image of the sun is considerably enlarged. This is due to *photographic irradiation*. It has been found by Lord Lindsay and Mr. A. C. Ranyard to be mainly due to the reflection of light from the back of the glass plate.* It can be almost entirely avoided by wetting the back of the plate, and placing black paper against it. There will still be probably a slight enlargement of the sun's diameter. This will not affect the relative positions of the centres of the sun and Venus ; but it will render it extremely difficult to determine the unit of measurement.

There are two ways of applying the photographic method. The first is the same as the heliometric method. For this purpose it is necessary to have one station in the north and another in the south. By the other method we do not determine the least distance between the sun and planet, but the actual position of the planet at each observation. In other words, we determine the distance of Venus's centre from the sun's centre, and also the angular distance measured from the north point of the sun. To do this we must have in the focus of the photo-heliograph a fine thread to indicate the direction of the meridian in the photograph ; or in the American method we must have a thread suspended vertically which shall indicate the vertical direction in the solar photograph. The arrangements of the American method, as set up by Lord Lindsay at Dunn Echt, are shown in Fig. 16. The siderostat, lens, and hut, are all shown in position.

The value of the different methods has been well discussed by De la Rue,† Tennant,‡ and Proctor.§ The method which takes into account the *actual* position of the planet on the sun is the more accurate, but it requires that the fiducial lines, or lines of reference, shall be exactly represented in the photographs. Mr. De la Rue says that this can be done to within one minute of space.

Besides photographic irradiation, however, there is a very important difficulty which enters into both the photographic and heliometric methods. This is due to the refraction of our atmosphere. Everyone knows the distorted forms which the sun assumes at the time of sunset. In our own climate these appearances are seldom seen on account of clouds and the haziness of the atmosphere. But even from a high mountain, or from any position which allows the form of the sun to be accurately seen up to the time of sunset, its shape may be noticed to be either square, elliptical, or pear-shaped, according to the circumstances of the atmosphere. Now at the most favourable points of observation the sun will be comparatively near to the horizon. Consequently its form will vary with the temperature of the air and with atmospheric disturbances. With our feeble knowledge of the laws of refraction it will be a matter of some difficulty to determine with accuracy the distance at different times between the centres of the sun and Venus.

* Monthly Notices of the R.A.S. 1872, p. 313.
† *Ibid.* xxix., 48 and 282.
‡ *Ibid.* 280
§ *Ibid.* xxx., 62.

The same remarks apply to the heliometric method. But with stations chosen where the sun is not too low, we

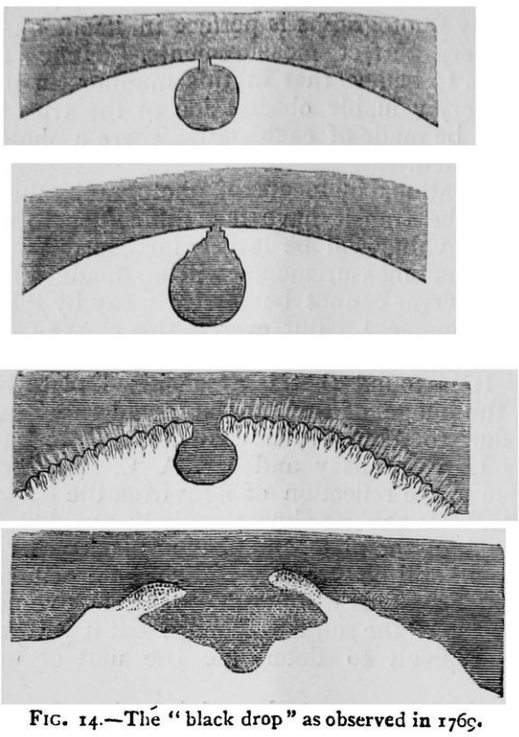

FIG. 14.—The "black drop" as observed in 1769.

may expect accurate results. The value of a heliometer over other instruments designed for measuring small angles consists in this, that by it we can measure angles as large as the sun's diameter. It is expected by observers with this method that an observation will be made each time with an accuracy comparable with that of an observation of the time of contact. In this case the heliometric method will give valuable results. For the

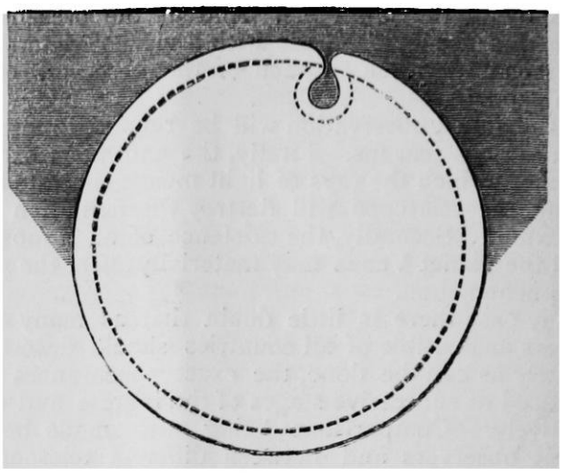

FIG. 15.

same reasons observations made by means of a double-image micrometer of the distance between the limbs of the sun and Venus near the time of contact will be as accurate as an observation of the contact itself.

The last difficulty which we shall mention in connection with this kind of observation is due to atmospheric

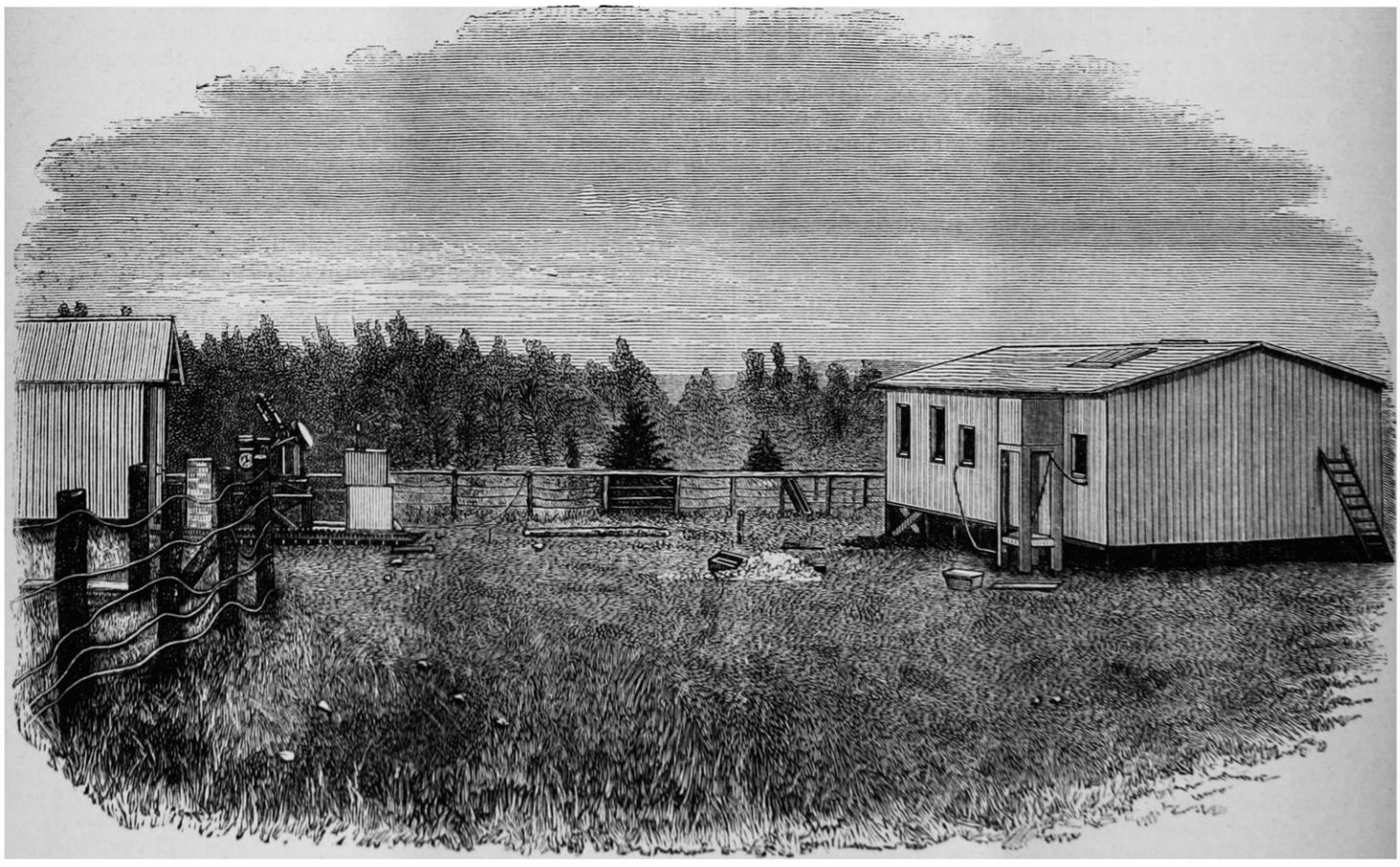

FIG. 16.—Lord Lindsay's Photographic Arrangements as set up at Dunn Echt.

