THURSDAY, DECEMBER 9, 1875

SCIENTIFIC AGRICULTURE

FARMING is a complex business. It embraces a greater variety of objects and interests than any other industrial pursuit. Its two great ends are the production of crops and the production of animals. It is among the oldest occupations of man. Its history has been very peculiar. In our own day the system of farming pursued by the great bulk of occupiers of land is far behind the state of agricultural knowledge ; and many of the practices of the most enlightened of our farmers are based on empirical data. Various agencies have been proposed for promoting agricultural progress. For the instruction of the mass we must look chiefly to the diffusion of agricultural knowledge through the medium of ordinary schools and colleges, as was pointed out some time ago in NATURE. For further progress in the acquisition of accurate knowledge we must look chiefly to experimental investigations.

In Germany they have had in operation for some years a number of experimental stations which are partly supported by the State, and which are said to work satisfactorily. France and other European countries are following the example of Germany. Recently the subject has been ventilated in Great Britain. It has been forced on our attention by a number of persons who are seemingly desirous of giving to the farmer every aid which science can suggest.

British experience of experimental stations is very limited. We happen to have one at Rothamstead in England, which was described in NATURE last year, and which we owe to the enterprise of Mr. John Bennett Lawes, F.R.S., the great manure manufacturer. He has for upwards of thirty years used a part of his estate for experimental purposes. He has published the results in a vast number of papers. The whole is the work of the man himself. He has had no aid from the Government or any agricultural society, and no advice from any committee or public body. He has obtained a larger body of facts in relation to manures and cropping, and the feeding of animals, than all the agricultural societies in the empire put together. It is manifestly desirable to dwell on his labours and to contrast them with the more public system projected elsewhere.

To Mr. Lawes' experiments I hope to be able to devote another paper before long. For the present I shall merely draw attention to the circumstances on which, in my judgment, the success which has attended his labours has depended. Mr. Lawes has not had an unqualified success, especially in drawing inferences from his facts. But his writings afford ample evidence of great earnestness of purpose. His manly, outspoken language shows that he loves truth for its own sake. He has had ample resources ; and he has had the motive of self-interest, as well as love of knowledge, to stimulate him in his investigations.

Here, then, we have a private individual who, unaided by the State, or by any scientific body, has made a greater number of useful experiments than all the experimental farms of European Governments put together. Had the British Government established experimental stations before Mr. Lawes commenced, would he have established his ? And if not, would British agriculture have derived more useful results from the governmental stations than from his ?

These are questions which cannot be answered by direct evidence. We possess, however, data which enable us to throw light upon them. It is notorious that the agriculture of Scotland has made great progress within the past one hundred years. The improvement of agriculture within that period has been greater in parts of Scotland than in any part of England. Yet the demand for means of effecting further progress is greater among the most advanced farmers of Scotland than among the most advanced English farmers. There is no man in Scotland who has come forward, or offers to come forward, to do for Scotland what Mr. Lawes has done and offers to do for England. The friends of agricultural progress in Scotland are endeavouring to effect, by co-operation, what the private enterprise of Mr. Lawes is doing for England. The subject has been discussed in English agricultural classes, more or less, for several years. The discussion has during the past few weeks assumed a practical shape to which it may be useful to refer. A member of the Council of the Royal Agricultural Society of England, Mr. Randell, desires to "prove, by a series of experiments, under every variety of soil and circumstances, how far the accuracy of the estimated value of manures obtained by the consumption of different articles of food as given by Mr. Lawes, is confirmed by practical results." Mr. Randell was supported by the Earl of Lichfield and Lord Vernon, and the matter was referred to the Chemical Committee of the Society. Mr. Randell has so far confined himself to one point, which has been suggested to his mind by the passing of the Agricultural Holdings Act of 1875. If one or more stations be established, the experiments would of course cover a wider field. The question arises at once, how are the experiments to be directed ? Could Mr. Lawes be induced to act as Director-General ? He could be assisted by a representative council. In due time the best man to succeed him would appear.

In Scotland the movement has of late been agitated with energy and intelligence. The Royal Agricultural Society of that country, better known as the Highland Society, has a large surplus fund, and contains among its members the leading gentry, many enlightened professional men, and a great array of intelligent farmers. It has been suggested that some of this fund should be applied to the maintenance of experimental stations. Several reports and suggestions have been made. It is said that a sum of 700*l.* a year, and no more, is available for the purpose.

One of the reports goes on to state that "considering the advantages which had already been derived from chemistry in its application to agriculture, it was expedient to reorganise a chemical department under the cognisance of the Society, for the purpose of conducting investigations on all subjects relating to agriculture ; and that in connection therewith a series of carefully conducted experiments in the open ground be instituted." The directors found that the Society had at its disposal, for the purpose of the chemical department and field experiments, a sum of 700*l.*, which they recommended should be set aside for a period of seven years. In

carrying out these recommendations they suggested that the 700*l.* should be expended as follows:—"Chemist's salary, 300*l.*; agricultural inspector's salary, 150*l.*," &c.

The report must render it plain to anyone who has had experience in experimental work of the kind contemplated that this part of the recommendation is based on imperfect knowledge. What evidence is there in the history of the Society, or elsewhere, which goes to show that the best man to initiate and conduct investigations on all subjects relating to agriculture should be a professional chemist? Such a man should have a good general knowledge of all the sciences relating to agriculture. He should be well known as a man of broad views and great grasp of mind. He should, moreover, be thoroughly conversant with the details of modern agriculture. He should have given evidence of being imbued with an ardent desire to elicit truth, as well as of his taste and fitness for conducting experiments. We submit that a really good chemist, possessing all these qualifications, can seldom be found. If he exists in Scotland, let him by all means be made director of the proposed station or stations; not, however, because he is a chemist, but because he is the best man. There are many chemists who would doubtless be glad to accept such an appointment, and who would be as unfit for it as for the direction of the Channel fleet. It seems incredible that any body of thoughtful men would propose to trust the initiation and direction of experiments on crops and animals to a man who would not necessarily know anything of the habits of either.

A most peculiar part of the report of the committee to which the Highland Society referred the consideration of this question is the remuneration (150*l.* a year) they propose for an agricultural inspector. If the views of the committee were acted on, the *bonâ fide* value of the experiments would depend on this officer. He should be an accomplished agriculturist. He should possess great intelligence, the highest personal character, and the most rigid love of truth, as well as the sternest sense of duty. He would be expected to initiate experiments from which results of national importance would flow. And this is the man for whom the munificent sum of 150*l.* a year is proposed! If a man like Mr. Lawes were to undertake the duty, he would accept no remuneration. In this case 150*l.* a year may be a fair sum to cover travelling and other expenses. But if a competent man is to be employed who cannot afford to work gratuitously, a salary equal to that of the average of intelligent professional men must be offered. This part of the Report has been already denounced in strong and emphatic language; and we understand it has been opposed by leading members of the Society who value science and appreciate the work to be done. The action of the committee has been openly exposed by Mr. David Milne Home, an ardent advocate of the application of science to agriculture, and by Mr. John Wilson, of Eddington Mains, a truly enlightened farmer. These gentlemen contend that the directing head or body should have the power to call in the professional aid of the best chemist or chemists, and such other experts as may be needed. This view is based on common sense. If they prevail in the councils of the Society, we may expect to see ere long in Scotland agricultural stations which in all human probability will give a new stimulus to agricultural progress. If they fail, and the work is entrusted to men who are not in every way equal to it, we may get an annual crop of worthless or misleading results, like those which have formed so large a portion of our agricultural literature.

While the Royal Agricultural Society of Scotland is discussing these matters, a local Agricultural Association formed in Aberdeenshire has actually fixed sites for five stations, at which experiments will be conducted for three years. The Marquis of Huntley is president of the Society, and Mr. Barclay M.P., is among the active members. A sum exceeding 1,000*l.* has been already subscribed. For the present the experiments will be confined to the determination of the best states in which to apply phosphates and nitrogen. Each plot is to be 1-112th part of an acre. It is to be regretted that potash and one or two other constituents of plants will not be tried. In some respects the scheme devised by the Association corresponds with that which I have carried out at Glasnevin for several years, and the results of which I have not, owing to pressure of other work, been able to publish. In the Glasnevin experimental ground the several crops are crossed by the manures; and thus we bring out the results in a striking way, and guard against inequalities in the soil. We also raised three consecutive grain crops without manure before commencing the experiments.

THOMAS BALDWIN

THE NEW GEOMETRY

Syllabus of Plane Geometry (corresponding to Euclid, Books i.-vi.) Prepared by the Association for the Improvement of Geometrical Teaching. (London: Macmillan, 1875.)

THE readers of NATURE are so well acquainted with the genesis and growth of the Association whose syllabus has recently been given to the public, that we are relieved from all necessity of explaining what objects it has in view. The main result of its five years of labour is this Syllabus, and we shall here briefly exhibit some of its chief features. It is a double syllabus, being a syllabus of geometrical constructions and a syllabus of plane geometry. The former is very brief, and contains such constructions as can be made with the ruler and compasses only. This subject of constructive geometry has been tried in many schools of late and has been found generally to answer the end in view. Boys thus obtain some idea of the objects of pure geometry and of what is involved in the postulates of the science. The more important syllabus is prefaced by a Logical Introduction—not that the Association wishes "to imply by this that the study of geometry ought to be preceded by a study of the logical independence of associated theorems." The opinion of the compilers is "that at first all the steps by which any theorem is demonstrated should be carefully gone through by the student, rather than that its truth should be inferred from the logical rules here laid down. At the same time they strongly recommend an early application of general logical principles." The President, in one of his addresses, states that the object of this introduction is "to guide the teacher immediately, and the student ultimately." It contains certain general axioms (as the whole is greater than its part), and taking as its typical theorem, if A is B

then C is D, it explains what is meant by its *contrapositive* (if C is not D, A is not B), by its *converse* (if C is D, A is B), and by its *obverse* (if A is not B, C is not D). This last term we have heard strongly condemned; it was substituted (see Fifth Annual Report) for the more usual term *opposite* on the ground that, in logic, two opposite propositions cannot be true together. The terminology, however, to our mind, is a matter of no great consequence. For proving converse theorems frequent use is recommended in the work of a "Rule of Identity" here given, *i.e.* if there is but one A and but one B, then if A is B, it necessarily follows that B is A. (De Morgan's illustration is given in Wilson's Geometry.)

The *Straight Line* is the subject of Book i., and takes up five sections, Angles at a point, Triangles, Parallels and Parallelograms, Problems, and Loci. Here, in the definitions, we have two difficulties to meet, What is a *straight line?* what is an *angle?* The former is defined to be "such that any part will, however placed, lie wholly on any other part if its extremities are made to fall on that other part." The latter is stated to be a "simple concept incapable of definition;" its nature, however, is explained and illustrated in some detail. Parallel straight lines are defined as in Euclid, and Playfair's axiom is Axiom 5. Theorem 21 (Euc. i. 27) is proved as the contrapositive of Theorem 9 (Euc. i. 16); Theorem 22 (Euc. i. 29) by Rule of Identity, using Axiom 5. Book ii. treats of *Equality of Areas* (Theorems, Problems); Book iii. is on the *Circle*. Here a novelty is the treatment of Tangents in two sections, directly, then by the method of limits. Some, if not all, of De Morgan's suggestions ("Companion to British Almanac, 1849) on this subject have been adopted here. The Syllabus so far is not a novelty to many of our readers. Those possessed of Mr. Wilson's "Elementary Geometry" (3rd edition) will know that he has in the main, if not altogether, adopted the lines laid down in the Association's work, adding proofs in full, and much interesting illustrative matter. It hardly needs our saying that the method of superposition is freely used, and that alternative constructions are indicated.

We come now to Books iv. and v., which cover pretty much the same ground, except that in the former book we have the subject of proportion and its application treated in a thoroughly rigorous method, which is a simplification of Euclid's mode of treatment by multiples. In the latter book the same subjects are treated in a confessedly incomplete manner (for commensurables only) for the use of students whose capacities or time may be limited.

Similar figures, areas, loci, and problems complete Book v.

We shall conclude our notice by taking a few extracts from the report made by the committee appointed by the British Association "to consider the possibility of improving the methods of instruction in elementary geometry."

"It seems advisable that the requisite uniformity should be obtained by the publication of an authorised syllabus, indicating the order of the propositions, and in some cases the general character of the demonstrations, but leaving the choice of the text-book perfectly free to the teacher. . . . The committee recommend that the teaching of practical geometry should precede that of theoretical geometry, in order that the mind of the learner may first be familiarised with the facts of the science, and afterwards led to see their connection. With this end the instruction in practical geometry should be directed as much to the verification of the theorems as to the solution of problems. . . . It appears that the principle of superposition might advantageously be employed with greater frequency in the demonstrations, and that an explicit recognition of it as an axiom of fundamental assumption should be made at the commencement. . . . The committee think also that it would be advisable to introduce explicitly certain definitions and principles of general logic, in order that the processes of simple conversion may not be confounded with geometrical methods."

The Syllabus now published is under the consideration of this body of distinguished mathematicians, who will report upon its merits and discuss the advisability of giving it the authority of the British Association. In the mean time it will be of considerable service if teachers will practically test it for themselves, and make known their views of its adaptation or want of adaptation for the end proposed. We may remark that Def. 38 (when a straight line intersects two other straight lines, it makes with them eight angles, which have received special names in relation to one another) is not quite correct, for the three lines may cointersect, and then six angles only are formed. Introduce the words "in two distinct points" between "straight lines," and "it makes."

ESKIMO TALES AND TRADITIONS

Tales and Traditions of the Eskimo, with a sketch of their Habits, Religion, Language, and other Peculiarities. By Dr. Henry Rink. Translated from the Danish by the Author. Edited by Dr. Robert Brown. With numerous Illustrations drawn and engraved by Eskimo. (Edinburgh and London: Blackwood and Sons, 1875.)

DR. Rink is probably the greatest living authority on all matters connected with the Greenland Eskimo. The high value of his contributions to our knowledge of Greenland and its people is universally admitted. The English reading public, and English ethnologists especially, will no doubt be grateful to him for having put his "Eskimo Tales and Traditions" into an English dress. The translation is perfectly idiomatic and altogether creditable to the author.

Not the least valuable portion of the work is the introduction, treating of the Eskimo themselves, in which, in a few short chapters, Dr. Rink presents a succinct and clear statement of all that is at present known of these interesting people. For his present purpose Dr. Rink divides the Eskimo into seven groups, groups which, we think, have quite marked enough distinctions to be regarded as convenient for most other purposes; they are as follows:—1. The East Greenlanders; 2. The West Greenlanders; 3. The Northernmost Greenlanders or Arctic Highlanders of Sir John Ross; 4. The Labrador Eskimo; 5. The Eskimo of the Middle Regions, from Baffin and Hudson Bays to Barter Island, near the Mackenzie River; 6. The Western Eskimo, from Barter Island to the west and south; and 7. The Asiatic Eskimo.

Anything like national or tribal union, however, seems untraceable, although at various periods, no doubt, the small communities of particular districts have united against a common enemy. The only communities which Dr. Rink can trace as anything like permanent are—1. The Family, the tie which unites the various members of which seems to be very strong; 2. The Housemates, or inhabitants of a house; for generally, except recently in some parts of Danish Greenland, one house sheltered two or more families which necessarily had many things in common, and many mutual duties and obligations; and 3. Place-fellows, or the inhabitants of the same hamlet or wintering-place, among whom communism in certain matters was distinctly recognised. Dr. Rink describes with some fulness the principal laws with regard to property and gain which are recognised as regulating the life of these three divisions of the various Eskimo groups.

