THURSDAY, MARCH 6, 1884

RECENT TEXT-BOOKS ON TECHNOLOGY

1. *Steel and Iron.* By William Henry Greenwood. (London: Cassell and Co., 1884.)
2. *Bleaching, Dyeing, and Calico Printing.* Edited by John Gardner. (London: Churchills, 1884.)
3. *The Art of Soap-Making.* By Alex. Watt. (London: Crosby Lockwood and Co., 1884.)

ALTHOUGH the comprehensive system of technological examinations established under the direction of the City and Guilds of London Institute has been at work only a comparatively short time, it has already called into existence a considerable number of manuals and text-books designed to meet the special requirements of teachers and students in connection with those examinations. No doubt excellent works in certain branches of technology already exist, but many of these are scarcely suited to the purpose of the teacher, and most of them are in price beyond the means of the class which the Institute seeks to benefit. The action of many of our leading publishing houses in thus vying with each other in the production of series of low-priced handbooks of technology to meet a demand primarily created by the policy of the Institute is calculated not only to serve the interests of those preparing for examinations but also to react beneficently upon the general intelligence of our workmen. Numbers of these smaller works find their way into the hands of the better class of our mechanics, foremen, and apprentices, to whom the larger and more elaborate works, even when present in our free libraries, are as sealed books. On the whole, it may be said that the handbooks which have already appeared have been prepared with a rational appreciation of the needs of intelligent practical men. The majority of them are written or compiled by specialists, or by men who are well acquainted with the industries to which their works relate, and their descriptions and statements are made with the authority and discrimination which result from a practical knowledge of the manufactures of which they treat. The first and third of the works before us are excellent illustrations of this fact. In Mr. Greenwood's manual we have not only a comprehensive account of the present condition of our iron and steel manufacture, full of sound, practical information, but a very clear and accurate exposition of the scientific principles upon which the manufacture depends. The information is fully up to date; the illustrations are not mere pictures, but diagrams based upon original drawings, the majority of which have been reduced from scale plans of existing plant, and so arranged as to be readily understood by those who have only a slight experience of mechanical drawings. The chemical portion of the work makes no pretensions to be exhaustive, but it is accurate and sufficiently full. On p. 63, however, we notice that the composition of spiegeleisen is represented by the formula $FeMn_4C$, probably a misprint for $(FeMn)_4C$, although the evidence in support of the existence of any such definite carbide is very weak. A characteristic feature of the work is seen in the prominence given to such Continental processes as may possibly react upon English methods, as for example the Perrot revolving puddling furnace, and the various reheating furnaces of Bicheroux, Casson, and Ponsard. The chapters on steel are remarkably concise and complete. The author meets the well-known difficulty of definition by assuming that any compound of iron and carbon which is delivered from a vessel in a state of fusion and at once cast into malleable ingots may be considered as steel. This definition is perhaps not very rational or precise; it seeks to exclude cast iron on the ground of its immalleability, and wrought iron from the circumstance that in practice it is never obtained wholly fused; however, it is at least more accurate than that based upon the quality of hardening and tempering, which the so-called mild steels do not possess to any sensible extent.

The volume on "Bleaching, Dyeing, and Calico Printing" is a production of a very different character. It has not the slightest claim to originality, but is mainly a compilation, of some 200 pages, from the standard works of Crookes, Stenhouse, and Groves and Ure, and consists very largely of receipts and formulæ. The chapter on bleaching is fairly well done, especially the portion relating to linen bleaching; and the section on mordants is good so far as it goes. What there is of chemistry in the book is generally accurate, but the author would in nowise have diminished the air of practicality about his work if he had removed or replaced some of the barbarisms in chemical nomenclature affected by dyers. It is quite possible to be precise without being pedantic. The book is poorly illustrated and somewhat loosely put together.

Mr. Watt's book on "Soap-Making" is a thoroughly practical treatise on an art which has almost no literature in our language. The author is the son of the late Mr. Chas. Watt, the inventor of the well-known process of bleaching palm-oil for soap-makers, and he has been connected with that industry for many years. Soap seems to have been made in England only since the middle of the seventeenth century, but the manufacture made very little progress until the invention of the Leblanc process for converting common salt into carbonate of soda. The art received its second great impetus from the labours of the venerable Chevreul in the early part of this century, who, with Liebig, elucidated the theoretical principles upon which the manufacture depends. Mr. Watt's book shows what influence these researches have had upon the development of the art, not only directly, but as demonstrating to the soap manufacturer the importance of a knowledge of chemistry in its applications to his processes. The general theory of saponification is first explained, and is followed by a chapter on the arrangement of a soap factory and a description of the materials used in soap-making. The various methods of making hard soaps and cheapened soaps are then fully described, both by the old processes and by those of Hawes and Bennett and Gibbs, Rogers, and Berghart. The processes for manufacturing potash soaps and soaps for printed goods and silks are next explained, and there are special chapters on toilet and medicated soaps, alkalimetry and the methods of soap-analysis, and on the recovery of glycerine from spent lyes. We congratulate Mr. Watt on the success of his endeavour to fill a void in English technical literature.

T. E. THORPE

MARINE ENGINEERING

Die Schiffsmaschine: ihre Construction, Wirkungsweise und Bedienung. Bearbeitet von Carl Busley, &c. (Kiel, 1883.)

THIS is designed to be a manual and book of reference on marine engineering, for the use of engineers, naval officers, students, and others interested in steamships. The author is a marine engineer in the Imperial German service, and a professor at the Naval Academy of Kiel. He has laid down a most comprehensive scheme for the work, and the first and second divisions already published contain good evidence that the book when completed will become the standard German work on the subject.

Marine engineering has made great strides in recent years, and is now much more largely regulated by scientific methods than it was formerly. The earlier text-books have become obsolete to a great extent, and a demand has arisen for new works in which modern principles and practice should be represented. In response to this demand two or three excellent books have recently been published in this country; and Mr. Busley has determined to do a similar service for Germany. It is but right to say that his book will bear very favourable comparison with any book of the class yet published, and it surpasses all of them in the fulness and beauty of the illustrations, which are contained in separate atlases and printed in colours, on a scale which makes many of them virtually working drawings.

Theoretical investigation and practical information on the details of the construction and management of marine engines and boilers both find a place in this book. Its arrangement is admirable. First, there is a clear and succinct description of the principles of the mechanical theory of heat, followed by a discussion of the properties of steam. Next comes a chapter on combustion, including a summary of the conditions essential to good boilers, and a statement of the steam-producing powers of various kinds of coal. If there is not much novelty in this section of the book, it is full of useful information. In the fourth chapter there is a long discussion of the various matters affecting the performance and economy of marine engines; details as to coal-consumption in various types of engines, with methods for estimating the expenditure of steam and coal in ships of new design; definitions of horse-power, nominal, effective, and indicated; together with remarks on various systems of condensing steam, &c.

Following these introductory chapters, three others are devoted to marine boilers, their construction and management, including the best means of preserving them. These chapters are chiefly of a practical character, and will repay careful study, as they contain a most valuable summary of information and good rules for guidance. The eighth chapter is also of a practical nature, containing detailed examples of the auxiliary engines used for a vast variety of purposes in steamships. Amongst these may be mentioned the turret-turning and air-compressing engines of modern war-ships; steam-steering engines of various types; engines employed for heaving-up anchors and cables; others used in the production of the electric lights now generally carried by war-ships or large passenger steamers; pumping engines; steam-winches; ventilating machinery; appliances for condensing fresh water, &c. All of these and many others are described and illustrated in a manner which makes this portion of the book most valuable for reference. No similar summary of information on these important, if subordinate, portions in the equipment of a steamship has been previously published; and Mr. Busley deserves great credit for his perception of the necessity for and value of the information herein collected.

The ninth, tenth, and eleventh chapters relate to the construction and theory of the various types of marine engines which are or have been in use. Full descriptions and drawings are given of different systems—including some which are, as yet, only in the experimental stage; screw-steamers, paddle-steamers, and vessels driven by water-jets all come under review; and very valuable tables are given of the dimensions and particulars of the machinery in a large number of German, English, and French ships. Mr. Busley throughout displays a cosmopolitan spirit in his massing of facts, and this makes his book all the more valuable. The theoretical investigations include rules for estimating the engine-power required to attain the assigned speed of a ship; examples of the analysis of indicator diagrams for simple and compound engines; graphic processes for dealing with the slide-valves; and detailed investigations or descriptions of slide-valve gear, steering gear, &c.

This completes the contents of the first half of this book; the other half has yet to be published, we believe. If it maintains the high character of the part already given to the world, the book will be certain to achieve success. It has been produced in excellent style, both as regards letterpress and illustrations. Its chief value consists no doubt in the large amount of information respecting modern practice which has been brought together; but the treatment of the scientific branches of the subject will assist to secure its favourable reception by the classes of readers for whom it is especially designed.

OUR BOOK SHELF

Guide to the Calcutta Zoological Gardens. By John Anderson, M.D., F.R.S., Honorary Secretary and Treasurer. (Printed by order of the Honorary Committee of Management, Calcutta, 1883.)

ALTHOUGH the meritorious idea of starting a zoological garden at Calcutta was put forward by the well-known naturalist MacClelland as long ago as 1842, and several attempts were subsequently made to carry out the plan, it was not until 1875, chiefly, we believe, owing to the exertions of the late Mr. Schwendler, the telegraph engineer, that an appropriate site was obtained, and the present gardens were founded. After eight years of development the Zoological Gardens of Calcutta, under the energetic rule of the present Honorary Director, have attained a degree of arrangement sufficiently stable to allow of a "Guide" being prepared. Dr. Anderson's able pen has accordingly been employed in describing the institution which he has so well organised.

For a "Guide" Dr. Anderson's volume is perhaps rather bulky, and the type employed unnecessarily large. It is also, we may add, in our opinion a little too learned for a popular handbook. But the information contained in it, compiled as it is by one of the leading zoologists of India, may be generally depended upon, and so much can scarcely be said for some similar publications. At the same time we may remind Dr. Anderson that the statement that the sternum in *all* Picarian birds has a "double notch behind" (p. 94) is not quite correct, and that he has overrated the number of African rhinoceroses.

Judging from the "Guide," the series of animals now exhibited in the Zoological Gardens of Calcutta must be considerable, although no actual statistics are furnished to us on the subject. Several animals of special rarity are mentioned as in the collection, such as a specimen of Grant's Gazelle (*Gazelle granti*) from East Africa, and the *second* known example of the Hairy-eared Rhinoceros of Chittagong. It is also of great importance to learn that the phenomenon of incubation of one of the large Pythons has been witnessed in Calcutta as well as in European Gardens. On the whole, the naturalist will find many things to interest him throughout the present volume, though, as already said, some of the disquisitions are not perhaps quite suitable to a popular work.

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 Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Earthquakes and Air-Waves

IN the *Comptes Rendus* of the French Academy of Sciences for February 18, 1884, there appears a communication from Prof. Förster of Berlin relative to a statement previously made in the *Comptes Rendus*, to the effect that it was from observations taken at Berlin that he had arrived at certain conclusions as to the propagation of the atmospheric disturbance caused by the last great explosion in the eruption of Krakatoa in August last.

Prof. Förster explains that the statement referred to was a mistake, and that he had in fact only reproduced, after verifying them by reference to the Berlin observations, the conclusions come to by me, as explained in a paper read before the Royal Society on December 17, 1883, the principal part of which was published in NATURE of December 20 last (p. 181).

He adds that in his original note on the subject he had not mentioned my name as the author of the conclusions referred to, in consequence of the manner in which I had spoken of them myself.

Prof. Förster, while putting himself right on this point, has interpreted my own intention with great sagacity. For the light I may have been able to throw on the facts was in truth consequent on information put before me by the intelligent officers of our Meteorological Office, aided by a suggestion from Prof. Stokes, who like myself is a member of the Meteorological Council.

Such credit, however, as is due for bringing to notice the curious phenomenon in question may be fairly claimed for our Meteorological Office, as there is little reason to doubt that it would have remained unnoticed had it not been for the comparison of the several records of the continuously self-registering instruments which the organisation provided from the public grant we receive has placed at our command, and which no individual effort could have supplied.

February 26 RICHARD STRACHEY

IN the Jamaica Weather Report, No. 35, for November last year, I was unable to explain how it was that the Krakatoa air-wave had affected our barometer so strongly: the explanation is that Jamaica is very near the antipodes of Krakatoa (NATURE, vol. xxix. p. 181).

The general effect of the disturbance at Jamaica was to produce a barometric depression, preceded and followed by small barometric elevations, according to the following table, which gives for local time the pressure of the atmosphere at the sea-level, expressed in inches of mercury at 32°, and corrected for diurnal variation:—

Kingston, Jamaica, 1883

		in.
August 26,	3 p.m.	29·972
26,	11 p.m.	·975
27,	7 a.m.	·982
27,	3 p.m.	·944
27,	11 p.m.	·983
28,	7 a.m.	·994
28,	3 p.m.	29·975

Now the impulse at Krakatoa occurred at 9.24 a.m. local time, and it reached Jamaica about 3 p.m. local time, or eighteen hours afterwards; consequently the average velocity of the wave was about 690 miles an hour—which is wholly in accordance with the velocity deduced by General Strachey from places in Europe and elsewhere.

But there was no great explosion at Krakatoa at 9.24 a.m., and it seems possible that this great air-wave was similar to the air-waves we always experience in Jamaica whenever there is a shock in Kingston sufficiently strong to be distinctly felt.

In August 1881 I published a Report on Earthquakes in Jamaica, No. 4, in order to call attention to the following facts:—

1. The atmospheric pressure oscillates for some hours before and after a shock, the lowest depression generally occurring at the time of the shock.
2. The wind generally lulls, so that "the weather" is hot and oppressive.
3. Clouds (stratus) gather over the sky after the shock.
4. The temperature of the air, if we allow for the cooling effect of (3), remains unchanged.
5. The rainfall is unaffected.

These facts have been fully confirmed by subsequent shocks. As an example let us consider the last shock which occurred on January 14 this year, and which was felt over nearly the whole of the island.

At Kingston it was felt as a sharp double-shock at 1.15 p.m.; the first shock lasted about three seconds, then there was an interval of about two seconds, which was followed by the second shock, lasting about five seconds. There was a strong sea-breeze blowing during the day, but a temporary lull occurred just before the earthquake.

The following table gives the pressure of the atmosphere at the sea-level, expressed in inches of mercury at 32°, and corrected for diurnal variation:—

Kingston, January 14, 1884

	in.
24 hours before the shock	30·061
16 ,, ,, ...	·047
8 ,, ,, ...	·043
At the time of the shock	·016
8 hours after	·024
16 ,, ...	·063
24 ,, ...	30·056

On January 13 the average amount of cloud was 7 per cent. of the whole sky, on the 14th it was 10, and on the 15th it was 43!

Further particulars will be found in the Jamaica Weather Report, No. 37, for January 1884, and it will here be sufficient to remark that the depression at the time of the shock was quite as strongly marked at the cinchona plantation, thirteen miles from Kingston, but 4850 feet above the sea-level.

It is needless to say that I am at a loss to account for the connection which most undoubtedly exists in Jamaica between earthquakes and air-waves; but it is evident that the latter may be connected with the former without any, the slightest, approach to volcanic explosion; and the Krakatoa air-wave was probably similar in all respects, except magnitude, to the waves we continually experience in Jamaica at the time of earthquake shocks.

Jamaica, February 7 MAXWELL HALL

The Remarkable Sunsets

AT 8.45 a.m. to-day the sun seen from here through a light mist was of a slightly metallic and very pale sea-green colour. The mist was not dense enough to render objects at a distance of twelve yards indistinct, but beyond that distance they rapidly became invisible. There was no wind, and the mist seemed free from smoke. I could form no opinion as to its height. Half an hour later, in Manchester, the sun glowed with the ordinary coppery-red hue it assumes when seen through a thin fog.

EDWARD J. BLES

Moor End, Kersal, near Manchester, February 26

Instinct

I DO not think that the difference between Mr. Lloyd Morgan and myself on the point to which he returns in his last letter is so great as it at first appeared. For he now admits that "the actions of animals testify to some corresponding mental states," and therefore that from such actions we are entitled to infer something as to these states. His objection to comparative psychology as a science is thus reduced to the observation that our inference from bodily actions to mental states cannot be so clear or certain in the case of animals as in the case of men, where intentional sign-making, or language, comes to our assistance. Now this is precisely what I argued in my own communication to NATURE (p. 379), and also in my books. Therefore I do not consider that this is "an ingeniously constructed argument of scepticism"; I applied that phrase to the argument which denies the possibility of all or any ejective knowledge, both of men and animals.

Thus the only point of dispute between us is whether such conceptions as we can form of the mental life of animals are sufficient to constitute this mental life the subject-matter of a science—*i.e.* whether this mental life admits of investigation. And, so far as I am aware, Mr. Morgan is the only individual who has ever said that such is not the case.

GEORGE J. ROMANES

THERE is a remarkable instance of instinct displayed by the common magpie which I have not seen noticed in NATURE or anywhere else, although it has long attracted my attention and is well known to farmers in the west of Scotland. This bird may be seen each year, on the first Sunday of March (old style), very busily employed carrying small twigs of branches to renew its old nest or form a new one for the approaching breeding season. This particular day appears to be appointed for taking formal possession of the premises, as no more work whatever is done for some weeks after. The instinct which enables a bird to take the sun's altitude on a particular day in March is certainly a very rare gift, but any person who wishes to satisfy himself of its truth, and who lives in a locality where these birds breed, has only to rise early on Sunday, March 16, this year, to see them at work for himself. It would be interesting to know within what degrees of latitude this particular day is observed by these birds.

WM. BROWN

"Mental Evolution in Animals"

I AM as unwilling as Mr. Romanes to continue this discussion needlessly, but inaccuracy calls for correction. Mr. Romanes says that "the glass wall of a tank is not an object upon the solidity of which a skate would be likely to calculate." If he will read my original account of the incident again, he will find that the skate made himself absolutely sure of the solidity of the glass wall of the tank; he tried hard to seize the food, and failed because he could not get his head through the glass, and therefore his mouth could not touch the food. As for his being unable to see the food when the current lifted it, that is precisely my case. But he saw it clearly enough, and had tangible experience of the conditions, before he adopted the successful device. If the matter is worth noticing, it may as well be described correctly.

F. J. FARADAY

Manchester, February 29

I WILLINGLY apologise for making the remark about the glass wall without having first consulted Mr. Faraday's original account; but as, in "noticing" the matter in "Animal Intelligence," I quoted that account *verbatim*, I cannot allow that on the only occasion when I "described" the circumstances, I failed to do so "correctly."

G. J. ROMANES

Natural Snowballs

IT is nearly a year since I inclosed to you an account of the natural snowballs or snow-rollers which were to be seen in great numbers for many square miles in this vicinity on February 21, 1883. A friend has called my attention to a brief newspaper report of a recurrence of the same remarkable phenomenon on a larger scale in Oneida and Herkimer counties, in the State of New York. The rollers were formed by the wind on the night of Tuesday, January 22, and are said to have been "innumerable," hundreds being seen on an acre of ground. The measurements of the largest are the same as those which I made of the largest that I saw last year, 18 inches in length and 12 in diameter. But, whereas all of last year's were extremely delicate, so as to yield to the touch, it is reported that some of those seen in January were "solid and so firm that they could be handled quite roughly without breaking." I send these memoranda to you, thinking that you may deem them worthy of preservation in the columns of your journal.

SAMUEL HART

Trinity College, Hartford, Conn., U.S.A., February 16

Common Domestic Duck Diving for Food

WHEN at Buxton last August I spent a good deal of my time in watching and occasionally feeding the water-fowl in the ponds of the garden. On week-days the ducks received large contributions from the visitors, but on Sundays they apparently were on rather short commons, judging by their greater activity in searching for food, and constantly standing *on their heads* in the water so as to search the bottom for aquatic plants. Of course every scrap of plant to the depth of ten or fifteen inches (eighteen inches where the geese were) was cleared away.

I was surprised one Sunday to see a common domestic duck (female) diving in three or four feet of water, and searching along the bottom, as if she had been "to the manner born," for plants, which, when she found, were brought to the surface; some fifteen or twenty other ducks watched her proceedings with great interest, and made an immediate rush at her when she came up to share in the food, exactly as the widgeon pounce upon the canvas-back ducks at the mouth of the Delaware River and other favourite winter feeding-places of these delicious birds, which, notwithstanding their difficulties with their thievish tormentors, must manage to pick up a fairly good living, as when killed they are usually in fine condition.