conditions as affecting the apparent time of contact. With regard to the British expedition, great care has been taken to choose stations where the weather can be depended upon. But in cases where the method of duration is applied, the observations will be useless if there be not a very clear atmosphere both at ingress and at egress. De l'Isle's method, on the other hand, requires a perfect observation only at the time of one of these phases. Hence the nations which have adopted this method are less likely to be disappointed than others.

GEORGE FORBES

(To be continued.)

LARVÆ OF MEMBRACIS SERVING AS MILK-CATTLE TO A BRAZILIAN SPECIES OF BEE

MY letter in NATURE, vol. viii. p. 201, was incomplete so far as the names of the Brazilian insects alluded to are concerned, but I am now enabled accurately to name both the supposed milk-cow and the supposed milker. With regard to the former, Mr. Rogenhofer, of Vienna, has had the kindness to compare my specimens of Membracis with the collection in the museum of that metropolis, and informs me that my Membracis belongs to the genus *Potnia* of Stäl (*Umbonia* of Fairmaire), the species most probably being *indicator* Fairm. As to the Trigona species referred to in the above letter, I have in the meantime received numerous good specimens, not only a number of workers, but also some males, and even one queen. Mr. Frederick Smith has been good enough to compare my specimens with the collection in the British Museum, and has found that they belong to an undescribed species. Having worked through the literature on Trigona and Melipona as completely as possible, and after perusing the descriptions of about one hundred species, not having found a single one of which all three kinds of individuals are known, I think it will be welcome to the readers of this journal who are interested in entomology, if I do not restrict myself to merely mentioning the name and diagnostics of my new Trigona species, but give a description of its workers, male and queen, adding a brief account of its peculiar habits and economy from my brother's (Fritz Müller) observations.

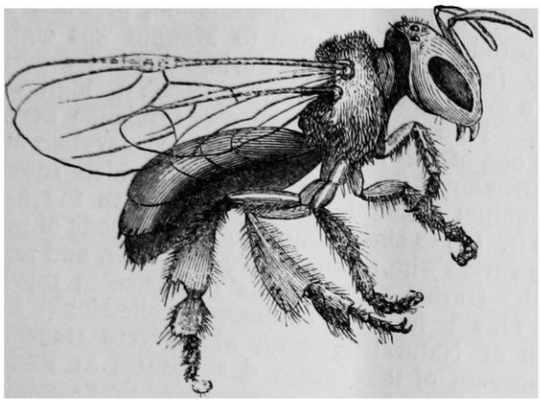

FIG 1.—Cacafogo, worker (side view).

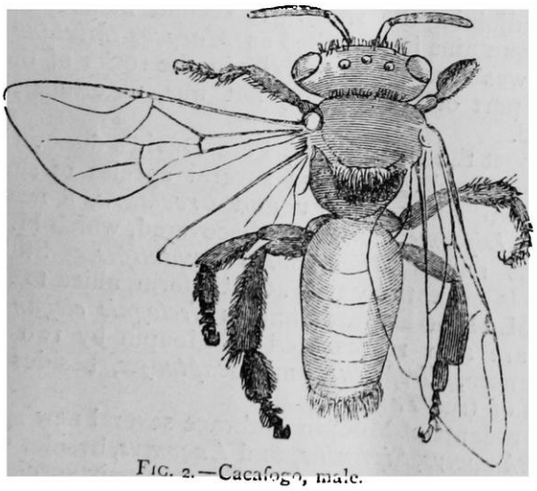

FIG. 2.—Cacafogo, male.

*Trigona cagafogo**

Length of the workers and males 5—5½, of the queen 6—7 mm. Males and workers are almost alike in size, colour, and outline of the body, and are distinguished from most other species of the same genus by the breadth of their head and the narrowness of their abdomen, which, in the workers, scarcely exceeds half the breadth of the head. In the males the abdomen is equally slender, but the head somewhat less broad; in the queen the head is of the same size and form as in the workers, but the abdomen is so much dilated as to reach one and a half times the breadth of the head.

The head, tegulæ, scutellum, and abdomen, in all three kinds of individuals, are ferruginous, smooth and shining, the posterior margins of the vertex, of the scutellum and of the last segments of the abdomen have a

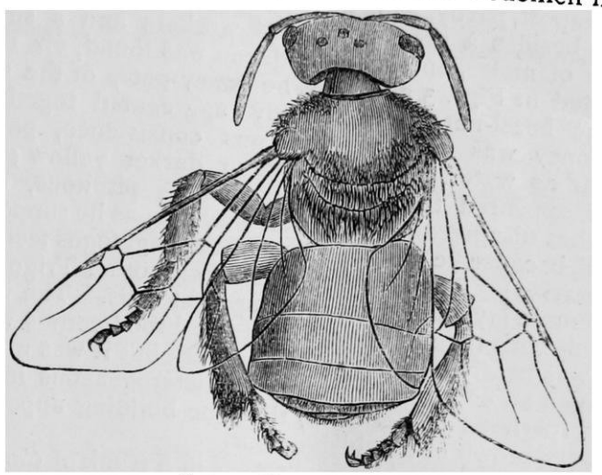

FIG. 3.—Cacafogo, queen.

black pubescence; the rest of the thorax, together with the legs, is black with black pubescence; the antennæ black, the greatest part (♀) or the whole (♂) of the scape rufo-piceous, the flagellum fuscous beneath. The wings by far exceed the abdomen; the basal portion and radical cell of the anterior wings dark fuscous; their apical portion and the posterior wings subhyaline; the stronger nervures brown, the feeblest ones pale ferruginous; no cubital cell at all. The mandibles with two teeth at their apex. The tibiæ triangular, their outside pubescent from the base to the middle, towards the apex slightly excavated, smooth, shining, and naked. The whole body destitute of feather-like hairs. The unguiculæ of the males are, in this as in other Trigona and Melipona species, two-cleft; whilst those of the workers and females are simple. The queen, besides her larger size and the much dilated abdomen, differs from the workers by the colour of the head being somewhat paler, the antennæ longer, the thorax stronger, its anterior and lateral margins and two longitudinal streaks rufo fuscous, the anterior wings provided with a completely closed cubital cell, the legs larger and more robust, especially the anterior and middle tibiæ much thicker, the outside of the posterior tibiæ slightly convex and pubescent nearly

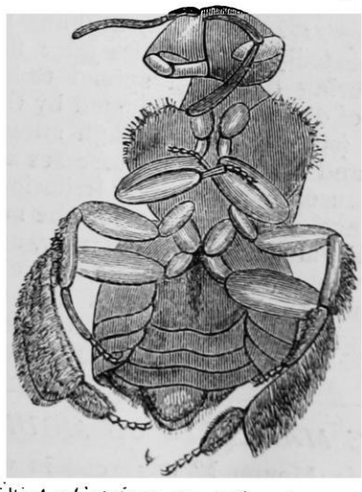

FIG. 4.—Cacafogo, queen (from beneath).