Dr. Rink is strongly of opinion that the Eskimo are an indigenous American people, who have been pushed northwards by the intrusive Indian tribes, who are frequently referred to in the Tales contained in the volume, under the name of "Inlanders." In the frequent reference to conflicts and other dealings with the Inlanders Dr. Rink finds a confirmation of his theory, but we think it would equally well support a theory which maintained that the Eskimo themselves are the intruders. We are inclined to think that the theory broached by Mr. C. R. Markham in the R.G.S. "Papers on Arctic Geography and Ethnology" (1875) is quite as consistent with all the facts as Dr. Rink's, if not more so. Mr. Markham adduces very cogent reasons for believing that at no very remote period the Eskimo entered America from Asia by Behring Straits, driven to do so by the pushing northwards of the hordes from Central Asia. We doubt if these Tales and Traditions will help us much towards a knowledge of the origin and early history of the Eskimo. Indeed we doubt very much if we have yet data sufficient to authorise us to pronounce with anything like confidence on the subject.

Woman with a Child in the amowt or hood (after present fashion). Godthaab.

The volume contains in all 150 Eskimo tales and traditions, some of which, however, are only fragments. They have been taken down from the recital of natives of South and North and East Greenland and of Labrador. A vast amount of material was thus collected, many of the tales being evidently variants of one original. This material Dr. Rink has redacted, "all the variations being most carefully examined and compared for the purpose of composing a text such as might agree best with the supposed original and most popular mode of telling the same story." For general purposes this method is, no doubt, quite satisfactory, but if these tales and traditions are to be of any service in enabling us to trace the origin of the Eskimo, the investigator should have before him all the supposed variations of the same original. By comparing these with each other, and with similar materials obtained from the Western and Asiatic Eskimo, and with the neighbouring Siberian and Indian tribes, we should think it not unlikely that some valuable hints might be obtained as to the Eskimo migrations. No one is more competent than Dr. Rink for such a task, if undertaken without prepossession in favour of any hypothesis.

The tales are roughly divided into ancient and recent The former may be regarded as the property of the whole

nation, and many of them Dr. Rink believes to be far older than a thousand years. Probably they originated when the Eskimo lived together before their migrations began, and while it is not unlikely that most of them took their rise in some actual incident, they have all evidently been much changed and elaborated by the introduction of the mythical and supernatural. The second class are limited to certain parts of the country, or even to certain people related to each other, "thus presenting the character of family records." But the recent, like the ancient, tales have all more or less of the mythical element in them, and indeed it is mainly from the tales and traditions as a whole that a knowledge of the elaborate and intricate Eskimo mythology has been obtained. The Eskimo have peopled the air, the earth, and the sea with a multitude of supernatural beings; they live as much in an unseen, but to them real and populous, world, as they do among the hard realities of their land and seas. It is very characteristic of them that they have placed their heaven where we have placed our "bad bit," as they call it in Galloway, under the earth, as being so much warmer than the ungenial sky, to which their wicked are condemned to freeze eternally. Of the comparatively modern tales a very few relate to the collision which took place in the fourteenth and fifteenth centuries between the Eskimo and the Icelandic colonists who had been settled in South Greenland since the eleventh century. One relates to two Eskimo who were taken to Europe by some of the early explorers of Greenland, and in both cases the mythical has been largely introduced, affording a good example of how these stories have grown, and show ing that while a basis of truth exists in the older stories, the older they are the more difficult it would be to get at it.

While many of the stories are really interesting, there is a great deal of sameness about most of them. Many of them relate to feats of strength, which, formerly at least, seem to have been much admired by the Eskimo. Indeed, it is evident that it was no uncommon thing among them for men to go through a regular and well-devised system of "training" in order to develop muscle and endurance. A large number of them relate to the means adopted by the people to carry on the struggle for existence both against the stern powers of nature that everywhere meet them and against the cunning and competition of their fellows. The satisfaction of revenge and spite form the subject of many, as also the sacrifices made by friend for friend and by the members of a family for each other. Altogether they show the Eskimo to be on the whole gentle, hardy, hospitable, capable of strong attachment, but often capriciously revengeful and spiteful, even to his dearest friend. There is very little of the tender element of love in these stories, an element which figures so prominently in the folk-lore of most other nations. These stories also show that the Eskimo have the poetic temperament in a very fair degree, though most of them are artless enough, and many of them quite objectless and tame in the result. They very frequently remind us of the Brownie tales of Scotland, and some fragments of poetry which Dr. Rink gives, have quite an Ossianic ring about them. The best complete stories are much too long to permit of our extracting one here, though the following short one is a fair example :—

"The inlanders and the coast-people in the beginning were friends. A servant-maid called Navaranak used to be sent out by the inlanders to the coast-people in order to fetch back *matak* (edible whale-skin), and in exchange brought them reindeer-tallow; but after a time she grew weary of this work, and resolved to free herself by making them enemies. For this purpose she told the inlanders that the coast-people were going to attack them, and to the coasters she asserted that the inlanders were making ready to invade them. At length she provoked the inlanders to such a degree that they resolved upon attacking the coast-people. They chose a time when they were well aware that the men had all gone out hunting, and, accompanied by Navaranak, fell upon the helpless women and children. In their fright some of the mothers killed their own children, but one woman who was pregnant fled down beneath the ledge; and when Navaranak was sent back by the inlanders to find her out, she promised her all she possessed not to betray her. Some also escaped by hiding themselves among the rocks, but all the rest were killed. When the men returned, those who were left alive ran down and told them what had happened; and on coming up from the beach to their houses and beholding all their dead, the men were almost desperate. When the time came for flensing and cutting up the whale, Navaranak did not arrive as usual; she seemed to have disappeared altogether. When summer had again come round, the men prepared a great many arrows, and set out for the interior to take revenge on the inlanders. On their way they called out, as was their wont, "Navaranak, come on; we have got matak for thee!" but no one appeared. Again they went on a good distance, and then repeatedly called out, "Navaranak," &c. And this time she answered the summons, and went up to them. On noticing their arrows, she was about to take flight. Reassuring her, however, they told her she had no need to do that. When she had ventured quite close to them, they asked her where her countrymen were to be found, and she said, "Further away in the interior of the country;" but now they made her fast to a rope, and dragged her along with them until she perished. At length they arrived at a very large lake, where the tents of the inlanders were pitched all around, and they saw people going out and in. But they waited till all had entered the tents, and then they made their attack. Arrows came flying from both sides; but those of the inlanders soon grew fewer in number, and the coast-people remained all unwounded. When they had done with the men, they went inside, killing women and children; and having thus satisfied their revenge, returned to their homes.

There can be no doubt about the scientific value of this addition to our Arctic literature. To anyone who wishes to have a succinct and trustworthy account of all that is known of the Eskimo, we could not recommend a better work. The tales themselves are perfectly novel, and many of them quite interesting enough and full of queer adventure to become favourites with omnivorous boyhood and even dainty girlhood.

The illustrations, all things considered, are creditable to the native artists who drew and engraved them. By the kindness of the publishers we are able to reproduce a specimen.

OUR BOOK SHELF

A Report on Trichinosis as observed in Dearborn Co. Ind., in 1874. By George Sutton, M.D., Aurora, Ind (Reprinted from the Transactions of the Indiana State Medical Society, 1875.)

THE literature of Trichinosis bids fair to become co-

extensive with that of all the other parasitic diseases rolled together. Whilst one can but admire the energy displayed by our Transatlantic brethren in turning every scientific discovery to practical account, we must at the same time observe that only a very few of the voluminous reports received by us from the various States contain matter sufficiently novel to demand extended notice at our hands. Dr. Sutton's report, admirable as it is in many respects, forms no exception to the general rule. By European helminthologists the recognition of Trichinosis in the human subject is no longer spoken of as a "recent discovery," seeing that Zenker, whose merit in this relation is supreme, diagnosed the "loathsome disorder" in 1860, whilst the antecedent steps in the chain of evidence were long previously established by Leuckart and Virchow (1859), Herbst (1850), and so on backwards, until we come to the date of the original discovery of the worm as a nematoid by Paget, and its subsequent description by Owen (1835). We may go even further back than this, and point to Wormald and Hilton's previous and independent recognition of the calcified trichina capsules, and also to their still earlier detection by Peacock (1828), to say nothing of the evidence in favour of Tiedemann (Froriep's *Notizen*, 1822). We must dissent altogether from the view expressed by Dr. Sutton, that Trichinosis probably caused "the ancient Jew to prohibit the use of pork" as food. On the other hand, we are glad to perceive that our author adds his testimony to the view previously taken by ourselves and others, that there is no connection between trichinosis and the so-called "hog cholera." In this regard Dr. Sutton would have done well to have consulted Prof. Verrill's various papers (*American Journal of Science and Arts; Report of Connecticut Board of Agriculture*, 1870), and, if possible to him, also, our own subsequent contribution on *Stephanurus* (NATURE, vol. iv. p. 508). Lastly, we can only remark that if Germans will not abandon their habit of eating "smoked sausages" they must expect to be trichinised. Clearly, the fault is their own.

T. S. COBBOLD

The Sea. By Jules Michelet. (London and Edinburgh: Nelson and Sons, 1875.)

MICHELET, as our readers know, wrote a number of works on subjects which suggest a scientific treatment—"L'Oiseau," "L'Insecte," "La Mer," and "La Montagne." The present volume is a translation of the third mentioned, and we believe that at least one of the others has been put into an English dress. These works can hardly be regarded as scientific, except in so far as Michelet seems to have taken laudable pains to acquaint himself, before writing, with some of the principal and especially the most interesting facts which science has discovered in connection with his various texts. For really the titles of his quasi-scientific works are only texts, or rather themes, round which he accumulates a vast variety of more or less appropriate facts, reflections, and word-pictures. He might indeed be regarded as the rhapsodist of science, a man of distinctly poetic or imaginative temperament, excited to enthusiasm by reflections on the facts furnished to him by science. Of course no one would think of resorting to Michelet's works to study any of the subjects he thus treats, but nevertheless his works have their uses from a scientific point of view, uses which we have often referred to in speaking of popular scientific works. "The Sea" will no doubt attract many English readers now that it is translated, and notwithstanding its rhapsodical nature it contains a very fair amount of really useful and trustworthy information concerning marine physics and marine life. But, as in his other works, Michelet skips about his subject on all sides, poses it in every possible attitude, sings about it from every possible point of view. The illustrations are charming, and the book as a whole is got up with great taste. The Messrs. Nelson have done well in publishing such a translation.

LETTERS TO THE EDITOR

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

The Dresden "Gorilla"

IT is a mere chance that I did not see the numbers of NATURE from Sept. 30 till to-day, and I therefore missed the note (vol. xii. p. 482) about the female chimpanzee of the Zoological Garden of Dresden, said to be a young gorilla. In my opinion there can be no question that this ape is not a gorilla. It is only a very fine specimen of a chimpanzee with a darker face than usual, it is true, but this is by no means sufficient in the present state of our knowledge to separate it specifically from *Troglodytes niger*. I only mention here the *one* characteristic referred to in NATURE—"the slight webbing between the fingers." There is no webbing at all between the fingers which deserves to be called so, and there is a fundamental difference from the hand of a gorilla, not only in respect to this characteristic, but also in respect to the proportion of the fingers to each other. The hand of the Dresden specimen is very long and slender; the hand of the gorilla, even of the young one, is known to be broad and short fingered. But there is a long series of reasons which clearly speak against the supposition that this specimen is a gorilla, and I really do not perceive how anyone can advance this opinion after a very insufficient inspection. It is not enough to say, "I take the specimen for a gorilla;" scientific reasons are needed, and that, too, from some one who really understands the question; it was at least very rash to come out with *this* gorilla. As soon as anyone of the supporters of the opinion that this chimpanzee is a gorilla shall have published *scientific* reasons, I will take occasion to report about it, and to discuss these reasons. Till then there is no reason whatever to go deeper into the matter, and to regard this ape as anything other than a *Troglodytes niger*.

The two specimens of Birds of Paradise, about which I wrote to you some time ago (vol. xii. p. 434), are now in the Zoological Garden of Berlin.

A. B. MEYER,
Director of the Royal Natural History Museum of Dresden

Dresden, Dec. 3

Dr. Stoliczka's Collection of Mammals

I SEND you an extract of a paper lately published in the *Journal of the Asiatic Society of Bengal* by Mr. W. T. Blanford, on the mammals collected by the late Dr. Stoliczka in Yarkand, &c., and have italicised one or two of the more important sentences. These show how the value of the fine collection has been materially reduced by the appropriation of the finest heads of ruminants, &c., after Dr. Stoliczka's death. The collection before its arrival in Calcutta was known to contain some splendid heads of *Ovis poli*, and other wild sheep, all of which were carried at the expense of the Indian Government from Yarkand over the Karakoram *viâ* Kashmir to India, a long and costly journey. The finest of these heads, it is well known, have passed into private hands, while the Government Museum in Calcutta cannot show a specimen of decent size. The whole should have passed intact to the above museum, and would have been there examined, and the duplicate specimens sent to the Indian and British Museums here in England. The extract from Mr. Blanford's paper tells its own tale, and I think it would do good to let the fact of the partial destruction of a valuable collection of an able naturalist be more widely known than to the few readers of the *Journal of the Asiatic Society of Bengal*. Every specimen in the collection was as much public property as the munitions in a Government store, and could not be disposed of by any member of the Government or mission.

Extract from the "Journal of the Asiatic Society of Bengal."
Vol. xliv. Part II., 1875.

"List of Mammalia collected by the late Dr. Stoliczka when attached to the Embassy under Sir D. Forsyth in Kashmir, Ladák, Eastern Turkistan, and Wakhau, with descriptions of new species. By W. T. Blanford, F.R.S., F.Z.S.

"The collections made by Dr. Stoliczka in Kashmir, Ladák, Kashgar, and Wakhau comprise a very fine series of Mammalia, the description of which has been entrusted to me by Mr. Hume, who has undertaken the general direction, besides a very large share in the details of a work intended to be a memorial of our

late friend. It is of course impossible to supply the place of the naturalist whose collections I shall do the best to describe, for with him has perished much knowledge of the habits and distribution of the animals, and although this want can be partially atoned for by the copious notes he has left behind, much unfortunately can never be replaced. . . . There is always more difficulty in procuring specimens of Mammalia than in collecting terrestrial animals belonging to most of the other classes of vertebrata and invertebrata, and this is especially the case with the larger forms. It is consequently not to be expected that the species represented will be more than a portion of those inhabiting the country. Still the collection is rich in some respects, and especially in kinds of rodents, and it adds largely to our knowledge of the fauna of Western Tibet and Eastern Turkistan. *The larger mammals, indeed, were originally better represented, but after Dr. Stoliczka's death many specimens appear to have been removed from the collection.* Such at least was the case with the ruminants. In a private letter which Dr. Stoliczka wrote to me, he told me he had sent twenty-two skins of wild sheep from Kashgar. Of these only eleven—seven males and four females—are now forthcoming, and not one of these has fine horns. There is not a single specimen of *Ovis poli* from the Pamir, the original locality, although I have reason to believe that Dr. Stoliczka brought away one head at least. Lastly, there are *skeletons* of wild sheep and ibex in the collection *of which the heads have disappeared.* It is highly probable that other specimens besides those of *Ovis poli* have been similarly made over to private individuals. The value of the collection has been seriously diminished by its being broken up, and the finest specimens distributed, before it had been examined," &c.

