THURSDAY, DECEMBER 16, 1880

THE CHEMISTRY OF THE FUTURE

Ideal Chemistry. By Sir B. C. Brodie, Bart., D.C.L., F.R.S. A Reprint of a Lecture delivered before the Chemical Society on June 6, 1867. (London: Macmillan and Co., 1880.)

CHEMISTS who wish to study the "Calculus of Chemical Operations" will value this reprint of the lecture delivered by Sir Benjamin Brodie shortly after presenting his first memoir on the subject to the Royal Society, as it is in the main devoted to the description and explanation of the special symbols employed in the Calculus.

Even if this were the time and place, I should not venture to submit Sir Benjamin Brodie's views to that exhaustive analysis, which I believe has hitherto never been accorded to them, but which they must ere long receive at the hands of chemists. As yet only portions of the Calculus have been published, viz., Part I. "On the Construction of Chemical Symbols," and Part II. "On the Analysis of Chemical Events," although a valuable supplementary explanation of certain features was recently elicited by Naquet's criticisms. We have still to learn how the author proposed to treat of isomerism, by far the most intricate and difficult problem yet to be solved in chemistry, and let us hope that his departure from amongst us, which we now deeply lament, may not involve the suspension of judgment on this point he asked for but a short time ago being for ever.

I cannot refrain from devoting this notice to specially directing attention to what appears to me to be the topic of fundamental importance in the lecture, viz. the suggestion, made the author believes for the first time excepting in a few words at the conclusion of his first Memoir in the *Philosophical Transactions*, of the possible decomposition at the elevated temperature of the sun of certain chemical elements.

The fundamental hypothesis of the Calculus is to express the symbol of the unit of hydrogen by one letter, α. Hydrogen is to be regarded as constructed at once, by one operation. But while hydrogen is conceived of as the product of a single operation, the hypothesis indicates that oxygen, ξ^2, cannot be conceived of as made by less than two operations; while chlorine, $\alpha\chi^2$, and nitrogen, $\alpha\nu^2$, for example, are each to be conceived of as made by three operations, one operation in each case being that by which hydrogen is made. In short, the hypothesis involves the conclusion that there are several distinct classes—three at least—of "elements," of which hydrogen, oxygen and chlorine are the types, formed respectively by a single operation, by two similar operations, and by several operations not all similar. In other words, to quote the author, "we are led to a certain physical hypothesis as to the origin and causes of chemical phenomena." He then continues:—

"Now what I am going to suggest you must consider to be put before you with reservation, but we may conceive that in remote time, or in remote space, there did exist formerly, or do exist now, certain simpler forms of matter than we find on the surface of our globe—α, χ, ξ, ν, and so on—I say we may at least conceive of, or imagine, the existence in time and space of these simpler forms of being, of which we have some records remaining to us in such elements as hydrogen and mercury. We may consider that in remote ages the temperature of matter was much higher than it is now, and that these other things existed then in the state of perfect gases—separable existences—uncombined. This is the farthest barrier to which in the way of analysis theory can reach. Beyond all is conjecture. There may be something further, but if so, we have no suspicion of it from the facts of the science. We may then conceive that the temperature began to fall and these things to combine with one another and to enter into new forms of existence, appropriate to the circumstances in which they were placed. We may suppose that at this time water ($\alpha\xi$), hydrochloric acid ($\alpha\chi$), and many other bodies began to exist. We may further consider that as the temperature went on falling, certain forms of matter became more permanent and more stable, to the exclusion of other forms. We have evidence on the surface of our globe of the permanence of certain forms of matter to the exclusion of others. We may conceive of this process of the lowering of temperature going on so that these substances, $\alpha\chi^2$ and $\alpha\nu^2$, when once formed, could never be decomposed—in fact, that the resolution of these bodies into their component elements could never occur again. You would then have something of our present system of things."