* I call the species Cagafogo, using the vernacular name for the specific one.

as far as the apex, the apex of the posterior tibiæ bordered with partly feather-like hairs.*

The nests of *T. cagafogo*, like those of many other species, are built in hollow trees. One of two nests which my brother had the opportunity of observing was found in a tree cut down a long time before; but its combs, lying in confusion, probably in consequence of the direction of the trunk having been altered by felling the tree, showed that the nest had probably been built before the tree was felled. In this nest, the inhabitants of which partly perished by having been plastered over with the honey which flowed from the damaged honey-pots during the transport, partly, as is to be supposed, flew away afterwards; besides a great number of workers and a small number of males, only a single queen was found, viz. that illustrated in Figs. 3 and 4. The honey-pots, of the size of large hazel-nuts, were closely aggregated together. The honey was of a very viscous consistence, partly as clear as water, partly lighter or darker yellow; its flavour appeared to my brother insipid, pituitous, and somewhat disagreeable (the latter perhaps, as he supposes himself, because he was conscious of the cagafogos feeding upon carrion). The brood-combs, as with other Trigonas, were simple layers of hexagonal upright cells. The wax, of which both the honey-pots and the brood-combs were built, was nearly of a pure white colour, but it was mixed with such an enormous quantity of heterogeneous ingredients (perhaps 90 per cent.) that the building appeared of a dirty brown or blackish colour.

Another nest, found by my brother in a trunk of *Canella pimenta*, about five meters above the ground, was brought safety home after cutting down the tree; but a week afterwards all the inhabitants had flown away.

The most striking feature in the natural history of this stingless bee is its fondness for oily matters, and its singular means of defence, connected with a great irritability. As I have already stated (vol. viii. p. 201) it feeds upon carrion; and is also fond of old stinking cheese. When visiting flowers, it seems to be also guided by its particular taste; it visits in swarms the flowers of a bean with glandular calyx; also a white-flowered Abutilon and *Sicyos angulata*, the flowers of which are glandular and secrete an oil. It was also observed fertilising the flowers of *Asclepias curassavica*, milking the larvæ of Membracis, repeatedly sucking the juice flowing out of trees, and devouring the sugar spread to be dried. Its singular means of defence are indicated by the vernacular name Cagafogo (spit-fire), for although stingless, like all other Trigonas and Meliponas, it possesses a very intense venom, which causes a most lively irritation in the skin. Whilst the defenceless species are for the most part very peaceable, the Cagafogos, on the contrary, are so irritable that the observation of their nests proves impossible, unless cold weather or strong breezes from the land keep them quiet.

Lippstadt HERMANN MÜLLER

THE MAMMALS OF MOUPIN

"WHERE is Moupin?" our readers will say, when they see the heading of this article. To this it may be replied that, if not already well known to zoologists, Moupin bids fair to become so very quickly, as it possesses one of the most strange and interesting faunas which have become known to us of late years. Moupin is the name of one of the small independent principalities lying on the extreme west of the great Chinese province of Setchuan. It does not appear to be marked on any of our charts, but if our readers will turn to the map of China and find Ching-tou, the capital of Setchuan, they will see still farther to the west a range of mountains designated the "Yungling Mountains," which separate China proper from Thibet. Amongst these the district called Moupin is situated.

The first and only European who has penetrated to this remote corner of the earth is the celebrated French traveller, Armand David, a missionary priest of the congregation of Lazarists, who has for many years, by permission of his superiors, devoted himself to the exploration of the Chinese flora and fauna. Père David left his mission in Pekin in May 1868, and travelled by the Yangze-kiang—the great high road into the interior of China—to Chong-kin. Hence he proceeded by land, leaving his baggage to follow by water, and after twelve days' journey reached Chong-tong, the capital of the great province of Setchuan, where there is a large Catholic mission, presided over by an Apostolic vicar. Hence to Moupin was eight days' journey farther westward, during the latter portion of which a mountain range nearly 10,000 ft. high was traversed. Père David's ordinary residence in Moupin was in one of the high valleys at an elevation of about 7,000 ft. above the sea-level, above which rose one of the principal mountains of the district to the height of 15,000 ft. Up to about 10,000 ft. dense woods of pines and cedars varied with rhododendrons, laurels, and magnolias prevail. During a ten months' residence in this locality, Père David formed extensive collections in every branch of Natural History, which were transmitted to the museum of the Jardin des Plantes at Paris. In a report* addressed to the professors of that establishment, which has been lately published in the 7th volume of the "Nouvelles Archives," Père David has given a complete list of the mammals of his collection, which embraces no less than 110 species. The novelties are shortly described by M. Alphonse Milne-Edwards, one of the naturalists of the Jardin des Plantes, who, however, is now giving a much more complete account of them in a large work on which he is engaged, entitled "Récherches sur l'histoire naturelle des mammifères." The following are some of Père David's most remarkable discoveries in Moupin in the class of Mammals.

Under the name *Rhinopithecus roxellanæ* is described a very singular new form of monkey, clothed with dense hair, and with a turned-up nose, which inhabits the highest forests adjoining the snow. A second monkey from the same mountains is described as *Macacus thibetanus*; and a third was ascertained to exist in the rocks of the more eastern part of the district, but was, unfortunately, not obtained.

Amongst the Insectivora, Père David's discoveries are also remarkable. Besides several species of shrew, of the known genera *Sorex* and *Crocidura*, a new form, allied to *Diplomesoaon*, was discovered, which M. Milne-Edwards names *Anourosorex squamipes*. Still more curious is an entirely new aquatic form, allied to *Mygale*, which M. Milne-Edwards names *Nectogale elegans*. The moles are also represented in Moupin by two entirely new genera, *Uropsilus* and *Scaptonyx*, besides a new species of true *Talpa*.

The rodents of Moupin embrace several new species of *Mus*, *Rhizomys*, *Siphneus*, and *Lagomys*, besides squirrels of different genera: examples of thirty-six species in all were obtained. The carnivores also furnished some important novelties, three new polecats (*Putorius*), two new species of the badger-like form *Arctonyx*, and a new cat (*Felis*). But in this group the most industrious discovery was that of the *Ælurus fulgens*—hitherto regarded as a type peculiar for the higher Himalayas, and of its allied but larger brother *Æluropus melanolencus*—one of the most wonderful of recent additions to the class of mammals. These two genera constitute a special family of carnivores, representing, in the Palæarctic region, the

* A more full and detailed description of this and some other new species will be given in a separate treatise on Trigona and Melipona, to be published by my brother and myself.

* Rapport addressé à MM. les Professeurs-Administrateurs du Muséum d'Histoire naturelle par M. l'Abbé Armand David. Nouv. Arch. d. Mus. vii. Bull. p. 75.

procyonidæ of the New World. The *Æluropus* is a large bear-like animal clad in snow-white fur. It inhabits the highest forests, and is called by the Chinese hunters "*Pe-shioung*" or "white bear." Its food is said to be of a vegetable character.

Proceeding to the Ungulates, we find other very remarkable discoveries recorded. The singular form *Nemorhedus*, hitherto only known from the Mishmee Hills of Assam, a large antilopine-looking creature with a pair of in-curved horns, is also met with in Moupin. Three new *Nemorhedi*, or goat-like antelopes, are also in the list. But perhaps the most interesting of all Père David's discoveries in this order of mammals is a new form belonging to the family *Cervidæ*, which M. Milne-Edwards has termed *Elaphodus cephalophus*. It is intermediate between the muntjacks and the true deer, having the highly developed upper canines of the former, but possessing a minute pair of horns about an inch in length, covered by a long tuft of frontal hairs as in the antelopes of the genus *Cephalophus*.

Altogether, out of the 110 species of mammals obtained by Père David in Moupin, no less than forty turned out to be new to Science, amongst which, as will be seen from what we have said above, were many of the most remarkable characters. There can be little question therefore, we think, that Moupin presents one of the most extraordinary faunas as regards its mammals that has become known to us for many years. It must be conceded that the land is difficult of access, and that perhaps no living European, except Père David, clad in Chinese garments, and speaking the ordinary vernacular of the country, could have found his way there. It has been lately stated in a scientific periodical that zoology is at a discount in France, and that their recent contributions to this science have been of the most meagre description. The splendid discoveries of Père David, and the works of Alphonse Milne-Edwards in which they are described, are of themselves sufficient to refute such a baseless charge.