(True extract.) H. H. GODWIN-AUSTEN,
Superintendent Topographical Survey of India

Glands of the Cherry Laurel

IN NATURE (vol. viii., p. 245) Mr. Thiselton Dyer, in answer to a correspondent, says that he knows of no explanation of the purpose or origin of the nectariferous glands on the back of the leaf of the cherry laurel. Mr. Darwin ("Origin of Species," sixth edition, p. 73) says: "Certain plants excrete sweet juice, apparently for the sake of eliminating something injurious from the sap; this is effected, for instance, by glands at the base of the stipules in some Leguminosæ, and at the backs of the leaves of the common laurel. This juice, though small in quantity, is greedily sought by insects; but their visits do not in any way benefit the plant." Glands cannot be considered very complex modifications of cellular tissue. They exist on all parts of plants, and contain a great variety of secretions. Mr. Darwin and others have shown that they perform the varied functions of secreting nectar to attract insects to flowers, of secreting odorous matter for the same purpose, of absorbing ammonia from rain-water and the products of decomposed or digested animal or vegetable matter, and of secreting acids capable of digesting solids. The existence of free acids in the plant would be injurious to it, so that their excretion would be beneficial to it apart from any digestive function which they may in some cases perform. The glands of the laurel are so far unspecialised that they are by no means constant in number or size. As their attracting insects is of no service to the plant, the nectar must be said to be excreted; but, being what Sachs has termed (p. 629) a "secondary product of metastasis," it should be looked upon rather as a physiologically accidental excretion than as positively injurious, as a substance which, having ceased to take part in the processes of growth, has not acquired an indirect function as has the nectar of flowers. To account for the position of the glands it may be suggested that, as in other evergreens, the leaves of the laurel are "reservoirs of reserve material" in which metastasis, including the separation of the "formative materials" from the "secondary products," mainly takes place (Sachs, p. 627).

G. S. BOULGER

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Saw-fish inhabiting Fresh Water

I AM not aware if a curious fact connected with the lake near Manila has been noticed by any traveller.

The Laguna de Baij is a large sheet of water some ninety miles in circumference, divided by an island and two peninsulas, from which it is often spoken of as the "lakes." This lagoon receives the waters of the small rivers of the provinces of the Laguna and Morong, and its only outlet is the river Pasig, which flows into the bay between the military city and suburbs of Manila. The volume of water discharged by the Pasig is augmented by that of another river which joins the main stream some eight or nine miles from Manila, and during gales in the S. W. monsoon, which prevent the free egress of the water, the Pasig overflows and covers the flat land round Manila.

The water of the lake is quite fresh, and after settling, perfectly potable. At certain times the waters of the lake of Baij possess an urticating property which makes bathing very disagreeable from the irritation they produce. The natives (who account for everything in some way or other) attribute this to the Pistia, a plant which is so abundant as to fill up small bays and form floating islands of considerable size. Great quantities of this plant are carried down the river into the bay, and are seen sometimes a long way out at sea, killed and yellow from the effect of the salt water. Sections of the leaves are beautiful microscopic objects. The lake is separated from the Bay of Manila by a few miles of very flat land, and there can be little doubt that before this barrier was thrown up it formed part of, or at least communicated with, the bay. One proof that the waters were once salt is the existence of a bank of fossil oysters at the point of Julu-julu, some twenty miles from the outlet by the river. When this barrier was raised the waters of the lake became gradually fresh from the influx of those of a number of small rivers which drain the surrounding provinces, the only outlet for which (as before mentioned) is the river Pasig.

The peculiarity to which I have alluded is the existence of a species of small shark and numbers of Saw-fish (*Pristis*) in the perfectly fresh water of the lake. They are seldom or never met with in the river, but there is a fishery in the lagoon in which numbers of the latter are taken. The flesh is eaten, the livers give a good deal of oil, and the snouts of the larger specimens make very formidable weapons, which the natives use and which are at times sent down to Manila as curiosities. These saw-fish, now living in perfectly fresh water, have no doubt become gradually accustomed to the change, as has been the case with the marine species of Crustacea discovered by Prof. Lóven in the fresh water lakes of Sweden.*

I am unable to describe the sharks, which I think from the account given me are a small species of dog-fish, quite harmless. Very different, however, are a larger kind inhabiting the brackish water of the lake of Bombon, in which is situated the active volcano of Taal (south-east of the great lake, about twenty or twenty-five miles distant by road). This kind of shark is feared by the natives, who avoid bathing at points which they frequent.

Manila W. W. WOOD

Observations on Fish

IN May last the writer dug a tank within the premises at Garden Reach. About the end of July it was stocked with young fish of several kinds, among others a species of carp, called by the natives "Katlah," which abounds in the turbid waters of the Hooghly, within the range of the tides. The fry varied from half an inch to an inch in length, some even smaller. The "Kutlah" does not breed in fresh water, but attains an extraordinary size in a wonderfully short time in ponds. So very rapid has been the increase of the fish in question, that the fact seems worthy of chronicle in the pages of NATURE. On Sept. 22, the tank was swept with nets to catch one or two fish of the pike species that had been introduced accidentally with the others, and attained a size that rendered them dangerous to the fry of other kinds. In the net several dozens of the "carp" referred to were taken; one of the largest weighed 14 oz, and measured 11 inches from the end of the upper lip to the tip of the tail, 1¾ inches thick behind the shoulder, and 3½ inches in breadth; the others were only one or two ounces lighter.

The tank (pond) in which these fish throve so marvellously is only 65 feet long by 58 feet broad, and 13 feet deep. The natives, many of whom live within the compound, wash their rice and other food in the water, preparatory to cooking, furnishing the fish with a large amount of food. As the writer saw the tank dug and the fish put in, there cannot be a doubt about their increase in the short space of three months from small fry barely an inch long, to fair-sized fish 11 to 14 oz. in weight, measuring from 10 to 11 inches.

ROBERT U. S. MITCHELL

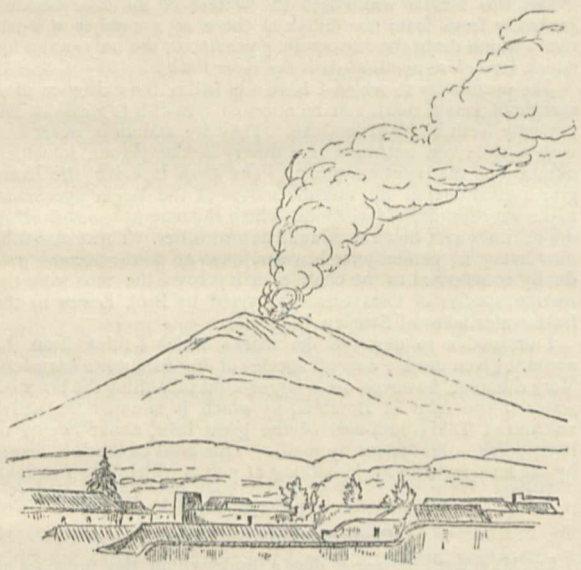
Misti and its Cloud

IN NATURE, vol. xii. p. 487, Mr. Stevenson gives an interesting example of the genesis of clouds, due to hills of about

* See NATURE, vol. i. p. 454.

900 feet high. Something similar is well known to the inhabitants of Arequipa, Peru. The city is built at the base of the extinct volcano "Misti," which rises above the plaza of Arequipa to a height of about 12,500 feet; Arequipa itself being over 7,000 feet above the level of the sea. It is not an uncommon occurrence (during the fall of the year, February and March) in the morning, from sunrise till about ten o'clock, to see a succession of clouds rolling along the summit from N.E. to S.W., much as if huge masses of white smoke were issuing from the extinct crater. These clouds are either suddenly shot upward by meeting the current from the S.W. and lost at a distance of from 30,000 to 40,000 feet to the eastward from the summit, or else, rolling over the summit, they are carried by the easterly breezes till they become absorbed by the dryer and warmer air of the region to the southward of Misti.

It must be remembered that between Arequipa and the sea, at a distance of not more than thirty miles, extends the great sandy desert of Islay, having an average breadth of about twenty-five miles, and before the days of the railroad the great terror of all travellers from the sea-coast to the interior. Of course the winds blowing across this desert (a part of the great rainless belt



of Peru) are greatly heated at all seasons of the year. The eastern slope of Misti, on the contrary, forms the edge of the elevated plateau extending for more than 150 miles to the eastern slope of the Andes, having an altitude of from 10,000 to 14,000 feet, and the amount of rain falling in this district is very great.

The formation of the cloud, seen from Arequipa on the summit only of Misti, is plainly seen from the railroad leading to Puno, which, after leaving Arequipa, makes a gigantic sweep northward round the Chacharni Mountains, and winds its way eastward behind Misti at a height of about 12,500 feet above the level of the sea. There I have several times seen masses of vapour, condensed into huge white clouds rolling along the slopes of Misti, travel up with great rapidity towards the summit, and either follow its crest as described above, or become at once reabsorbed on reaching the top. This shows plainly that the clouds seen from Arequipa are not due to volcanic action; the Indians also all agree in stating that there is no tradition among them of Misti having been active. I enclose a sketch of Misti and its cloud from a photograph obtained during my visit to Peru.

ALEXANDER AGASSIZ

Cambridge, Mass., Nov. 6

The Effect of Waves

IT is generally believed that at a moderate depth the influence of heavy waves ceases, and that during a hurricane all is quiet a few fathoms beneath the surface. If this be correct, why should a swell show such a marked increase in height when it rolls over the edge of soundings?

On the parallel of Cape Clear, in longitude 15° W., seamen are familiar with this phenomenon, although the depth is nearly five hundred fathoms; at times it is so marked that the dead reckoning may be checked by carefully noting the increase in the depth of the hollow of the waves. Shortly after the edge of soundings is passed the sea becomes more regular, and consequently less dangerous to deeply laden vessels.

Anyone who has watched during a moderate breeze the commotion of the water close to a quay wall can form a good idea of the ocean when it receives its first check against the Irish Plateau; the great waves twist around each other, run up and down in heaps, and then fall suddenly as if bereft, in a great measure, of their forward motion.

Again, it is a well-known fact that during a "norther" in the Gulf of Mexico the frailest vessels weather out the storm if they can cross the edge of the Campeachy Banks; a striking proof that at a depth of over fifty fathoms there is sufficient abrasion to destroy the force of the heaviest wave in a very effectual style. On one occasion the writer witnessed this remarkable fact by running from a turbulent sea into comparative smooth water in this locality.

On George's Shoals, off Nantucket, during a heavy gale, the New York pilots and masters of coasting vessels assert that sand is frequently left on deck after a sea has broken on board, although the depth of water may be twelve or fourteen fathoms. It must require an enormous amount of ebullition at the bottom to raise such dense matter to the surface through such a distance; for a cubic foot of ordinary sea-sand weighs about 100 pounds.

In this wild spot the tide, which frequently runs with a velocity of three miles per hour, would assist the lifting power of the wave if running counter to it. During a winter gale, when the strong springs are thus running, the confusion of the sea is indescribable, although the depth may be thirty fathoms. The shortness of the sea (*i.e.* the distance between the crests of the waves) on the banks of Newfoundland, where the soundings are from thirty to fifty fathoms, is noticed by all the navigators of the Western Atlantic, as it reduces the speed of an ocean steamer more than the heavier waves of deeper water with a similar force of wind will do. It is evident that this can only arise from the friction of the bottom, as the waves increase in height when deeper water is reached a short distance to the eastward.

In the Gulf Stream north of the Straits of Bemine, after a "norther" has blown a few hours, the surface of the sea is covered with lanes of weed, although only a few patches might have been seen before the commencement of the gale. As these lanes are often at a considerable distance from shoal water, which lies at right angles to the direction of the current and wind, it is evident they must have grown near the spot where they float, and been torn from their moorings by the mechanical force of the waves.

W. W. KIDDLE

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1605, Oct. 12.—Clavius, observing the solar eclipse of April 9, 1567, at its maximum, remarked "a narrow ring of light round the moon which he supposed to be the margin of the solar disc." Kepler, however, maintained that this could not be in reality a portion of the sun, because the moon's apparent diameter at the time must have been greater than that of the sun, and he concluded, as Prof. Grant relates in his "History of Physical Astronomy," that the sun must have been totally covered by the moon while the narrow ring of light was visible, a phenomenon again exhibited in the total eclipse of Oct. 12, 1605, which was observed at Naples. Of this eclipse Kepler says (De Stella Nova in pede Serpentarii)—"Accuratè rectum fuisse totum Solem, quod quidem non diu duraverit; in medio, ubi Luna, fuisse speciem quasi nigræ nubis; circumcirca rubentem et flammeum splendorem, æqualis undique latitudinis, qui bonam cœli partem occupaverit: E regioni Solis, versus Septentrionem, cœlum obscurum planè, et cum profunda nox est; stellas tamen non visas."

Adopting the same system of elements of the lunar motions, employed in previous calculations of past eclipses, the results of which have appeared in this column, we have the following elements of the eclipse to which Kepler refers:—

Conjunction in R.A. Oct. 12, 1605, at oh. 31m. 44s. G.M.T.			
R.A.	197°	41′	51″
Moon's hourly motion in R.A.		35	37
Sun's ,, ,, ...		2	19
Moon's declination	6	40	28 S.
Sun's ,, ...	7	31	33 S.
Moon's hourly motion in Declination ...		10	50 S.
Sun's ,, ,, ,, ...		0	56 S.
Moon's horizontal parallax		59	21
Sun's ,, ,, ...			9
Moon's true semi-diameter		16	10·4
Sun's ,, ,, ...		16	3·9

The sidereal time at Greenwich mean noon Oct. 12 was 13h. 24m. 10·9s., and the equation of time 13m. 29s. additive to mean time. The eclipse would be total and central with the sun on the meridian, in longitude 11° 18′ W., and latitude 52° 26′ N. For Naples, a direct calculation gives a total eclipse, the sun at an altitude of 31°. Beginning of totality at 2h. 18m. 18s., ending at 2h. 19m. 28s., mean time at Naples, or duration 1m. 10s., which appears to correspond fairly with Kepler's statement that the sun was "covered for a short time" only.

THE MINOR PLANETS.—M. Stephan, Director of the Observatory at Marseilles, announces the discovery of another small planet by M. Borelly, on December 1. Right ascension at midnight, 65° 31′; north polar distance, 66° 2′; motion towards north-east, thirteenth magnitude. Supposing all the recently detected minor planets to be new, this will be No. 157. The last circular of the "Berliner Astronomisches Jahrbuch," however, has a suggestion by Prof. Tietjen that No. 152, discovered by M. Paul Henry at Paris on November 2, may prove to be the same planet which was found by M. Borelly, 1868, May 29, and which received the name Dike. No. 152 passed the ascending node soon after noon on November 3, the geocentric longitude at the time being 41° 54′, and it was not far from opposition, which is so far favourable to the supposition of identity with Dike, with ascending node in 41° 50′ according to the most probable orbit that could be obtained from the short course of observations in 1868. Dike was estimated of thirteenth magnitude, yet in 1868 was observed within 10° from perihelion; in ascending node the planet would be less than 29° from aphelion; No. 152 is called eleventh magnitude, a difference, considering the respective orbital positions, which is adverse to identity. The unfavourable weather has prevented observations sufficient for a proper calculation of elements for No. 152. Should this planet prove to be identical with No. 99 (Dike), the numbers from 153 onwards will of course require to be diminished by one, and the actual number of small planets, including M. Borelly's late discovery, will stand at 156.