I saw only one duck (a mallard) at Buxton make any attempt to imitate the clever diver, but his efforts were always ignominious failures. Had I been living in Buxton I should have endeavoured to get some eggs of this diving duck and had them hatched, with the object of finding out if the progeny inherited the peculiarity of the mother.

JOHN RAE

4, Addison Gardens, March 1

Circular Rainbow seen from a Hill-top

IN the evening of the first Sunday in last September, when, it will be remembered, there was a very severe storm, I was walking alone up the south side of the top of the Belchen, in the Black Forest; the sun was setting in the west over the Rhine, and for some time my shadow was thrown on the mist filling up the valley to the east of the Belchen, and around it was a most distinct rainbow, with all the usual colours. It was so striking that it at once suggested the halo one sees in religious pictures, except that it was round the whole figure, and not confined to the head. I thought this anecdote might interest those gentlemen who have already written to you about this beautiful phenomenon, and especially Mr. Maynard, who I see writes from the Black Forest.

W. HALE WHITE

4, St. Thomas's Street, S.E., March 1

Girton College

IN reference to a paragraph in NATURE (vol. xxix. p. 388) respecting the representation of the students of the College Hall of Residence, Byng Place, on their governing body, allow me to state that the students of Girton College have been represented on the College Committee for some seven years past. The representatives of the students are three in number, one retiring annually; they are elected by those students who hold the college certificate, and have been chosen, so far, from among themselves. As the certificated students keep up a more or less close connection with the College, and their representatives pay regular visits of inspection, the views of past and present students can be formally laid before the College Committee. This privilege is much appreciated by the students. If you have received no other letter to this effect, may I ask you to insert the above information?

CERTIFICATED STUDENT

February 26

ANTHROPOLOGICAL NOTES IN THE SOLOMON ISLANDS

IN my last paper on the physical characters of the natives of St. Christoval and the neighbouring islands (NATURE, vol. xxvii. p. 607) I drew attention to the variation which was presented towards the opposite extremity of the Solomon group by the Treasury Islanders, of whom I considered the natives of the large adjacent island of Bougainville would prove to be a more pronounced type. My observations during 1883, which were confined, however, to the islands of the Bougainville Straits, and did not extend to the large island of that name, have confirmed the existence of this variation in the type of the natives at the western end of the group.

Proceeding at once to the comparison of the inhabitants of these two regions, I find that the most important distinction lies in the form of the skull. The cephalic indices obtained from forty head-measurements amongst the men of the islands of Bougainville Straits (Treasury Island, Shortland Islands, Faro Island) ranged between 76 and 85; three-fourths were included between 79 and 83 (inclusive); and the mean was 80·6. Of the same number of measurements amongst the men of St. Christoval, half produced cephalic indices between 75 and 78 (inclusive); the range was 69 to 83; and the mean 76·7. In the first region therefore brachycephaly may be said to prevail; in the latter, mesocephaly. But in addition to being more brachycephalous, the men of Bougainville Straits belong to a noticeably taller and more robust race, their average height being 5 feet 4½ inches to 5 feet 5 inches, as contrasted with 5 feet 3 inches to 5 feet 4 inches in the case of the St. Christoval natives. I should also add that the hue of the skin is of a darker shade, corresponding to numbers 35 and 42 of the colour-types of M. Broca. The character of the hair resembles that of the natives of the eastern islands of the group in being frizzly and bushy; but there is introduced among the populations of these islands in the Bougainville Straits an almost straight-haired element, to which further reference will be made.

The inhabitants of the islands just alluded to are also distinguished from those of St. Christoval and the eastern islands of the group in many of their arts and usages, to some of which I can here only just refer. Cannibalism is rarely if ever practised among the natives of Bougainville Straits: it is, however, frequent amongst those of St. Christoval. Polygamy is more prevalent in the former region, where Gorai, the powerful chief of the Shortlands, possesses between eighty and one hundred wives, and Mulé, the chief of Treasury Island, owns between twenty-five and thirty. The patriarchal and despotic rule of these chiefs must be contrasted with the little authority which belongs to the majority of the chiefs in the eastern islands. The women of Bougainville Straits manufacture a kind of unglazed pottery, employing for this purpose a wooden trowel, a large smooth pebble 3 to 4 inches across, and a ring-cushion of palm leaf; a rudely-shaped saucer is first made from a lump of the clay; and upon this the vessel is built up, strip by strip. A large number of the houses in the principal villages of Faro—an island in the middle of the Straits—are built upon piles. I should here refer to the greater prevalence amongst the natives of the islands in Bougainville Straits of the cutaneous disease—an aggravated form of "body-ringworm"—to which I alluded in my description of the St. Christoval natives: four-fifths of the inhabitants of Treasury Island are thus affected; and half of the chief's wives are covered with this disease from head to foot.

From frequent observation of the different modes of wearing the hair which prevail among the Solomon Islanders, I am of the opinion that their variety is to be attributed more to individual fancy than to any difference in the character of the hair. According to his taste, a man may prefer to wear his hair close and uncombed, when the short matted curls with small spiral give a woolly appearance like that of the hair of the African negro. Should he allow his hair to grow, making but little use of his comb, the hair will hang in ringlets 3 to 8 inches long—a mode more frequent amongst the natives of the eastern islands of the group, and best described as the "mop-headed" style. More often from a moderate amount of combing, the locks are loosely entangled and the hair-mass assumes a somewhat bushy appearance, the arrangement into locks being still discerned and the surface of the hair presenting a tufted aspect. The majority of natives, however, produce by constant combing a bushy periwig in which all the hairs are entangled independently into a loose frizzly mass, the separate locks being no longer discernible. These four styles of wearing the hair—the woolly, the mop-like, the partially bushy, the completely bushy—prevail with both sexes, the fashion varying in different islands of the group. I am inclined to view the mop-headed style as the natural mode of growth, it being the one which the hair would assume if allowed to grow uncombed and uncut. The Solomon Islander unfortunately makes such a constant use of the comb that one rarely sees his hair as nature intended it to grow. When, however, a man with bushy hair has been diving for some time, the hairs, disentangling themselves to a great extent, gather together into long narrow ringlets—nature's *coiffure* of the Solomon Island native.

Amongst the natives of Bougainville Straits the hair is coarser and of a darker hue, corresponding to numbers 34 and 49 of the colour-types of M. Broca; whilst the lighter hue of the hair of the St. Christoval natives more accords with numbers 35 and 42. The diameter of the spiral when measurable varied between 5 and 10 mms.—its usual range throughout the group; but on account of the practice of combing it was often difficult to measure it with any accuracy. Here I may allude to the almost straight-haired element which has been infused among the inhabitants of Bougainville Straits. The individuals thus characterised have very dark skins, which for want of comparison might be termed black; the hue, however, nearly agrees with colour-type 42 of M. Broca; the hair, which is even darker, corresponding with types 34 and 49, is almost straight, often erect, and giving the person a shock-headed appearance; whilst it may in some instances tend to gather into curls of a large spiral. I was unable to detect any constant change in physical characters accompanying this variety in the growth of hair. The general colour of the iris amongst the natives of Treasury Island may be described as a deep muddy-violet, approaching nearest to number 11 of the colour-types of M. Broca.

The relation between the lengths of the upper and lower limbs in over thirty individuals was fairly constant, the mean intermembral index being 68. A steady index, giving a mean of 33·4, indicated the proportion of the length of the upper limb to the height of the body; but the corresponding index which my measurements gave for the lower limb was somewhat variable, and the mean 49·2 is therefore not so reliable. H. B. GUPPY

H.M.S. *Lark*, Auckland, N.Z., January 2

ON THE CLASSIFICATION OF THE ASCIDIÆ COMPOSITÆ

COMPOUND ASCIDIANS should undoubtedly be studied in the fresh condition. This becomes evident to any one who, after having admired the graceful forms, gorgeous colouring and transparency of tissue exhibited by the living animals on our western and southern coasts, or in such a favoured spot as the Chausey Archipelago, seeks in vain for these or any other beauties in the leathery repulsive-looking masses usually exhibited in a collection of Tunicata.[1] And it becomes painfully impressed upon one when working through a large collec-

[1] There are exceptions: some few species retain both form and colour airly well when preserved.

tion which has been in alcohol for about ten years. Laborious dissection and the preparation of large numbers of sections are necessary to reveal characteristics which may often be seen in the living specimen by observation merely. And, what is of more consequence, there is a risk of being led into errors and misinterpretations by the abnormal contraction and distortions caused by the alcohol.

Such plates as those of Prof. Giard,[1] and of Dr. R. von Drasche's beautifully illustrated monograph on the Synascidiæ of the Bay of Rovigno,[2] which has just appeared, show how much can be made out from a natural representation of the living animal, and leave little or nothing to be desired so long as we must be content with some substitute for the actual specimen. In this important work von Drasche criticises Giard's classification of the Synascidiæ, and explains fully a scheme of his own which appeared in the *Zoologischer Anzeiger* for 1882. Many attempts have been made to classify naturally this difficult group, and this latest effort, although it has corrected some previous errors, appears still to be susceptible of improvement, especially as regards the interesting forms which occupy the borderland between simple and compound Ascidians. Some of these (the Clavelinidæ) are placed by Giard and von Drasche in the Synascidiæ, while in 1880 I tried to show that their proper position was amongst the Ascidiæ Simplices, and close to the genus *Ciona*. At the present moment I confess that I am unable to find a single satisfactory character by which to distinguish these two large groups, the simple and compound Ascidians.

Savigny, in 1815, in his "Observations sur les Alcyons gélatineux à six tentacles simples,"[3] first rescued the compound Ascidians from the Alcyonaria with which they had previously been associated, and demonstrated their affinity with the other Tunicata.[4] In the "Tableau Systématique" Savigny gives no formal statement of the characters distinguishing the two groups, but it is evident from some passages in his "3e Mémoire" that he relied chiefly, if not entirely, for their separation upon the arrangement of the Ascidiozooids of the compound forms around a central cloaca—a character which he declared was visible even in the young embryo. In this latter point he was mistaken, and it seems rather singular that he should have laid such stress upon the union of the atrial apertures when we find that he describes and figures their separate and independent existence in *Diazona* and *Distoma*, two of the genera of his "Téthyes Composées." *Clavelina* in his system is placed next to the "Phallusiæ Cionæ" (= the modern genus *Ciona*) in the Ascidiæ Simplices.

Savigny classified the nine genera which he recognised amongst compound Ascidians by means of characters taken from the branchial and atrial apertures. But although such characters are most useful and constant marks of affinity in the simple Ascidians, they fail signally as applied by Savigny to the compound forms, and result in the separation of his closely allied genera *Didemnum* and *Eucœlium*, while *Diazona*, *Distoma*, and *Sigillina* are thrown together in one group, and *Eucœlium* is placed with *Botryllus*, a genus with which it has certainly no close relationship.

Lamarck's arrangement of the Tunicata, published about the same time, showed no improvement upon that of Savigny.

In 1841 Milne-Edwards[5] established the group of "Ascidiæ Sociales" as occupying an independent position between the simple and compound forms. This group (in which he placed the genera *Perophora* and *Clavelina*) he defines as comprising Ascidians which reproduce by buds as well as by eggs, and which live united by common radiciform prolongations, but which otherwise are free of all adhesion to one another. He distinguished the simple Ascidians as forms which never reproduced by gemmation and were never found in groups united by a common tegumentary tissue; while he separated the compound from the social Ascidians on account of their possessing a test common to all the members of the colony. If we unite the simple and social Ascidians, which I have shown in the Report upon the *Challenger* Tunicata there is reason for doing, we shall have, according to Milne-Edwards, the simple and compound Ascidians distinguished merely by the members of the colony in the latter being united by a common test, while in the former each individual has its own distinct tunic. This character, although better than the one made use of by Savigny, is, as we shall see later on, by no means an infallible guide.

Milne-Edwards formed a classification of the genera of compound Ascidians into "Polycliniens," "Didemniens," and "Botrylliens," which, with our present knowledge of the group, still seems fairly natural. These three divisions are distinguished by such anatomical characters as the relations of the other viscera to the branchial sac. In the "Polycliniens" the body has three regions—the "thorax," containing the branchial sac; the "abdomen," formed by the stomach and the greater part of the intestine; and the "post-abdomen," having the reproductive organs and the heart. In the "Didemniens" there are only two regions—thorax and abdomen—the reproductive organs and heart being placed on the intestine. In the third group, the "Botrylliens," the viscera form a single mass, in which the alimentary canal lies alongside the branchial sac.

This arrangement of the Ascidiæ Compositæ was generally accepted until 1872, when Giard published[1] his important memoir, "Recherches sur les Ascidies Composées ou Synascidies," in which is given a classification based upon the method of gemmation. He distinguishes three points of origin for the buds—the pyloric region of the alimentary canal, the reproductive organs, and the posterior end of the body. The latter region is the place of gemmation in his "Catenatæ," a group which contains three families—the Clavelinidæ, the Perophoridæ, and the Botryllidæ. But he gives no sufficient reasons for placing the first two families in the compound Ascidians, and, as von Drasche has pointed out, the third one does not really exhibit the essential character of the Catenatæ.

Giard's second group, the "Glomeratæ," is characterised mainly by the formation of ovarian buds. It corresponds to Milne-Edwards' "Polycliniens," in addition to half of the "Didemniens." The remainder of the "Didemniens" correspond to Giard's third group, the "Reticulatæ," and are characterised by gemmation taking place from the pyloric region. This seems a natural and well-defined section, including two families, the Didemnidæ and the Diplosomidæ, but the "Glomeratæ" cannot stand without several changes which von Drasche suggests, and which really reduce it merely to Milne-Edwards' section "Polycliniens." Upon the whole, there can be little doubt that Milne-Edwards' classification is preferable to that proposed by Giard.

We come now to Dr. von Drasche, the latest authority, who, both in his preliminary note[2] and in the detailed memoir,[3] wisely abstains from any attempt to form main divisions, and merely groups the genera in a series of carefully chosen families. Of these the Botryllidæ corresponds to Milne-Edwards' section "Botrylliens," while the Didemnidæ and Diplosomidæ are identical with Giard's families bearing the same names. The Polyclinidæ

1 "Recherches sur les Ascidies Composées ou Synascidies" (*Archives de Zoologie expérimentale et Générale*, t. i. 1872).
2 "Die Synascidien der Bucht von Rovigno." Ein Beitrag zur Fauna der Adria, von Dr. Richard von Drasche (Wien, 1883).
3 "Mémoires sur les Anim. sans Vert."
4 The class Tunicata was established by Lamarck in the year following—1816.
5 "Observations sur les Ascidies Composées des Côtes de la Manche" (*Mém. Instit. France*, vol. xviii.).

1 *Arch. de Zool. expér.*, t. i.
2 *Zoologischer Anzeiger* for 1882, p. 695.
3 "Die Synascidien der Bucht von Rovigno" (Wien, 1883).

and Distomidæ do not correspond exactly to any of Giard's families, but the former is Milne-Edwards' "Polycliniens" without change. A new family, the Chondrostachyidæ, has been formed for the reception of Macdonald's *Chondrostachys* and von Drasche's *Oxycorynia*, remarkable forms in which the Ascidiozooids are placed upon a common peduncle penetrated by large canals. I am inclined to admit the necessity for this new family, and several undescribed and interesting forms obtained during the *Challenger* Expedition will, I hope, take up a position within its bounds. The two remaining families of von Drasche's system, the Clavelinidæ and the Perophoridæ, I would still maintain are more closely allied to the simple than to the compound Ascidians. They correspond to Family IV. Clavelinidæ of my arrangement of the Ascidiæ Simplices.

Dr. von Drasche does not define the Synascidiæ, and from one or two passages in his work it seems probable that he is in very much the position in which I now find myself, viz. unable to find any character or combination of characters which will serve to distinguish simple from compound Ascidians. Reproduction by gemmation and the formation of colonies in the latter group will not hold, since it is possible to pass from *Ciona*—a typical simple Ascidian—to *Distoma* and the very heart of the compound Ascidians through the following series of forms, which shows a perfect gradation of these characters :—*Ciona*, *Rhopalæa*, *Ecteinascidia*, *Clavelina*, *Diazona*, *Chondrostachys*, *Oxycorynia*, *Distoma*. The formation of common cloacal cavities, canals, and apertures cannot be considered as a diagnostic feature of the compound Ascidians. Although Giard has demonstrated their presence in some genera in which they were previously unknown, yet there are some forms considered by all authorities as Synascidiæ, such as *Chondrostachys*, *Diazona*, *Distoma*, and others, in which the atrial apertures of the Ascidiozooids open independently on the surface of the colony, and no common cloaca is formed.

Lastly, we come to characters taken from the condition of the test, but these break down like the others. In the first place, in passing along the series of forms mentioned above as connecting *Ciona* and *Distoma*, we encounter all stages between a distinct test or tunic for each individual and a common mass in which a number of Ascidiozooids are embedded. And, secondly, the remarkable group "Polystyelæ," briefly characterised by Giard in 1874 presents many of the characters of highly differentiated simple Ascidians (the Cynthiidæ), along with the supposed Synascidian feature of a colony composed of many Ascidiozooids completely buried in a common test.

In the *Challenger* collection there is an interesting series of Polystyelæ—all from southern seas—in which it is possible, I believe, to trace a passage from such aggregated Styelinæ as *Polycarpa* to the Botryllidæ. If this passage indicated genetic affinity between these two very distinct groups, which I greatly doubt, it would be impossible to escape from the conclusion that the Ascidiæ Simplices and the Ascidiæ Compositæ have *two* points of connection, almost at the extreme ends of the two series. I think I am justified in believing that probably both groups were derived from a form not unlike *Ecteinascidia* or *Clavelina*. From this common ancestor the simple Ascidians diverged through the Ascidiidæ to the Cynthiidæ (including *Polycarpa*) and the Molgulidæ, while the compound Ascidians diverged through *Diazona* and the Chondrostachyidæ to the Polyclinidæ, Didemnidæ, and Botryllidæ. Hence it seems much more probable that the Polystyelæ have acquired independently certain characters of *Polycarpa* or of *Botryllus* (I have not yet been able to determine to which of the two they are really most closely related) than that there is any direct affinity between such highly differentiated groups as the Cynthiidæ and the Botryllidæ. This, however, does not affect the practical difficulty that the Polystyelæ completely bridge across the gap between simple and compound Ascidians as distinguished by the nature of the test or tunic, and consequently it is extremely difficult to separate them from either of these two great series.

Thus all the diagnostic features usually employed fail utterly, and we find ourselves unable to discover a single character or combination of characters which will serve to distinguish the Ascidiæ Simplices from the Ascidiæ Compositæ. W. A. HERDMAN

A METEOROLOGICAL LABORATORY

TO the last issue of *Science et Nature* M. L. Mangin contributes an interesting account of the chemical laboratory recently installed on the Pic du Midi, Pyrenees, at an altitude of nearly 9500 feet above the sea. As shown in our first illustration, the laboratory stands between the dwelling-house and the Observatory, of which it forms a dependency, under the direction of MM. Müntz and Aubin. In the second illustration a fuller view is given of the building, which faces southwards, and the slated roof of which is so constructed as to constitute a sort of pluviometer registering the annual rainfall, and retaining sufficient for chemical analysis. This unique establishment, which promises to render great services both to meteorology and to the economic industries, is at present chiefly occupied with the constituent elements of the terrestrial atmosphere, especially in connection with vegetable life. The student of chemistry need scarcely be reminded that, besides oxygen and nitrogen, the air contains in smaller proportions carbonic acid, ammonia, and certain nitric compounds playing an important part in the nutrition of plants, and supplying them with nearly all the nitrogen and carbon that enter into the composition of their tissues. During the summer months of the years 1881-82, MM. Müntz and Aubin were mainly engaged with the quantitative analysis of these substances, under conditions peculiarly favourable for the prosecution of such investigations. The results so far obtained may here be briefly resumed.

Carbonic Acid.—The proportion of this element found in the air at different altitudes is still a subject of discussion amongst analytical chemists. But de Saussure's average of from ·0004 to ·0006 has been shown to be considerably too high by various observations taken of late years at different stations on the globe. These observations are now fully confirmed by the researches on the Pic du Midi, which reduce the average to 2·86 ten-thousandths.