THE TRANSIT EXPEDITIONS TO RODRIGUEZ AND KERGUELEN'S LAND

SOME four years ago (NATURE, vol. i. p. 527), we directed attention to the desirable opportunity, presented by the Transit expeditions to several little-known spots in the Pacific, of sending out qualified Natural-History observers to the same islands, in order to obtain a knowledge of their flora and fauna. The astronomical stations selected as being especially worthy of this kind of research were the Sandwich Islands, Kerguelen's Land, and the Island of Rodriguez. This subject having been brought before the Council of the Royal Society last year, and thus to the notice of the Treasury, we are glad to be able to announce that, after certain little difficulties on account of the change of Government, the present ministry were induced to grant a sum of money sufficient to send out naturalists to two of these stations, and that arrangements are now being made for their speedy departure along with their astronomical brethren.

Three naturalists will proceed to Rodriguez, the most remote and least known of the Mascarene group of islands. Dr. T. B. Balfour, son of the well-known Professor of Botany of the University of Edinburgh, will devote himself to an examination of the general geological structure of this island, which presents features of the greatest interest, inasmuch as it forms one of the few exceptions to the general rule that all oceanic islands of the deep sea are of volcanic origin. Dr. Balfour will also collect the plants of Rodriguez so as to increase our acquaintance with the flora of the island, which has hitherto, we believe, been scarcely touched.

Mr. George Gulliver, of the University of Oxford, has undertaken the zoological department, and will form as complete a series as possible of the recent animals of the island of every kind. The fauna of Rodriguez, as is well known, is excessively meagre, but it is very desirable that what little endemic life there is left on it should be investigated and collected at once, as being the relics of a very peculiar phase of life which is now passing away very rapidly.

To Mr. Henry H. Slater, of the University of Cambridge, who has had good experience of cave-digging in the north of England, has been entrusted the task of the complete exploration of the limestone caverns of Rodriguez, which has been so ably commenced by Mr. Edward Newton, the Colonial Secretary of Mauritius, with successful results well known to the majority of our readers. We trust also that Mr. Edward Newton may himself be able to accompany the party to Rodriguez, in order to give them the benefit of his advice and assistance. If this can be arranged, there remains no doubt that the Rodriguez expedition will attain most successful results.

For the expedition to Kerguelen's Land, the second point to which it has been agreed that natural history investigaton shall be directed, one naturalist has been considered to be sufficient, regard being had to the well-known poverty of its flora and fauna, and to the fact that the *Challenger* expedition has paid, or will shortly pay, a visit to the island. For this post the Committee of the Royal Society has selected the Rev. A. E. Eaton, who has already distinguished himself by making excellent collections, both zoological and botanical, in Spitzbergen. Spitzbergen, as observed by Dr. Hooker, lies under somewhat similar conditions as regards climate in the northern hemisphere, to Kerguelen's Land in the southern, and there can be no doubt that a naturalist who has worked well in the former will have gained experience likely to assist him in the latter locality.

As regards the exact time of the departure of these two expeditions, we believe that nothing is yet finally settled; but it is probable that the naturalists will in each case depart in company with the astronomers, who are under orders to leave England in the course of the ensuing month.

NOTES

AT a meeting of Convocation of the University of London held on Tuesday evening last, a motion "That in the opinion of Convocation it is desirable that women should be permitted to take degrees in the University of London," was carried by a majority of 83 against 65. The subject will, it is said, shortly be brought before the Senate, with whom originates all fresh legislation, Convocation having only a power of veto.

AT the same meeting a motion urging the Senate not to permit the practice of vivisection to be carried on in the physiological laboratory of the Brown Institution under any circumstances except for medical or curative purposes, was lost by a majority of 59 against 16.

WE have, on more than one occasion, spoken of the disgraceful way in which the Natural History Collections belonging to the defunct East India Company have been treated. They have been "boxed up" several years and deposited in the cellars of the India Office, so that they cannot be got at even when access to a particular type-specimen is requisite to enable a naturalist to determine a *vexata quæstio*. On the 5th inst. Sir John Lubbock endeavoured to ascertain from the Under-Secretary for India whether there is any prospect of the grievance being remedied, but did not succeed in getting much more than the cautious reply that the subject was "under consideration." We believe, however, that there is really a negociation for the transfer of the whole of the collection to South Kensington, in accordance with the suggestion put forward in our article on this

subject in NATURE, vol. vii. p. 457, and are glad to recognise that the present Government show some symptoms of paying attention to the just claims of scientific men.

THE Senate of the University of Cambridge last week conferred a great boon on students of Natural Science who intend going to the University, by deciding to accept the certificate of the Leaving Schools Examination in lieu of the Previous Examination. The student who obtains this certificate, passing the examination with distinction, will be able to enter uninterruptedly upon the pursuits of Natural Science as soon as he goes up to the University, and will therefore be able to attain greater proficiency than has hitherto been the case. The examination is, we believe, likely to be a very thorough one, but the particulars can be obtained through the "Regulations of the Oxford and Cambridge Schools Examination Board," which may be obtained for a shilling at any bookseller's.

TRINITY COLLEGE, Cambridge, offers one or more foundation scholarships of the value of 100*l.* per annum. The examination will be open to all undergraduates of Cambridge who have passed the Previous Examination. Also an exhibition of the value of 50*l.* per annum. This examination to be open to all persons under 20 who have not commenced residence at the University. The examination will commence on March 30, 1875. Candidates must send certificates of age and moral character to one of the Tutors of Trinity before March 13.

THE use of a lecture-room in the New Museums, Cambridge, has been granted to Dr. Carpenter for the purpose of giving a lecture on some of the results of the voyage of the *Challenger*.

THE visit of the *Challenger* to Melbourne has been exceedingly pleasant. Free passes have been granted by the railway companies in the most liberal fashion, and excursions have been the order of the day. Letters will reach the *Challenger* if directed to Sydney, by the mails leaving London *via* Brindisi, May 15, *via* San Francisco, June 3. They will find the ship at Somerset, Cape York, on August 16. Letters to Singapore should be sent *via* Southampton, June 18, and July 16; *via* Brindisi, June 26, and July 24.

THE Council of the Society of Arts has fixed Wednesday, May 20, for a general meeting on the subject of Public Museums and Galleries. To it will be invited the Mayors of Corporations, Chairmen of Art and Science Schools, and others interested in the question. The object of the meeting will be to name a deputation to wait upon the Prime Minister, and urge upon him the importance of bringing all National Museums and Galleries under the authority of a Minister of the Crown, with direct responsibility to Parliament; and also of causing all such museums to be made conducive to the advancement of education and technical instruction. The chair will be taken by the Right Hon. Lord Hampton, at 12 o'clock.

THE annual meeting of the Iron and Steel Institute was held on the 6th, 7th, and 8th inst., under the presidency of Mr. J. Lowthian Bell, M.P. The president's address as well as the papers read were almost entirely of a technical nature. The Bessemer medal founded by Mr. Bessemer since the last meeting of the Institute, was awarded to Mr. Lowthian Bell. According to the Report of the Council, the number of members was 644, showing an increase of 122 since the last annual meeting. In Friday's sitting Mr. G. W. Maynard read a paper On the iron ores of the Lake Champlain region. The author gave a topographical and geographical description of the district, and placed before the meeting a large amount of information respecting the minerals existing throughout the whole of the United States.

WE regret to learn the death of Dr. Meissner, the eminent botanist, which took place on the 2nd inst. at Bâle, in the 64th year of his age, "après de longues souffrances." He was a foreign member of the Linnean Society.

MR. EDWARD BARTLETT has been appointed Curator of the Maidstone Museum, which contains so many objects of interest collected by the late Mr. Julius Brenchley in his numerous and extended travels.

IN reply to a question on Monday in the House of Commons Mr. Disraeli said that the claims of the late Dr. Livingstone's family "will be considered by her Majesty's Government, and, if they think they ought to be provided for, we shall not hesitate to ask the House to grant such a vote as they think would be proper under the circumstances." The ways of "her Majesty's Government" are mysterious. Chumah and Susi, Dr. Livingstone's two faithful servants, are expected to arrive at Southampton in the next homeward-bound Indian mail steamer.