*THE MAMMALS OF YARKAND**

THE unfortunate death of the lamented naturalist, Stoliczka—one of the most promising members of the Indian Geological Survey—must be fresh in the memory of many of our readers. After a successful campaign in Yarkand in company with Sir D. Forsyth's late expedition, he did not live to return to India, but perished of exhaustion amongst the snows of the Himalayas. We are pleased to hear that his Indian friends have undertaken the preparation of a work intended as a memorial of him, which will embrace an account of the extensive collections of natural history amassed during his last journeys. Mr. W. T. Blanford has just issued a preparatory list of the mammals of which specimens were obtained in Yarkand and the adjoining countries. They are referable to forty-two species, mostly belonging to groups characteristic of the elevated districts of the Palæarctic region. No new types were discovered, but amongst the novelties are species of Field-voles, Hares, and Pikas (*Lagomys*), all very distinctive of the regions traversed by the expedition, and adding largely to our knowledge of the fauna of Western Tibet and Eastern Turkestan. The larger mammals were originally better represented, but after Dr. Stoliczka's death, many specimens appear to have been removed from the collection. Of a fine series of twenty-two wild sheep from Kashgar, only eleven are now left, and not one of these has fine horns. Moreover there remain skeletons of wild sheep and ibex in the collection, of which the heads have entirely disappeared. Mr. Godwin Austen has invited public attention to these unpleasant facts in another column of this journal. One would have supposed that in the case of a naturalist thus perishing in the performance of his arduous duties, no pains could have been too great to protect the specimens in procuring which he had sacrificed his life. On the contrary, however, advantage appears to have been taken of his untimely death to rob his collection of the choicest specimens. We can only trust that, attention having been called to the fact, restitution will be made, and the missing heads and horns promptly restored to the mutilated specimens now deposited in the Imperial Museum at Calcutta.

* "List of Mammalia collected by the late Dr. Stoliczka when attached to the Embassy under Sir D. Forsyth, in Kashmir, Ladák, Eastern Turkestaa, and Wakhau, with descriptions of new species." By W. T. Blanford, F.R.S., F.Z.S. (Journ. As. Soc. Bengal, vol. xliv. p. 105, *et seqq.*)

ARCHÆOLOGICAL RESEARCHES IN KENTUCKY AND INDIANA

IN January last Mr. Putnam laid before the Society of Natural History of Boston, U.S., an extended account of his recent archæological researches in Kentucky and Indiana, in which he had examined several rock-shelters, caves, mounds, and circular graves. He called attention to the numerous ancient fortifications in the Ohio valley, and gave a description of two which he had visited in Indiana. These fortifications are generally earthworks, many of them of great extent; but there have been several discovered in which immense walls of stone have been used, extending in one case to several hundred feet in length, and to nearly ten feet in height; whilst in another instance a wall about seventy-five feet in height had been erected to fill a gap in the otherwise nearly precipitous natural wall. The stones of these walls were simply laid, one overlapping another, so as to break joints, without cement of any kind. Mr. Putnam exhibited to the meeting a number of human skulls and other bones found under various conditions, and pointed out that while the skulls of the New England Indians were long and narrow and belonged to the *dolichocephali*, those from the mounds, the circular graves, the stone graves, and the caves were of the short, broad and high type, or the *brachicephali*. In the caves, however, there were two, if not three, classes of burials, and at least two well-marked forms of skull. The skulls he found in graves protected with slabs of stone were all of a form very closely resembling the high, short and broad crania of the mound builders; those of the numerous skeletons from the caves were characterised by the marked depression of the frontal bone and the equally marked concavity on the anterior part of the parietals; and the skulls from the circular graves were distinguished from the others by their decided width and shortness, and the more vertical occipital portion.

A series of shin-bones was also exhibited to show the various degrees of flattening, and to confirm the opinion of Mr. Busk and others that *platycnemism* cannot be taken as an important race character.

Of a number of circular graves which formerly existed on a hill near Glasgow, one, having escaped the plough, had been carefully opened. It was a circle about four feet in diameter, and had been dug to a depth of three feet, where a floor had been formed with pieces of shale brought from a distance of about a quarter of a mile

Around the circumference were placed upright slabs of limestone three feet high, and at least ten bodies had been lodged in the grave, arranged in a sitting posture with their backs against the slabs, and the hole had then been filled up. The teeth showed that the majority were of middle age, whilst the remainder included old persons and children still retaining their milk teeth. The limestone slabs projected a few inches above the present surface of the soil, so that if the grave had ever been covered with an earth mound the latter must have been removed, perhaps washed away. The only artificial object found was one solitary potsherd; hence there is no evidence to prove or disprove any speculation which may be indulged respecting the people whose burial-ground had been thus laid open in the interest of science. It is perhaps safe to conclude that all the bodies found in the grave were placed there at one and the same time.

The Salt Cave, near the Mammoth Cave, and rivalling it in the size of some of its branches, was difficult of access, on account of loose rocks which had fallen from the roof, and of a stream of falling water running off between them. Having effected an entrance, the descent of a steep hill of loose rock led into a large gallery several miles in length, the floor of which was covered with fallen rocks. Small areas were occasionally found, however, where no such masses presented themselves, but where fires had been kindled, and where small piles of stones had been raised around a small central hole having ashes and remnants of burnt sticks at the bottom; whilst on the adjacent rocks there were in some cases found small bundles of sticks tied with bark, and of a convenient size to be placed in the holes, thus indicating that they had been brought into the cave to be used as lights and as firewood.

Further on, in a small chamber never previously visited by a white man, there were seen on the cave earth the imprints of feet shod with peculiar braided mocassins or sandals. In some of the side chambers were found a great number of cast-off sandals, very finely made of the twisted leaves of some rush braided in a careful and artistic way. The manner of braiding was identical with that of the straw sandals from China, but the form of the sandal itself was different. About twenty-five of these sandals, of various sizes and of slightly varying designs, but all worn through at toe and heel, were found in the interior chamber of the cave.

A piece of cloth more than a foot square, and finely and regularly woven, probably from the inner bark of some tree, was also found, and was especially interesting from having been dyed or coloured with black and white stripes, and from having in one place been mended by darning.

Mr. Putnam also exhibited bunches of the bark used to make the cloth, and of different degrees of fineness; a number of pieces of bark, twine, and rope, some made of twisted strands simply, whilst others were of a five-strand braid and of a more pliable substance; a small piece of quite a delicate fringe or tassel of neatly braided fibres; a number of reed "torches," generally burnt at one end; a few small fragments of burnt wood, one of them showing the rough cutting of a flint axe; several fragments of a large gourd, of a species probably not indigenous; two flint arrow-points; a few fragments of shells of the *Unio*; and a few feathers of probably the wild turkey. All the specimens of cloth, &c. from Salt Cave were extremely brittle, and had only been preserved by saturating them with gelatine and afterwards mounting between glass. No bones or other relics indicative of the food of the cave people were found, nor was there any evidence of human interment, though the earth in one of the chambers had been disturbed; the state of Mr. Putnam's health, however, prevented him from making anything like an exhaustive examination. It is encouraging to know that it is intended to continue the work until more is ascertained of the archæology of this large group of important American caves.

The discovery, in 1812-15, of bodies buried with care in some of the caves of Kentucky and Tennessee, and of the numerous articles found with them, was alluded to by Mr. Putnam, who stated that since his return from Kentucky he had examined the body, and what remained of the very large number of articles found with it, that was so widely known as the "Mammoth Cave Mummy" sixty years ago. This body, in reality found in Short Cave, had been taken to the Mammoth Cave, eight miles distant, for exhibition. The relics had been sadly neglected, and many of the articles found in the grave had been lost and others had gone to decay; still enough remained, at the rooms of the American Antiquarian Society at Worcester, to identify the articles found in Salt Cave as the same in material, design, and structure as those found with the body in Short Cave, so that he had thus secured undoubted osteological characters to go with the articles of clothing, &c., of the Salt Cave people, and he thought that we could, with little doubt, class this people among the more highly civilised and agricultural of the prehistoric races of America.

*SCIENCE IN ITALY**

JUDGING from the number of scientific papers that we are in the habit of receiving from Italy, we are glad to infer that the restoration of political unity and freedom has also brought about a revival of that intellectual vigour which we are accustomed to associate with the names of Dante and Tasso, Galileo and Torricelli. When Italy was divided, and each State politically oppressed, her best men were in exile, and their best scientific work was expressed in a foreign tongue. Research was not only not encouraged, it was practically prohibited. It seems incredible, but it is nevertheless true, that the Austrian and Bourbon Governments, in their dread of novelty, would not allow the results of modern research to be taught in the schools. The text-books reproduced the exploded science of the past, in which the modern theory of dew, for example, was ignored; so that Melloni (whose best work was done in Paris, and its results published in French journals), in making a series of observations on the nocturnal cooling of bodies in the neighbourhood of Naples, wished to show that the laws of terrestrial radiation were the same in Italy as in countries where there was more political liberty. We have it on the authority of Matteucci, that he and others, when they revisited their native land, were placed under the surveillance of the police, not from the fear of their meddling with politics, but on account of the scientific reputation which conferred distinction upon them.

Under such circumstances science could not flourish, and the time has perhaps been too short since Italy recovered her freedom to enable her to do much more than revive the glories of the past, and to seek encouragement in the example of the great men who have gone before. Hence it is that in the papers before us, points are discussed in connection with objects of Italian discovery, such as the electrophorus and the condenser, in which old names are curiously mingled with new. Thus Beccaria, Œpinus, Priestley, Volta, and Avogadro are asso-

* "On Certain Principles of Electrostatics." A series of experiments. By Prof. G. Cantoni. "Su Alcuni Principj," &c. (Milan, 1873.)—"On Certain Controverted Points in Electrostatics." Note by the same. (Milan, 1873.)—"Important Observations of Beccaria on Electrical Condensers." By the same. Read before the Royal Society of Science and Literature of Lombardy, Feb. 20, 1873.—"On the Polarisation of Electrics." By the same. Read December 4 and 18, 1873.—"On the Limits of Resistance in Electrics." By the same. Read April 23, 1874.—"Experiments in Electrostatics." Parts 1 and 2. By the same. Read June 25 and Dec. 24, 1874.—"The Discoveries of Fusinieri; historical notes illustrated by an account of some of his instruments preserved in the Civil Museum of Vicenza." By G. Nardi. "Le Scoperte del Fusinieri," &c. (Vicenza, 1875.)—"The Theory of the Combination of Gases by means of Solids, as elaborated by Fusinieri, in 1824," &c. By G. Nardi. Read before the Academie Olimpica, 19th May, 1875. "La Teoria," &c. (Vicenza, 1875.)

ciated with Faraday, Tyndall, and a host of modern Italian physicists, whose names we are sorry to say are not so familiar to us. Prof. G. Cantoni's numerous papers, the titles of some of which are given in translation above refer to minute but interesting points in connection with the electrophorus and condenser, in which certain views of Beccaria (1769) and of Volta (1775) are revived and defended and connected with Faraday's theory of electrical induction and the action of the Holtz machine. The title at the head of our list refers, not to papers read before the Lombard Academy, as in the case of the last five, but to a neat little pamphlet which gives an account of forty-nine experiments, and the inference to be drawn from each one, and illustrated by a number of wood engravings representing the arrangement of the apparatus. One portion of the object of these papers is to confirm and extend Faraday's beautiful theory. Indeed, the subject, with the exception of the Holtz machine, has been so extensively investigated by Faraday, Snow Harris, and others, that we do not feel called upon to give an analysis of these ingenious papers. Among the instruments for estimating charge we miss the elegant scale beam electrometer, the hydrostatic electrometer, the electrical balance, the unit jar, and other instruments contrived by Harris and used by him with so much effect. Indeed, Harris's last work on "Frictional Electricity" (1867) seems to be unknown to the Italian physicists. In this work some of the points in question have already been considered experimentally.

Signor Nardi's first pamphlet is a curious exemplification of the dearth of original scientific research to which we refer. When men have but little of their own, they are proud of the wealth of their ancestors. We do not say this is wrong, although its expression sometimes takes an amusing form. Thus, our author, who is Director of the Royal School of Technology at Vicenza, in his visits to the museum of that town, frequently cast an admiring eye on certain cases that contained some of the apparatus of the physicist Fusinieri, who in his own day occupied a respectable position in science, and whose results, when true, have since been absorbed into the great body of science. Hence his name is not much known out of Italy; but, in his native town, his memory is naturally and very properly cherished; so that, when holding a centenary festival in honour of his birth, in February last, the good citizens of Vicenza were naturally grateful to be reminded as forcibly as possible of the genius of their hero. Our author had long regarded these relics with curiosity, until, stimulated by the prospect of this festival, he felt an ardent desire to accomplish something. He says:—"The exquisite politeness of the keepers of this museum, first, that of Monsignor Pietro Canonico Doctor Marasca, and then that of Monsignor Ludovico Canonico Gonzati, threw open to me the sanctuary [that is, they unlocked the cases]. Their encouragement imparted to me the courage to do something, which I now publish in time for the public festival, which I may emphatically term national, in honour of him who is now revered as one of the most eminent physicists of this age."

Guided by the published collected works of Fusinieri, our author examines every article and fragment of the imperfect collection thus thrown open to his inspection. No devotee before the shrine of a saint could display more ardour. If successful in tracing a bit of apparatus to its original use, he is in ecstasy; if unsuccessful, in despair. He has no misgivings as to the originality of his hero, or as to his absolute superiority in all the varied controversies in which he was engaged. Perhaps the most memorable of these (and to which the second pamphlet above cited is devoted) is on some of those obscure catalytic phenomena in which chemical combination is effected by means of certain solids which themselves escape apparently unchanged. Signor Nardi claims for Fusinieri the merit of having refuted Faraday's theory on this point, and of establishing the true theory on a sound basis. And what is this theory? It is, that "platina determines upon its surface a continual renovation of *concrete laminæ* of the combustible substance of the gases or vapours, which, flowing over it, are burnt, pass away, and are renewed: this combustion at the surface raises and sustains the temperature of the metal." Faraday, in his sixth series of "Electrical Researches" (Nov. 1833), in referring to this theory and its author, says:—"I cannot form a distinct idea of the power to which he refers the phenomena." Certainly the revived discussion of the theory has not tended to throw more light upon it.

Considering the wide range of subjects that occupied Fusinieri's attention from the date of his first publication in 1819 to that of his latest in 1850, we must speak in the highest terms of his industry. His works, collected into three large volumes, contain memoirs on Geometry, the Mechanical Sciences, the Electrical Sciences, Terrestrial Magnetism, Optics, Heat, Meteorology, Astronomy, Chemistry, and Molecular Mechanics. But it is surprising how little influence all this labour had on science in general. We seldom meet with Fusinieri's name out of Italy; and the reason is, not that science is unjust, but that she is stern, and requires discovery to be both new and true, before she welcomes the discoverer. Now it must be confessed that Fusinieri is not original. In his best work there is always something reflected from a greater mind than his own. One of his most striking experiments is to show the repulsive force of heat, for which purpose two slightly convex surfaces of glass are screwed together, so as to exhibit Newton's rings, and heat being applied, the rings contract, and the central tint descends in the scale, until the whole vanishes. But in so capital a result as this we are reminded of Fresnel, while the actual experiment was performed by Baden Powell two years before the date of Fusinieri's paper. Fresnel dates from 1825, Powell 1835, Fusinieri 1837; and yet Signor Nardi attaches an inscription to the lenses in the museum to the indefinite effect that "Long before 1837, Fusinieri made with these and other glasses the discovery of the repulsion of heated bodies." In like manner Fusinieri has a long series of researches on the cause of the colour in metals exposed to heat, while Davy decided by a single experiment that it is due to oxidation. He inclosed a bright surface of steel in an atmosphere of nitrogen, heated it, and there was no colour; he raised it to the same temperature in air, and colour was immediately produced. Fusinieri's theories may be more original than his facts, but then they are not accepted. His best known theory is perhaps that which confers a material body on electricity, because it is capable of conveying matter from place to place, and varying its properties with the kind of matter conveyed and acted on. Nor is his theory of dew, in opposition to that of Wells, more favourably received. Our author laments that Wells's theory is the result of a series of illusions, which has seduced many, and he regrets that the latest sad example of this leading astray is in the case of one John Tyndall, who is so infatuated as to believe in Wells; and yet this theory which was so clamorously received and crowned by the Royal Society depends merely on a spider's thread!