Another important conclusion is that the carbonic acid does not perceptibly vary with the altitude, as had hitherto been supposed. Thus the proportion is found to be much the same at Vincennes near Paris, Luz (740 m.), Pierrefitte (500 m.), and Pic du Midi (2900 m.). On the other hand, the quantity varies slightly in the same locality, being somewhat greater at night and in moist weather than during the day and in dry weather. The subjoined table shows the average quantity of carbonic acid present in the atmosphere during the day and at night at various meteorological stations in different parts of the world :—

	Night	Day
Vincennes	2·98	2·84
Pic du Midi... ...	2·90	2·86
Hayti	2·92	2·70
Florida	2·94	2·89
Martinique	2·85	2·73
Mexico...	2·86	2·66
Patagonia	2·67	2·66
Chili	2·82	2·66

Ammonia.—Although the presence of ammonia in the air has long been known, Schlösing was the first to show that for this substance, as well as for carbonic acid, the sea is the great reservoir whence the atmosphere receives its supplies. But no light had hitherto been thrown upon

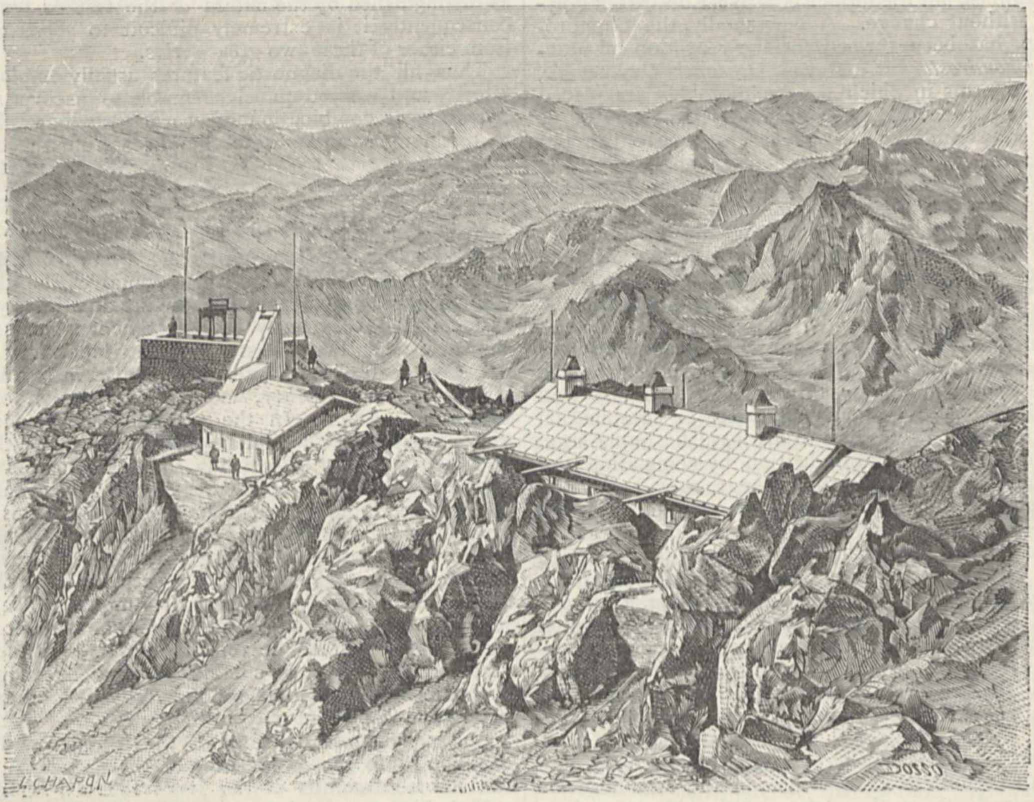

FIG. 1.—General View of the Pic du Midi Observatory.

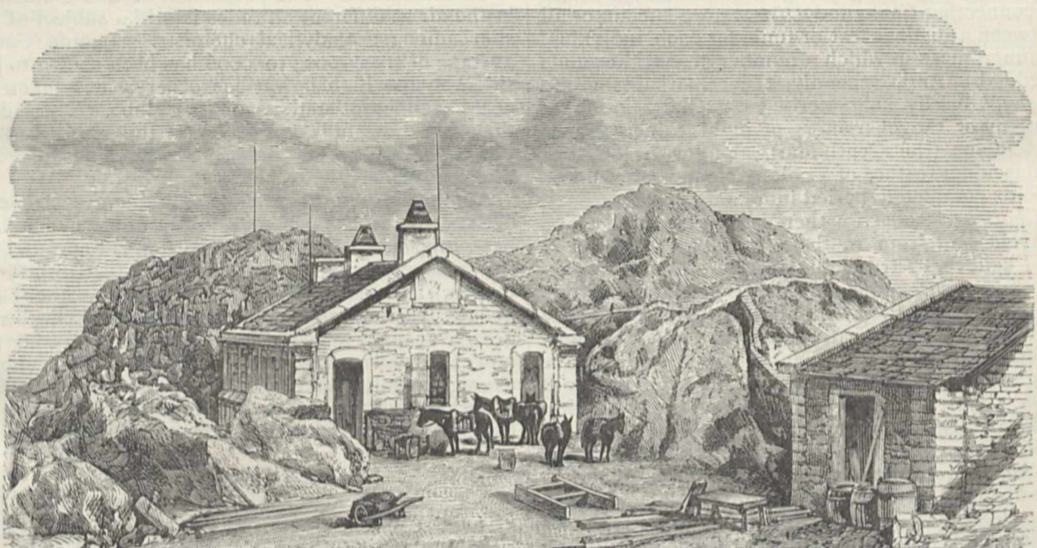

FIG. 2.—The Observatory and Laboratory.

the distribution of ammonia at different altitudes. Examining the atmosphere from this point of view, MM. Müntz and Aubin now find that at an elevation of nearly 3000 m. the quantity does not sensibly differ from that at extremely low levels, which is ascertained to be about 1·35 mgr. to 100 c.m. Hence the diffusion of ammonia in the air is as complete as that of carbonic acid. Consequently it is in the gaseous state that this substance is incessantly transmitted from the marine basins to the atmosphere. The rain and snow collected on the Pic du Midi also revealed the presence of ammonia in solution, as was to be expected.

Atmospheric Nitrification.—The analysis of rain falling during thunderstorms is known invariably to yield certain nitrous compounds in the form of sal ammoniac. From what is known regarding the affinities of nitrogen, it is argued that these compounds are developed under the influence of electric discharges. The nitrous compounds (nitric acid and sub-nitric acid) are converted, in the presence of water and of ammonia, into sal ammoniacs, which are precipitated by the rain. Hence electric disturbances in the air came to be regarded as the chief source of nitrous compounds.

MM. Müntz and Aubin have analysed by the most delicate processes the rain-water collected on the Pic du Midi, but never succeeded in detecting any nitrates in it, although they are always present in rain-water collected on the plains. Their absence corresponds with the absence of thunderstorms taking their rise above the Pic du Midi. Of 184 storms observed during a period of nearly nine years by M. de Nansouty, the director of the Observatory, not more than twenty-three originated at an altitude of over 2300 m.; but in no case were electric phenomena observed at an elevation higher than 3000 m. Hence the electric discharges, which give rise to the nitrates, are limited to the lower atmospheric regions between sea-level and 3000 m. above the sea.

To the general results here resumed MM. Müntz and Aubin have added some details concerning the formation of vegetable soil. They have distinctly determined the presence of nitric ferment in the ground on the highest summits. But owing to the low temperature prevailing at those altitudes, the activity of this ferment is extremely weak.

It may be observed in conclusion that the uniform proportion of carbonic acid and ammonia in the atmosphere, as determined by these remarkable researches, is a fresh confirmation of Schlösing's theory regarding the interchange of gases between the sea and the air. The marine basins are incessantly discharging or absorbing carbonic acid and ammonia in such a way as to maintain the constant proportion of these substances. They thus constitute a vast regulator, restoring to the atmosphere the nitrous or carbonic compounds of which it had been deprived by vegetation.

SCIENCE IN ROME

THE recent changes introduced into the constitution of the Accademia dei Lincei, followed by its removal to new and sumptuous quarters in Trastevere, seem to call for more than a passing notice. There are certainly many other famous societies scattered over the Peninsula, all the large towns of which have long possessed one or more scientific, literary, or artistic corporations. But, with perhaps the single exception of the Florentine Academy, none of them have been so intimately identified with the progress of the physical sciences since the "Renaissance" as this oldest of still existing learned institutions. Founded on August 17, 1603, by the young prince, Federigo Cesi, for the express purpose of cultivating "le scienze matematiche e filosofiche," it began its useful career forty years before the birth of Newton, and six before Galileo had rendered Jansen's telescope a suitable instrument for astronomic observation. The very name of the Lincei, or "Lynx-eyed,"[1] breathes the quaint spirit of the times, when every capital in Italy had its centres of intellectual movement, bearing such eccentric titles as the Accademia dei Sonnacchiosi ("The Drowsy"), dei Sitibondi ("The Thirsty"), dei Svegliati ("The Wide-Awake"), degli Ottusi ("The Dull"), degli Innomati ("The Nameless"), dei Storditi ("The Dazed"), dei Tenebrosi ("The Darklings"), and so forth. But while most of these ephemeral corporations have left little but their names behind them, the Lincei have gone on prospering and continually widening the field of their utility until the Academy now finds itself formally constituted the chief national exponent of the natural sciences in Italy, thus taking rank with the French Institute and the Royal Society of London.

Although such a proud position could scarcely have been anticipated by its founder, the Academy none the less possessed from the outset certain elements of stability, which under favourable circumstances could not fail to insure it a prolonged existence. Its generous patron not only provided it with a home in his ancestral palace, but also placed at its disposal a botanical garden, a rich museum and a choice library soon increased the valuable collection of Virginio Cesarini. Its three first members, the founder, Fabio Colonna, and Francesco Stellati, were all noted for their varied accomplishments, and Colonna especially, at once a mathematician, philosopher, painter, musician, and *savant*, may be regarded as the greatest of botanists previous to Linné.[2]

During the seven first years after its foundation, Gaetano Marini tells us that the Academy "dared to stand up against the tyranny of the Peripatetics, and to introduce a new and more certain method of philosophy, bravely and religiously enduring a long and most unworthy persecution" (*Ist.* i. p. 493). The reference in the last clause, necessarily worded somewhat vaguely, is to the action taken by the Lincei in defence of Galileo, who had joined the Academy, and who had in 1615 received his first summons to Rome to recant his "errors." A feeble attempt seems to have been made to continue the struggle between light and darkness till 1632, when Galileo was finally "suppressed." The "Lynx-eyed" were now shrewd enough to perceive that they had fallen upon times when silence was "golden." Henceforth for many years their records are practically a blank, broken only in 1651 by the publication under their auspices of Francisco Hernandez's great work on the natural history of Mexico.

After the untimely death of Prince Cesi in 1630 the Academicians, now numbering thirty-two members and foreign associates, received a temporary shelter in the house of the Commendator Cassiano del Pozzo. Their first organic constitution had been issued in 1624, and since that period both residence and regulations have been subjected to many changes. After the political unification of Italy and the selection of Rome for its capital, fresh modifications became inevitable, and a new constitution was published in the year 1875. But so rapid has been the progress of the natural sciences, and so great the zeal displayed by the Lincei in the cause for which their predecessors endured "a long and most unworthy persecution," that further alterations in the sense of expansion were soon felt to be imperative. According to the reform introduced in July 1883, better provision is made for the cultivation of all branches of physics by the final and absolute exclusion of the arts and letters. The new

[1] Tiraboschi tells us that this title was adopted "per chè gli accademici presero a lor simbolo un lince, a spiegar l'acutezza con cui si erano prefissi di osservare e di studiar la natura" (viii. p. 72).

[2] "Quicumque," says Boerhaave, "historiam antiquitatis plantarum scire vult, legat opera Fabii Columnæ, qui vix habet similem, sed quidem imitatores" ("Method. discend. Medic.," pars 4, § 8). Colonna, who was born in Naples in 1567, and died an octogenarian in 1647, was also the inventor of the musical instrument by him named the "sambuco linceo," in honour of the Academy.

conditions have of course necessitated this departure from the original scope of the Institute, which, as we are expressly told by Tiraboschi, did not exclude the "humanities."[1] The scheme of the natural sciences itself has also been entirely recast, with a corresponding increase and redistribution of members among the various sections. As regards foreign membership the Lincei take the lead in an important innovation, which will doubtless be adopted in due course by the great scientific institutes of other countries. In a truly "international" spirit, they henceforth practically abolish the distinction between *Associates* (Socî, or home members) and *Correspondents* (Corrispondenti, or foreign members). The clause bearing on this point in the President's Circular of June 26, 1883, deserves to be here quoted in full:—

"Per ciò che concerne gli stranieri fu unanime il pensiero di togliere la distinzione fra i Socî ed i Corrispondenti: distinzione la quale riferendosi a pochi personaggi eminenti nelle scienze a cui attendono e disseminati in tutto il mondo civile, riesce difficilissima e di utilità molto dubbia. Per le scienze fisiche, matematiche, e naturali parve necessario un aumento nel numero degli stranieri aggregabili all' Accademia, non solo per dare una dimostrazione d'onore a personaggi cosi benemeriti, ma anche per agevolare le relazioni scientifiche le quali si fanno ogni giorno più frequenti, più necessarie, e più intime fra i cultori delle stesse scienze ed i direttori di analoghi stabilimenti scientifici, independentemente dai confini politici che li separono."[2]

Amongst the foreign *savants* who thus receive full membership, occur the names of Airy, Adams, Lockyer, and Huggins in Astronomy, Ramsay in Geology, Hooker in Botany, Huxley in Zoology, Cayley and Roberts in Mathematics, Whitney in Philology, Freeman in History and Geography, Gladstone in Social Science.

As reorganised under the new constitution, the Academy consists henceforth of two classes: (1) Physical, Mathematical, and Natural Sciences; (2) Moral Sciences,—distributed into a number of Categories and Sections as under:—

CLASS I.

Categories	Sections	Members
1.	Mathematics	15
	Mechanics	11
	Astronomy	11
	Geography (Physical)	4
2.	Physics	17
	Chemistry	8
	Crystallography and Mineralogy	9
3.	Geology and Palæontology	11
4.	Botany	9
	Zoology and Morphology	8
5.	Agronomy	3
	Physiology	6
	Pathology	3

CLASS II.

Categories	Members
1. Philology	17
2. Archæology	19
3. History and Historical Geography	16
4. Philosophy	15
5. Jurisprudence	10
6. Social Science	21

On May 14, 1881, an Act was passed granting a large sum for the purpose of erecting or purchasing a suitable edifice for the Lincei, henceforth officially recognised as the "Royal Academy of Sciences." After protracted negotiations, an arrangement was made with Prince Tommaso Corsini, in virtue of which for the sum of 95,400*l.* the Academy acquired the perpetual use of the magnificent Palazzo Corsini, situated in the Via della Longara, Trastevere. The purchase, which was effected in May 1883, included the furniture, fittings, gardens, and annexes, but not the Library and Pinakothek, which, being entailed, the prince had no power to alienate. To meet this difficulty a special Act was subsequently passed, which removed the entail, and enabled the prince to make a free gift of the Pinakothek to the nation, and of the Library to the Accademia dei Lincei. The Library, originally collected by Cardinal Neri Corsini, and bequeathed by him in 1774 to his nephew, Duca don Filippo Corsini, comprises the prints, drawings, books, and manuscripts occupying the nine rooms on the first floor of the north side of the building so well known to English visitors in Rome. It passes to the Lincei on the condition of being preserved by them for the public use under the name of the "Biblioteca Corsiniana." It is also to be kept for ever not only in Rome, but in Trastevere, as set forth in the disposition of its chief founder, Cardinal Neri Corsini. Some of our readers may possibly remember the two allegorical busts at the main entrance of the palace. These are now to be replaced by busts of the Cardinal and of Prince Tommaso Corsini, with inscriptions recording their services to the cause of the arts and sciences. The prince also receives from the Academy the gift of a complete copy of its *Atti* or *Proceedings*, of which there are three series: (1) under the Pontifical "dispensation," 23 vols.; (2) 1873–76, 8 vols.; (3) 1876–83, 7 vols. On the yellow wrapper of the present series the tiara gives place to the royal crown of Italy above the lynx, and the Lincei pass from the shadow of the now silent Sant' Uffizio to a right royal residence on the banks of yellow Tiber.

A. H. KEANE

[1] "E benchè il principal loro oggetto fosser le scienze matematiche e filosofiche, non trascuravono però l'amena litteratura e gli studi poetici" (viii. p. 73).

[2] As finally modified in the new articles, the clause affecting foreign members runs thus:—"I soci stranieri sono equiparati ai nazionali allorquando essi sono in Italia."

NIELS HENRIK CORDULUS HOFFMEYER

WE have already (p. 387) briefly referred to the death of Capt. Hoffmeyer; the importance of his work in meteorology deserves more detailed notice.

Capt. Hoffmeyer was born at Copenhagen, June 3, 1836. His father was Col. A. B. Hoffmeyer. He commenced his studies with a view to a professional career, but the idea was soon abandoned, and he was entered as a pupil in the military academy. At the age of eighteen he became an officer, and on completing his studies he received an appointment in the artillery service.

He was engaged in the Schleswig-Holstein war of 1864, but as early as February he was compelled by illness to retire from active service. In early youth he had suffered from rheumatic fever, and the exposure and fatigues of the winter campaign soon laid him prostrate with another severe attack of the same fever. On the reduction of the army at the close of that year, Capt. Hoffmeyer was placed on the retired list.

He spent the early part of the summer of 1865 recruiting his health at Sophienbad, a watering-place near Hamburg, and in August he proceeded to Paris, where and at Nantes he remained a year studying the works carried on at the iron foundries there. On his return to Denmark he took an active part in establishing a similar foundry at Christiansholm, but in 1867 he was appointed to a post in the War Department, and became at the same time a captain of the militia of Copenhagen.

It was while residing in France that Hoffmeyer's attention began to be directed to meteorology. At that time, fortunately, the principles which distinguish modern meteorology were being developed and prosecuted by the genius and energy of Leverrier, in the daily publication in the *Bulletin International* of a weather map for all Europe, which had been begun only two years before. After his appointment to the War Department, he devoted his energies with characteristic ardour to the study of meteorology, and when the Danish Government established the Meteorological Institute in 1872, Capt. Hoffmeyer was appointed director.

He continued to suffer from occasional attacks of rheumatic fever, and during the last year of his life was never quite well; but in spite of the great weakness under which he laboured, his overmastering passion for hard work would not be controlled. His health again gave way at the end of January, and he finally succumbed at one o'clock on the afternoon of February 16.

It was from a singularly clear and firm apprehension of the characteristic principles of modern meteorology, and an unflinching application of them to the facts of observation, that Capt. Hoffmeyer has left his mark on the science,—these principles being the relations of winds, temperature, and rainfall to the distribution of atmospheric pressure. In working out the weather problem of Europe, no country occupies a more splendid position for the observation of the required data than does Denmark with its dependencies of Farö, Iceland, and Greenland. Denmark was slow to occupy the field, nothing being done in this direction by the Danish Government prior to Hoffmeyer's appointment as Director of the Meteorological Institute. In a short time these important regions were represented by stations in Greenland, Iceland, and Farö. The meteorology of Denmark proper was pushed forward with great vigour. In truth, the monthly meteorological *Bulletin* of Denmark is in several respects among the best that reach us. The number for January, 1884, just received, presents the monthly results of pressure for 13 stations, temperature for 109 stations, and rainfall and other forms of precipitation for 159 stations. These results are graphically shown on four maps, accompanied with a full descriptive letter-press—one map giving the isobars for the month, another the isothermals, and on the same map the mean temperature at each of the 109 stations; a third map, the minimum temperature at each of the stations; while the fourth gives isohyetal lines showing the rainfall, and here again the amount at each of the 159 rain stations is entered in plain figures on the map. The educative effect of these instructive monthly sheets on a people whose industries are so largely pastoral and agricultural must be very great.