THE Rev. Charles New has just left England for the scene of his former labours in Eastern Africa. After investigating some of the less-known portions of the coast he purposes to press forward into the interior in the direction of the sources of the Nile.

A sharp frost set in in many parts of France on May 4-6, and destroyed a quantity of young plants, especially in vineyards. The occurrence had been predicted by M. Sainte Claire-Deville, who is now in Algeria for the purpose of organising meteorological observations in the remotest French desert stations. The disasters are serious, although they do not endanger the future crops and vintage. Several agricultural papers propose to protect young plants against cold spring nights by covering them with canvas or burning substances which produce much smoke in order to create artificial clouds over the fields. It remains to be seen with what success such schemes, which appear rather rash, may be followed.

WE have received a few additional letters on the destruction of flowers by birds, which we have forwarded to Mr. Darwin.

AT a meeting of the Alpine Club on the 5th inst., Mr. W. S. Watts spoke of a proposed exploration of the Vatna Jökull, Iceland. An exploration devoted to this purpose would, he observed, possess peculiar interest, since the vast area known as the Vatna Jökull, situated on the south-eastern side of the island, is at present wholly unexplored. Mr. Watts visited Vatna Jökull and spent some time upon it in 1871, in company with his friend Mr. John Milne, F.G.S. So far as they could determine, Vatna Jökull, with its surrounding jökulls, was an aggregation of volcanoes and glaciers, encompassed on all sides by a desert formed by the action of the sea, huge lava streams and fragmentary ejectments and detritus brought down by the flooded rivers incidental to volcanic eruptions. The object of the proposed expedition is to cross and explore Vatna Jökull, reach, if possible, the seat of present volcanic activity, and to determine the character and position of any other phenomena it might contain. In order to accomplish this it is essential that his party should not be less than six in number. Three gentlemen have already promised to accompany him, and he hopes that from the club, or others who might hear of his undertaking, he may get four more to join him. He proposes to start on May 31, and remain away about three months, and thinks should his party consist of eight the expenses would not exceed 50*l.* per man.

A NEW drug from Brazil has appeared in France, under the name of Jaborandi. It consists of the leaves and small branches of a shrub growing in the interior of some of the northern provinces of Brazil, and from specimens which have come into the hands of Prof. Baillon, it seems that the plant is the

carpus pinnatus Lem., belonging to the Rutaceæ. It is stated that this drug has been used with great success in France, and that it is looked upon "as an incomparable diaphoretic and sialogogue." Dr. Gubler expresses himself in the belief that it "will be the first indisputable example of a diaphoretic truly worthy of the name; that is to say, a medicine having the power of provoking directly by an electric action the secretion of perspiration."

IN the same manner as the lichen dyes have been superseded by those derived from coal tar, so the demand for madder roots seems to be rapidly falling off, owing to the discovery of alazarine. In a report on the trade of Beyrout, it is stated that heavy losses have been incurred in the article, owing to its great fall in value in the English markets from the cause above stated; indeed it is said that so far as England is concerned, the trade in this article with Beyrout has almost, if not quite, ceased. Its cultivation, however, in this neighbourhood, has never been on a very extensive scale, being confined to a few outlying districts; it is, moreover, very exhaustive to the soil. Nevertheless, in the early part of the year 1872, 2,300 cwt. of the value of 5,728*l.* were shipped from Beyrout to English ports.

WE have just received the publications of the "Bataviaasch genootschap van Kunsten en Watenschappen" for 1873. In the "Tijdschrift" is a short paper on Rotti, by Mr. Jackstein, a missionary in the island, followed by another paper by him on the Rotti words in use by the Malay-speaking people in the district of Koepang. Several papers are devoted to the accounts of the suppression of piracy, which has so long been a characteristic of the Malay race. Dr. Adolf Meijer has also communicated a paper On the Language spoken in Mendanoa, Solog, &c.

PROF. WILLIAM M. GABB, of Philadelphia, who is at present engaged in an exhaustive geological exploration of Costa Rica, has lately made a very important discovery in reference to the sedimentary rock on the Atlantic slope of Costa Rica, namely, that even such portions as are auriferous are not earlier than the Tertiary. Indeed, in Prof. Gabb's opinion, they are of Miocene age, which is, of course, strongly in contradiction of the hypothesis of Sir Roderick Murchison, that gold is of Silurian origin.

THE last part of the Transactions issued by the Geological Society of Manchester contains a paper by Mr. S. Aitken, On the Discovery of the new Fish of the Genus *Acrolepis* Ag. in the millstone grit near Habden Bridge, Yorkshire. There is also a paper On the Economic Value of Heat Fuels, by Mr. Plant.

A CURIOUS phenomenon happened at Belfast recently while some men were sinking a well. A light having been let fall, a flash overspread the bottom of the well; and a pipe about 60 ft. long having been conveyed from the bottom of the well to the second storey of a building, the gas was ignited, and continued burning all day. The strata passed through in digging the well were esturine, clay, gravel, boulder clay, and New Red sandstone. The gas has been proved to be marsh gas (carburetted hydrogen) probably generated in the decomposed vegetable matter, which abounds in the lower stratum of the esturine clay, in which were also vast numbers of fossil shells.

ONE of the most elaborate mineralogical papers that has appeared for some time in the United States, with the exception of Dr. Genth's on corundum, is that by Prof. Josiah P. Cooke, jun., upon the vermiculites, and their crystallographic and chemical relations to the micas, together with a consideration of the variation of the optical angle in these minerals. This appears in the Proceedings of the American Academy of Arts and Sciences, and is to be considered as a very valuable contribution to the science of mineralogy.

WE have received a very interesting map of Victoria showing the distribution of forest trees in that colony by an ingenious arrangement of different colours. It is compiled by Mr. Arthur Everett from the Record Maps in the Office of the Surveyor-General, under the direction of Mr. R. Brough Smith. The map is accompanied by notes on the various trees by Dr. F. von Mueller, Government Botanist.

A MADEIRA correspondent writes us concerning the damage caused to objects of natural history from cedar-wood cases. A naturalist in Madeira, to do his collection of the remarkable land shells of the island more honour, had made for them a case of this wood. Unobserved for a month, the shells were found drenched with the turpentiny resin exhaling from the wood. Shells covered with a rough epidermis seemed to have attracted the oil less. *Craspedopoma*, and the smooth fresh-water shells had specially suffered; semi-fossils full of sand had escaped; all others, whether recent or semi-fossil, had suffered to such an extent that the cardboard to which they were attached was in many cases soaked. This occurred, however, only when the affixed shells offered the needful point of attraction and condensation.

WE have received an appendix to the Annual Report for 1873 upon the Survey of the (U.S.) Northern and North-western Lakes in charge of Major C. B. Comstock. Notwithstanding much unfavourable weather, a great deal of work has been done. It was expected that a continuous chain of triangulation, reaching from St. Ignace Island, on the north shore of Lake Superior to the southern end of Lake Michigan, a distance of 500 miles, would be completed during 1873. It has been measured with sufficient precision to give an arc of the meridian 7° in length. This is the longest arc measured on the American continent, and it is hoped to extend it further south.

THE additions to the Zoological Society's Gardens during the last week include a Capybara (*Hyrochœrus capybara*) and a Coypu (*Myopotamus coypus*) from S. America, presented by Dr. H. Young; a Garnett's Galago (*Galago garnetti*) from E. Africa, presented by Mr. R. H. Cusack; an African Civet Cat (*Viverra civetta*) from the Gold Coast, presented by Mr. W. B. Ramsay; a Grey Ichneumon (*Herpestes griseus*) from India, presented by Mr. H. Humphry; a Sun Bittern (*Eurypyga helias*) and seven Upland Geese (*Chloëphaga magellanica*) hatched in the gardens; a Black Saki (*Pithecia satanas*) and a Red-backed Saki (*P. chiropotes*) from S. America, deposited; a Blue-faced Green Amazon (*Chrysotis bouqueti*) from Honduras, purchased. Of this last-named bird Dr. Finsch, in his monograph on the parrots, remarks that he has never been able to find a skin in any of the many museums to which he has had access.