Much of the science of Fusinieri arose out of the questions of the day, and it is to his credit, considering the difficulties of his position, that he endeavoured to keep pace with the scientific mind of his time. He is, however, eminently controversial, disputing whenever opportunity offered, and persisting in his views, even though all, his fellow-countrymen included, are against him, his last opponent being Melloni. He is also very sanguine, and fancies he has solved great and difficult questions, should a single experiment turn out satisfactorily to himself. Thus, when by the action of light on an acid solution of ferrocyanide of potassium he obtained

Prussian blue, he fancied he had settled the grand and difficult problems connected with the colouring matter of leaves. While the isolated position of Fusinieri, and the want of contact with better scientific minds than his own, will account for this, we must not forget that the abject political condition of the land and the narrow jealousy of its multiplied rulers made it difficult for a man to work intellectually or to teach properly, so that we may well express our admiration that one so hampered has achieved so much, and set so good an example to his more fortunate countrymen. May their scientific efforts prosper! C. T.

SCIENCE IN GERMANY

(*From a German Correspondent*)

HERR W. SIEMENS has recently made the following interesting communication to the Academy of Sciences of Berlin :—

It has been shown by Willoughby Smith and by Sale that crystalline selenium conducts electricity better when illuminated than when in darkness. The specific conductivity, however, of selenium rendered crystalline by heating from 100° to 150° C. is very small and extremely variable; and also the increase of the conductivity through illumination is very inconstant, so that it is impossible to establish a determinate dependence of the conductivity on the illumination.

Herr Siemens has succeeded, by continuous heating of amorphous selenium to a temperature of 210°, as also by cooling of melted selenium to 210° (at which temperature, long continued, the selenium passes into a coarse-grained crystalline state), in producing another modification of the crystalline selenium, which has considerably greater conductivity, and retains it, and conducts electricity metallically, so that with increase of temperature the conductivity decreases. The action of light on this modification of crystalline selenium is much greater, and apparently quite constant. By fusing in two flat spirals of wire, about 1 millimetre apart, between two leaves of mica in coarsely crystalline selenium, he has obtained an exceedingly sensitive measure of light. Dark heat rays are *without direct influence* on the conductivity, and heating of the selenium, as already mentioned, *diminishes* the same. Diffuse daylight even doubles the conductivity of this light-measure, and direct sunlight increases it sometimes *more than tenfold*. The increase of conductivity of the coarse-grained selenium through illumination takes place very quickly. And similarly, the diminution of it, on shutting off the light, occurs, apparently, at once; but a longer time is required before the state corresponding to darkness is again fully established. The increase of the conductivity is not proportional to the light intensity, but a function of it, which comes near the proportion of the square root of the light intensities.

Herr Siemens hopes this interesting property of selenium may be utilised for construction of a reliable photometer. W.

NOTES

EVERY one will hear with genuine regret of the proposed resignation by Prof. Max Müller of the Chair of Comparative Philology in Oxford University. He has resolved to take this step on the ground that he begins to feel the need of rest, and that he wishes to be able to devote all his attention to the ancient language and literature of India. He has just finished, he says, the work of his life, the *Editio Princeps* of the text and commentary of the oldest of the sacred books of the Brahmans, the oldest of the Aryan world. It was this which first brought him to England in 1846, and it was in order to be able to stay in England that he accepted the duties of professor. Dr. Müller was appointed to the Chair of Natural Philology in 1868, in which year it was founded and endowed. "I have," he justly states, "satisfaction that I leave the new science of language, to which my work as Professor has been mainly devoted, firmly established in the system of academic studies, and that the University will find among my pupils several quite able to fill my place." It will not be an easy matter, we fear, to find a worthy successor.

THERE has just been placed in Westminster Abbey a marble scroll bearing an appropriate inscription to the memory of Jeremiah Horrocks. The movement for such a memorial was commenced some time ago, and is referred to in NATURE, vol. x. p. 190, and xi. p. 31. The scroll is affixed to the pedestal of the monument of John Conduitt, nephew of Sir Isaac Newton, which is situated at the extreme west end of the north side of the nave, and exactly opposite that of Newton, at the extreme east end. The inscription is as follows :—

In Memory of
JEREMIAH HORROCKS,
Curate of Hoole, in Lancashire,
Who died on the 3d of January, 1641, in or near his 22d year;
Having in so short a life
Detected the long inequality in the mean motion of Jupiter and Saturn;
Discovered the orbit of the Moon to be an ellipse;
Determined the motion of the lunar apse;
Suggested the physical cause of its revolution;
And predicted from his own observations the Transit of Venus,
Which was seen by himself and his friend William Crabtree
On Sunday the 24th of November (O.S.) 1639:
This Tablet, facing the Monument of Newton,
Was raised after the lapse of more than two centuries, December 9, 1874.

The friends of Horrocks are indebted for the inscription to the joint labour of the Dean of Westminster and Prof H. J. S. Smith. It is a simple act of justice to state that the idea of this tablet was suggested by two ladies, Mrs. Orme and Mrs. Patmore, and that upon the latter has fallen the burden and heat of the day so far as the correspondence with subscribers is concerned.

M. LE VERRIER, as President of the Scientific Association of France, has received the handsome sum of 2,300 francs from M. P. Bischoffsheim to meet the balance of the expense incurred during the important and refined experiments conducted by M. Cornu, towards determining with great precision the velocity of light, an expense which otherwise must have been borne by the eminent savant who directed the experiments.

CONSIDERABLE dissatisfaction is felt among the Fellows of the Linnean Society at the delay in the publication of the zoological papers communicated to it. The zoological paper last published in the Journal is dated Dec. 17, 1874, and that in the Transactions, Nov. 19, 1874. It is said that there are at least a dozen awaiting publication, and the number is likely to be increased. There is reason to fear that no zoological paper communicated during the present year will appear before the end of it.

A REPORT is widely circulating in Oxford University to the effect that Lord Salisbury, its Chancellor, is endeavouring to obtain the issue of a Commission for inquiring into the question of University Reform. Another form of the report is that the Commission will have an executive character. A third rumour names Mr. Gladstone as one of the Commissioners. But nothing certain is known upon the subject at Oxford.

THE January number of the *Practitioner* will contain a memoir of the late Dr. Francis E. Anstie, by Dr. Buzzard, with a portrait engraved on steel. This number will also contain some of Dr. Anstie's unpublished researches on alcohol.

DR. BURDON SANDERSON announces that the first of his annual course of Lectures on Comparative Pathology will be given at the University of London, on Wednesday next, Dec. 15. Subject—The Pathology of Inflammation.

We are glad to see that the movement for organising a University College of Science and Literature in Bristol is so far advanced that a meeting of the subscribers will be held in Bristol on Saturday next, to authorise the committee to take the necessary steps to incorporate the College. In a telling article in Monday's *Western Daily Press* the need of such an educational institution in Bristol, as well as in all our other industrial centres, is forcibly shown. The increasing importance of scientific knowledge even in our most trivial manufactures is well pointed out; only by thoroughly training the rising generation can we hope to compete successfully with foreign manufacturers. It is a hopeful sign to find the subject taken up by the newspaper press in the spirit which animates the article referred to.

The Vivisection Commissioners, having now received the evidence of a large number of witnesses, will not meet again for some weeks. They will then assemble to examine a few more witnesses, after which it is announced they will at once proceed to consider their report.

The French Society of Aërial Navigation held its anniversary meeting on the 3rd December, under the presidency of M. Paul Bert. M. Bert delivered, before a full audience, an address reviewing all the scientific ascents executed during the year. The Society, after hearing a lecture by M. Tissandier, illustrated with dissolving views, awarded him a prize. A similar reward was given to the President of the London Aëronautical Society.

The Cambridge Board of Natural Sciences Studies report that the period of three years for which the University agreed to pay 100*l.* a year towards the expenses of Dr. Dohrn's Zoological Station at Naples will expire next year, and they have had under consideration the expediency of recommending a continuance of the grant. For the sum of 100*l.* the University has hitherto had the exceptional privilege of occupying two of the large working tables. Dr. Dohrn is unable to continue the offer of accommodation on the same terms, but offers one or two tables of 75*l.* per table. The Board, considering the claims upon the Worts' Travelling Bachelors' Fund, do not think it right to charge that fund with two tables at the increased price; and, therefore, recommend that one table be retained by the University for five years at the rate of 75*l.* per annum. The Board have reason to believe that very valuable work has been done by nominees of the University at the station, and the Cambridge Museum enriched by important specimens procured from it. Mr. T. W. Bridge, scholar of Trinity, and Mr. J. F. Bullar, of Trinity, have been nominated by the Board of Natural Sciences Studies to study at the Zoological Station, Naples, until July 1876.

There will be an examination at Christ's College, Cambridge, for scholarships and Exhibitions in Natural Science on April 4, 1876. The examination will be open to any one, and there is no restriction as to age. This examination will be held at the same time as similar ones in connection with Sidney Sussex and Emmanuel Colleges, the candidates of either of these colleges being eligible at the other two in default of properly qualified candidates at these colleges.

Dr. Gustavus Hinrichs has written in the *Popular Science Monthly* an interesting account of one of the most remarkable meteors of recent times, which lighted up the entire State of Iowa and neighbouring parts of the States of Missouri, Illinois, Wisconsin, and Minnesota, at 10.20 P.M., on Friday, Feb. 12, 1875. This meteor is stated to have become visible at a height of about 150 miles above Pleasantville, Iowa, to have descended at an angle of about 45°, its course being at first a little to E. of N., but deviating gradually more and more to E. in a curved line. It divided into two in passing over the N.W. township of Keokuk country, and finally exploded at a height of ten miles over a point three miles S.W. of Norway, one of the stations on the Chicago and North-Western Railway. It was the smaller portion of the meteor which produced the meteorite shower in Iowa and Amana townships of Iowa County. Two dollars a pound being given for all meteors collected, a large number have been gathered together varying in weight from 75 lbs. to 2 oz., and amounting in all to upwards of 500 lbs. A woodcut is given, showing nine of the fragments, drawn to one-seventh of their natural size, and a small map with the positions in which the meteors have been found. A map, defining the course of the meteor from all the observations made would have been a useful addition to the paper.

The *Meteorological Bulletin* of the Pyrénées-Orientales for the year 1874, published under the auspices of the department and the town of Perpignan, contains the following:—(1) *Résumé* of the daily observations referring to agricultural meteorology and the state of vegetation collected at Collioure during 1873–74, by M. Ch. Naudin, Member of the Academy of Sciences; (2) Returns of the state of the crops in Roussillon during the same time, by M. Labau, Director of the school-farm of Germainville; (3) Notice of the thunderstorms observed in the department of the Pyrénées-Orientales, by M. Tastu, Chief Engineer; (4) Tables of the rainfall measured at the different stations of the department during each month of the year, with a sketch of the specialities of the rainfall of last year, by Dr. Fines; and (5) Meteorological observations made at fifteen stations in the department. The close union now being drawn in France between meteorology on the one hand, and agriculture and horticulture on the other, as evinced by the Annual Report of the Meteorological Commission of the Pyrénées-Orientales, as well as by the subjects brought under special consideration at the Meteorological Congress of Poitiers, speaks well for the future of French meteorology.

The *Agricultural Students' Gazette* is a small quarterly publication, evidently issued under the auspices of the authorities of the Royal Agricultural College at Cirencester, and which is professedly edited by students of that Institution. Such a publication ought to be eminently useful. It should aid in promoting an enlightened system of agricultural education, which is one of the great wants of the age. If well conducted, the journal cannot fail to assist in making known the merits of the College and of kindred institutions. It does not rival any existing periodical. While edited by students, the chief articles are contributed by professors. To No. 3 Prof. Church contributes a valuable paper on the flesh-forming matter of root-crops. Among the other contributions we would refer to a short but interesting paper from the pen of Prof. McNab, on mould, and another on sewage farming, written by one of the students, Mr. John D. Custance. Prof. Wrightson contributes a paper on the improvement of poor clay pastures, which has evidently been carelessly if not thoughtlessly put together. This periodical merits our best wishes. We see no reason why it should not in due time occupy a leading place among our scientific agricultural journals.

Prof. Kerner, of Innsbrück, has published an interesting pamphlet on the Hybrid Primulaceæ of the Alps. Of these he enumerates no less than twenty-five belonging to the genus *Primula*, four to *Androsace*, and two to *Soldanella*; some of which have been treated as independent species, as that between *P. subacaulis* and *officinalis* under the name *P. brevistyla*, DC., and that between *P. superauricula* and *hirsuta* under that of *P. pubescens*, Jacq. By far the majority (twenty) of the *Primula*-hybrids belong to a single section, *Auriculastrum*, the remainder to *Primulastrum*. Of "derivative-hybrids"—that is, those resulting from the crossing of a hybrid with one of its parent-forms—he knows only one or two certain instances. In two separate reprints, "Floristische Notizen" and "Ueber einige Pflanzen der Venetianer Alpen," Prof. Kerner describes several new plants of the Southern Alps.

On November 1 a Stenographic Exhibition was opened in a room of the Pedagogic Museum of the College, Rome. Stenography at the present day occupies a very important part in the requirements of public life, and we believe the effort to encourage its study by a public exhibition will lead to useful results. On the walls of the room were a list of the Italian towns that had a school or society for stenography. The only method followed is that of Gabelsberg-Noe. On a table in the centre of the room were stenographic attempts of every kind, from large plates for elementary study to the smallest and most minute works. In one case, Dante's "Divine Comedy" was copied out into a book of Lilliputian dimensions. On a post-card one stenographer had written 3,660 words. The committee who arranged the exhibition wish to reproduce on the historical wax tablet the stenographic marks with which Tiro wrote the speeches of Cicero.

On November 2 took place the opening ceremony of the scholastic year of the University of Rome. Prof. Scalzi read a critico-historical exposition of a collection of surgical apparatus belonging to lithotomists and oculists of the sixteenth and eighteenth centuries, which he found among families of the province of Umbria. Prof. Scalzi gave some very interesting details, showing that these instruments were invented in Italy, and not by foreigners, as has been supposed. He showed also that the study of the original instruments was of great interest in connection with the history of the progress of the surgical art. On two tables were arranged eighty instruments which had belonged to surgeons of Novicia and Delle Preci in Umbria. Many of these instruments, it was interesting to observe, resembled those found at Pompeii and others found at Ravenna.

A report by Mr. Frank Buckland, on the fisheries of Norfolk, recently issued, states as a remarkable fact that large numbers of sea trout are annually caught off the coasts of that county, though the rivers which flow through it are naturally incapable of producing *Salmonidæ*. The fish thus caught are visitors from the salmon rivers in the north, viz., the Tyne, the Tees, the Coquet, and the Tweed. The object of this visit to the coasts of Norfolk and Suffolk is to find food, which exists in abundance in the shape of the spawn and fry of the many varieties of fish which abound in those waters. The report contains much interesting matter relative to the crab, lobster, and other sea-coast fisheries, and to the fisheries in the fresh-waters of Norfolk and Suffolk.

The *Comptes Rendus* for October 4 last contains a paper on the interpretation of the sphygmograph trace, by M. Bouillaud. The author gives reasons, which we think peculiarly unsatisfactory, in favour of the sphygmograph trace—a curve now fairly understood—supporting an assumption of his that each cardiac revolution consists of two periods of action and two of repose, instead of one systole and its associated secondary consequences.

Our readers will find, in the current number of the *Ibis* a short account of the late veteran Swedish ornithologist, Carl J. Sundevall, whose excellent investigations, especially with reference to the Passerine birds, have done much towards the development of sound classificational principles.

We would direct the special attention of our zoological and geological readers to a paper by Prof. Owen in the current number of the *Quarterly Journal of the Geological Society*, on a fossil Sirenian animal from Jamaica, previously described by him, and named *Prorastomus sirenoïdes*. In this animal the premaxilla of each side gives indications of having supported three not large teeth, at the same time that there were eight teeth of the molar series above and below, on each side. The species was considerably smaller than the Manatee; the skull and atlas vertebra are the only parts known; in conjunction with *Felsinotherium forrestii* it fills an important gap in our knowledge of the pedigree of the Sirenia.