It was, however, to the department of meteorology which is concerned with the preparation and study of synoptic weather charts that Hoffmeyer chiefly directed his attention. The great services he rendered in this direction may be indicated by a reference to his atlas of daily weather maps of the Atlantic, embracing a period of fully three years, the expense of which was almost wholly borne by himself, and his annual reports giving tri-daily observations for the Denmark, Farö, Iceland, and Greenland stations—a work which no working meteorologist can afford to be without. It was arranged last summer to resume the publication of the synoptic charts in conjunction with Neumayer, and the work was so far advanced that the first sheets were printed off on February 17, the day after his death.

Of the positive additions Hoffmeyer made to science, the most noteworthy are his papers on the Greenland foehn (NATURE, vol. xvi. p. 294), and on the distribution of atmospheric pressure in winter over the North Atlantic, and its influence on the climate of Europe (NATURE, vol. xviii. p. 680). The latter is an original and highly important contribution to science, whether regard be had to the method of investigation or to the results. He showed that the character of the weather, as regards mildness or severity of the winter of the regions surrounding the North Atlantic, is really determined by the position of the region of minimum pressure, according as it is localised to the south-west of Ireland, in Davis Straits, or midway between Jan Mayen and the Lofoden Islands.

It was but fitting that he should have occupied the honourable position of Secretary to the International Polar Commission, one of the principal objects of which was to collect materials for a satisfactory discussion of the different questions raised by the weather maps of the northern hemisphere. For this office the sincerity of his convictions, his honesty of purpose, and his business habits, eminently fitted him. To all who knew him, the memory of his eager readiness to assist fellow-workers, the urbanity of his manner, his joyous nature, and the unusual warmth of his friendship, cannot but awaken the keenest feelings of regret for his early death.

NOTES

As the British Association meets this year—its fifty-fourth—on August 27, in Montreal, preparations for the meeting have had to be made unusually early. Already everything is ready, and we are able to announce the lists of officials. President: the Right Hon. Lord Rayleigh, D.C.L., F.R.S., Professor of Experimental Physics in the University of Cambridge. Vice-Presidents: His Excellency the Governor-General of Canada; the Right Hon. Sir John Alexander Macdonald, K.C.B., D.C.L.; the Right Hon. Sir Lyon Playfair, K.C.B., M.P., F.R.S; the Hon. Sir Alexander Tilloch Galt, G.C.M.G.; the Hon. Sir Charles Tupper, K.C.M.G.; Sir Narcisse Dorion, C.M.G.; the Hon. Dr. Chauveau; Principal J. W. Dawson, C.M.G., F.R.S.; Prof. Edward Frankland, M.D., D.C.L., F.R.S.; W. H. Hingston, M.D.; Thomas Sterry Hunt, LL.D., F.R.S. General Treasurer: Prof. A. W. Williamson, LL.D., F.R.S. General Secretaries: Capt. Douglas Galton, C.B., D.C.L., F.R.S.; A. G. Vernon Harcourt, F.R.S. Secretary: Prof. T. G. Bonney, D.Sc., F.R.S., P.G.S. Local Secretaries for the meeting at Montreal: L. E. Dawson, R. A. Ramsay, S. Rivard, S. C. Stevenson, Thomas White, M.P. Local Treasurer for the meeting at Montreal, F. Wolferstan Thomas. The Sections are the following:—A.—Mathematical and Physical Science.—President: Prof. Sir William Thomson, M.A., LL.D., D.C.L., F.R.SS.L. and E., F.R.A.S. Vice-Presidents: Prof. J. B. Cherriman, M.A.; J. W. L. Glaisher, M.A., F.R.S., F.R.A.S. Secretaries: Charles H. Carpmael, M.A.; Prof. A. Johnson, M.A., LL.D.; Prof. O. J. Lodge, D.Sc.; D. MacAlister, M.A., M.B., B.Sc. (Recorder). B.—Chemical Science.—President: Prof. H. E. Roscoe, Ph.D., LL.D., F.R.S., F.C.S. Vice-Presidents: Prof. Dewar, M.A., F.R.S., F.C.S.; Prof. B. J. Harrington, B.A., Ph.D. Secretaries: Prof. P. Phillips Bedson, D.Sc., F.C.S. (Recorder); H. B. Dixon, M.A., F.C.S.; T. McFarlane, Prof. W. W. Pike. C.—Geology.—President: W. T. Blanford, F.R.S., F.G.S., F.R.G.S. Vice-Presidents: Prof. Rupert Jones, F.R.S., F.G.S.; A. R. C. Selwyn, LL.D., F.R.S., F.G.S. Secretaries: F. Adams, B.Ap.Sc.; G. M. Dawson, D.Sc., F.G.S.; W. Topley, F.G.S. (Recorder); W. Whitaker, B.A., F.G.S. D.—Biology.—President: Prof. H. N. Moseley, M.A., F.R.S., F.L.S., F.R.G.S., F.Z.S. Vice-Presidents: W. B. Carpenter, C.B., M.D., LL.D., F.R.S., F.L.S., F.G.S.; Prof. R. G. Lawson, Ph.D., LL.D. Secretaries: Prof. W. Osler, M.D.; Howard Saunders, F.L.S., F.Z.S. (Recorder); A. Sedgwick, B.A.; Prof. R. Ramsay Wright, M.A., B.Sc. E.—Geography.—Vice-Presidents: Col. Rhodes; P. L. Sclater, M.A., Ph.D., F.R.S., F.L.S., F.G.S., F.R.G.S. Secretaries: R. Bell, M.D., LL.D., F.G.S.; Rev. Abbé Laflamme; E. G. Ravenstein, F.R.G.S.; E. C. Rye, F.Z.S. (Recorder). F.—Economic Science and Statistics.—President: Sir R. Temple, G.C.S.I., C.I.E., D.C.L., F.R.G.S. Vice-Presidents, J. B. Martin, F.S.S.; Prof. J. Clark Murray, LL.D. Secretaries: Prof. H. S. Foxwell, M.A., F.S.S.; J. S. McLennan, B.A.; Constantine Molloy (Recorder); Prof. J. Watson, M.A., LL.D. G.—Mechanical Science.—President: Sir F. J. Bramwell, F.R.S., M.Inst.C.E. Vice-Presidents: Prof. H. T. Bovey, M.A.; P.G.B. Westmacott, M.Inst.C.E. Secretaries: A. T. Atchison, M.A., C.E.; J. Kennedy, C.E.; L. Lesage, C.E.; H. T. Wood, B.A. (Recorder). H.—Anthropology.—President: E. B. Tylor, D.C.L., LL.D., F.R.S. Vice-Presidents: Prof. W. Boyd Dawkins, M.A., F.R.S., F.S.A., F.G.S.; Prof. Daniel Wilson, LL.D., F.R.S.E. Secretaries: G. W. Bloxam, M.A., F.L.S. (Recorder); Rev. J. Campbell, M.A.; Walter Hurst, B.Sc.; J. M. P. Lemoine. It is expected that the public lectures will be by Mr. Crookes, Dr. Dallinger, and Prof. Ball. Liberal reductions of fares will be made by the steamship companies and the American railways; the Canadian Pacific Railway, indeed, gives free travelling to all members from August 1 to the time for the excursion to the Rocky Mountains, which it offers free to 150 members. Many other excursions have been arranged for, and the American Association invites the members to join its meetings and excursions at Philadelphia on September 3. We are glad to see that Section A is following the good example set by Prof. Lankester in Biology last year. A circular signed by Sir William Thomson has been issued by the Committee of Section A, inviting the co-operation of mathematicians and physicists, and requesting those willing to read papers and take part in the discussions to send their names to the Secretaries of Section A, British Association, Albemarle Street. The following subjects have been selected for special discussion by the Committee:—On Friday, August 29, The Seat of the Electromotive Forces in the Voltaic Cell. On Monday, September 1, The Connection of Sunspots with Terrestrial Phenomena.

THE death is announced on March 1 of Dr. Isaac Todhunter, F.R.S., the well-known mathematician, at his residence, Brookside, Cambridge. Dr. Todhunter was born in 1820, and having passed some years of his life as usher in a school, proceeded to University College, London, and when twenty-four years of age, entered as an undergratuate of St. John's. He graduated in the Mathematical Tripos of 1848, obtaining the distinction of Senior Wrangler and first Smith's Prizeman in a year which produced some remarkably able men. Dr. Todhunter was in due course elected to a Fellowship at St. John's, and subsequently filled the offices of assistant tutor and principal lecturer in mathematics. Dr. Todhunter is well known as the author of numerous mathematical treatises, which have obtained a wide circulation, and are recognised as standard works of education in the universities and public schools. His treatises on the "Differential Calculus," "Analytical Statics," "Plane Coordinate Geometry," "Plane Trigonometry," and "Spherical Trigonometry," greatly enhanced his reputation. He also published various elementary works, all of which enjoyed a large circulation. In 1871 he obtained the Adams Prize for an essay, "Researches on the Calculus of Variations." He published, in 1873, "A History of the Mathematical Theories of Attraction and the Figure of the Earth from the time of Newton to that of Laplace." In 1876 there also appeared from his pen, "An Account of the Writings of William Whewell, D.D., Master of Trinity College, with selections from his literary and scientific correspondence." By the new University statutes the University was authorised to confer the degrees of Doctor in Science and Doctor in Letters. Dr. Todhunter was among the first upon whom the distinction of Doctor in Science was conferred, and last year proceeded to that degree. A few years previously he had been elected an honorary Fellow of his College as a mark of recognition of his great mathematical attainments. It may be mentioned that Dr. Todhunter took an active part in University affairs, was a member of several Syndicates and Boards of Studies, and an elector to the Plumian Professorship of Astronomy. He had been in failing health for some time, and a few weeks ago was attacked with paralysis, which precluded all hope of recovery.

NATURAL HISTORY, and especially Palæontology, in Sicily, have sustained a great loss in the decease of the septuagenarian Abbé Brugnone, who died at Palermo on the 3rd of last month. He published several excellent papers on the recent and Pliocene shells of his native island, which were illustrated by his own pencil. His real name appears from the obituary card to have been Rugnone. We understand that his valuable collections are for sale.

M. FAYE read at the last meeting of the Academy of Sciences the draft of a resolution which will be presented by the Special Commission appointed to report on the removal of the Observatory, and which will be discussed by the Academy at one of its next private sittings. It approves the removal of the Observatory to a site in close proximity to Paris, and the sale of the grounds, on condition that the existing building will remain intact, and so much land as is necessary for executing astronomical observations in the establishment.

THE Academy of Sciences has nominated M. Darboux a member in the Section of Geometry. Mr. Darboux is the editor of a mathematical paper published in Paris, and the author of numerous memoirs on analysis and geometry printed in the *Transactions* of the Academy.

M. BERTRAND has issued the first number of a monthly astronomical journal published by the Observatory of Paris under the title of the *Bulletin*. It is edited by M. Tisserand, with the cooperation of a number of astronomers of the Paris Observatory.

UNDER the auspices of the Paris Geographical Society a course of lectures is being delivered by some of the most eminent French men of science. These lectures, eight in number, are held every Monday, at 8.30 p.m.; they began on February 11, and end on March 31, in the Hall of the Geographical Society. The following are the subjects of these lectures:—M. Faye, of the Institute, the connection of astronomy and geography in the principal periods of history; M. de Lapparent, M.E., reliefs of the globe; M. E. Fuchs, M.E., distribution of minerals; M. Mascart, director of the Meteorological Bureau, climate; M. Vélain, lecturer at the Sorbonne, glaciers and their action on the reliefs of the globe; M. Bureau, professor at the Museum of Natural History, geographical distribution of plants; M. Ed. Perrier, professor at the Museum of Natural History, the depths of the sea and their inhabitants; M. Alphonse Milne-Edwards, of the Institute, geographical distribution of animals. The course will be continued next year. Information respecting the above lectures, to which the public is admitted, may be had at the rooms of the Geographical Society, 184, Boulevard St. Germain.

THE Rev. Marc Dechevrens, S.J., of Zi-ka-wei Observatory, writes to us under date January 22, that the sky there continues to exhibit remarkable colours; during this winter the zodiacal light appeared to M. Dechevrens to be more feeble than in preceding years. He incloses a letter from Dr. D. J. Macgowan of Hankow to the *North China Daily News*:—"A phenomenon similar to the 'green sun in India' (observed at Ceylon from September 9 to 11 inclusive; from various portions of the Indian Ocean on the 10th and 13th; and at Trichinopoly, for some three weeks preceding October 2) has been witnessed several times at Hankow; on November 17 by the Rev. A. W. Nightingale, and on another occasion about the same time (date unrecorded), and again so recently as December 29 by the Rev. G. John and Rev. A. Foster. On these occasions the sun shortly before setting was of a pale green tint, the colour deepening as the orb declined; then followed an exhibition of the glowing redness of the western and southern horizon, which since the early part of December last has been observed from the sea-board far into the interior. Information from other parts of China respecting the 'green sun' is a desideratum."

THE latest official report on the condition of the districts overwhelmed by the Krakatoa eruption states that the surviving inhabitants of the various villages have reassembled under their headmen, and are erecting their huts. The volcanic ashes did little harm to the soil, the growing crops all presenting a luxuriant appearance. The trees, however, have suffered greatly, as had some of the coffee plantations. Two bays, Lampong and Semengka, which were blocked up by the fields of pumice, were free by the middle of December.

ON a summer night of 1882 a woman in Högsby parish, in Sweden, saw a shining object fall from the sky, disappearing behind a stable. Search was made for the meteorite, according to the statements of the woman, but without success. Last autumn it was, however, accidentally discovered near the spot indicated, and has now been forwarded to proper quarters in the town of Oskarshamn. The surface of the meteorite appears as if it had been welded from various substances; it is about the size of a billycock hat, very thick, and weighs a little over 14 lbs.

M. W. DE FONVIELLE writes:—"I took the liberty of suggesting in one of the last issues of the *Ville de Paris* a scheme for discovering clock-work in parcels deposited in luggage-rooms. All the luggage should be laid flat on wooden tables supported by iron feet, and not nailed to them; the least noise within the parcels would be made audible if a microphone of proper construction were placed on each table. The charge for keeping should be made heavier to diminish the number of parcels, and the right of opening optional with the railway companies."

THE Commission for Montsouris Observatory held its annual sitting at the end of February. It was resolved to ask from the Municipal Council an increase of the annual allocation, which is somewhat less than 1200*l*., exclusive of some extra charges. But it is not supposed the request will be granted, and a diminution is rather expected. It must be remembered that meteorological observations are now conducted at Montsouris, at Parc Saint Maur, and at the Paris Observatory, almost on the same principles and with analogous instruments. It is curious to see this triple working by almost independent administrations.

THE long isolated kingdom of Corea having now been definitely opened by treaties to European trade and residence, we may soon expect English scholars to take their part in exploring its language, literature, and history. For the benefit of those about to study in the new field, it may be well to recall the fact that, so far, we are entirely dependent on French priests for the meagre knowledge we possess of the country. There is a paper in the *Transactions of the Royal Asiatic Society*, by Mr. Aston of Japan, on the Corean language, but the two works to which for some years to come European students must first resort are the Grammar and Dictionary edited by Msgr. Ridel, and published by Lévy of Yokohama. The latter appeared in 1879, and is a large volume of some 700 pages, containing about 30,000 words. The native words are accompanied not only by a French transliteration, but also by the Chinese characters representing them, so that the work can be used by a Chinese as well as a European, and, to those who already know Chinese or Japanese, an additional explanation is thus supplied. All that is known respecting the country to the priests—its fauna, flora, arts, manners, and customs—finds a place in the volume. An appendix gives a brief sketch of the grammar, while another contains the geography, the names, and position of the provinces, mountains, rivers, and chief towns. The Grammar was published last year, and contains an introduction on the character of the Corean language, and a comparison of it with Chinese, as well as appendices on the divisions of time, weights, measures, the mariner's compass, &c. Throughout the East the Catholic missionaries have been the advanced guard of European science and methods of study. The volumes which they produced nearly a hundred years ago on China are still as necessary to thorough study of that country as they were then. The student who cannot refer to the original authorities, as, for instance, Chinese history, had, until the recent publication of Mr. Boulger's work, to go to the long series of volumes published towards the close of the last century by the Société des Missions Étrangères under the editorship of de Mailla, Amyot, and other missionaries.

WE learn from *Science* that at 7.24 p.m. on January 25 earthquake waves were indicated by the delicate levels of the astronomical instruments of the San Francisco Observatory. The amplitude of each vibration was three seconds of arc in three seconds of time, and they continued for twenty minutes.

AT the last meeting of the Sociological (Spencerian) Section of the Birmingham Natural History Society it was decided to commence making an index to the study of Sociology. Letters were read from Mr. Spencer approving of the system about to be adopted, and stating that time and health had alone prevented him commencing such an undertaking previously.

THE Westphalian Próvinzial Verein for Science and Art is about to publish a large work entitled "Westphalen's Thierleben in Wort und Bild." The Society also intends establishing a Provinzial Museum.

AT Berlin a branch of the German Meteorological Society was founded on January 29 last.

WE are pleased to learn that a complete catalogue of the Reference Department of the Nottingham Free Library is in course of preparation, but as that will be the work of some time, class lists have been issued for public use in the meantime. The publication noticed in these columns on January 31 was one of these, already supplemented considerably.

AT the suggestion of the Austrian Crown Prince, a work on the ethnography of the Empire is about to be written. Maurus Jokaj, the well-known Hungarian, has been intrusted with the task of editing it.

A SEVERE shock of earthquake, lasting two seconds, was felt at 4 a.m. on February 25 at Chios, Tchesme, and Vourla. So far as is known at present no damage has been done. An earthquake-wave, lasting about fifteen minutes, and inundating part of the town, was noticed at Montevideo on January 14, at 7.30 a.m. The weather was fine; the direction of the wave was from the Patagonian coast. Several people were drowned on the south side of the town.

THE death is announced of Prof. Heinrich Karl Berghaus, the well-known geographer and historian. Born at Kleve on May 3, 1797, he died at Stettin on February 17 last.

AN Engineering Exhibition will be held at Breslau from June 9 to 11 next.

THE additions to the Zoological Society's Gardens during the past week include a Grey Ichneumon (*Herpestes griseus*) from India, presented by Mr. J. B. Drew; an Arabian Gazelle (*Gazella arabica* ♀) from Arabia, presented by Lieut. Brown, R.N.; two Herring Gulls (*Larus argentatus*), European, presented by Mr. G. D. Macgregor; a Ring-necked Parrakeet (*Palæornis torquatus*) from India, presented by Mr. J. Biehl; a Black-headed Gull (*Larus ridibundus*), European, presented by Miss Elise Cooper; eight Hoary Snakes (*Coronella cana*) from South Africa, presented by Mr. C. B. Pillans; a Robben Island Snake (*Coronella phocarum*) from South Africa, presented by Mr. R. A. Robertson; a Common Heron (*Ardea cinerea*), a Cirl Bunting (*Emberiza cirlus*), British, a Banded Parrakeet (*Palæornis fasciatus*) from India, purchased; three Mute Swans (*Cygnus olor*), European, received in exchange; eight Brown-tailed Gerbilles (*Gerbillus erythyrurus*), born in the Gardens.

THE SIX GATEWAYS OF KNOWLEDGE[1]

I THANK you most warmly for the honour you have done me in electing me to be your president. I value the honour very highly; but when I look at the list of distinguished men who have preceded me in the office, I feel alarmed at the responsibility I have undertaken. A very pleasing duty, however, has been already performed in the interesting and not onerous function we have now gone through. I would gladly speak on the several subjects, for merit in the study of which these prizes have been awarded; but I am afraid that if I were to do so, it would be more for my own gratification than for your pleasure and profit, and I feel that I shall best consult your wishes in passing on at once to the subject of the address which it becomes my duty to give.

The title of the subject upon which I am going to speak this evening might be—if I were asked to give it a title—"The Six Gateways of Knowledge." I feel that the subject I am about to bring before you is closely connected with the studies for which the several prizes have been given. The question I am going to ask you to think of is: What are the means by which the human mind acquires knowledge of external matter?

John Bunyan likens the human soul to a citadel on a hill, self-contained, having no means of communication with the outer world, except by five gates—Eye Gate, Ear Gate, Mouth Gate, Nose Gate, and Feel Gate. Bunyan clearly was in want of a word here. He uses "feel" in the sense of "touch," a designation which to this day is so commonly used that I can scarcely accuse it of being incorrect. At the same time, the more correct and distinct designation undoubtedly is, the sense of touch. The late Dr. George Wilson, first Professor of Technology in the University of Edinburgh, gave, some time before his death, a beautiful little book under the title of "The Five Gateways of Knowledge," in which he quotes John Bunyan in the manner I have indicated to you. But I have said *six* gateways of knowledge, and I must endeavour to justify this saying. I am going to try to prove to you that we have six senses—that if we are to number the senses at all we must make them six.