SCIENTIFIC SERIALS

THE *Journal of the Chemical Society* for March contains the following papers read before the Society:—On the preparation of standard trial plates to be used in verifying the composition of coinage, by W. Chandler Roberts, chemist of the Mint. The author had been instructed by the Lords of the Treasury to prepare new plates of gold and silver for comparing annually with the coinage being issued, in order to guarantee the fineness of the latter. The gold plate consists of an alloy of copper and gold ranging in composition in its different parts from 916·5 to 916·7 parts of fine gold in 1,000 (the standard is 916·66). This plate did not present much difficulty in its preparation, since the two metals were obtained in a state of perfectly homogeneous mixture after repeated meltings. The silver plate presented much greater difficulty owing to the tendency of the silver to concentrate itself in the centre of the mass. The difficulty was overcome by casting the alloy into a plate, which was then planed down on both surfaces and afterwards greatly extended by roll-

ing; a portion cut out from the side of this plate served for the new trial plate. Its composition ranges from 924·6 to 925·1 parts of pure silver per 1,000 (925 being the standard). The author has also constructed supplementary plates of pure silver and gold. An interesting table of assays of trial plates from 1477 down to the present time is given.—Mr. J Hannay contributes a description of a sp. gr. apparatus for temperatures other than atmospheric.—Dr. Gladstone and Mr. Tribe give the fourth part of their researches on the action of the copper-zinc couple on organic substances. They have now turned their attention to the series containing the C_nH_{2n-1} radicals, the first body acted upon being iodide of allyl, which yields with the dry couple a resinous body of the formula $n(C_3H_4)$, but when mixed with ether rapid decomposition sets in at ordinary temperatures, and the ethereal solution gives zinc oxide on mixing with water. All attempts to isolate zinc-allyl have, however, failed. Allyl iodide and water acted upon by the couple give propylene $C_3H_5I + H_2O + Zn = ZnI.HO + C_3H_6$. The iodide mixed with alcohol is acted upon violently by zinc alone yielding propylene $C_3H_5I + C_2H_6O + Zn = Zn\begin{cases} C_2H_5O \\ I \end{cases} + C_3H_6$.—On ferrous anhydro-sulphate, by T. Bolas. A mixture of 10 per cent. of a saturated aqueous solution of ferrous-sulphate with oil of vitriol deposits, on cooling, small white prismatic crystals having the formula FeS_2O_7. When exposed to moist air the anhydro-sulphate yields granular crystals of the formula $FeSO_4.6H_2O$.—On tetranickelous phosphide, by Dr. R. Schenk. This substance (Ni_4P_2) was obtained by adding a sufficient quantity of tartaric acid to a solution of nickelous chloride, to prevent precipitation by potash, boiling the potash solution with phosphorus and then drying the precipitate in a stream of hydrogen. The remainder of the journal is devoted to the usual abstracts from other journals, British and foreign.

Poggendorff's Annalen der Physik und Chemie, No. 2, 1874.—In the commencing paper, by M. Hermann Herwig, it appears demonstrated that the conducting power of mercury, for heat, is perfectly constant between 40° and 160°.—A continuation of Julius Thomsen's Thermo-chemical Researches treats of several agents of oxidation and reduction; and in the next paper, Dr. Röntgen discusses several points connected with M. Kundt's dust-figures (produced when a metallic plate, strewn with lycopodium, receives an electric spark): the dependence of the size of the dust-circle on the nature of the gas in which the discharge occurs; on the thickness of the lycopodium layer; on the distance of wire-point from plate; and on the kind of electricity that is in the plate. He also studies the mode of production of the figure, the nature of the discharge, and the phenomena to which Prof. Guthrie lately called attention.—The concluding portion of M. Braun's paper on elastic vibrations whose amplitudes are not infinitely small, is given. Various experiments were made with steel rods, and it is shown that the pitch of tone decreases if the amplitude increases, and that with high tones the influence of amplitude is greater than with low. The deadening is dependent on pitch of tone (being greater for higher tones), on amplitude (the influence of which is also greater the higher the tone), and on figure of vibrations (those in one direction being more deadened when there are simultaneous vibrations in the direction at right angles).—This article is followed by a translation of Prof. Roscoe's account of a self-registering instrument for meteorological measurements of light.—A paper by M. Friedrich C. G. Müller (first part) has for its subject galvanic polarisation, and the distribution of the current in electrolytes. The author's experimental plan was (1) to vary the section and length of a parallelipipedal electrolyte, and the size of the pole plates, and determine each time the resistance; (2) to insert metallic conductors of small resistance (*e.g.* thick copper-wire) in the long direction of the liquid conductor, but not touching the electrodes, and measure the increase of conduction; (3) to measure the current-density in different portions of any section by the electrolytic action taking place on a small plate brought to that part.—M. Avenarius has a paper On internal latent heat, in which he arrives at the conclusion that the temperatures (determined by direct observations) of the volatilisation of a liquid in a hermetically-closed space, perfectly agree with those calculated on the basis of empiric formulæ for internal latent heat. The experiments were made with ether, sulphide of carbon, chloride of carbon, and aceton.—Prof. Julius Kohn proposes a simplification of König's method of manometric flames, doing away with the membrane, and making the sound pass from the mouth of an organ-pipe, *e.g.* through a narrow glass tube, directly to the base of the flame (whose motions are mirrored in the revolving case, as usual).—In an article On the motion and action of glaciers, Dr. Pfaff describes some very delicate measurements he lately made on the Aletsch glacier, which seemed to prove that the progressive motion of the ice took place without any break. A minimum motion of 8 mm. per hour was observed at noon, and a maximum of 30 mm. about 5 P.M.; the latter being thus nearly four times the former. Dr. Pfaff also urges a number of considerations against certain theories of valley-formation by glaciers.—The only remaining paper is one On function of magnetisation of various iron bodies, by Prof. Stoletow, of Moscow.

Der Naturforscher, March.—In this number are described a series of experiments by M. Hansemann, who considers they demonstrate the production of a difference of temperature, in columns of air, by the attraction of the earth.—An account is given of recent observations by Dr. Boltzmann, on what he calls "dielectric action at a distance." If the hypothesis be correct (he argued), that in the molecules of an insulator, by electric forces, positive electricity is driven to one side and negative to the other, then an originally unelectrified, insulating body brought near one which is charged with electricity, must be attracted by it, simply through dielectric polarisation of the molecules, and without conduction; in fact, as a piece of soft iron is attracted to a magnet. Experiment confirmed this; and he determined, by his new method, the "dielectric constants" of several insulating substances.—We might here also call attention to M. Barthelemy's striking experiments in vibration forms, produced at the surface of liquids by means of vibrating tuning-forks. In square vessels containing mercury, systems of bright lines appear parallel to the sides, and the breadth of the waves is in inverse proportion to the number of vibrations. In this way is explained Prof. Tyndall's observation that many liquids are not set in wave-motion by vibrations. Such is the case when the breadth of the waves is greater than the breadth of the vessel; there can only then be a motion of the whole surface. The distance between two lines corresponding to the same pitch of fork is found to be independent of the density of the liquid. M. Barthelemy experimented also with round, three-cornered, and elliptical vessels, and on the rhythmical vertical flow of water from narrow orifices.—M. Spörer adduces evidence of the presence of ascending and descending currents in the atmosphere of the sun.—There are also, in the physical department, notes of Helmholtz's researches on galvanic polarisation in gaseous liquids, Lockyer's on spectrum analysis of metals, Tyndall's on conduction of sound through the atmosphere, &c.—In geology, we find a summary of M. Laube's late observations as to the evidence of a much more intense Ice-period in Greenland than the present; while M. Fuchs describes the geological formation of the region about Nizza, south of the Maritime Alps.—Two curious cases of mimicry in the Articulata are discussed in a note by M. Gerstaecken, who theorises on the nature of the general phenomenon; and there is, in the same section, a paper by M. Milne-Edwards, in which the colour of birds is studied in relation to their geographical distribution.—In botany, lastly, the following topics are treated; immigration of a rust fungus, *Puccinea malvaccarum* (from Chili); light and the regeneration of albuminous matter from asparagine; and the electrical phenomena in the leaves of Dionæa.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 30.—On Leaf arrangement, by Hubert Airy, M.A., M.D. Communicated by Charles Darwin, F.R.S. Received March 23, 1874.