We have here a most distinct prior statement by Sir Benjamin Brodie of views almost identical with those which have been so persistently urged for several years past by Mr. Lockyer, whose arguments, however, have hitherto met with but little sympathy from chemists, mainly perhaps on account of the unwonted character of the evidence. In his paper read before the Royal Society in December 1878, Mr. Lockyer adduced two lines of evidence in support of his hypothesis of elemental dissociation at high temperatures: The existence of lines common to several spectra—so-called basic lines—and the progressive alteration in the character of the spectra of the stars with temperature. Neither of these lines of argument has, I believe, yet been impugned, and the criticisms launched against the hypothesis have been on side issues of no real importance to the main question under discussion. More recently additional evidence in the same direction has been obtained by the comparison of the observations of Tacchini and others on solar storms. It appears that whereas at certain times lines which are admittedly all iron lines are visible, at other times certain of these lines are wanting from the spectrum, new lines appearing in their place: fluctuations of this kind taking place at frequent intervals, but evidently in accordance with some well-defined law. Facts such as these may after all meet with some other interpretation than that furnished by the "dissociation" hypothesis, although at present this affords by far the simplest explanation of them. A communication of Mr. Lockyer's, read at the last meeting but one of the Royal Society, however, adduces evidence which if confirmed must, it would seem, be regarded as final. It is well known that the velocity of uprush or downrush of vapours at the sun may be determined by observations of the amount of displacement from their normal position of the lines in the spectrum of the vapours, and obviously if all the lines in a given spectrum—that of iron, for instance—are lines due to one substance, it must be a matter of indifference by which of the lines the velocity is measured. Whereas, on the other hand, if this be not the case, and the simpler substances into which the body is split up be of different degrees of volatility—of different molecular weight—we may expect that measurements of the displacement of different lines will not all furnish the same results. Mr. Lockyer states that in an observation of a sun-spot on August 31 of this year, when the iron line at λ 5207·6 was doubly contorted, indicating an ascending and descending velocity of about fifteen miles a second, the two adjacent iron lines at λ 5203·7 and 5201·6, visible in the same field of view, were perfectly steady. Observations of this kind are necessarily very difficult, and the communication is made with all reserve; but it is to be hoped that observers elsewhere will co-operate in at once putting this observation to the test.

It is difficult to exaggerate the importance of the question to the chemistry of the future, for should it once be proved that the dissociation of the so-called elements is taking place in the sun and still hotter stars, it will be within the power of the physicist with the aid of the telespectroscope to build up a theory of elemental evolution not inferior in interest to the doctrine of organic evolution. For my part, I have no fear of the result, for apart from Sir Benjamin Brodie's hypothesis and apart from spectroscopic evidence, I believe that in the relations of the "elements" to each other when arranged more or less in accordance with the now well-known periodic law of Mendeljeff we have distinct proof of progressive development, but of this I hope to say more on another occasion.

Sir B. Brodie points out in his lecture that if the symbol a'^2 were assigned to hydrogen, instead of the symbol a, a different symbolic system analogous in its form to the system in vogue amongst chemists would result In the second part of the Calculus he has fully explained his reasons for adopting the hypothesis a, notwithstanding that it leads to conclusions so entirely different from those ordinarily accepted, the chief reason being that this hypothesis satisfies the so-called law of even numbers—the law that the sum of all the units of affinity in a compound is an even number. The recent remarkable discovery—probably one of the most important theoretically ever made by chemists—of the behaviour of the halogens at high temperatures would appear to furnish an opportunity of experimentally ascertaining whether Sir B. Brodie's hypothesis a is admissible, for this hypothesis would not admit of a simple resolution of the diatomic molecules of chlorine, bromine and iodine into monatomic molecules which has been regarded as the more probable explanation of the results obtained by Victor Meyer and by Meier and Crafts. Two well-established exceptions to the law of even numbers exist, nitric oxide, NO, and nitric peroxide, NO_2, but as is well known, Sir B. Brodie has suggested that in these we may not be dealing with homogeneous gases, but that each is constituted of two gases which, taken together, are made up of oxygen and nitrogen, but which separately are not so made up: hypothesis a would lead to similar conclusions regarding the constitution of chlorine, bromine and iodine at high temperatures.

At present all that is *established*, however, regarding the halogens is that iodine begins to undergo dissociation at a temperature between 600° and 700°, and that its vapour gradually diminishes in density until at a white heat it attains not far short of half the "normal" value. Whatever the nature of the dissociation products, the occurrence of dissociation must be regarded as *placed beyond doubt*, for Victor Meyer's results have been in the main confirmed not only by Meier and Crafts, but also by Deville and Troost, who had previously obtained normal results. Bromine does not undergo dissociation so readily as iodine, the ratio of the observed to the theoretical "normal" density being, according to Meier and Crafts, ·8 for bromine when it is ·66 for iodine. In a recent communication, Victor Meyer has stated that the results of his earlier experiments with chlorine would appear to have been vitiated by some as yet undiscovered source of error; this gas probably is not dissociated except at extremely high temperatures, and it is doubtful whether there is any difference in behaviour between free and nascent chlorine.

HENRY E. ARMSTRONG

HANDBOOK OF BOTANY

Handbuch der allgemeinen Botanik. Von Prof. Dr. N. J. C. Müller. Zweiter Theil. Allgemeine Morphologie und Entwickelungslehre der Gewächse. Pp. 482, Figs. 277. (Heidelberg, 1880: Carl Winter's Universitätsbuchhandlung.)