The only census of the senses, so far as I am aware, that ever made them more than five before was the Irishman's reckoning of seven senses. I presume the Irishman's seventh sense was common sense; and I believe that the large possession of that virtue by my countrymen—I speak as an Irishman—I say the large possession of the seventh sense, which I believe Irishmen have, and the exercise of it, will do more to alleviate the woes of Ireland than even the removal of the melancholy ocean which surrounds its shores. Still I cannot scientifically see how we can make more than six senses. I shall, however, should time permit, return to this question of a seventh sense, and I shall endeavour to throw out suggestions towards answering the question—Is there, or is there not, a magnetic sense? It is possible that there is, but facts and observations so far give us no evidence that there is a magnetic sense.

The six senses that I intend to explain, so far as I can, this evening, are according to the ordinary enumeration, the sense of sight, the sense of hearing, the sense of smell, the sense of taste, and the sense of touch, divided into two departments. A hundred years ago Dr. Thomas Reid, Professor of Moral Philosophy in the University of Glasgow, pointed out that there was a broad distinction between the sense of roughness or of resistance, which was possessed by the hand, and the sense of heat. Reid's idea has not I think been carried out so much as it deserves. We do not, I believe, find in any of the elementary treatises on natural philosophy, or in the physiologists' writings upon the senses, a distinct reckoning of six senses. We have a great deal of explanation about the muscular sense, and the tactile sense; but we have not a clear and broad distinction of the sense of touch into two departments, which seems to me to follow from Dr. Thomas Reid's way of explaining the sense of touch, although he does not himself distinctly formulate the distinction I am now going to explain.

The sense of touch, of which the organ commonly considered is the hand, but which is possessed by the whole sensitive surface of the body, is very distinctly a double quality. If I touch any object, I perceive a complication of sensations. I perceive a certain sense of roughness, but I also perceive a very distinct sensation, which is not of roughness, or of smoothness. There are two sensations here, let us try to analyse them. Let me dip my hand into this bowl of hot water. The moment I touch the water, I perceive a very distinct sensation, a sensation of heat. Is that a sensation of roughness, or of smoothness? No. Again, I dip my hand into this basin of iced water. I perceive a very distinct sensation. Is this a sensation of roughness, or of smoothness? No. Is this comparable with that former sensation of heat? I say yes. Although it is opposite, it is comparable with the sensation of heat. I am not going to say that we have two sensations in this department—a sensation of heat, and a sensation of cold. I shall endeavour to explain that the perceptions of heat and of cold are perceptions of different degrees of one and the same quality, but that that quality is markedly different from the sense of roughness. Well now, what is this sense of roughness? It will take me some time to explain it fully. I shall therefore say in advance that it is a sense of force; and I shall tell you in advance, before I justify completely what I have to say, that the six senses, regarding which I wish to give some explanation, are: the sense of sight, the sense of hearing, the sense of taste, the sense of smell, the sense of heat, and the sense of force. The sense of force is the sixth sense; or the senses of heat and of force are the sense of touch divided into two, to complete the census of six that I am endeavouring to demonstrate.

Now I have hinted at a possible seventh sense—a magnetic sense—and though out of the line I propose to follow, and although time is precious, and does not permit much of digression, I wish just to remove the idea that I am in any way suggesting anything towards that wretched superstition of animal magnetism, and table-turning, and spiritualism, and mesmerism, and clairvoyance, and spirit-wrapping, of which we have heard so much. There is no seventh sense of the mystic kind. Clairvoyance, and the like, are the result of bad observation chiefly, somewhat mixed up, however, with the effects of wilful imposture, acting on an innocent, trusting mind. But if there is not a distinct magnetic sense, I say it is a very great wonder that there is not.

Many present know all about magnetism. A very large number of pupils have gained an immense amount of valuable knowledge in various subjects, from the classes carried on nightly within the walls of the Birmingham and Midland Institute; and I can see from the prizes that have been awarded, and that I have just now had the pleasure of distribuiing for excellence and proficiency in this department, that many have learned of magnetism. I had the pleasure of seeing the class-rooms this morning, and I wished I could be in them in the evening to see the studies as carried on in them every evening. Well now, the study of magnetism is the study of a very recondite subject. We all know a little about the mariner's compass, the needle pointing to the north, and so on; but not many of us have gone far into the subject, and not many of us understand all the recent discoveries in electromagnetism. I could wish, had I the apparatus here, and if you would allow me, to show you an experiment in magnetism. If we had before us a powerful magnet, or say the machine that is giving us this beautiful electric light by which the hall is illuminated, it, serving to excite an electromagnet, would be one part of our apparatus; the other part would be a piece of copper. Suppose then we had this apparatus, I would show you a very wonderful discovery made by Faraday and worked out admirably by Foucault, an excellent French experimenter. I have said that one part of this apparatus would be a piece of copper, but silver would answer as well. Probably no other metal than copper or silver—certainly no other one, of all the metals that are well known, and obtainable for ordinary experiments—possesses, and no other metal or substance, whether metallic or not, is known to possess, in anything like the same degree as copper and silver, the quality I am now going to call attention to.

The quality I refer to is "electric conductivity," and the result of that quality in the experiment I am now going to describe is, that a piece of copper or a piece of silver, let fall between the poles of a magnet, will fall down slowly as if it were falling through mud. I take this body and let it fall. Many of you here will be able to calculate what fraction of a second it takes to fall one foot. If I took this piece of copper, placed it just above the space between the poles of a powerful electromagnet and let it go, you would see it fall slowly down before you; it would perhaps take a quarter of a minute to fall a few inches.

This experiment was carried out in a most powerful manner by Lord Lindsay (now Lord Crawford), assisted by Mr. Crom-

[1] An Address at the Midland Institute, Birmingham, October 3, 1883, by Prof. Sir William Thomson, LL.D., F.R.S., president.

well F. Varley. Both of those eminent men desired to investigate the phenomena of mesmerism, which had been called animal magnetism; and they very earnestly set to work to make a real physical experiment. They asked themselves, Is it conceivable that, if a piece of copper can scarcely move through the air between the poles of an electromagnet, a human being or other living creature placed there would experience no effect? Lord Lindsay got an enormous electromagnet made, so large that the head of any person wishing to try the experiment could get well between the poles, in a region of excessively powerful magnetic force. What was the result of the experiment? If I were to say *nothing!* I should do it scant justice. The result was marvellous, and the marvel is that nothing was perceived. Your head, in a space through which a piece of copper falls as if through mud, perceives nothing. I say this is a very great wonder; but I do not admit, I do not feel, that the investigation of the subject is completed. I cannot think that the quality of matter in space which produces such a prodigious effect upon a piece of metal can be absolutely without any—it is certainly not without any—effect whatever on the matter of a living body; and that it can be absolutely without any *perceptible* effect whatever on the matter of a living body placed there seems to me not proved even yet, although nothing has been found. It is so marvellous that there should be no effect at all, that I do believe and feel that the experiment is worth repeating; and that it is worth examining, whether or not an exceedingly powerful magnetic force has any perceptible effect upon a living vegetable or animal body. I spoke then of a seventh sense. I think it just possible that there may be a magnetic sense. I think it possible that an exceeding powerful magnetic effect may produce a sensation that we cannot compare with heat or force or any other sensation.

Another question that often occurs is, "Is there an electric sense?" Has any human being a perception of electricity in the air? Well, somewhat similar proposals for experiment might, perhaps, be made with reference to electricity; but there are certain reasons, that would take too long for me to explain, that prevent me from placing the electric force at all in the same category with magnetic force. There would be a surface action that would annul practically the force in the interior, there would be a definite sensation which we could distinctly trace to the sense of touch. Any one putting his hand, or his face, or his hair, in the neighbourhood of an electric machine perceives a sensation, and on examining it he finds that there is a current of air blowing, and his hair is attracted; and if he puts his hand too near he finds that there are sparks passing between his hand or face and the machine; so that, before we come to any subtle question of a possible sense of electric force, we have distinct mechanical agencies which give rise to senses of temperature and force; but that this mysterious, wonderful, magnetic force, due, as we know, to rotations of the molecules, could be absolutely without effect—without perceptible effect—on animal economy, seems a very wonderful result, and at all events it is a subject deserving careful investigation. I hope no one will think I am favouring the superstition of mesmerism in what I have said.

I intend to explain a little more fully our perceptions in connection with the double sense of touch—the sense of temperature and the sense of force—should time permit before I conclude. But I must first say something of the other senses, because if I speak too much about the senses of force and heat no time will be left for any of the others. Well, now, let us think what it is we perceive in the sense of hearing. Acoustics is one of the studies of the Birmingham and Midland Institute, of which we have heard many times this evening. Acoustics is the science of hearing. And what is hearing? Hearing is perceiving something with the ear. What is it we perceive with the ear? It is something we can also perceive without the ear; something that the greatest master of sound, in the poetic and artistic sense of the word at all events, that ever lived—Beethoven—for a great part of his life could not perceive with his ear at all. He was deaf for a great part of his life, and during that period were composed some of his grandest musical compositions, and without the possibility of his ever hearing them by ear himself; for his hearing by ear was gone from him for ever. But he used to stand with a stick pressed against the piano and touching his teeth, and thus he could hear the sounds that he called forth from the instrument. Hence, besides the Ear Gate of John Bunyan, there is another gate or access for the sense of hearing.

What is it that you perceive ordinarily by the ear—that a healthy person, without the loss of any of his natural organs of sense, perceives with his ear, but which can otherwise be perceived, although not so satisfactorily or completely? It is distinctly a sense of varying pressure. When the barometer rises, the pressure on the ear increases; when the barometer falls, that is an indication that the pressure on the ear is diminishing. Well, if the pressure of air were suddenly to increase and diminish, say in the course of a quarter of a minute—suppose in a quarter of a minute the barometer rose one-tenth of an inch and fell again, would you perceive anything? I doubt it; I do not think you would. If the barometer were to rise two inches, or three inches, or four inches, in the course of half a minute, most people would perceive it. I say this as a result of observation, because people going down in a diving bell have exactly the same sensation as they would experience if from some unknown cause the barometer quickly, in the course of half a minute, were to rise five or six inches—far above the greatest height it ever stands at in the open air. Well, now, we have a sense of barometric pressure, but we have not a continued indication that allows us to perceive the difference between the high and low barometer. People living at great altitudes—up several thousand feet above the level of the sea, where the barometer stands several inches lower than at sea-level—feel very much as they would do at the surface of the sea, so far as any sensation of pressure is concerned. Keen mountain air feels different from air in lower places, partly because it is colder and drier, but also because it is less dense, and you must breathe more of it to get the same quantity of oxygen into your lungs to perform those functions, which the students of the Institute who study animal physiology—and I understand there are a large number—will perfectly understand. The effect of the air in the lungs—the function it performs—depends chiefly on the oxygen taken in. If the air has only three-quarters of the density it has in our ordinary atmosphere here, then one and one-third times as much must be inhaled, to produce the same oxidising effect on the blood, and the same general effect in the animal economy; and in that way undoubtedly mountain air has a very different effect on living creatures from the air of the plains. This effect is distinctly perceptible in its relation to health.

But I am wandering from my subject, which is the consideration of the changes of pressure comparable with those that produce sound. A diving bell allows us to perceive a sudden increase of pressure, but not by the ordinary sense of touch. The hand does not perceive the difference between 15 lbs. per square inch pressing it all around, and 17 lbs., or 18 lbs., or 20 lbs., or even 30 lbs. per square inch, as is experienced when you go down in a diving bell. If you go down five and a half fathoms in a diving bell, your hand is pressed all round with a force of 30 lbs. to the square inch; but yet you do not perceive any difference in the sense of force, any perception of pressure. What you do perceive is this: behind the tympanum, is a certain cavity filled with air, and a greater pressure on one side of the tympanum than on the other gives rise to a painful sensation, and sometimes produces rupture of it in a person going down in a diving bell suddenly. The remedy for the painful sensation thus experienced, or rather I should say its prevention, is to keep chewing a piece of hard biscuit, or making believe to do so. If you are chewing a hard biscuit, the operation keeps open a certain passage, by which the air pressure gets access to the inside of the tympanum, and balances the outside pressure and thus prevents the painful effect. This painful effect on the ear experienced by going down in a diving bell is simply because a certain piece of tissue is being pressed more on one side than on the other; and when we get such a tremendous force on a delicate thing like the tympanum, we may experience a great deal of pain, and it may be dangerous; indeed it is dangerous, and produces rupture or damage to the tympanum unless means be adopted for obviating the difference in the pressures; but the simple means I have indicated are, I believe, with all ordinary healthy persons, perfectly successful.

I am afraid we are no nearer, however, to understanding what it is we perceive when we hear. To be short it is simply this: it is exceedingly sudden changes of pressure acting on the tympanum of the ear, through such a short time and with such moderate force as not to hurt it; but to give rise to a very distinct sensation, which is communicated through a train of bones to the auditory nerve. I must merely pass over this; the details are full of interest, but they would occupy us far more than an hour if I entered upon them at all. As soon as we get to the nerves and the bones, we have gone beyond the subject I proposed to speak upon. My subject belongs to physical science;—what is called in Scotland, Natural Philosophy. Physical science refers to dead matter, and I have gone beyond the range whenever I speak of a living body; but we must speak of a living body in dealing with the senses as the means of perceiving—as the means by which, in John Bunyan's language, the soul in its citadel acquires a knowledge of external matter. The physicist has to think of the organs of sense, merely as he thinks of the microscope; he has nothing to do with physiology. He has a great deal to do with his own eyes and hands, however, and must think of them, if he would understand what he is doing, and wishes to get a reasonable view of the subject, whatever it may be, which is before him in his own department.

Now what is the external object of this internal action of hearing and perceiving sound? The external object is a change of pressure of air. Well, how are we to define a sound simply? It looks a little like a vicious circle, but indeed it is not so, to say it is sound if we call it a sound—if we perceive it as sound, it *is* sound. Any change of pressure, which is so sudden as to let us perceive it as sound is a sound. There [giving a sudden clap of the hands]—that is a sound. There is no question about it—nobody will ever ask, Is it a sound or not? It is sound if you hear it. If you do not hear it, it is not to you a sound. That is all I can say to define sound. To explain what it is, I can say, it is change of pressure, and it differs from a gradual change of pressure as seen on the barometer only in being more rapid, so rapid that we perceive it as a sound. If you could perceive by the ear, that the barometer has fallen two-tenths of an inch to day, that would be sound. But nobody hears by his ear that the barometer has fallen, and so he does not perceive the fall as a sound. But the same difference of pressure coming on us suddenly—a fall of the barometer, if by any means it could happen, amounting to a tenth of an inch, and taking place in a thousandth of a second,—would affect us quite like sound. A sudden rise of the barometer would produce a sound analogous to what happened when I clapped my hands. What is the difference between a noise and a musical sound? Musical sound is a regular and periodic change of pressure. It is an alternate augmentation and diminution of air pressure, occurring rapidly enough to be perceived as a sound, and taking place with perfect regularity, period after period. Noises and musical sounds merge into one another. Musical sounds have a possibility at least of sometimes ending in a noise, or tending too much to a noise, to altogether please a fastidious musical ear. All roughness, irregularity, want of regular, smooth periodicity, has the effect of playing out of tune, or of music that is so complicated that it is impossible to say whether it is in tune or not.

But now, with reference to this sense of sound, there is something I should like to say as to the practical lesson to be drawn from the great mathematical treatises which were placed before the British Association, in the addresses of its president, Prof. Cayley, and of the president of the mathematical and physical section, Prof. Henrici. Both of these professors dwelt on the importance of graphical illustration, and one graphical illustration of Prof. Cayley's address may be adduced in respect of this very quality of sound. In the language of mathematics we have just "one independent variable" to deal with in sound, and that is air pressure. We have not a complication of motions in various directions. We have not the complication that we shall have to think of presently, in connection with the sense of force; complication as to the place of application, and the direction, of the force. We have not the infinite complications we have in some of the other senses, notably smell and taste. We have distinctly only one thing to consider, and that is air pressure or the variation of air pressure. Now when we have one thing that varies, that, in the language of mathematics, is "one independent variable." Do not imagine that mathematics is harsh, and crabbed, and repulsive to common sense. It is merely the etherealisation of common sense. The function of one independent variable that you have here to deal with is the pressure of air on the tympanum. Well now in a thousand counting houses and business offices in Birmingham and London, and Glasgow, and Manchester, a curve, as Prof. Cayley pointed out, is regularly used to show to the eye a function of one independent variable. The function of one independent variable most important in Liverpool perhaps may be the price of cotton. A curve showing the price of cotton, rising when the price of cotton is high, and sinking when the price of cotton is low, shows all the complicated changes of that independent variable to the eye. And so in the Registrar-General's tables of mortality, we have curves showing the number of deaths from day to day—the painful history of an epidemic, shown in a rising branch, and the long gradual talus in a falling branch of the curve, when the epidemic is overcome, and the normal state of health is again approached. All that is shown to the eye; and one of the most beautiful results of mathematics is the means of showing to the eye the law of variation, however complicated, of one independendent variable. But now for what really to me seems a marvel of marvels: think what a complicated thing is the result of an orchestra playing—a hundred instruments and two hundred voices singing in chorus accompanied by the orchestra. Think of the condition of the air, how it is lacerated sometimes in a complicated effect. Think of the smooth gradual increase and diminution of pressure—smooth and gradual, though taking place several hundred times in a second—when a piece of beautiful harmony is heard! Whether, however, it be the single note of the most delicate sound of a flute, or the purest piece of harmony of two voices singing perfectly in tune; or whether it be the crash of an orchestra, and the high notes, sometimes even screechings and tearings of the air, which you may hear fluttering above the sound of the chorus—think of all that, and yet that is not too complicated to be represented by Prof. Cayley, with a piece of chalk in his hand, drawing on the blackboard a single line. A single curve, drawn in the manner of the curve of prices of cotton, describes all that the ear can possibly hear, as the result of the most complicated musical performance. How is one sound more complicated than another? It is simply that in the complicated sound the variations of our one independent variable, pressure of air, are more abrupt, more sudden, less smooth, and less distinctly periodic, than they are in the softer, and purer, and simpler sound. But the superposition of the different effects is really a marvel of marvels; and to think that all the different effects of all the different instruments can be so represented! Think of it in this way. I suppose everybody present knows what a musical score is—you know, at all events, what the notes of a hymn tune look like, and can understand the like for a chorus of voices, and accompanying orchestra—a "score" of a whole page with a line for each instrument, and with perhaps four different lines for four voice parts. Think of how much you have to put down on a page of manuscript or print, to show what the different performers are to do. Think, too, how much more there is to be done than anything the composer can put on the page. Think of the expression which each player is able to give, and of the difference between a great player on the violin and a person who simply grinds successfully through his part; think, too, of the difference in singing, and of all the expression put into a note or a sequence of notes in singing that cannot be written down. There is, on the written or printed page, a little wedge showing a diminuendo, and a wedge turned the other way showing a crescendo, and that is all that the musician can put on paper to mark the difference of expression which is to be given. Well now, all that can be represented by a whole page or two pages of orchestral score, as the specification of the sound to be produced in say ten seconds of time, is shown to the eye with perfect clearness by a single curve on a riband of paper a hundred inches long. That to my mind is a wonderful proof of the potency of mathematics. Do not let any student in this Institute be deterred for a moment from the pursuit of mathematical studies by thinking that the great mathematicians get into the realm of four dimensions, where you cannot follow them. Take what Prof. Cayley himself, in his admirable address, which I have already referred to, told us of the beautiful and splendid power of mathematics for etherealising and illustrating common sense, and you need not be disheartened in your study of mathematics, but may rather be reinvigorated when you think of the power which mathematicians, devoting their whole lives to the study of mathematics, have succeeded in giving to that marvellous science.