The author is led to suppose:—

I. That the original form of leaf-arrangement was two-ranked.

II. That this original two-ranked form gave rise to forms with 2, 3, 4, 5, 6, 7, &c., ranks, by "sporting," as opposed to any process of accumulative modification.

III. That, of the orders so formed, those with an even number of ranks (except 2) have, as a rule, assumed a *whorled* arrangement, and those with two or an odd number of ranks have assumed an *alternate* arrangement, under the need of lateral accommodation of ranks in the bud (taken as type of close packed forms).

IV. That all these orders have been subject to vertical condensation, under the need of vertical economy of space in the bud (taken as type of close-packed forms).

V. (*a*) That such condensation operating on a 2-ranked or 3-ranked or 5-ranked alternate order $\left(\frac{1}{2}, \frac{1}{3}, \frac{2}{5}\right)$ has produced subsequent orders of series A $\left(\frac{1}{2}, \frac{1}{3}, \frac{2}{5}, \frac{3}{8}, \frac{5}{13}, \frac{8}{21}, \frac{13}{34}, \frac{21}{55}, \frac{34}{89}, \frac{55}{144}\right.$ &c.$\left.\right)$.

(*b*) That condensation of a 7-ranked $\left(\frac{2}{7}\right)$ or rarely of a 3- or 4-ranked $\left(\frac{1}{3}, \frac{1}{4}\right)$ alternate order has produced subsequent orders of series B $\left(\frac{1}{3}, \frac{1}{4}, \frac{2}{7}, \frac{3}{11}, \frac{5}{18}\right.$, &c.$\left.\right)$

(*c*) That condensation of a 9-ranked $\left(\frac{2}{9}\right)$ or rarely of a 4- or 5-ranked $\left(\frac{1}{4}, \frac{1}{5}\right)$ alternate order has produced subsequent orders of series C $\left(\frac{1}{4}, \frac{1}{5}, \frac{2}{9}, \frac{3}{14}, \frac{5}{23}\right.$, &c.$\left.\right)$.

(*d*) That condensation of a 4-ranked whorled order (whorls of two) has produced successive orders of series *a*, with spirals in sets of 4, 6, 10, 16, 26, 42, &c.

(*e*) That condensation of a 6-ranked whorled order (whorls of three) has produced successive orders of series *β*, with spirals in sets of 6, 9, 15, 24, 39, &c.

(*f*) That condensation (if any) of an 8-ranked whorled order (whorls of four) would produce successive orders of series *γ*, with spirals in sets of 8, 12, 20, 32, &c. Higher numbers of ranks would lead to higher series.

The Structure of the Mucous Membrane of the Uterus and its Periodical Changes, by John Williams, M.D., Assistant Obstetric Physician to University College Hospital. Communicated by Dr. Sharpey.

On the Improvement of the Spectroscope, by Thomas Grubb, F.R.S.

The author refers to a statement appearing in the "Astronomical Notices" for March, viz. that the spectral lines can be rendered perfectly straight, simply by returning them (after their first passage through a series of prisms arranged for minimum deviation) by a direct reflection from a plane mirror; and further, that this has been accomplished in a spectroscope in construction for the Royal Observatory. He then shows reasons for doubting the accuracy of this statement.

The remedy, or means of producing straight spectral lines, which the author has alluded to is simply that of constructing the "slit" with curved edges instead of rectilinear. There is but little practical difficulty incurred in construction and no apparent objection to its use. It may be objected that for such variation of prism power in use there should be a special slit. It is, however, only in spectroscopes arranged for high dispersion that the curvature becomes objectionable; in such there is seldom a change required, and a single slit of medium balancing power would probably remove all practical difficulty or objectionable curvature of the lines. The author has found by trial, that when two compound prisms were in use, giving a dispersion from A to H of nearly 14°, that the spectral lines were straight in a field of one degree when the radius of curvature of the slit was made 1·25 inch.

Zoological Society, May 5.—Dr. E. Hamilton, vice-president, in the chair.—The secretary read a report on the additions that had been made to the Society's Menagerie during the month of April 1874, amongst which were a Vigne's Sheep (*Ovis vignii*), presented by Capt. Archibald; a white-cheeked flying squirrel (*Pteromys leucogenys*), presented by Mr. A. Gower; a new kangaroo (*Halmaturus luctuosus*), deposited by Sig. L. M. d'Albertis, and four bladder-nosed seals, presented by Capt. D. Gray and Capt. Alexander Gray.—Mr. Sclater made some remarks on the cassowary, living in the Society's Gardens, hitherto called Kaup's cassowary, which, it appeared, ought to bear the name *Cassuarius papuensis*.—Mr. Sclater announced that H.M. Government had consented to send a Naturalist to Kerguelen's Land to accompany the Astronomical Expedition shortly proceeding there, and that the Rev. A. E. Eaton had been selected by the Royal Society for the post.—Mr. Blandford exhibited and made remarks on a series of heads of the Ibex of Persia, which he considered to be referable to *Capra ægagrus*.—Mr. A. H. Garrod read a paper on the anatomy of the Columbæ, in which a new arrangement of that group of birds was proposed, based upon certain points not hitherto sufficiently investigated.—A communication was read from Dr. Julius Haast, containing the description of a new species of *Euphysetes* (*Euphysetes pottsi*), a remarkably small catodont whale, which had occurred on the coast of New Zealand.—A communication was read from Mr. Frederick Moore, containing a list of Diurnal Lepidoptera collected in Cashmere by Capt. R. B. Reed, 12th Regiment, with descriptions of new species.—A communication was read from Mr. A. G. Butler, containing a complete list of the known Diurnal Lepidoptera of the South Sea Islands.—Mr. Howard Saunders read a paper on the Grey-capped Gulls, in which several species hitherto confounded were distinguished.—A paper was read by Dr. A. Günther, F.R.S., entitled A contribution to the fauna of Savage Island, in which several new lizards peculiar to the island were discribed, and other animals found in it were mentioned.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the sixth part of his "Contributions to a General History of the Spongiadæ."—Mr. R. B. Sharpe read a paper on a small collection of birds made in Bulama, one of the Bissagos Islands, West Africa, by Lieut. Bulger.

Chemical Society, May 7.—Prof. Odling, F.R.S., president, in the chair.—A paper On the action of ammonia on phenylic and cresylic chloracetamide, was read in French by the author, Dr. D. Tommasi.—Researches on the action of the copper-zinc couple on organic bodies; Part VII. On the chloride of ethylidene and ethylene," by J. H. Gladstone, F.R.S., and A. Tribe, F.C.S. The authors find that these two isomerides behave differently when treated with the couple, the latter splitting up into ethylene and chlorine, whilst the former gives zinc chlorethylate, $\left.\begin{matrix}C_2H_5O\\Cl\end{matrix}\right\}$ Zn.—Mr. Charles E. Groves then read a note On the preparation of ethyl chloride and its homologues. He finds that when hydrochloric acid is passed into a boiling solution of zinc chloride in alcohol, the latter is completely converted into ethyl chloride; other alcohols, such as the methylic and amylic, under similar treatment yield the corresponding chlorides.—On a new mineral from NewCaledonia, by Mr. A. Liversidge.

Geological Society, April 29.—John Evans, F.R.S., president, in the chair.—The following communications were read:—On the Gault of Folkestone, by F. G. H. Price. The author divided the Gault into two great sections, Upper and Lower Gault, which he again subdivided into eleven well-defined zones, mostly named after characteristic ammonites. Each of these zones or beds is numbered, commencing with No. XI., the zone of *Ammonites interruptus*, which bed forms the base of the Gault, reposing upon the Folkestone beds of the Upper Neocomian. He found the thickness of the deposit at Copt Point to be 99 ft. 4 in.—On the Cretaceous Rocks of Beer Head and the adjacent cliff-sections; and on the relative horizons therein of the Warminster and Blackdown fossiliferous deposits, by C. J. A. Meyer. The author remarked that in advancing westward from the Isle of Wight the cretaceous rocks diminish steadily, although unequally, in thickness, and change slightly both in mineral character and fossil contents, while the base of the series rises gradually in the cliff-sections. The chalk-cliffs of Beer Head, the most westerly chalk promontory in England, owe their preservation, in his opinion, partly to a local synclinal arrangement of the strata. The cretaceous rocks of the district include the following, in descending order:—

Upper Chalk (in part)?
Medial Chalk.
Lower Chalk.
Chalk Marl.
Chloritic Marl.
Upper Greensand.
Gault.
(?)