The *Geographical Magazine* for December contains a paper of great value on the Amú Darya region, by N. P. Barbot de Maruz, who in the summer of 1874 made a journey from Fort Alexandrovski, in the Caspian, to the foot of the Thian-shan. He describes the principal geological features observed along the route, and promises a full report of his researches when he has been able to arrange his abundant materials. Another paper, by Mr. Ravenstein, describes Mr. Stanley's recent discoveries, and is illustrated by two good maps, one of the Victoria Nyanza, principally according to Mr. Stanley, and another of the regions of the Upper Nile, embodying the results of the explorations of Burton, Speke, Grant, Stanley, Baker, Long, and others.

Parts 10, 11, and 12 (in one), of the well-conducted Italian geographical journal, *Cosmos*, are to hand. The following are the principal papers:—A letter from F. Giordano, giving some account of the condition of New Guinea, in reference to a proposal to make use of some part of it as an Italian penal settlement. Another letter, from Dr. Beccari, describes some results of his investigations into Papuan ethnology. The first of a series of papers on Arctic Geography gives the results of recent Arctic exploration in the Baffin's Bay and Spitzbergen directions.

We learn from the *American Naturalist* that State Associations of Archæology have been formed in Indiana and Tennessee, similar to that already existing in the State of Ohio. Their field of work is most extensive and important.

On Thursday, November 26, at 6.35 P.M., an earthquake shock was distinctly felt at Lyons. The commotion, which travelled northwards, lasted from fifteen to twenty seconds.

A shock of earthquake was felt at Naples on Dec. 6, and also throughout the provinces of the Basilicata, Terra di Lavoro, and Salerno.

The additions to the Zoological Society's Gardens during the past week include a male Prince Alfred's Deer (*Cervus alfredi*), born in the Gardens; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. C. F. Wood; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Miss Kate Symonds; two Alligators (*Alligator mississippiensis*) from North America, deposited; twenty-nine Basse (*Labrax lupus*); a Grey Mullet (*Mugil capito*), and six Cottus (*Cottus bubalis*) from home seas, purchased.

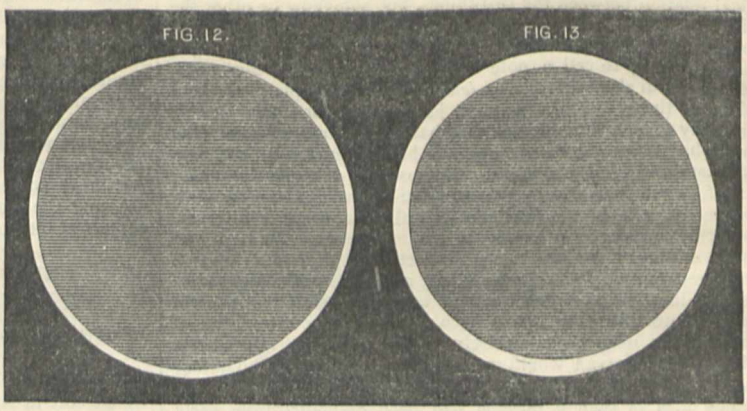
THE DIFFERENCE OF THERMAL ENERGY TRANSMITTED TO THE EARTH BY RADIATION FROM DIFFERENT PARTS OF THE SOLAR SURFACE

The observations relating to the temperature of the polar regions, referred to in the article (vol. xii. p. 517), at first led to the supposition that the rays projected from the north pole of the sun transmit a perceptibly greater energy to the actinometers than the rays from the opposite pole. Subsequent observations having positively established the fact that the polar and equatorial zones transmit equal intensities, it became evident that some other cause than difference of temperature within the polar regions influenced the actinometers. The only valid reason that could be assigned in explanation of the anomaly being the considerable angle subtended, and the consequent difference of zenith distance of the opposite poles of the sun, my table of maximum solar intensity for given zenith distances (prepared from data collected during a series of years) was consulted, in order to ascertain the influence of zenith distance. The observations indicating a higher temperature at the north pole, it should be mentioned, had been made while the sun's zenith distance ranged between 32° and 33° at noon. Now the table referred to shows that there is a difference of radiant intensity of 63°·63 − 63°·40 = 0°·23 F. between the stated zenith distances. The mean angle subtended by the sun being fully thirty-two minutes,

it will thus be seen that, owing to the absorptive power of the terrestrial atmosphere, the radiant intensities transmitted from the opposite poles of the luminary differ considerably. The magnitude of this difference, adequate to explain the discrepancy under consideration, need not excite surprise if we consider that thirty-two minutes of zenith distance involves an additional depth of more than half a mile of atmosphere to be penetrated by the rays projected towards the actinometer from the *south* pole of the sun. The foregoing facts show the necessity of taking the difference of zenith distance between the opposite poles into account in making exact observations of the sun's polar temperature, especially at the lower altitudes where the secant of the zenith distance increases rapidly.

Regarding the calorific energy of the radiation emanating from the border of the sun, I deem it proper to present the following brief statement. Several observations during the early part of the investigation pointed to the fact that increased energy is transmitted to the actinometers by radiation from the sun's border. Again, considerable irregularity was observed in the progressive diminution of the force of radiation towards the circumference of the solar disc. It was shown in the preceding article (vol. xii, p. 520) that the radiation from the border zone, 1′ 42″ wide, occupying one-fifth of the area of the solar disc, transmits 0·638 of the intensity transmitted from an equal area at the centre of the disc. Of course it will be supposed that the rate of the diminution of intensity within the zone thus ascertained is much greater near the border of the photosphere than at the middle of the zone. Such, however, is by no means the case, notwithstanding the assumption of phycisists that the heat transmitted by radiation from the border is very feeble. In order to test the truth of the indications referred to showing considerable radiant energy at the border of the photosphere, a very careful investigation was made, Sept. 9, 1875, by means of screens excluding the rays from the solar disc, as shown in Figs. 12 and 13. The diameter of the screen represented in Fig. 12 being 154·06 millimetres, covered nine-tenths of the area of the disc; while the screen shown in Fig. 13, being 145·25 millimetres, covered four-fifths of the disc. It will be well to mention that the dimensions of the screens referred to correspond with the angle subtended by the sun when the earth is in aphelion. Accordingly the distance between the actinometers and the screens was adjusted previous to the observation, viz. shortened, in order to compensate for the increase of the angle subtended by the sun. Agreeable to the stated dimensions of the screens, it will be found that the zone represented in Fig. 13 is 1′ 42″, while the zone in Fig. 12 is 49″·6. The mean width of the latter is consequently situated only 24″·3 from the border of the photosphere.

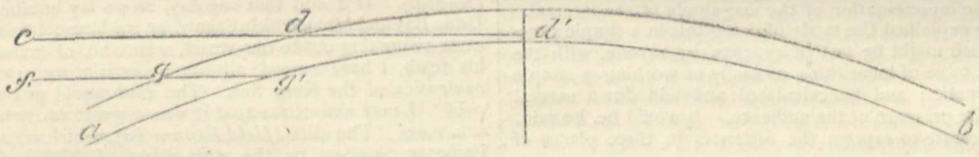
The following table shows the intensities transmitted to the actinometers from the zones represented in Figs. 12 and 13:—



Time.	Zone, Fig. 13. Cent.	Zone, Fig. 12. Cent.	Rate of difference.
4′	2°·011	1°·333	$\frac{1·333}{2·011} = 0·662$
5′	2°·248	1°·471	$\frac{1·471}{2·248} = 0·654$
6′	2°·425	1°·583	$\frac{1·583}{2·425} = 0·652$
7′	2°·485	1°·666	$\frac{1·666}{2·485} = 0·670$
			Mean = 0·660

The rate of difference inserted in the last column, it will be noticed, is not quite so consistent as in the table contained in the previous article recording the observations made Aug. 25. The discrepancy is, however, not material, the difference between the lowest and the mean rate being 0·008. It will be seen on inspecting the registered intensities, that the border zone represented in Fig. 12, whose area is only one-half of the area of the zone in Fig. 13, transmits 0·660 of the intensity of the latter. This at first sight indicates an extremely disproportionate transmission of heat from the narrow border zone; but it should be considered that the inflected radiation imparts relatively more heat to the actinometer exposed to the radiation from the narrow zone than from the wide zone. It will be readily understood that since the inflection of the calorific rays is 14″·7 (see preceding article, page 519), the first-mentioned actinometer receives radiant heat from 14′·7 + 49′·6 = 64″·3; while the actinometer exposed to the radiation from the wide zone receives heat from 1′ 42″ + 14″·7 = 116″·7. Consequently, the radiant heat emanating from the narrow zone will be $\frac{64″·3}{116″·7} =$ 0·551 of that transmitted from the wide zone, hence somewhat more than one-half. Our investigation therefore proves that the radiant heat transmitted from the narrow border zone represented in Fig. 12 is 0·660 − 0·551 = 0·109 more intense than that transmitted from the zone represented in Fig. 13, although the mean distance of the latter is twice as far from the border of the photosphere as the mean distance of the former. The singular fact thus revealed can only be accounted for by supposing that internal radiation is not incompatible with the constitution of the photosphere, and by adopting Lockyer's views expressed in the Senate House at Cambridge, 1871, that "the photosphere must be a something suspended in the solar atmosphere." Let *a b*, Fig. 14, represent a section of the "suspended" photosphere, and *d c*, *g f*, rays projected towards the earth. Agreeable to the conditions mentioned, and in view of the fact that the force of radiation from incandescent gases presenting equal areas, varies nearly as their depth, we are warranted in concluding that since the depth *d d′* is greater than *g g′*, the radiant heat transmitted from the photosphere by the ray *d c* will be greater than that transmitted by the ray *g f*. It should be observed that the energy transmitted towards the earth by *d c* suffers a greater diminution than the energy transmitted by *g f* in consequence of the greater depth of the solar atmosphere penetrated. Hence the augmented energy established by our investigation, does not show the full amount of the increase of radiant heat transmitted from the border of the sun.

FIG. 14.



J. ERICSSON

THE GRAPHIC METHOD OF REPRESENTING MUSICAL INTERVALS *

THE object of the paper was to explain a method of representing musical intervals, which was very useful in giving a clear idea to the mind of relations often complex and obscure.

The author pointed out that there was a natural tendency to refer the positions of musical notes to positions in space. It was by no means clear that there was any real physical or physiological relation between the two things, but somehow or other the idea had become so firmly rooted in the mind that it had developed itself in expressions of every-day use. For example, it was customary to call a note with rapid vibrations a *high* note, and one with slow vibrations a *low* note. Few people considered whether there was any natural justification for these terms; probably there was none, but they had existed almost ever since music had taken a definite form, and had given rise to the form of notation employed to express the positions of musical sounds.

It followed from this that the musical idea of distance between two notes, which was technically called a musical interval, might be considered as having an analogy between the high and low positions of the two notes respectively, a greater interval being represented by a greater space, and *vice versâ*; and carrying this idea out to its full extent it became possible to represent musical intervals to the eye in such a way as to convey ideas of comparative magnitude precisely analogous to the impressions which these intervals would make on the ear. This the author called the *graphic* method of representing intervals.

The idea of such a method had been embodied from early times in the word *scale*, which was derived from the Latin *scala*, a ladder, thereby clearly implying an analogy between the spaces of the steps and the intervals of the notes. Mr. Hullah, in some of his elementary books, had actually made use of a diagram of a ladder for this purpose, and he had introduced the improvement of representing the intervals between the third and fourth and between the seventh and eighth steps (of the diatonic major scale) as only half the length of the other degrees, thereby embodying, in a graphic mode, the distinction in magnitude between the whole tones and the semitones. What the author proposed to do in this paper was merely to establish this mode on definite principles, and to give it more capability and more accuracy.

It was well known that the scientific definition of a musical interval was expressed by the ratio which the vibration-number of the higher sound bore to that of the lower one, and it had been shown that the idea of the magnitude of the interval in a musical sense might be expressed by the logarithm of this ratio. Hence, by plotting down this logarithm with a scale of equal parts, and drawing a line of that length, such a line would be a correct graphic representation of the magnitude of the interval.

The author explained the mode of doing this in a simple practical way, which might be put in practice by anyone, with the aid of a small table of logarithms, as easily as working a simple sum in arithmetic; and he calculated and laid down several examples in the presence of the audience. It would be, he said, sufficiently accurate to express the distances in three places of figures, as, for example:—

The interval of an octave would be expressed by a line whose length was—

= log. 2	= 301
That of a major—	
Sixth = log. $\frac{5}{3}$	= 222
That of a minor—	
Sixth = log. $\frac{8}{5}$	= 204
That of a fifth—	
= log. $\frac{3}{2}$	= 176
That of a fourth—	
= log. $\frac{4}{3}$	= 125
That of a major—	
Third = log. $\frac{5}{4}$	= 97
That of a minor—	
Third = log. $\frac{6}{5}$	= 79

And so on for any others.

It would be seen how truly these numbers corresponded to the ideas of the intervals existing in musical practice, for, according to the usual musical rules—

Fifth + Fourth	= Octave.
Major Sixth + Minor Third	= Octave.
Minor Sixth + Major Third	= Octave.
Major Third + Minor Third... ...	= Fifth.
Fourth + Minor Third	= Minor Sixth.

And so on.

The author then, as a more extended illustration of the principle, showed the process of determination of the exact positions of the various notes of the modern musical scale, including all the accidental sharps and flats necessary for chromatic purposes and for modulation; and he proceeded to draw the same on a large diagram, making the octave 3 feet long. This enabled the audience to appreciate clearly many delicate points of intonation, which were difficult to be conveyed to the mind by any process of verbal description, and which the author explained and commented on in their theoretical and practical bearings. He also drew a corresponding scale on the plan of equal temperament, and pointed out the more important differences between this and the true scale, concluding with some remarks on the subject of intonation generally.

* Abstract of a paper read by W. Pole, F.R.S., Mus. Doc., Oxon., at the second meeting of the Musical Association for the Advancement of the Art and Science of Music on Dec. 6, at the Beethoven Rooms, Harley Street, Mr. Bosanquet in the chair.

THE SWEDISH ARCTIC EXPEDITION

THE following extracts are taken from a letter addressed to Mr. Oscar Dickson, of Gothenburg by Dr. F. R. Kjellman, who (and not his brother Dr. Theél Kjellman, as was stated by mistake in NATURE, vol. xiii. p. 75) was in command of the *Pröven*, the vessel of the Swedish Arctic Expedition during the return voyage from the mouth of the Jenesei to Norway. The *Pröven* left the mouth of the Jenesei on the 19th August, fell in with ice on the 23rd in 75° 22′ N. lat. and 66° 30′ E. long. from Greenwich; sailed along the edge of the ice until, a little south of Cape Middendorff, it was found to connect itself with the land so as to bar all passage northwards. The *Pröven* then turned south and was carried by a current twelve miles south of Matotschkin Scharr.

"Before going farther I may perhaps be permitted to make some remarks on the higher vertebrate animals which we found to inhabit or visit the Kara Sea. The walrus occurs here plentifully, and has of late years been the object of exterminating pursuit on the part of the Norwegians. At many places on the Samoyede peninsula and White Island we saw great herds of these beautiful animals. The Kara Sea has three species of seals, *Phoca barbata*, *hispida*, and *Grœnlandica*. The last-named was that which we saw most frequently and in greatest numbers. Off Obi and Jenesei white fish (? dolphins) were very common, and on the east coast of Novaya Zemlya we saw a large fin-whale (*fenhval*). If I add that one day, as we lay becalmed between Udde Bay and Matotschkin Scharr, an ice-bear quite unexpectedly came swimming out to our vessel, where he, of course, soon met his death, I have named all the mammalia we saw during our navigation of the Kara Sea. The bird world was exceedingly poor. I may almost say that it was a great rarity to see a tern or a mew. The alka (*Uria Brünnichii*), which occurs in such immense numbers on the west coast of Novaya Zemlya, is believed to be absent on the east coast. We saw here only one, and it appeared to have gone astray. Only some few species of fish were observed."