(*To be continued.*)

THE GEOLOGICAL POSITION OF THE HUMAN SKELETON FOUND AT TILBURY

IN a paper on this subject read by Mr. T. V. Holmes, F.G.S., at the meeting of the Essex Field Club on Saturday, February 23, at Buckhurst Hill, the author pointed out that the Tilbury skeleton was found in recent alluvium. The section at

Tilbury, consisting of blue clay with peaty bands, above sand and gravel, strongly resembles those given by Prof. Sollas of the alluvial deposits of the estuary of the Severn; the amount of subsidence, as shown by the present position of the lower peaty band, being also nearly the same. Mr. Holmes considered the notions promulgated in the brief newspaper reports regarding the antiquity of the remains to be entirely misleading. If any strata were entitled to be styled "recent," those at Tilbury must be so; for their deposition would now be going on but for the embankment of the Thames during the Roman occupation of Britain. Yet the newspaper reports described these beds by the extremely vague term "Pleistocene," while the skeleton was styled "Palæolithic." The remains of man, however, have been found in alluvial deposits fifty feet above the present level of the Thames, and remains found in such beds must be immensely more ancient than any discovered in recent alluvium. Geological position furnishes the only absolute test of relative age. The test of association with extinct mammalia is largely dependent on negative evidence. A hint on this point was given by the results of the drainage of Haarlem Lake thirty years ago. Excellent sections were made in all directions across its bed, and carefully examined by skilled geologists. Hundreds of men were known to have perished in its waters three centuries before, and it had always been the centre of a considerable population. Yet no human bones were found, though works of art were. Thus hundreds or even thousands of mammalia, incapable of producing works of art, might be interred in particular strata, and yet leave no signs whatever of their former existence two or three centuries afterwards. And, on the other hand, were extinct mammalia present in the Tilbury Dock beds no additional antiquity would thereby be conferred on the beds themselves, but the period at which the animals became extinct would be shown to be later than had been supposed. Similarly as regards the rude implements known as Palæolithic; their presence could confer no antiquity on recent beds. Still, as the skeleton was found thirty-two feet below the surface, in alluvium that has received no additions since Roman times, it is unquestionably prehistoric. And the extreme rarity of prehistoric human skeletons gives to this discovery an interest greater than could have been claimed for that of a bushel of flint implements. The age of the Tilbury skeleton may possibly be not far removed from that of the Neanderthal man, to which it is said to have a strong resemblance: a resemblance which, if as great as it is stated to be, goes far to show that we have in each a normal type of prehistoric man.

At the same meeting a communication from Mr. Worthington G. Smith was read. Mr. Smith stated that he had seen the skeleton, and specimens of the sand in which it was found. Palæolithic sands with fossil bones and stone implements occur about a mile to the north of Tilbury, and with these Mr. Smith was well acquainted. The Palæolithic sand is quite different in colour from the Tilbury sand, and the former swarms with fossil shells of land and freshwater mollusks. As far as could be seen no such shells were present in the Tilbury sand sent to the British Museum. Mr. Smith's specimens of fossil bones from the Palæolithic sand were in an entirely different mineral condition from the bones of the Tilbury skeleton, and he could trace no resemblance whatever either in sand or bones. Mr. Smith made this statement with great deference to the opinion of Sir Richard Owen, and confessed that a Palæolithic skeleton might have been washed from the high ground to the low, and got into the mineral state of the Tilbury skeleton, although at present there was no evidence of anything of the sort having taken place. His opinion was that there was no proof of the Palæolithic age of the Tilbury relic.

NOTES ON THE VOLCANIC ERUPTION OF MOUNT ST. AUGUSTIN, ALASKA, OCTOBER 6, 1883[1]

ON the western side of the entrance to Cook's Inlet (forty-five miles wide) lies Cape Douglas; and to the northward of the cape the shore recedes over twenty miles, forming the Bay of Kamishak. In the northern part of this bay lies the Island of Chernaboura ("black-brown"), otherwise called Augustin Island. It is eight or nine miles in diameter, and near its north-eastern part rises to a peak, called by Cook Mount St. Augustin. As laid down by Tebenkoff, the island is nearly round.

[1] From *Science*.

The northern shores are high, rocky, and forbidding, and are bordered by vast numbers of rocks and hidden dangers. The southern shore is comparatively low.

Mount St. Augustin was discovered and named by Capt. Cook, May 26, 1778; and he describes it as having "a conical figure, and of very considerable height." In 1794 Puget describes it as—

"A very remarkable mountain, rising with a uniform ascent from the shores to its lofty summit, which is nearly perpendicular to the centre of the island, inclining somewhat to its eastern side. . . . Towards the seaside it is very low, from whence it rises, though regular, with a rather steep ascent, and forms a lofty, uniform, and conical mountain, presenting nearly the same appearance from every point of view, and clothed with snow and ice, through which neither tree nor shrub were seen to protrude; so that, if it did produce any, they must either have been very small, or the snow must have been sufficiently deep to have concealed them."

At that time there were native hunters, under the direction of two Russians, hunting or living in the vicinity of the north-eastern point of the island.

Vancouver placed the peak of this mountain in latitude 59° 22′; Tebenkoff places it in latitude 59° 24′.

The peak of St. Augustin is distant forty-nine miles nearly due west (true) from the settlement on the southern point of Port Graham, or, as it is sometimes called, English Harbour. This harbour is situated on the eastern side of Cook's Inlet, near Cape Elizabeth.

In connection with the fall of pumice-dust at Iliuliuk on October 16, 1883, it may be of interest to observe that the peak of Augustin is over 700 miles to the north-eastward of Bogosloff Island off Unalashka.

About eight o'clock on the morning of October 6, 1883, the weather being beautifully clear, the wind light from the south-westward (compass), and the tide at dead low water, the settlers and fishing parties at English Harbour heard a heavy report to windward (Augustin bearing south-west by west three-fourths west by compass). So clear was the atmosphere that the opposite or north-western coast of the inlet was in clear view at a distance of more than sixty miles.

When the heavy explosion was heard, vast and dense volumes of smoke were seen rolling out of the summit of St. Augustin, and moving to the north-eastward (or up the inlet) under the influence of the lower stratum of wind; and, at the same time (according to the statements of a hunting-party of natives in Kamishak Bay), a column of white vapour arose from the sea near the island, slowly ascending, and gradually blending with the clouds. The sea was also greatly agitated and boiling, making it impossible for boats to land upon or to leave the island.

From English Harbour (Port Graham) it was noticed that the columns of smoke, as they gradually rose, spread over the visible heavens, and obscured the sky, doubtless under the influence of a higher current (probably north or north-east). Fine pumice-dust soon began to fall, but gently, some of it being very fine, and some very soft, without grit.

At about 8.25 a.m., or twenty-five minutes after the great eruption, a great "earthquake-wave," estimated as from twenty-five to thirty feet high, came upon Port Graham like a wall of water. It carried off all the fishing-boats from the point, and deluged the houses. This was followed at intervals of about five minutes, by two other large waves, estimated at eighteen and fifteen feet; and during the day several large and irregular waves came into the harbour. The first wave took all the boats into the harbour, the receding wave swept them back again to the inlet, and they were finally stranded. Fortunately it was low water, or all of the people at the settlement must inevitably have been lost. The tides rise and fall about fourteen feet.

These earthquake-waves were felt at Kadiak, and are doubtless recorded on the register of the Coast Survey tide-gauge at that place. Also the pumice-ashes fell to the depth of four or five inches, and a specimen of the deposit was given to the tidal observer at St. Paul. It will be interesting to compare these ashes with those collected at Iliuliuk on October 16, and which, from a confusion of dates, were supposed to have come from the new Bogosloff volcanic island. I am of the opinion that they came from St. Augustin.

The condition of the Island of Augustin or Chernaboura, according to the latest accounts, is this:—

At night, from a distance of fifty or sixty miles, flames can be seen issuing from the summit of the volcano; and in the daytime vast volumes of smoke roll from it. Upon nearer approach from English Harbour it was found that the mountain had been split in two from peak to base by a great rupture extending across it from east to west, and that the northern slope of the mountain had sunk away to the level of the northern cliff.[1] This is corroborated by the statement of the hunting-party in Kamishak Bay. Smoke issued from the peak at a very short distance to the southward of the rupture.

The party of natives on Kamishak did not approach the islet, though they gave clear and distinct accounts of its eruption and subsequent appearance; but Capt. C. T. Sands, who was at English Harbour, gave the Alaska Company a full description; and Capt Cullie, of the *Kodiak*, states that, if there were plenty of water in the line of rupture, it would be possible for a vessel to sail through. At the time of Capt. Sands' observations the low ground of the island was visible, and seemed to be a vast crater, from which smoke and flames were issuing.

But beyond all these phenomena, apart from the volcanic eruption and the rupture of the island, we have the report of Capt. Cullie, of the schooner *Kodiak* (from whom we also obtain a statement in regard to the rupture), who approached the island from English Harbour on November 10, and found that a new island about a mile and a half long and seventy-five feet high, had been upheaved in the ten-fathom passage between Augustin and the mainland to the westward. This passage is from six to eight miles wide, and was sailed through by Puget in Vancouver's voyages of discovery.

This new island (also reported by the hunting-party in Kamishak) would appear to have arisen during the late volcanic activity. It lies to the north-westward of Chernaboura Island (Augustin), and was distinctly seen from the *Kodiak*, as that vessel lay ten miles to the north-eastward, and had clear weather.

To show the violence of the volcanic convulsions at this time, two extinct volcanoes on the Alaska peninsula, which are reported to be about west (true) from the active volcano Iliamna (twelve thousand feet high), had burst into activity; and during the day volumes of smoke were distinctly seen, and columns of flame at night. Usually, at that season, Augustin and the peak are covered with deep snow. On November 10, however, when Capt. Cullie approached the island, while there was a depth of four feet of snow at Port Graham (English Harbour), Mount St. Augustin was bare and black.

GEORGE DAVIDSON,
Assistant U.S. Coast and Geodetic Survey

THE ORIGIN OF THE SCENERY OF THE BRITISH ISLANDS[2]

THE Plains of Britain, like those elsewhere, must be regarded as local base-levels of denudation, that is, areas where, on the whole, denudation has ceased, or at least has become much less than deposit. Probably in all cases the areas they occupy have been levelled by denudation. Usually a greater or less depth of detrital material has been spread over them, and it is the level surface of these superficial accumulations that forms the plain. But in some instances, such as the flats of the Weald Clay and the Chalk of Salisbury Plain, there is hardly any such cover of detritus, the denuded surface of underlying rock forming the actual surface of the plain. Our plains, if classed according to the circumstances of their origin, may be conveniently regarded as (1) river plains—strips of meadow-land bordering the streams, and not infrequently rising in a succession of terraces to a considerable height above the present level of the water; (2) lake plains—tracts of arable ground occupying the sites of former lakes, and of which the number is ever on the increase; (3) marine plains—mostly flat selvages of alluvial ground, formed of materials originally laid down as a littoral marine deposit when the land lay below its present level: in the northern estuaries these up-raised sea-beds spread out as broad carse-lands, such as those of the Tay, Forth, and Clyde; (4) glacial drift plains—tracts over which the clays, sands, and gravels of the Ice Age form the existing surface; (5) submarine plains—the present floor of the North Sea and of the Irish Sea, which must be regarded as essentially part of the terrestrial area of Europe.

When plains remain stationary in level, they may continue for an indefinite period with no material change of surface. But, should they be upraised, the elevation, by increasing the slope of the streams, augments their erosive power, and enables them once more to deepen their channels. Hence, plains like that of the New Forest, which have been deeply trenched by the water-courses that traverse them, may with probability be assigned to a time when the land stood at a lower level than it occupies at present. In this connection the successive river-terraces of the country deserve attention. They may be due not to the mere unaided work of the rivers, but to the cooperation of successive uplifts. It would be an interesting inquiry to correlate the various river-terraces throughout the country, for the purpose of discovering whether they throw any light on the conditions under which the most recent uprise of the country took place. That the elevation proceeded intermittently, with long pauses between the movements, is shown by the succession of raised beaches. It may be possible to establish a somewhat similar proof among our river-terraces.

The submarine plains are by far the most extensive within the British area. In the case of the North Sea the tendency of tidal scour and deposit must modify the form of the bottom. This great basin of water is obviously being slowly filled up by the deposit of sediment over its floor. A vast amount of mud and silt is borne into it by the rivers of Western Europe, as well as by those that drain the eastern and larger part of Britain, and the sea itself is cutting away the land on both sides and swallowing up the waste. We have only to contrast the colour of the Atlantic on the west of Ireland or Scotland with that of the North Sea to be assured of the wide diffusion of fine mud in the water of the latter. There is practically no outlet for the detritus that is thus poured into the basin of the North Sea. From the north a vast body of tidal water enters between Scotland and Norway, and travelling southward, aided by the strong northerly winds, sweeps the detritus in the same direction. On the other hand, another narrower and shallower tidal stream enters from the Strait of Dover, and, aided by the south-west winds, drives the sediment northward. Yet, making every allowance for the banks and shoals which this accumulating deposit has already formed, we can still, without much difficulty, recognise the broader features of the old land-surface that now lies submerged beneath the North Sea. It presents two plains, of which the southern has an average level of perhaps a little more than 100 feet below the surface of the water. This upper plain ends northward in a shelving bank, probably the prolongation of the Jurassic escarpment of Yorkshire, and is succeeded by the far wider northern plain, which lies from 100 to 150 feet lower, and gradually slopes northward. As mentioned in a previous lecture, the drainage-lines of the united Rhine, Thames, &c., on the one side, and the Elbe, Weser, &c., on the other, can still be partially traced on the sea-floor. The Irish Sea was probably, in its later history, a plain dotted with lakes. It appears to have been submerged before the whole of the present fauna and flora had reached Ireland.

Some of the most characteristic and charming scenery of the British Islands is to be found along their varied sea-board. Coast-scenery appears to depend for its distinctive features upon (1) the form of the ground at the time when by emergence or submergence the present level was established; (2) the composition and structure of the shore-rocks; (3) the direction of the prevalent winds, and the relative potency of subaërial and marine denudation. The British coast-line presents three distinct phases: in many places it is retreating; in others it is advancing; while in a few it may be regarded as practically stationary. As examples of retreat, the shores of a large part of the east of England may be cited. In Holderness, for instance, a strip of land more than a mile broad has been carried away during the last eight centuries. Even since the Ordnance Survey maps were published, thirty-three years ago, somewhere about 500 feet have in some places been removed, the rate of demolition being here and there as much as five yards in a year. The advance of the coast takes place chiefly in sheltered bays, or behind or in front of projecting headlands and piers, and is due in large measure to the deposit of material which has been removed by the sea from adjoining shores. The amount of land thus added does not compensate for the quantity carried away, so that the total result is a perceptible annual loss. The best examples of a stationary coast-line where there is no appre-

[1] Capt. Cullie's account.

[2] Abstract of fifth and concluding lecture by Archibald Geikie, F.R.S., Director-General of the Geological Survey, given at the Royal Institution, March 3. Continued from p. 420.

ciable erosion by the waves and no visible accumulation of detritus, are to be found among the land-locked fjords or inlets of the west coast of Scotland. In these sheltered recesses the smoothed striated rocks of the Ice Age slip under the sea, with their characteristic glaciated surfaces still so fresh that it is hard to believe that a long lapse of ages has passed away since the glaciers left them.

The remarkable contrast between the scenery of the eastern and western coast-line of the British Islands arises partly from the preponderance of harder rocks on the west than on the east side, but probably in large measure upon the greater extent of the submergence of the western sea-board, whereby the sea has been allowed to penetrate far inland by fjords which were formerly glens and open valleys. The details of coast-scenery vary with the rock in which they are developed. Nowhere can the effects of each leading type of rock upon landscape be more instructively studied than along the sea-margin. As distinct types of coast-scenery, reference may be made to sea-cliffs and rocky shores of granite, gneiss, basalt, massive sandstone and flagstone, limestone, alternations of sandstone shale or other strata, and boulder-clay, and to the forms assumed by detrital accumulations such as sand-dunes, shingle-banks, and flats of sand or mud.

The concluding portion of the lecture was devoted to an indication of the connection between the scenery of a country and the history and temperament of the people. This subject was considered from four points of view, the influence of landscape and geological structure being traced in the distribution of races, in national history, in industrial and commercial progress, and in national temperament and literature.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The proposal to allow women to enter for the same honour examinations as men met with less opposition in Congregation than was generally anticipated. By 100 votes to 46 the statute was passed by Congregation permitting women to enter for both Classical and Mathematical Moderations, and for the final Schools of History, Mathematics, and Natural Science. On March 11 the statute will come before Convocation, and will in all probability be passed.

In a Convocation held on March 4 a decree was passed authorising the Professors of Anatomy and Physiology to engage a table for the use of students of the University at the Zoological Station at Villefranche. The anti-vivisectionists were demonstrative, but did not divide the House.

The Professor of Medicine gives notice that the Testamurs for Chemistry and Physics in the Preliminary Honour Examination excuse candidates from the Chemistry and Physics Examination in the First M.B., but that the Testamurs for Chemistry and Physics in the Pass School are not recognised. Candidates may take up Chemistry and Physics separately from Anatomy and Physiology.

An examination will be held at Keble College on March 18 to elect a Scholar in Natural Science. Candidates may offer Chemistry and Biology.

CAMBRIDGE.—Plans have been obtained for the building of a new foundry and a temporary lecture-room and museum for the Department of Mechanism, suitable eventually for additional workshops. The cost is to be 450*l*. The number of pupils in this department has now increased to fifty-seven.

Plans have also been prepared for the new botanical class-rooms for microscopic work, the estimated cost being 1065*l*.

Messrs. E. C. Ames, B.A., B. H. Bent, and J. H. Nicholl, B.A., have been appointed Demonstrators of Mechanism and Applied Mechanics.

The following Colleges hold Examinations for Open Scholarships in Natural Sciences on the respective dates mentioned:—Clare, March 18; Jesus, March 13; Downing, June 10; Cavendish, August 6. For particulars, application should be made to the tutors of the Colleges. A Clothworkers' Exhibition in Physical Science, tenable either at Oxford or at Cambridge, will be awarded in July. Information may be obtained from the Censor of Non-Collegiate Students, Cambridge.

SCIENTIFIC SERIALS

Journal of Botany.—The number for February commences with the first part of an important paper by Mr. Thomas Hick on protoplasmic continuity in the Florideæ. The connection of protoplasm from cell to cell has now been established in a number of instances in the vegetable kingdom. It may be seen with very great ease, as described and drawn by Mr. Hick, in the frond of some of the red seaweeds, as *Polysiphonia* and *Callithamnion*, without any chemical reagent, except one that causes a slight contraction.—Mr. Carruthers contributes a useful paper on the mode of distinguishing the seed of the sweet vernal grass, *Anthoxanthum odoratum*, from that of *A. Puellii*, an annual species with which it is often adulterated by seed-growers.

THE last part (vol. iii. heft 3) of Cohn's *Beiträge zur Biologie der Pflanzen* contains two important cryptogamic papers: one by E. Eidam, on the development of the Ascomycetes, in which two new forms are described; the other, by M. Franke, describing an interesting new genus of parasitic algæ, *Endoclonium*, dimorphic, and growing on decaying fronds of *Lemna gibba*.

Journal of the Russian Chemical and Physical Society, vol. xv. fasc. 9.—On the action of the hydrocarbons of the acetylene series upon oxide of mercury and its salts, by M. Kutscheroff.—Thermic data of pyrosulphuryl, by D. Konovaloff. The heat of formation of a molecule of $S_2O_5Cl_2$ from its elements in a gaseous state is equal to 180·6 calories.—On a hydrate of silicium obtained from cast iron, by G. Zabudsky.—On the characters of the infra-molecular force, by M. Bardsky (second article).—On electrolytic light, by N. Sloughinoff, being an experimental and mathematical inquiry into the light disengaged during the electrolysis of liquids at one of the electrodes: historical sketch of the subject; instruments employed; the laws of the extra-currents of Edlund; light disengaged in a water solution of sulphuric acid, and dependence of it upon the number of elements in the battery; oscillations of the force of the current; experiments with a rotating glass; wearing of the electrodes; spectrum; light in the acid solutions of salts; on the resistance, the electro-spheroidal state, and the heat disengaged; the oscillating currents.—On the theory of the curved nets, by A. Sokoloff.

Atti della R. Accademia dei Lincei, Rome, October 18 and 19, 1883.—On the alterations undergone by the red globules of the blood in malarious infections, by Prof. Ettore Marchiafava.—Meteorological observations made at the Royal Observatory of the Campidoglio during the months of August, September, and October, 1883.