Royal Astronomical Society, May 8.—Sir G. B. Airy, vice-president, in the chair.—Prof. Otto Struve read a paper On the irregularities in the proper motion of Procyon. He said that last year Prof. Auwers of Berlin had expressed grave doubts as to the possibility of the minute companion of Procyon being sufficiently large to account for the observed irregularities in the motion of the principal star; he had calculated that it would be

necessary to assume for Procyon a mass eighty times as great as that of our sun, and for the perturbating companion a mass at least five times as great as that of our sun. He had further calculated that if the minute companion were the perturbating body, it should, at the beginning of this year, occupy a position-angle 9° or 10° greater than that occupied by it last year, whereas if it were only a small star, situated in the neighbourhood, the observed proper motion of Procyon would carry it forward so as to diminish the position-angle of the companion by about 4°—on recently examining Procyon he had found that the companion had moved forward during the year from a position-angle of 87½° till it now occupied a position-angle of 96°. He was therefore disposed to think that there could now no longer be any doubt that the minute companion is the perturbating body, which accounts for the irregularities in the motion of the primary. —Mr. Glaisher gave an account of some MS. volumes of twelve figure-logarithms which have recently been presented to the Society by the executors of the late Mr. Thompson of Greenock, the table of logarithms of numbers extends as far as 120,000. No account has been left of the way in which Mr. Thompson obtained the logarithms of the prime numbers, but from internal evidence Mr. Glaisher was inclined to think that they had been independently calculated. He attached great value to the manuscripts. No table of twelve-figure logarithms has as yet been published. Mr. Glaisher estimated that the cost of printing these tables would be about 1,000*l*.

Royal Microscopical Society, May 6.—Charles Brooke, F.R.S., president, in the chair.—A paper by Dr. Anthony, On the suctorial organs of the blow-fly was read to the meeting. The paper suggested that the so-called pseudo-tracheæ were really sucking or pumping organs.—A paper was read by Mr. Slack On certain silica films artificially produced, in which the results of a number of interesting experiments and observations were detailed; and Mr. W. T. Read communicated to the meeting the results of similar researches, in which he had recently been employed.—A paper by Dr. Royston-Pigott was taken as read, On the use of black shadow markings, and on a black shadow illuminator.

Entomological Society, May 4.—Sir Sidney Smith Saunders, president, in the chair.—Mr. Butler exhibited an example of arrested development in a Peacock butterfly caused by the tail of the pupa having become detached during the process of emerging, the right wings being completely developed, whilst those on the left side were not developed at all, the pupa case remaining attached to the left side of the body of the butterfly.—Mr. W. C. Boyd exhibited specimens of *Solenobia inconspicuella*, taken in St. Leonard's Forest, and amongst them a specimen of a remarkably pale colour, which might possibly be an Albino variety; but it had a very different appearance from the ordinary form.—Mr. Boyd also exhibited some leaves of the common Comfrey (*Symphytum officinale*), gathered at Cheshunt, the undersides of which were found to be completely covered with specimens of *Brachycentrus sub-nubilus*. All were said to be males, but on close examination a single female specimen was discovered amongst them.—Mr. C. O. Waterhouse read a note by Dr. Lamprey, Surgeon-Major 67th Regiment, On the habits of a boring beetle, one of the *Bostrichidæ*, found in British Burma. It belonged to the genus *Sinoxylon*. Dr. Lamprey did not know the name of the tree on which it was found; but he described the insect as making a small hole in a stem that was about ½ in. in diameter; and by devouring the wood completely round, severed it with a clean cut, so that it was only kept together by the thin outer layer of bark, the first gust of wind snapping off the weakened branch. The beetle turned on its side while boring, its back being towards the bark, and in this way its form appeared to adapt itself to the circumference of the stem.

PARIS

Academy of Sciences, May 4.—M. Bertrand in the chair.—M. Jamin presented a communication on the depth of the magnetised layer in a steel bar. The author announced as the result of his experiments that in a thick steel bar there is no magnetisation in the centre, and that the elemental bars composing the magnet do not begin to appear till 3 or 4 millimetres from the surface, but become more and more numerous and contracted against the free surface. Study of and experiments upon the metallic sulphides, by M. Berthelot, a continuation of former thermo-chemical researches.—Observations on the fecundation of the urodelous batrachians, by M. Ch. Robin. The fecundation of the oviparous urodelous batrachian (*Siredon, Triton*), like that of the *Anoura*, is internal.—Observations concerning a recent communication by M. Faye relating to a calculation by Pouillet of the cooling of the solar mass, by M. A. Ledieu. The author has arrived at a result not quite in accordance with that obtained by M. Faye in his recent calculations.—M. Favre presented the continuation of his researches on hydrogen. The condition of this gas when absorbed by palladium and by platinum black is in no way comparable in these two cases. In platinum black the condensed gas is not chemically modified, but in palladium it undergoes an allotropic modification before combining with the metal. The author in concluding called attention to the importance of thermic measurements of chemical phenomena; notably of the allotropic changes of bodies.—On the action of distilled water on lead by M. Is. Pierre. Water condensed in a leaden worm was found to contain about ·000375 grms. of Pb. per litre.—Report on the apparatus intended for the operation of the transfusion of blood, presented to the Academy by MM. Moncoq and Matthieu.—On the illumination of opaque bodies by neutral or polarised light, by M. A. Lallemand. —Determination of clay in arable soil, by M. T. Schlœsing.—On gravitation, cohesion, and the distances of the centres of molecules, by M. G. West.—M. Ad. Chatin presented a continuation of his researches on "organogenesis compared with androgenesis in its relations with natural affinities." The classes treated of were Polygalaceæ and Æsculinaceæ.—Influence of vernal heat on *Phylloxera vastatrix*, by M. M. Cornu. The insect changes from brown to bright yellow and becomes larger. —On the integrals of the differential equations of curves which have an even polar surface, by M. l'Abbé Aoust.—Phenomena observed on Jupiter's satellites, by M. C. Flammarion. The author's observations lead to the hypothesis of the existence of an atmosphere surrounding the second and third of the planet's satellites.—On the reflecting power of flames, by M. J. L. Soret. Experiments have shown that carbon preserves its reflecting power at very high temperatures, thus confirming Davy's theory of the luminosity of flame, since a ray of sunlight reflected from a bright flame is polarised in precisely the same manner as when reflected from non-luminous smoke.—Study of the properties of explosive bodies, by M. F. A. Abel. Third memoir.—Note on a process for determining phosphoric acid, by M. F. Jean. Influence of the presence of nitrogen in the textile fibre on the direct fixation of the aniline colours, by M. E. Jacquemin—On the physiological phenomena observed in the high regions of the atmosphere, by M. Barral.—On the study of the fumeroles of Nisgros and of some of the products of the eruption of 1873, by M. H. Gorceix—Partial resection of the calcaneum; absolute anæsthesia produced by an intravenous injection of chloral; immediate cessation of anæsthesia after the operation by the application of electric currents, by M. Oré.—On the mechanical aptitude of horses, by M. A. Sanson. —On the occurrence of a Cycada in the Miocene deposit of Koumi (Eubée), by M. G. de Saporta. This insect (*Encephalartos gorceixianus*) is the first fossil Cycada that is capable of being referred without anomalies to a living genus. The discovery enables the author to affirm that a Cycada belonging to a genus now confined to South Africa inhabited Miocene Europe: in the same manner this region supported at a somewhat later period the African type of rhinoceros, giraffes, and antelopes, thus giving greater probability to the hypothesis of a union between Austro-oriental Europe and Africa, during the Miocene period.

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