The *Pröven* passed through Matotschkin Scharr on the 10th and 11th September, arriving at Hammerfest on the 26th of the same month, and at Tromsö on the 3rd October. Dr. Kjellman sums up the scientific results of the expedition as follows:—

"We botanists have endeavoured not only to ascertain what species of plants Novaya Zemlya possesses, but also to get an insight into the varying distribution of the different species, the nature of the vegetation at different localities, in different latitudes, at varying heights above the sea, at varying distances from the seashore, &c. We have made a great number of such observations, and thereby will, I believe, be in a position to give such an account of the vegetation of Novaya Zemlya as will satisfy the requirements of science. Of flowering plants we have rich collections from Matotschkin Scharr, from many places on the west coast of Southern Novaya Zemlya, from Waigats Island and the mainland lying opposite to it, from the Samoyede peninsula and the region lying round Dickson's Harbour, and these collections contain a considerable number of species new to those localities. The phanerogamic vegetation of Novaya Zemlya has a strong resemblance to that of Spitzbergen, but at the same time, as might be expected from

its position, has a more southern stamp. This appears partly by Novaya Zemlya being much richer in species than Spitzbergen, of which species several occur which belong to families not represented on Spitzbergen, and partly by the vegetation of Novaya Zemlya being richer in individuals. At many places, especially in the more southerly parts of the land and the interior of the fiords, the ground is covered with thickly-matted plants, to which there is nowhere on Spitzbergen anything corresponding. Their closeness and variety of colour often awoke our surprise and astonishment. The phanerogamic vegetation of Novaya Zemlya connects itself by means of common species not only with that of Spitzbergen, but also with the floras of Arctic America and northern Norway, and that of the shores of the Gulf of Bothnia and the Asiatic Continent.

"The more southern character exhibited by the phanerogamic vegetation of Novaya Zemlya, as compared with that of Spitzbergen, is as good as absent in its marine algæ. The same dissimilarity is also apparent with regard to the fauna. The land fauna is more southern, the marine fauna is high Arctic. The most of the marine algæ known to exist at Spitzbergen are found at Novaya Zemlya, and of the species collected here there is only one that is wanting on the coasts of Spitzbergen.

"Of fresh-water algæ, mosses, and lichens, we have made considerable collections. Of mushrooms, on the contrary, we obtained very few. Either it was a bad mushroom year on Novaya Zemlya, or else, what is less probable, this class of plants is very sparingly distributed on these islands.

"As on the coasts of Greenland and Spitzbergen, so in the parts of the Polar Sea we now visited, the surface of the sea at certain places which appear to be sharply defined is quite full of diatomaceæ. A belt of special richness we found on the north coast of Norway, extending in an easterly direction from North Cape to the mouth of Tana Fiord; another, less rich and of less extent, we found in the neighbourhood of the Samoyede peninsula.

"Through the researches of Th. von Heuglin, we have already a good knowledge of the vertebrates of Novaya Zemlya. The attention of our zoologists has, however, been directed to this group of animals, and by their observations our knowledge of them has been very considerably extended. This specially holds good of the birds.

"Along the whole west coast south of Matotschkin Scharr, as well in the open sea as in the fiords and sound where we sailed through and lay at anchor, dredging has been assiduously carried on. The rich collections thus made will certainly, when they are examined, afford a very complete idea of animal life in this region. Few species of animals were previously known as existing here, and as to the distribution of the different species along that extensive coast all information has hitherto been wanting.

"Among the zoological work a conspicuous place is occupied by a rich insect collection by which the knowledge that we previously had of Novaya Zemlya's insect world will be very considerably extended. Formerly from this region only four or five species of insects were known. The expedition's collection consists of about 500 specimens, and includes numerous representatives of nearly all the orders of insects.

"Most important, however, in a zoological aspect, appear to me the numerous dredgings which were carried on in the Kara Sea, and which prove that in this sea there is, as has been already mentioned, abundant animal life of very various types. The collections made here are large, and must be specially valuable for zoological science as coming from a considerable region of the Polar Sea, of which the zoology is little known, but especially because this extent of sea exhibits in different tracts so considerable dissimilarities with respect to depth, content of salt in the water, &c."

BOTANICAL NOTES

THE CALCUTTA BOTANICAL GARDENS.—Dr. King's report on the Royal Botanical Gardens, Calcutta, for the year ending March 31, 1875, to which we have recently referred (vol. xii. p. 541), contains some interesting notes on the cultivation of useful plants, especially the Para rubber plant (*Hevea braziliensis*) and the Ipecacuanha (*Cephælis ipecacuanha*). With regard to the former, Dr. King is of opinion that the plants will not thrive in that part of India. Mr. Collins, in his report on the Caoutchouc plants, describes the *Heveas* as growing in their native country in situations where the heat is not generally above 87° Fahr. in the afternoon, and below 74° at night, and shows, on the authority of Wallace, that the temperature in the caoutchouc districts during three years only once reached to 95°, the greatest heat being about 2 P.M., when it ranges from 89° to 94°, and never lower than 73°. The meteorological returns for Calcutta show a wide difference between the Brazilian and the Indian climates. Another Caoutchouc plant, however, the *Vahea madagascariensis*, Boj., a climbing apocyneous shrub, native of Madagascar, promises to thrive much better than the *Hevea*. The fact of the plant being of climbing habit militates considerably against its value as a cultivated plant, owing to the difficulty in providing supports as well as in obtaining the caoutchouc. Nevertheless, it is a kind highly valued in the English market, realising a price next to Para rubber. With regard to Ipecacuanha, which has been shown to require much care and attention as to soil and situation, we learn that a number of sets of plants were put out during the early part of the year at different spots at low elevations in the Cinchona reserve at Sikkim; warm, well sheltered situations, with good virgin soil, were chosen. "Some of the plants thus put out were protected by the natural shade of the forest, others by a sloping thatch of grass. Until the arrival of the cold weather all went well, but the unusually low temperature that prevailed during that season was fatal to the majority of the plants." Dr. King further says that he is "driven reluctantly to the conclusion that it is doubtful whether ipecacuanha can be successfully cultivated as an out-door crop in Sikkim." Further trials, however, are to be made before its experimental cultivation is recommended to be abandoned.

Eucalyptus globulus has had its share of attention in India, and without considering the question of the truth or otherwise of its reputed value, it is proved that although it grows quickly and with vigour on the Neilgherries and Khasia hills at 5,000 to 8,000 feet above the sea, it cannot be induced to live even for a year or two in the hot plains of India. Dr. King's description of the fine old Banyan tree, "one of the greatest curiosities and ornaments of the place," will, we are sure, be read with interest. He says: "Although considerably damaged by the cyclone of 1864, which carried away two of its largest arms, this fine tree continues to grow vigorously. It now covers an area of ground 800 feet in circumference; its trunk girths 51 feet, and from its branches no fewer than 170 aërial roots are sent down to the ground, some of them being more than ten feet in circumference. This fine old tree supports quite a colony of orchids, ferns, and creeping plants of about twenty distinct species, and gives shelter to innumerable birds. Its exact age is not known, but, considering how rapidly banyans grow, it probably does not much exceed that of the garden, and is therefore less than a century."

GUM ARABIC.—In a recent number of the *Revue des Sciences Naturelles*, Prof. Charles Martins, of Montpelier, draws attention to a peculiar mode of exudation of gum arabic from the *Acacia verek* of Senegal. On the authority of Schweinfurth, quoted in the "Pharmacographia," p. 206, it is stated that this tree, exclusively, yields the fine white gum of the countries bordering the Upper Nile, and especially of Kordofan. It is described as growing to a height of about twenty feet, and though the gum is one of the principal productions of the colony, being collected in large quantities by the Moors, who exchange it for European commodities, no notice occurs of any peculiarity in its formation or collection; indeed, it is stated that "the gum generally exudes from the trees spontaneously, in sufficient abundance to render wounding the bark superfluous. The Somali tribes of East Africa, however, are in the habit of promoting the outflow by making long incisions in the stem and branches of the tree. In Kordofan the lumps of gum are broken off with an axe, and collected in baskets." Prof. Martins shows that the exudation of the gum is often promoted by the growth of a species of Loranthus, his observations being founded on actual specimens of branches of the Acacia upon which the parasite had formed. In several instances the gum had exuded in a vermicular form always at the point of union of the parasite with the stock. This union of the two plants forms, as is usual with other Loranthaceous species, an irregular, gnarled-like protuberance, from which are given off both the branches of the Acacia and also of the Loranth, each of which is very distinct from the other, those of the Acacia being spiny and more slender than those of the parasite. Rather than this mode of exudation being rare, it would seem to be of frequent occurrence. M. Martins considers the parasite to be a new species of Loranthus, for which he proposes the name of *Loranthus senegalensis*, placing it near *L. pentagonia*, DC.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Nov. 25.—"On the Replacement of Electro-positive by Electro-negative Metals in a Voltaic Cell," by J. H. Gladstone, Ph.D., F.R.S., Fullerian Professor of Chemistry in the Royal Institution, and Mr. Alfred Tribe, Lecturer on Chemistry in Dulwich College.

It is well known that one metal exerts a greater chemical force than another, and is capable of displacing it from its combinations. Among those metals with which we are familiar, potassium is looked upon as the most powerful; and it is a certain fact that calcium, barium, strontium, aluminium, and magnesium have been isolated by its agency. It could scarcely be expected, therefore, that any other metal could directly replace potassium. If such should happen, we should have an instance of reversal, and should expect to find, on examination of the conditions, an agent capable of doing just the reverse work of what is usually assigned to affinity.

It is also well known that in a simple voltaic cell, such as zinc connected with platinum in dilute hydrochloric acid, the more powerful or electro-positive metal, zinc, displaces the hydrogen that is in combination with chlorine, and the hydrogen makes its appearance against the less powerful or electro-negative metal, platinum. The chemical theory of galvanism supposes that the force originates in the chemical action which takes place between the zinc and the acid; the contact theory supposes that it originates in some unexplained manner in the opposite electrical condition of the two metals induced by their contact. If the chemical theory be the true one, it is evident that a zinc-platinum cell can only become active when the binary liquid contains hydrogen or some metal which is less powerful than zinc. If, for instance, we were to employ a potassium-salt instead of a hydrogen compound, it is inconceivable, on the pure chemical theory, that there should be any action at all.

Such an action, however, does take place if we substitute the chloride of potassium for the hydrochloric acid; the zinc combines with the chlorine, and the potassium is set free in some form against the platinum, manifesting itself by the presence of free alkali and hydrogen gas. The same holds good with chloride of sodium, or ammonium, or barium, strontium, calcium, or magnesium.

This action is slow; but if magnesium be used instead of zinc, it takes place sufficiently rapidly to be easily observed, and we have therefore studied the action of platinum and magnesium in connection.

After an account of the experiments, the paper concludes as follows:—

If one metal in conjunction with another more electro-negative than itself will decompose the salt of a more positive metal, it may be expected, *d fortiori*, that it can decompose one of its own salts. Instances of this are not wanting.

Magnesium connected with platinum will decompose a magnesium salt, the almost insoluble hydrate of magnesium being found adhering to the negative metal. The deposition of zinc on the plates of an old-fashioned battery, when the battery is pretty well exhausted, is a well-known phenomenon. In our experiments with copper and silver in conjunction in a solution of nitrate of copper, we never succeeded in reducing the galvanic action to *nil* by our utmost efforts to exclude all oxygen, and the whole of the present inquiry originated in an experiment described by us before the Physical Society, that mercury and gold in conjunction would decompose mercuric chloride, with deposition not only of lower chloride, but also of metallic mercury upon the gold.

These experiments are inexplicable on the theory that the chemical action supplies the whole of the decomposing force, but show that there is an antagonistic force produced somewhere in the circuit which is greater in amount than the superior affinity of potassium over magnesium for the negative radicals.

Little doubt can be entertained but that this force is called into existence by contact; but our experiments do not teach us whether the energy requisite to keep up the action results from the disappearance of heat at the junction of the metals or contact of the metals and liquids (an idea that has long been in our minds), or at the expense of some other form of energy. Of course a momentary disappearance of heat would give only a momentary supply of voltaic energy; but since the loss of heat would be constantly made up by absorption from surrounding objects, the action would be continuous.

Linnean Society, Dec. 2.—Dr. G. J. Allman, F.R.S., president, in the chair.—Mr. J. G. Baker made some remarks on *Pyrus Briggsii*. The following papers were then read:—On Polynesian Ferns of the *Challenger* Expedition, by Mr. J. G. Baker. The new species amounted to ten or twelve, closely allied to species already known, and establishing no new genus.—Genera and Species of Liliaceæ, by Mr. J. G. Baker. The present instalment, completing the series, comprises the Tribes Anthericeæ and Eriosperineæ; the latter characterised by remarkably woolly seeds.—Botanical Notes from Darjeeling to Tongle, by Dr. C. B. Clarke.—On *Edgaria*, a new genus of Cucurbitaceæ, by Dr. C. B. Clarke.

Chemical Society, Dec. 2.—Prof. Abel, F.R.S., president, in the chair.—Dr. J. H. Gladstone read a paper, by himself and Mr. A. Tribe, on the decomposition of alcohol and its homologues by the joint action of aluminium and its halogen compounds. The action on alcohol gives rise to hydrogen and aluminic ethylate, a greenish white fusible solid.—The second communication, a note on incense resin, by Dr. J. Stenhouse and Mr. C. E. Groves, was read by the latter. The authors have succeeded in obtaining a crystalline substance and a liquid hydrocarbon from it.—Mr. J. Spiller gave a notice of the occurrence of native calcium chloride at Guy's Cliffe, Warwickshire; after which Mr. G. S. Johnson described certain sources of error in the ultimate analysis of organic substances containing nitrogen, upon which an interesting discussion took place.—The other papers were: On certain bismuth compounds, by Mr. M. M. P. Muir; and On bismuthiferous tesseral pyrites, by Dr. W. Ramsay.

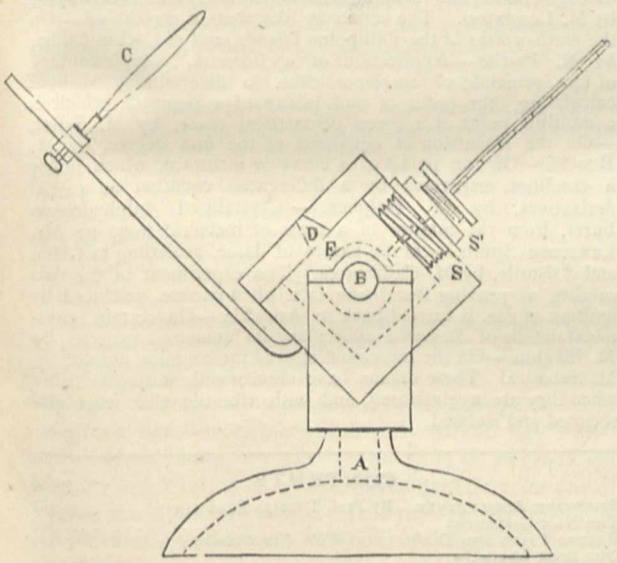
Royal Microscopical Society, Dec. 1.—Mr. H. C. Sorby, F.R.S., president, in the chair.—A number of presents were announced, including an injected specimen of the ova of *Amphiuma* presented by Mr. Beck.—A very useful addition to microscopes with concentric rotating stage was exhibited by Mr. Crouch, by which the instrument could be accurately adjusted to the centre of the stage when different objectives were employed.—Dr. Lawson exhibited and described a new apparatus termed the *Hematimetre*, designed by M. Hagen and constructed by Nachet, for the purpose of estimating the number of corpuscles in a given quantity of blood.—Mr. A. W. Bennett called attention to some minute organisms which he had discovered upon the leaves of Drosera and other carnivorous plants, and which he regarded as being intimately connected with the process of nutrition.—A very interesting paper was read by Prof. W. Rupert Jones, on Foraminifera with special reference to their variability of form. The subject was profusely illustrated by large diagrams, models, &c.