December 2.—Remarks on Dr. F. Mercanti's memoir on the cilian muscle in reptiles, by Signor Moriggia.—On the alterations in the red globules of the blood in malarious infections, by S. Todaro.—Report on Prof. E. Millosevich's memoir on the diameter of Uranus, by S. Respighi.—On the molecular velocities of gaseous bodies, by A. Violi.—Note on fluorbenzine and fluorotoluine, by P. Emanuele and O. Vincenzo.—A new series of compounds of titanium, by A. Piccini.—On the transformation of the fluorbenzoic acids in the animal organism, by F. Coppola.—A study of the resins of *Thapsia garganica*, by Fr. Canzoneri.—On a new species of Salpa (*S. dolicosoma*), by Fr. Todaro).—Observations on the Pons-Brooks comet, by Pietro Tacchini.—On the unipolar induced electric current and nervous excitement, by G. Magini.—Archæological discoveries at Angera, Peschiera, Viterbo, Rome, Sulmona, and in other parts of Italy, from June to October, 1883.—S. Sella and S. Mamiani were elected president and vice-president for the ensuing four years, 1884-7.

Rivista Scientifico-Industriale, Florence, November 15-30, 1883.—Further applications of the nephoscope invented by Filippo Cecchi (four illustrations).—Description of a new electro-magnet recently exhibited before the Society of Natural and Economical Sciences at Palermo, by Prof. A. Riccò.—An account of some of the important results already obtained in the Acclimatisation Garden established ten years ago by General Vincenzo Ricasoli at Portercole, by G. Arcangeli. Amongst the exotics here successfully reared are *Cocos flexuosa*, *Caloricà borbonica*, *Phœnix reclinata*, *Boldea fragrans*, *Citharexylon reticulatum*, *Casuarina quadrivalvis*, *Edwardsia grandiflora*, *Eugenia australis*, *Ficus elastica*, *Picconia fragrans*, besides numerous species of *Bignonia*, *Agave*, *Acacia*, and *Eucalyptus*, and other Australian plants.

Rendiconti del R. Istituto Lombardo, Milan, December 13, 1883.—On the distinctions observed in criminal law between the authors and accomplices in a felony, by Prof. A. Buccellati.—Inquiry into the nature of the underground disturbances that occurred at Ischia on July 28, 1883, by Prof. A. Serpieri.—On numbers irreducible by complex numbers, by Prof. C. Formenti.—On some forms of right lines produced by two reciprocal stars, by Prof. F. Aschieri.—Meteorological observations made at the Brera Observatory, Milan, during the months of October and November, 1883.

SOCIETIES AND ACADEMIES

London

Royal Society, February 14.—"On a New Reflecting Galvanometer of Great Sensibility, and on New Forms of Astatic Galvanometers." By Thomas Gray, B.Sc., F.R.S.E., and Andrew Gray, M.A., F.R.S.E. Communicated by Sir William Thomson, F.R.S.

The paper describes first a very sensitive galvanometer, of novel construction, which the authors have had made, with aid from the Government Research Fund, for their experiments on the electric resistance of glass and allied substances. It consists of two pairs of coils with hollow cores, arranged so that the axes of each pair are parallel and in a vertical plane, which act on a needle-system, consisting of two horse-shoe magnets of thin steel wire connected by a very light frame of aluminium, and hung with their planes vertical, so that a horse-shoe corresponds to each pair of coils and has its poles within the hollow cores. In the instrument constructed each pair of coils is carried by a vertical brass plate, and these two plates are set so as to make an angle with one another of about 106°. A line drawn from the suspension thread (a single fibre of silk) to a point near a pole of either of the needles, when the needles are at the same distance within both pairs of coils, is nearly at right angles to the axis of the coil, and the motion of the needle for small deflections is nearly along the axis. The needles enter the coils from the same side, and the current is usually sent through the coils, so that one pair cause their horse-shoe to move outwards and the other pair their horse-shoe to move inwards, thus turning the needle-system round the suspension fibre. A mirror fixed to the aluminium connecting-bar gives a measure of the deflection in the ordinary manner. This system of needles, when rightly adjusted, is practically astatic in a magnetic field of uniform intensity.

A magnet (or system of magnets) is generally arranged to give a differential field at the upper and lower ends of the needles, which are usually placed with unlike poles turned in similar directions; but any magnetic system may be employed to give directive force in the proper manner and degree for a particular purpose or arrangement.

Another form of the instrument is described in which the coils are all in one plane, and the connecting aluminium bar carrying the horse-shoe needles passes through the plate in which the coils are set from one side to the other, so that one horse-shoe enters its pair of coils from one side, and the other horse-shoe from the other side. When the needle-system is deflected thus, both needles are pushed out of the coils or both pulled in.

By the method of arranging the needles and coils adopted in these instruments the current is made, when the hollow cores are made small, to act very advantageously on the needles, and hence in great measure their high sensibility. By attaching to the suspended system a small needle to give directive force in a uniform field, the great magnetic moment and leverage of the horse-shoes may be taken advantage of.

The paper then describes a new and very compact form of distributing plate, by means of which a multiple coil galvanometer, or one in which the coil is wound in sections, may be connected in any desired manner to vary its resistance or its sensibility.

Finally, two forms of instrument are described, in which two perfectly vertical and straight needles connected together rigidly by bars of aluminium are used to give a perfectly astatic system, not disturbed by the magnetising or demagnetising action of neighbouring magnets, a result the authors think practically unattainable in any arrangement of horizontal needles. Two vertical needles, with their upper ends in the position occupied by the upper needle of a so-called astatic galvanometer, and their lower ends in the position of the lower needle, experience, if their like poles are turned in dissimilar directions, a similar electromagnetic action to that in the horizontal needles; and the authors propose when convenient to use such an arrangement instead of the ordinary needle system.

Also a pair of vertical needles may be used instead of the horse-shoe needles described above, the coils being so placed as to act advantageously, and give a convenient arrangement of the parts of the instrument.

Geological Society, February 15.—Annual General Meeting.—J. W. Hulke, F.R.S., president, in the chair.—The Secretaries read the Reports of the Council and of the Library and Museum Committee for the year 1883. In the former the Council congratulated the Fellows upon an improvement in the state of the Society's affairs since the date of their last Report, the income of the Society having been greater, and its expenditure less, in 1883 than in 1882, while, although the removal from the list of the names of twelve Fellows whose addresses were unknown, and whose election dated back before the incorporation of the Society in 1826, had produced an apparent loss of three Fellows during the year, the Society might really be regarded as having received an increase of nine Fellows. The increase in the number of contributing Fellows was twenty-two. The Council's Report further announced the awards of the various Medals and of the proceeds of the Donation Funds in the gift of the Society.

In presenting the Wollaston Gold Medal to Prof. A. Gaudry, F.M.G.S., the President addressed him as follows:—"Prof. A. Gaudry,—The Council of the Geological Society has awarded you the Wollaston Medal in recognition of the value of your palæontological researches and the important scientific generalisations you have deduced from long and laborious observations. The numerous papers on topographical geology and on palæontology you have contributed during the past thirty years, your important 'Recherches Scientifiques en Orient entreprises par les ordres du Gouvernement pendant les années 1853–1854,' your 'Animaux fossiles et géologie de l'Attique,' and, lastly, your work 'Les Enchaînements du monde animal dans les temps géologiques,' have made your name so familiar, wherever our branch of natural science is cultivated, that in receiving you we feel we are not receiving a stranger, but a scientific brother, and one who, by his labours and singleness of aim, has achieved a position as a palæontologist such as few can hope to attain. Personally it affords me great and sincere pleasure that it has fallen to my lot to hand you this medal, which, by the consent of all, has never been more worthily bestowed."

The President then presented the balance of the proceeds of the Wollaston Donation Fund to Mr. E. Tulley Newton, F.G.S., and addressed him as follows:—"Mr. Newton,—The Council has voted you the balance of the proceeds of the Wollaston Donation Fund, in recognition of the value of your researches amongst the Pleistocene Mammalia of Great Britain, and to assist you in the prosecution of further investigations. Your memoirs published by the Geological Survey of England and Wales, 'On the Vertebrata of the Forest-bed Series of Norfolk and Suffolk,' and on 'The Chimæroid Fishes of the Cretaceous Rocks,' and your papers published in our *Journal* are considered by the Council to evince great merit; they regard them as a bright earnest of future work which they hope may be promoted by this award."

In presenting the Murchison Medal to Dr. Henry Woodward, F.R.S., the President said: "Dr. Henry Woodward,—The Council has awarded you the Murchison Medal and a grant of ten guineas in recognition of your valuable researches into the structure and classification of the fossil Crustacea, especially of the Merostomata and Trilobita, and your services to the progress of geology in Great Britain by your conduct of the *Geological Magazine* for nearly twenty years. Your monograph on the 'Merostomata,' published by the Palæontographical Society, and your 'Catalogue of British Fossil Crustacea, with their synonyms and the range in time of each genus and order,' will long continue to be works of reference indispensable to every student of these interesting life-forms. But valuable as are these written records, they discover but a small part of the services you have rendered in the advancement of our science. How much more you have done by the assistance you have so freely given to all who have sought your help at the Museum in deciphering some difficult matters in palæontology will never be fully known."

The President then handed the balance of the proceeds of the Murchison Geological Fund to Mr. R. Etheridge, F.R.S., for transmission to Mr. Martin Simpson, of Whitby, and addressed him as follows: "Mr. Etheridge,—The balance of the proceeds of the Murchison Donation Fund has been awarded by the Council to Mr. M. Simpson, Curator of the Whitby Museum. He has devoted much attention to the fossils of that district, and he is the author of two books descriptive of them. The Council hopes that this cheque may be of assistance to him in continuing the useful extra-official work he has long been carrying on in that locality."

The President next handed the Lyell Medal to Prof. W. H. Flower, F.R.S., for transmission to Dr. Joseph Leidy, F.M.G.S., and addressed him as follows:—"Prof. Flower,—The Council has bestowed on Dr. J. Leidy the Lyell Medal, with a sum of 25*l*., in recognition of his valuable contributions to palæontology, especially as regards his investigations on the Fossil Mammalia of Nebraska and the Sauria of the United States of America. These vast and, in comparison with our own country, but little explored territories have for some years past yielded a harvest of fossil vertebrate remains of exceeding richness, of which we have no example here. How well this harvest is being garnered by our Transatlantic *confrères* the flood of memoirs published by them during the last quarter of a century bears witness. Amongst these scientific labourers in the palæontological harvest-field, Dr. J. Leidy has held a foremost place. Careful in observing, accurate in recording, cautious in inferring, his work has the high merit which trustworthiness always imparts. The well-nigh astounding number of papers written by him between 1845 and 1873, amounting to 187, his Reports on the 'Extinct Vertebrate Fauna of the Western Territories,' his 'Synopsis of the Extinct Mammalia of North America,' and his 'Cretaceous Reptiles of the United States,' testify to the fertility of his pen."

In presenting to Prof. C. Lapworth, F.G.S., the balance of the Lyell Geological Fund, the President said: "Prof. Lapworth,—The Council has awarded to you the balance of the proceeds of the Lyell Donation Fund in recognition of the value of your researches into the palæontology and physical structure of the older rocks of Great Britain, carried on frequently under unfavourable circumstances and to the injury of your health, and to aid you in similar investigations. Your papers on 'The Girvan Succession,' 'The Moffat Series,' published in our *Journal*, and 'The Graptolites,' and 'The Secret of the Highlands,' contributed to the *Geological Magazine*, were the outcome of an extremely laborious and detailed exploration of the districts to which they refer—an exploration in conducting which you spared no pains and shrank from no hardships. No one who desires to know the structure of these districts can safely omit a careful study of these very instructive papers."

The President then handed to Prof. Bonney, F.R.S., for transmission to Dr. J. Croll, a portion of the proceeds of the Barlow-Jameson Fund, and said: "Prof. Bonney,—The Council, in recognition of the value of Dr. James Croll's researches into the 'Later Physical History of the Earth,' and to aid him in further researches of a like kind, has awarded to him the sum of 20*l*. from the proceeds of the Barlow-Jameson Fund. Mr. Croll's work on 'Climate and Time in their Geological Relations,' and his numerous separate papers on various cognate subjects, including the 'Eccentricity of the Earth's Orbit,' 'Date of the Glacial Period,' the 'Influence of the Gulf Stream,' the 'Motion of Glaciers,' 'Ocean Currents,' and the 'Transport of Boulders,' by their suggestiveness have deservedly attracted much attention. In forwarding to Dr. Croll this award, the Council desires you to express the hope that it may assist him in continuing these lines of research."

In handing to Prof. Seeley, F.R.S., a second portion of the proceeds of the Barlow-Jameson Fund for transmission to Prof. Leo Lesquereux, F.C.G.S., the President spoke as follows: "Prof. Seeley,—The Council has awarded to Prof. Leo Lesquereux the sum of 20*l*. from the proceeds of the Barlow-Jameson Fund, in recognition of the value of his researches into the palæobotany of North America, and to aid him in further investigations of a similar kind. Prof. Lesquereux's 'Contributions to the Fossil Cretaceous and Tertiary Flora of the Western Territories,' published in the 'Reports of the United States Geological Survey,' are works which, for their matter, typography, and illustrations, leave nothing to desire. In transmitting this award to Prof. Lesquereux, you will convey to him the hopes of the Council that it may assist him in prosecuting further investigations in the difficult branch of research in which he has already accomplished so much."

The President then read his Anniversary Address, in which, after giving obituary notices of some of the Members lost by the Society in 1883, he passed in review the principal work done by the Society since the last Anniversary Meeting, and finally referred more in detail to some important results obtained elsewhere in connection with the comparative osteology of the Vertebrata, dwelling particularly upon the question of the existence in the lower jaw of an unpaired bone occupying, or anterior to, the symphysis—the "os présymphysien" of M. Dollo, the "mento-Meckelian" of Cope, the "inferior intermaxillary element" of W. K. Parker,—and upon certain cranial and pelvic characters of the Dinosauria.

The ballot for the Council and Officers was taken, and the following were duly elected for the ensuing year:—President: Prof. T. G. Bonney, F.R.S. Vice-Presidents: W. Carruthers, F.R.S., John Evans, F.R.S., J. A. Phillips, F.R.S., Prof. J. Prestwich, F.R.S. Secretaries: W. T. Blanford, F.R.S., Prof. J. W. Judd, F.R.S. Foreign Secretary: Warington W. Smyth, F.R.S. Treasurer: Prof. T. Wiltshire, F.L.S. Council: H. Bauerman, W. T. Blanford, F.R.S., Prof. T. G. Bonney, F.R.S., W. Carruthers, F.R.S., John Evans, F.R.S., Col. H. H. Godwin-Austen, F.R.S., Henry Hicks, Rev. Edwin Hill, M.A., G. J. Hinde, Ph.D., J. Hopkinson, Prof. T. M'Kenny Hughes, M.A., J. W. Hulke, F.R.S., J. Gwyn Jeffreys, F.R.S., Prof. T. Rupert Jones, F.R.S., Prof. J. W. Judd, F.R.S., J. A. Phillips, F.R.S., Prof. J. Prestwich, F.R.S., F. W. Rudler, Warington W. Smyth, F.R.S., J. J. H. Teall, M.A., W. Topley, Prof. T. Wiltshire, F.L.S., Henry Woodward, F.R.S.

Chemical Society, February 21.—Dr. W. H. Perkin, president, in the chair.—The following gentlemen were elected Fellows of the Society:—L. Archbutt, J. H. Burland, D. Bain, W. H. Barr, R. A. Bush, P. S. Chantrell, A. F. Damon, H. C. Draper, T. R. Duggan, V. Edwards, W. T. H. Elsley, G. W. Gibson, F. W. Harris, T. Hilditch, R. E. Moyle, P. Morton, W. J. Orsman, F. R. Power, A. E. Simpson, C. W. Sutton, H. G. Shaw, E. F. Smith, F. W. Tompson, A. Tarn, and E. W. Voelcker.—The following papers were read:—On the composition of the ash of wheat grain and straw grown at Rothamsted in different seasons and by different manures, by Sir J. B. Lawes and Dr. J. H. Gilbert. This is an extremely lengthy paper giving the details of 253 analyses of ashes from produce whose history as to growth, soil, season, and manuring is known. The experiments are given in three series. The first gives the results obtained during sixteen consecutive seasons under three characteristically different conditions as to manuring, and thus illustrates the influence of the fluctuation of season from year to year. The second represents nine different conditions as to manuring obtained in four seasons—two favourable, two unfavourable—and so shows the influence of characteristic seasons under a great variety of manuring conditions. The third series represents the proportionally mixed produce for the ten years 1852–61, and again for the succeeding ten years, 1862–71, from ten differently manured plots, and thus brings out the influence of continuous exhaustion or supply of certain constituents. The general results are that the influence of the season on the composition of the ash is very much more marked than the influence of the manure, and that the composition of normally-ripened grain is very uniform and in fact only varies in any marked degree according to manure, when there is a very abnormal deficiency of one or more constituents; the amounts of mineral constituents in the straw have a very obvious connection with the supply or exhaustion of these constituents in the soil.—On the analysis of Shotley Bridge Spa water, by H. Peile. This is a chalybeate water containing 0·0155 grm. Fe_2O_3 per litre as ferrous bicarbonate, 1·73 grm. sodium chloride, calcium salts, some lithium chloride, magnesium bromide and iodide, &c.

Zoological Society, February 19.—Mr. Osbert Salvin, F.R.S., president, in the chair.—Mr. Sclater laid on the table and made some remarks on a copy of the lately issued "Guide to the Calcutta Zoological Gardens."—Mr. W. T. Blanford, F.R.S., made some observations on the collection of drawings of Himalayan birds lately presented to the Society's library by Brian H. Hodgson, F.Z.S.—Prof. F. Jeffrey Bell read the second part of his contribution to the systematic arrangement of the Asteroidea. In the present communication the author treated of the species of the genus *Oreaster*.—A communication was read from M. Fernand Lataste, C.M.Z.S., containing the description of a new species of Gerbille from Arabia. This new species was founded on specimens living in the Society's Gardens, which had been hitherto referred to *Gerbillus erythrurus*, Gray. M. Lataste considered the species to be undescribed, and proposed to call it *Meriones longifrons*.—A communication was read from Mr. J. Wood-Mason, F.Z.S., in which he gave a description of a new species of the Neuropterous genus *Corydalis*. The first example of this insect (a female) was captured by Lieut.-Col. H. H. Godwin-Austen, F.R.S., on the Naga Hills, north-east frontier of India; but male specimens had since been obtained. The author proposed to call this species *Corydalis asiatica.*—A communication was read from Dr. J. Gwyn Jeffreys, F.R.S., on the Mollusca procured during the *Lightning* and *Porcupine* Expeditions 1868-70, forming the seventh part of his series of papers on this subject. The present part comprised the genera from *Rissoa* to *Acirsa*, with seventy-four sp cies, of which fourteen were new to science, as was also one new genus.