MANCHESTER

Literary and Philosophical Society, Nov. 2.—Mr. R. Angus Smith, F.R.S., vice-president, in the chair.—Mr. Peter Spence, F.C.S., &c., exhibited a piece of 2 to 3-inch lead pipe in which the metal had been entirely transformed into galena, the crystallisation being visible through the whole of the specimen. The pipe had been used for the conveyance of gas ammoniacal water, and was sunk under ground. A considerable leak of gas-water having occurred, a constant atmosphere of sulphide of ammonium would surround the pipe, and this seems to have been the cause of the conversion of the lead into sulphide, as only that part of the pipe which was in the vicinity of the leak was found to be transformed.—On the principle of the electro-magnet constructed by Mr. John Faulkner, by Prof. Osborne Reynolds. The magnet which forms the subject of this paper consists of a soft iron bar with a flat plate attached to one end, and surrounded by a coil of wire in the same way as the ordinary electro-magnet. Outside this coil is placed a tube of soft iron of the same length as that portion of the interior bar which projects beyond the plate; this tube has flat ends, one of which is in contact with the plate, while the other comes up flush with the end of the bar, so that a plate or keep placed over the end is in contact with both the bar and the cylinder. The magnet is excited in the ordinary way, by connecting the ends of the wire which forms the coil with the poles of a battery. When thus excited this magnet exhibits certain peculiarities as compared with a common magnet. The object of the paper was to suggest explanations of these phenomena.

Nov. 16.—Rev. William Gaskell, vice-president, in the chair.—On an instrument for measuring the direct heat of the Sun, by Prof. Balfour Stewart, F.R.S. The instrument generally em-

ployed for giving the radiant energy of the sun's rays acts upon the following principle:—In the first place the instrument is sheltered from the sun, but exposed to the clear sky, say for five minutes. Let the heat so lost be termed r. Secondly, the instrument is turned to the sun for five minutes. Let the heat so gained be termed R. Thirdly, the instrument being now hotter than it was in the first operation, is turned once more so as to be exposed to the clear sky for five minutes while it is shielded from the sun. Let the heat so lost be termed r'. It thus appears that r denotes the heat lost by convection and radiation united, when the instrument, before being heated by the sun, is exposed for five minutes to the clear sky, while r' denotes the heat lost by these same two operations by a similar exposure after the instrument has been heated by the sun; and it is assumed that the heat lost from these two causes during the time when the instrument is being heated by the sun will be a mean between r and r', and hence that the whole effect of the sun's rays will be in reality $R + \frac{r + r'}{2}$. Now although this assumption may in the average of a great number of experiments represent the truth, yet in many individual cases it may be far from being true. It would therefore seem to be desirable to get rid of this uncertainty by constructing an instrument in which we are sure that the causes of variability are not allowed to operate. These causes of variability I have attempted to get rid of in the following manner. With the help of Mr. Jordan, mechanician at Owens College, the following instrument has been constructed. It consists of a large mercurial thermometer with its bulb in the middle of a cubical cast-iron chamber, this chamber being of such massive material that its temperature will remain sensibly constant for some time. The chamber with its thermometer has



a motion in azimuth round a vertical axis A, and also a motion in altitude round a horizontal axis B. A 3-inch lens C of 12 inches focal length is attached by means of a rod to the cubical chamber, so as to move with it. The nature of this attachment will be seen in the figure. Thus the whole instrument may be easily moved into such a position that the lens, as well as the upper side of the chamber which is parallel to the plane of the lens, may face the sun, and an image of the sun be thrown through the hole D in the side of the chamber upon the thermometer bulb E. The stem of the thermometer protrudes from the chamber as in the figure. A screw S, somewhat larger in diameter than the bulb of the thermometer, is made use of to attach the thermometer to its enclosure, and a smaller screw S', pressing home upon india-rubber washers, enables the thermometer to be properly adjusted and kept tight when in adjustment. In the present instrument the internal diameter of the chamber is two inches, while the bulb of the thermometer is about 1¼ inches in diameter. The scale of the thermometer is very open, more than an inch going to one degree. I have generally allowed the image of the sun given by the lens to heat the thermometer bulb for one minute, during which time an increase of temperature, not exceeding in any case two degrees, has been produced. As far as principle is concerned there appears to be no objection to the present instrument; nevertheless it is open to a very serious practical objection. The scale being so very open, the stem comprehends only a few degrees; frequently, therefore, the temperature is such that the extremity of the mercurial column is either below or above the stem. Now the thermometer has a small upper chamber, and by means of a method of manipulation well known to those who work with thermometers, it is possible to add to or take away from the main body of mercury in the bulb, so as to keep the end of the mercurial column always in the stem. But experience has convinced me that for a thermometer with such a large bulb, frequent manipulation of this kind is not unattended with danger to the bulb. On this account the instrument in its present form is, I conceive, unsuited for steady work in an observatory from year to year. It is however possible, without any appreciable sacrifice of the scientific principle of the instrument, to alter it in such a manner as to remedy this defect. Without altering the size of the bulb, I should propose for a permanent instrument a stem say eighteen inches long with a bore of such diameter that the stem should embrace a range of temperature between 20° Fahr. and 92° Fahr. Thus somewhat less than five degrees will go to the inch. The stem might be protected from the risk of accident by an appropriate shield. Let such a thermometer be heated for two minutes and the size of the lens be somewhat increased. In this case a rise of something like 5° Fahr. will be obtained, and this heating effect might very easily be estimated to one hundredth of the whole, while the same thermometer would serve for all the temperatures likely to occur in these islands during the course of the year. I ought to add that a pasteboard cover, gilded on the outside, is made to surround the chamber, and also that between the lens and the chamber there is a pasteboard shield with a hole in it to permit the full rays from the lens to pass—the object of this shield being to prevent rays from the sun or sky from reaching the instrument. In such an instrument r, or the change taking place in the thermometer before exposure to the sun, will in all probability completely disappear, while r' will be extremely small. At any rate we may be quite certain that $R + \frac{r + r'}{2}$ will accurately represent the heating effect of the sun.

We may probably suppose that in the same instrument the lens (which must always be kept clean) will always stop the same or nearly the same proportion of the solar rays. But the lens of one instrument may not stop the same proportion as that of another instrument. This, however, is no objection if it be borne in mind that the instrument is a differential one. In practice there would be some standard instrument which would be retained at a central observatory, and all other instruments would, before being issued, be compared with it. It would be thus possible to compare together the indications of various instruments working in different places, provided that these before being issued had their co-efficients determined at the central observatory.—On a colorimetric method for determining small quantities of copper, by Thomas Carnelley, F.C.S., Demonstrator in the Chemical Laboratory of Owens College. Communicated by Prof. H. E. Roscoe, F.R.S.

BERLIN

German Chemical Society, Nov. 22.—A. W. Hofmann, president, in the chair.—V. Gomp-Besanez has discovered diastatic ferments, transforming fibrine and albumin into peptones in malt and in linseed and hemp-seed, proving thereby a hypothesis of Hooker and Darwin respecting the power of plants for dissolving starch, &c. (expressed in Darwin's "Insectivorous Plants," p. 362).—F. Salomon, in a paper on the formation of anhydrides in chemical reactions, tries to explain why sulphocarbonate of ethyl treated with methylate of potassium yields sulphocarbonate of methyl, while *vice versâ* sulphocarbonate of methyl and ethylate of potassium yield sulphocarbonate of ethyl. He supposes that in these reactions CSO is set free and reacts on methylate or on ethylate of potassium.—H. Skraup described a product of the action of chlorine on ferricyanide of potassium, perhaps $FeCy_6K_2$.—L. Barth has obtained a ferrocyanide of tetramethylammonium (yellow crystals) by saturating ferrocyanic acid with tetramethylammonium-hydrate.—L. Barth and C. Senhofer, in preparing disulphobenzolic acid, have found this acid to be, when prepared at a moderate temperature, metadisulphobenzolic acid, at a higher temperature paradisulphobenzolic acid; the former yielding isophtalic, the latter terephthalic acid; both, however, by fusion with potash yielding resorcine.—C. Senhofer has prepared naphthalintetrasulphurous acid, $C_{10}H_4(SO_3H)_4$, by treating naphthalin with oil of vitriol and

phosphoric anhydride.—O. Hausamann, by distillation of β-naphtoate of calcium, has obtained a ketone identical with the one that β-naphthoyl-chloride and naphthalin yield by heating them with zinc.—C. Jaeger, by fusing nitrosophenol with potash, has obtained azophenol, $C_6H_4(OH)NNC_6H_4(OH)$, crystals of the constant melting-point 214°.—Robert Schiff has succeeded in producing nitroso-thymol, $C_{10}H_{19}(NO)OH$, by treating thymol with nitrite of potassium and sulphuric acid. Nitrosothymol yields nitrophenol when oxidised with ferricyanide of potassium. Nitrothymol has been transformed into amidothymol and diazothymol by the ordinary methods.—O. Rembold, by treating ellagic acid ($C_{14}H_8O_9$) with zinc powder at high temperatures, has obtained a new isomeride of anthracene, to which he gives the name ellagene (melting-point, 88°, boiling-point, 252°; its chinone insoluble in sulphite of ammonium, yielding itself no precipitate with picric acid). Ellagic acid boiled with potash yields a new acid ($C_{14}H_8O_6$), which, by sodium amalgam (?) and water, is transformed into the acid $C_{14}H_{10}O_7$.—F. Schardinger described nitro-derivatives of anthraflavone.—A. Vogel showed absorption-bands of manganic, uranic, and chromic salts; also absorption-bands of hydrate of cobalt, which, suspended in water, shows absorption-bands on D and between D and C. They appear also in the presence of nickel with great clearness. Sulphocyanate of iron shows an absorption-band between G and E.—A. Pinner, who from 1870 up to the present time has studied the derivatives of what he considered croton-chloral, has now come to the conclusion that the greater part of his researches have been erroneous, in as far as all the compounds described by him contain two atoms of hydrogen more than he has alleged. Thus what has been called crotonic chloral is really butyric chloral. Its derivative with hydrocyanic acid is not trichloroangelic, but trichorovalerianic acid. Its product of oxydation and subsequent reduction are not chlorocrotonic, but chlorobutyric acids. Potash does not produce a chloride $C_3H_2Cl_2$, but chloride of allylene ($C_3H_4Cl_2$), which by sodium is not transformed into "a new hydrocarbon, C_3H_2," of which he has lately taken the trouble of giving a structural formula, but into allylene, C_3H_4!—W. Weith has proved the sulpho-ureas produced by the action of aniline on ethylic isosulphocyanide, and of ethylamine on phenylic isosulphocyanide, to be identical. Oxide of lead transforms them into an imide, $C(NC_2H_5)(NC_6H_5)$; and the action of aniline and of HCl NC also produce identical derivatives.

Geneva

Society of Physics and Natural History, Nov. 4.—Prof. Calladon published in 1872 (tome xxi. of the Memoirs of the Society) a paper on the effects of lightning on trees, &c. A case of a pyramidal poplar struck by lightning on August 4 last, near Rolle, in the Canton de Vaud, enabled him to verify some of his previous conclusions, and to add some new observations. The flash which struck this tree, situated 11 metres from the shore of the Lake of Geneva, left perfectly intact the upper portion. At seven-eighths of its height commences the trace left by the lightning, in the form of a wound (*plaié*) three to four centimetres in width, and from seven to eight centimetres in depth. This wound descends as far as the ground, turning round the trunk in the form of a screw, and describing four-fifths of the complete circumference of the tree. Fragments of wood of various sizes were projected to distances as far as fifty metres. Some are pierced by jagged holes, indicating a violent eruption of the electric fluid from the interior to the exterior, the track of the fluid having probably been in the layer which separates the alburnum from the old wood or duramen. The places where the emission of the fluid occurred are sometimes indicated by spots of a red colour, similar to the effect which might be produced on wood by the application of a hot iron. They correspond to a slight depression of the surface of the wood. The wound of the tree is turned from the shore of the lake, lightning striking more readily plants which grow near watercourses, visible or underground.

Paris

Academy of Sciences, Nov. 29, M. Frémy in the chair.—The following papers were read:—Theorems in which there is a condition of equality of two segments taken on normals and tangents of curves of any order and class, by M. Chasles.—Reply to notes of M. Duchartre and M. Violette, *à propos* of stripping off the leaves of beet, by M. Cl. Bernard.—Memoir on organic elements considered as electro-motors, by M. Becquerel.—Examination of a piece of wood petrified by subcarbonate of lime found at Bourbonne-les-Bains, in a Roman cesspool, by M. Chevreul. This is regarded as confirming the author's theory of petrefaction given in 1866.—Mineralisation of organic *débris*, vegetable and animal, in the thermal water of Bourbonne-les-Bains, by M. Daubrée.—Thermal researches on phosphoric acid, by MM. Berthelot and Louguinine.—Atmospheric perturbations of the hot season of 1875; group of rains from 21st to 24th of June; Flood of the Garonne, disasters at Toulouse, by M. Belgrand. The floods of the Garonne since 1770 have always been in spring or early summer, and, almost without exception, the maximum of rain and flood has been on the 23rd of June.—Reply to some objections raised by our recent communications on the useful effect of steam injectors, by M. Ledieu.—M. Daubrée presented a flattened angular meteorite sent by Prof. Hinrichs, from Iowa.—On the coefficient of capillary flow, by M. Guerout. The flow is in a horizontal tube; and in the case of alcohols the coefficients do not form a regular series; they diminish for alcohols richer in carbon; but bodies of similar composition and density often differ in fluidity.—On the composition of arable land in Auvergne; importance of phosphoric acid for its fertility, by M. Truchot.—On a system of irrigation of meadows by means of rain-water, in mountainous and impermeable regions, by M. Le Play.—On the Meteorological Observatory of the Pic du Midi de Bigorre (Hautes-Pyrenees), by General de Nansouty.—On some indications of the existence of Edentata at the commencement of the miocene epoch, by M. Gaudry.—On the contraction produced by rupture of the battery current, in the case of unipolar excitation of nerves, by M. Chauveau. The negative pole has but little aptitude to produce contraction at opening. Positive or negative, the opening contractions are distinguished for their brevity and equality.—On the poisonous principle in damaged maize, and its application in pathology and therapeutics, by M. Lombroso. The action is like that of strychnine.—On the earth-worms of the Philippine Islands, and of Cochin China, by M. Perrier.—Application of a theorem, complementary of the principle of correspondence, to determining, without calculation, the order of multiplicity of a point O, which is a multiple point of a given geometrical place, by M. Saltel.—On the discussion of equations of the first degree, by M. Rouché.—On the points of a curve or a surface, which satisfy a condition expressed by a differential equation or partial derivatives, by M. Halphen.—Crystallised sulphydrocarburet, from the interior of a mass of meteoric iron, by Mr. Lawrence Smith.—On the nature of flame, according to Galen and Aristotle, by M. Calliburcés. The experiment of the two candles, as proving that flame is a phenomenon produced by ignition of gas, is carried back to Aristotle.—On certain anatomical details of *Sarcoptes scabiei* and its numerous varieties, by M. Megnin.—On the musculoid cilia of the common mussel, by M. Sabatier. These organs have affinity with muscular tissue when they are agglutinated, and with vibratile cilia when dissociated and isolated.

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