Physical Society, February 23.—Prof. F. Guthrie, president, in the chair.—New Members:—Mr. E. F. J. Love, Mr. James Grundy, Rev. F. J. Smith, Mr. F. R. Bawley.—Prof. Silvanus P. Thompson read a paper on a new method of making resistance coils. This consisted in cutting off a piece of the wire of which the coil is to be made, long enough to give a resistance some 2 per cent. higher. From the formula—

$$\text{Shunt} = \frac{R\,r}{R - r}$$

(where R is the rough resistance, and r the final resistance), the value of a wire wherewith to shunt the first piece in order to give the resistance required is found. A length of wire giving this resistance (or, rather, about 2 per cent. more) is then cut off and soldered as a shunt to the first piece. Practice shows that this method is very quick and accurate. It is useful for shunts under 10 ohms. Prof. Thompson also described a new form of "meter bridge" devised by him. The wire is 2 m. long, and there are two wires, one of a resistance about ¼ ohm., the other 8·21 ohms. Contact is made by one or other by a sliding contact with vernier attached. This arrangement is more convenient than the single wire meter bridge, and allows of higher resistances being measured. A special switch board with an arrangement of mercury cups avoids the necessity of transposing the coils in Foster's method, this being effected by shifting the contact links in the mercury cups.—Mr. R. T. Glazebrook, F.R.S., explained a cam or axle key devised by Mr. Shaw to effect the contacts necessary to transpose the coils by a single movement. He pointed out that a certain pressure was necessary to make good contact with mercury. The ordinary way of making coils was to double the wire, cut the bight, bare the ends there, and solder a piece of copper across them, which could be shifted until the resistance was got. Prof. G. C. Foster said that the copper links in mercury cups should rest on the copper.—Prof. Foster read a paper by himself and Mr. Pryson on the difference of potential required to give sparks in air. Let V = this difference of potential, l = length of spark in centimetres, their experiments gave (approximately) $V = 102\,l + 7{\cdot}07$. Tables and curves of the sparking distances, potentials, and electric forces in the experiments were given. The results were got with brass balls 1·35 centimetres in diameter, a frictional machine, and a Foster absolute electrometer. When l = ·142, the electric force giving a spark was 154·76; l = ·284, the electric force was 133·35, or less than at a shorter distance; l = 497, the electric force was 131·66; l = ·9, the electric force was 138·57; that is, it began to rise again.—Prof. G. Forbes made a communication on a magnetised chronometer watch. The watch slowed several minutes a day. He found the rate to vary with the position of the watch with respect to the cardinal points and also in a vertical plane. The bar of the balance was magnetised and some screw nails. He traced the variation of rate to magnetisation of the spring, the bar, and screws. The fact that it varied with position suggested that a magnetised ship's chronometer might be made which would integrate the course and give a mean course. Messrs. E. Dent and Co. had fitted a gold spring and a platinum iridium balance to the chronometer, and rendered it non-magnetisable.

Royal Meteorological Society, February 20.—Mr. R. H. Scott, M.A., F.R.S., president, in the chair.—T. G. Benn, Capt. C. F. Cooke, Francis Galton, M.A., F.R.S., Prof. S. A. Hill, B.Sc., Capt. A. W. Jeffery, G. Paul, F.G.S., F.R.H.S., R. Veevers, H. T. Wakelam, and E. Wells were elected Fellows of the Society.—The following papers were read:—The great storm of January 26, 1884, by William Marriott, F.R.Met.Soc. This storm was remarkable for its violence and large area, as well as for the unprecedentedly low barometer reading at its centre. The author has prepared isobaric charts for each hour from noon on the 26th to 3 a.m. on the 27th, and by this means has tracked the storm across the British Isles. The centre of the depression appears to have first reached the north-west coast of Ireland at noon, and passed in a north-easterly direction over the north of Ireland and across the middle of Scotland, reaching Aberdeen about midnight. Its rate of progress was therefore about thirty miles an hour. A violent gale was experienced all over the British Isles, the greatest hourly velocity of the wind being 68 miles at Valencia at 11 a.m., 70 miles at Holyhead at 2 p.m., 63 miles at Falmouth at 3 p.m., 69 miles at Armagh and 59 miles at Aberdeen at 5 p.m., 58 miles at Greenwich from 5 to 7 p.m., and 76 miles at Alnwick at midnight. Thunderstorms occurred on the south-eastern side of the depression, and travelled across the south of Ireland and England at the rate of about thirty miles an hour. The lowest readings of the barometer (reduced to sea-level) yet reported were 27·32 inches at Kilcreggan at 8.30 p.m., and 27·332 inches at Ochtertyre, near Crieff, at 9.45 p.m. In the southern part of England, directly after the minimum had occurred, there was a very sudden rise in the reading of the barometer, in some cases amounting to ·08 inch in five minutes. From an examination of previous records, it appears that there has never before been so low a barometer reading as 27·32 inches, so that this storm may be considered as one of the most remarkable that has occurred in the British Islands.—The height of the neutral plane of pressure and depth of monsoon currents in India, by Prof. E. D. Archibald, M.A., F.R.Met.Soc.—The sunrises and sunsets of November and December, 1883, and January, 1884, by the Hon. F. A. Rollo Russell, M.A., F.R.Met.Soc. The author gives a very interesting account of all the special features of the remarkable sunrises and sunsets which have been observed from November 8 to February 2. The following are stated to be the marks distinguishing the peculiar sky-haze from cirrus:—1. It is commonly much more evenly spread over the sky than cirrus. 2. It is visible (except when very dense or in the neighbourhood of the sun) only about the time of sunrise and sunset. During the day not the faintest trace obscures the clear azure, whereas cirrus becomes more distinct with more daylight. 3. When actually glowing with bright colour, it loses its wavy appearance. 4. It has no perceptible motion, unless perhaps when watched through a long period. 5. It does not interfere with the clear definition of the moon or brilliancy of the stars. 6. It lies, almost without exception, in long streaks, stretching from between south-south-west and west-south-west to between north-north-east and east-north-east. 7. Its radiant point lies, not on the horizon, but far below it. 8. If both cirrus and sky-haze be present, the sky-haze begins to shine with a red light soon after the cirrus has ceased to glow above the western horizon. When cirrus is present, however, there is in general a reaction of effects. 9. The sky-haze is destitute of the fibrous twists and angular branches of cirrus, and, since the sunlight leaves it in regular progression, it must be stratified at the same uniform level. 10. It has always been visible on every clear day for more than two months, and has been quite independent of wind and weather.

Entomological Society, February 6.—Mr. J. W. Dunning, president, in the chair.—The President nominated Sir S. S. Saunders and Messrs. F. P. Pascoe and R. Meldola as vice-presidents for the ensuing year. Two new members were elected.—Mr. P. Crowley exhibited specimens of *Castnia eudesmia*, with eggs, larval galleries, and pupæ.—Mr. W. F. Kirby exhibited a coloured photograph of an abnormal specimen of the genus *Samia*, which had been bred by M. Alfred Wailly.—Mr. H. T. Stainton remarked on the food of the larva of *Aglossa pinguinalis*.—The Secretary exhibited photographs of the female of *Hypocephalus armatus*, and read some notes on the subject by Dr. Sharp.—Mr. F. P. Pascoe exhibited a collection of *Curculionidæ* from New Guinea.—The President made some remarks on the attempt to introduce humble-bees into New Zealand. He also called attention to the disappearance of many common butterflies and moths from the neighbourhood of Huddersfield, upon which a discussion ensued, the opinion of most of the speakers being that butterflies were rapidly becoming much scarcer in England than they used to be.—The Secretary read a report from the Committee appointed to inquire into the alleged occurrence of *Phylloxera* in Victoria, confirming its presence in that colony.—Mr. J. W. Douglas communicated a description of a new species of *Orthezia* from Monte Cristo.—Sir S. S. Saunders communicated further notes on the caprification of domestic figs.

Anthropological Institute, February 12.—Mr. John Evans, F.R.S., vice-president, in the chair.—The election of Mr. Joseph

Fothergill, F.R.G.S., was announced.—Mr. Park Harrison exhibited some remains found last year in Castlefield, Wheatley, by Mr. E. Gale, the occupier of the land. The skulls were of two types, and belonged to subjects who have been interred for the most part in a flexed or contracted position, but some at full length. The objects associated with the skulls were also diverse. Amongst those lent by Mr. Gale were an unusually long and narrow spear-head and the boss of a target with rivets ornamented with tinned studs, such as have been found elsewhere in Oxfordshire. Other objects excavated at the expense of the late eminent archæologist, Mr. J. H. Parker, and given by him to the Ashmolean Museum, which he had intended to send, were not exhibited, owing to his lamented death. Mr. Harrison thought the remains at Wheatley dated from the time of the extension of the kingdom of Mercia to the Thames. Dr. Garson is preparing a description of the cranial peculiarities of the skulls.—Mr. Worthington G. Smith exhibited two skulls of the Bronze Age from a tumulus at Whitby.—Mr. Henry Prigg exhibited two Palæolithic implements and a fragment of a human skull from Bury St. Edmund's.—Mr. R. Morton Middleton exhibited some human bones from Morton, near Stockton.—Mr. John T. Young read a paper on some Palæolithic fishing implements from the Stoke Newington and Clapton gravels. Mr. Young exhibited a large collection of flints of various sizes, which he considered had been manufactured for use as fish-hooks, gorges, and sinkers; some of them showed evident traces of human workmanship; and the paper gave rise to an animated discussion.—Miss A. W. Buckland read a paper on traces of commerce in prehistoric times, in which she urged that the similarity of three cups of gold discovered, one in Cornwall, another at Mycenæ, and the third in the Necropolis of old Tarquinii, might be taken as evidence of the existence of commercial relations between Etruria and Ancient Britain.—A paper was read on a human skull found near Southport, by Dr. G. B. Barron.

Institution of Civil Engineers, February 26.—Sir J. W. Bazalgette, C.B., president, in the chair.—The paper read was on hydraulic propulsion, by Mr. Sydney Walker Barnaby, Assoc.M.Inst.C.E.

Edinburgh

Royal Physical Society, February 20.—Ramsay H. Traquair, M.D., F.R.S., president, in the chair.—The following communications were read:—On the geological structure and age of the Harz Mountains, by H. M. Cadell, B.Sc., of H.M. Geological Survey of Scotland, a continuation of his former paper. The rocks of the Palæozoic core of the region had been deposited in an area subject to occasional volcanic outbursts. There were many patches of diabase on the Lower Harz which were usually associated with rocks of Hercynian age, and were regarded by German geologists as portions of interbedded sheets. Mr. Cadell believed they were intrusive sheets and bosses of later date, and gave as his reasons that (1) the adjacent strata were metamorphosed by heat on all sides; (2) the diabase sometimes cut obliquely through the sedimentary strata; (3) there was no tuff associated with these diabases as there was with the true interbedded lavas of the Harz; (4) these diabases did not, like the contemporaneous volcanic rocks, occur as continuous sheets, but were found in isolated patches like the intrusive diabases of the Scottish Midlands. The Whintill of Northumberland was cited as an example of an intrusive sheet which, like some of those on the Harz, kept on nearly the same horizon for considerable distances, but was not on that account alone to be regarded as interbedded. The first great break in the deposition of the Harz rocks took place in the middle of the Carboniferous period at the time of the irruption of the Brocken granite. The metalliferous veins of Clausthal and St. Andreasberg were all in faults traversing the culm strata and the granite, but were truncated by the Zechstein, which rested unconformably on the flanks of the Harz, and were therefore of Permian age. The Harz was bare during the Coal-measure and Permian periods, as conglomerates of Harz fragments were found in these strata. During the Secondary period the whole region appeared to have remained submerged, but the huge fault which bounded the north side of the Harz and inverted the whole of the Secondary rocks showed that the final upheaval had begun at the close of the Cretaceous period.—Remarks on the genus *Megalichthys* (Ag.), with description of a new species, by R. H. Traquair, M.D., F.R.S. This specimen was found at Burdiehouse, and was believed to be a different species from the *Megalichthys* of the Coal-measures.—On the principles of classification, by Prof. J. Cossar Ewart, M.D.—On the occurrence of an adult specimen of Sabine's gull (*Larus sabinii*) in Scotland, with exhibition of specimen, by Mr. E. Bidwell. This was a male bird shot last autumn on a loch in Mull, and is said to be only the second specimen of the bird in a mature state known to have been found in Europe. Immature specimens of this rare bird have occasionally been met with on the west coast of Ireland, but its home is on the borders of the Arctic region. In connection with this, Mr. Harvie-Brown, F.Z.S., made some interesting remarks on the migration of birds.

Paris

Academy of Sciences, February 25.—M. Rolland in the chair.—Notice of the scientific labours of the late M. Th. du Moncel, by M. Edm. Becquerel.—A second communication on hydrophobia, by MM. Pasteur, Chamberland, and Roux. The results are reported of further experiments on dogs, rabbits, poultry, sheep, monkeys, and other animals who were inoculated with the virus, chiefly by trepanning. The object of the operation was to ascertain how far immunity could thus be secured against rabies communicated by mad dogs. As many as twenty-three dogs have by the process been rendered absolutely safe from the effects of the virus in whatever way and in whatever quantity administered. To make the whole species in this way free from the disorder would afford a practical solution of the question in a prophylactic sense, for human beings are never affected by rabies except from virus proceeding directly or indirectly from dogs.—On the equilibriums established between chlorhydric and fluorhydric acids, by MM. Berthelot and Guntz.—General considerations on the distribution of plants in Tunis, and on their chief botanical affinities, by M. E. Cosson.—On the quantities forming a group of nonions analogous to the quaternions of Hamilton, by M. Sylvester.—Note on the chief inventions of the Genevese watchmaker, G. A. Leschot, who died on Feb. 4, by M. D. Colladon. Leschot was the first to suggest the use of carbonado (fragments of Brazilian black diamonds) for piercing rocks and tunnelling.—Memoir on atmospheric movements above barometric depressions and risings; schemas deduced from the results of the work of Hildebrand-Hildebrandsson, entitled "On the distribution of the meteorological elements about the barometric minima and maxima," by M. A. Poincaré.—*Résumé* of the observations made at Cape Horn on atmospheric electricity, by M. Lephay.—Determination of the proportion of carbonic acid present in the air effected by the mission to Cape Horn, by MM. A. Müntz and E. Aubin. From these observations it appears that the quantity of carbonic acid present in the atmosphere at Cape Horn is only about 2·56 in 10,000 volumes of air, as compared with 2·84, the average in Europe.—Observations of the Pons-Brooks comet made at the Observatory of Marseilles, by M. Borrelly.—On the appendices to the nucleus of the Pons-Brooks comet, by M. P. Lamey.—On the red glows observed at sunset and sunrise during the mild winter of 1876–77, by M. P. Lamey.—On the rosy, crepuscular after-glows recently observed at Buenos Ayres, by M. Beuf.—On a sudden earthquake-wave observed on January 14, at Montevideo, by M. Beuf. At 7.30 a.m. the water suddenly fell several feet, and then rose in two successive waves about 1·5 m. above the ordinary sea-level. The disturbance seems to have been quite local, and was not felt at Buenos Ayres on the opposite side of the estuary.—On the calculation of the diurnal rotation of the solar spots, by M. Pansiot.—On the hyperfuchsian groups (mathematical analysis), by M. H. Poincaré.—On the propagation of a uniform shock communicated to a gas inclosed in a cylindrical tube, by MM. Sebert and Hugoniot.—On the lowering of the freezing-point of solutions of alkaline salts, by M. F. Raoult.—Heat of formation of the chloride and oxychlorides of antimony, by M. Guntz.—On the heat of formation of the oxybromides of mercury, by M. G. André.—Synthesis of the pyridic and piperidic bases, by M. A. Ladenburg.—On the addition of the chloride of iodine ICl to monochloruretted ethylene, $CH_2 = CHCl$, by M. L. Henry.—New reduction of the carbamate of ethyl, by M. G. Arth.—On ethyl and the methylacetylcyanacetate of ethyl, by M. A. Held.—On the action of bromuretted ethylene on benzine in the presence of chlorine of aluminium, by MM. Hanriot and Guilbert.—On the action of rennet on milk, by M. E. Duclaux.—Researches on the fermentation of farmyard manure, by M. U. Gayon.—Experimental researches on rabies, showing (1) that birds are liable to be attacked; (2) that they recover spontaneously, by M. P. Gibier.—Note on the electric reaction of the sensory nerves of the skin in ataxic animals, by M. M. Mendelssohn.—On the treatment by electricity of the elephantiasis prevalent amongst the Arabs, by MM. Moncorvo and Silva Araujo.—On the poison of the toad and other batrachians, by M. G. Calmels.—On the sexual differences of the *Corbœus bifasciatus*, and on the pretended eggs of this coleopterous insect injurious to the evergreen oak, by M. A. Laboulbène.—On the coincidences observed between the solar phenomena witnessed in 1831 and 1883, by M. A. Witz.

BERLIN

Physiological Society, February 1.—Dr. W. Wolff had had occasion to make an intimate study of the electrical plates of the torpedo, in the course of which he came upon a series of facts which served to explain the still very diverse views of authors on the structure of the electrical organ, and so confirmed his conception of the subject. The electrical organ of the fish in question consists, as is well known, mostly of hexagonal columns extending from the dorsal usually to the ventral side, though occasionally not so far. They were embedded in sheaths of ligamentous texture, in which were found the nerves and vessels of the organ, and consisted of single plates of 0·012 millimetres thickness piled one above the other, without any intermediary substance; detached cells of connective tissue, each with two or three fine offshoots, were now and again found between the plates, which themselves, in the main consisting of elastic fibres, were easily capable of being coiled in at the edges. In the plates, between the fibres were found detached round granules of a diameter equal to the thickness of the plates. These granules were for the most part enveloped each in a transparent sheath. On the lower side of the plate were seen punctiform organs consisting of small, powerfully refracting granules of a semi-liquid gelatinous consistence. Hitherto they had been for the most part regarded as the terminal organs of the nerves, and in the descriptions given of them by different authors the most diverse structures were imputed to them. According to Dr. Wolff, however, these were all accidental productions. The granules had no relation whatever to the nerves, their only function being probably that of making the plates cohere. The nerves ran in the sheaths of connective tissue belonging to the columns, and there split up into bundles of primitive fibers bending each to a single plate, in order to spread out on its lower side, dividing, as they constantly did, in a dichotomous manner. Soon the medullary sheath terminated either at a dividing spot or in the course of a twig, and all that remained was but the axial cylinder with the Schwann sheath. The dichotomous partition having been pushed forward to the most delicate filaments capable of being recognised, the Schwann sheath passed over into the membrane of the plate, while the axial cylinder in all probability came suddenly to an end.—Prof. Kronecker handed in a treatise for the *Proceedings*, in which he rebutted as unjustifiable the claims of priority advanced by M. Arloing in Paris against Herren Kronecker and Meltzer in the matter of the stoppage of the movements of swallowing.—Dr. Mœli gave a report on changes occurring in the cortex of the cerebrum of guinea-pigs, which he had observed after cutting through the capsula interna of the thalamus. Conjectures he had made on the course of the fibres in the cerebrum led him to cut through the fibrous courses of the corona (*Stabkranz*) radiating from the thalamus and running to the cerebrum at a point as far as possible from the cerebral cortex, and after a considerable time to examine the changes that had been produced in the cortical tissue in consequence of this cutting. By this examination he found that a large part of the fine filaments of the cortical substance had degenerated and faded away. A part of the ganglia, on the other hand, had continued unchanged, while another part had been essentially altered. Altogether Dr. Mœli distinguished in the cortex four species of ganglia: (1) round, (2) fusiform, (3) pyramidal, and (4) small and round, with short appendages. The first two, slightly tinged with colouring matter, remained unchanged on the side operated on, and like those on the sound side. The pyramidal and caudated cells, on the other hand, which were strongly tinged with colouring matter, had shrunk on the side operated on, and were greatly altered from those on the sound side. From this Dr. Mœli concluded that there was a centripetal propagation of the degeneration from the cut fibres to their central ganglia.—Dr. J. Munk took a survey of the various views held on the resorption of fat, and called to mind that in former experiments he had demonstrated how sebacic acids might, in the process of nourishment, take the place of neutral fat, but that even in the chyle neutral fats were alone to be found. By many physiologists the absorption of neutral fats from the food was disputed, and it was sought to derive the whole deposition of fat from decomposed albumen. Dr. Munk considered the arguments adduced in support of this view as not pertinent, and had repeated the fundamental experiment, which consisted in the absorption of a heterogeneous, and therefore easily demonstrable, neutral fat. He gave a dog, which through a long course of starvation had lost almost all the fat of its body, a large quantity of rape seed, and only so much albumen as was just necessary for the preservation of its life. After having been kept on this artificial food for a length of time, the dog was killed, and the fat of the skin, together with that of the ventral cavity, was melted in one lot, and compared with the fat of a dog that had been normally fed. The very appearance of the two kinds of fat under the temperature of the sitting-room was greatly different. The fat of the dog fed on rape seed was clear and fluid, and had but a little sediment of a firmer fat, while the fat of the normally fed dog formed a soft opaque mass. Chemically analysed, the first yielded some 80 per cent. of sebacic acid, while the normal fat contained but 68 per cent. of sebacic acid. Finally, Dr. Munk was able to demonstrate the presence of erucic acid in the fat of the rape-seed fed dog, though in a somewhat impure state, a fact which conclusively proved the absorption of rape seed, and therefore of alimental fat. Dr. Munk stated that at the next meeting of the Society he would communicate further experiments regarding the formation and deposition of the fat in the animal body.—After their addresses Dr. Wolff and Dr. Mœli gave demonstrations in the demonstrating hall of the Physiological Institute.

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