THIS is the second instalment of a work by a single author which is to treat of all the different departments of botanical science. The first volume, which is devoted to the consideration of the Physiology and General Anatomy of Plants, was reviewed in NATURE, vol. xxi. p. 589. It is impossible to pass a more favourable verdict upon this volume than upon its predecessor. It is characterised by the same failing, namely, a want of clearness and definiteness in the statement of important facts and fundamental principles. The first section of the book is devoted to a discussion of the theory of descent, the origin of species, and the occurrence of varieties and monstrosities, with the object, presumably, of making the reader acquainted with some, at least, of the influences which determine the forms of living organisms. The account of the morphology of plants begins at p. 38, and after ten pages of general considerations the subject is actually grappled with. Prof. Müller commences with the Thallophytes, though he does not call them so, for his first section on them is headed "Der Algenstamm." It is not easy to understand what he means by the suffix "stamm"; does he mean to describe the thallus of the Alga as being a "stem," or does he use the word in the sense of "tribe"? Whichever be the true interpretation, it still remains unexplained why this word should appear as the heading of a section which treats not only of Algæ, but of Fungi as well. The prospectus of the work sets forth that the Classification of Plants is to form the subject of a subsequent volume, and there is therefore some hope that Prof. Müller will there give a classification of the Algæ which is more in accordance with facts and with reason than the one which he now follows. It is impossible to imagine on what grounds the Palmelleæ, the Protococcæ, and the Volvocineæ should be united together to form the Order Palmellaceæ, and yet this is done on p. 51 of this work, although the author is evidently aware of the fact that in Volvox reproduction is effected by means of sexually produced oospores, as his account of that plant, a singularly inaccurate one be it said, on p. 62 testifies.

His account of the Lichens is not more trustworthy than that which he gives of Volvox. He appears to be halting between two opinions with regard to the burning question of the nature of these organisms, for although he states on p. 69 that the germinating spore gives rise to both gonidia and hyphæ, thereby implying that those cells of the thallus which do not contain chlorophyll and those which do have a common origin, yet he admits (p. 74) that the gonidia may escape from the thallus and lead an independent existence, and further (p. 84), that he has observed the formation of a lichen-thallus by the combination of algal and fungal forms which were originally distinct.

His treatment of the Cormophytes is also disappointing. If the student, anxious to become acquainted with the most recent views as to such important points as the gymnosperms of the Conifers and the morphological significance of the embryo-sac and its contents in Flowering Plants, turns to the sections of this book which profess to treat of them, he will find only a few dogmatic statements with regard to the former point, and none at all with regard to the latter. Perhaps these points may have been thought too recondite for discussion in a work which professes to be a handbook for learners of the science, but many pages are devoted to the consideration of subjects, such as the more complicated forms of phyllotaxis, which have principally a mathematical interest. Again, the morphology of the stem, of the leaf, and especially of the root, is dismissed far too summarily. It is to be hoped that these organs, as well as inflorescences, flowers, and fruits, will have justice done to them in the volume on the Classification of Flowering Plants. One further shortcoming must yet be mentioned, namely, the scantiness of the account given of the embryology of plants. This is a subject which has been much studied in recent years, and, from the title of this book, it might naturally be expected that it would give a satisfactory account of the results which have been attained. This is, unfortunately, by no means the case. Some of the facts are mentioned, it is true, but they are stated too briefly to be very intelligible, and no attempt seems to have been made to connect them together and to explain their significance.

It must be admitted that the book contains a considerable amount of information scattered through its pages, but the purely theoretical principles upon which this information has been arranged render it difficult of acquirement, and for this reason, if for no other, the book is not one which can be recommended for the use of students.

OUR BOOK SHELF

The Gardens of the Sun; or, A Naturalist's Journal on the Mountains and in the Forests and Swamps of Borneo and the Sulu Archipelago. By F. W. Burbidge. (London: John Murray, 1880.)

THIS book is the itinerary of a competent and enthusiastic botanist, whose main object was "the collection and introduction of beautiful new plants to the Veitchian collection at Chelsea," in which he so far succeeded as to add about fifty ferns to the list of those already collected in Borneo, about twenty being also new to science, and to introduce alive the giant pitcher-plant of Kina Balu (*Nepenthes Rajah*, Hook. f.). But these alone by no means show the floral riches which have induced the author to use the by no means exaggerated term "Gardens of the Sun." Amongst epiphytal orchids which here growing in mid-air "screened from the sun by a leafy canopy, deluged with rains for half the year or more at least, and fanned by the cool sea-breezes or monsoons," is found the beautiful *Phalænopsis grandiflora;* nor in the mountain vegetation are like floral riches absent; at 5000 feet the curious pitcher-plant, *Nepenthes Lowi*, was found epiphytal on mossy trunks and branches, and higher still a "large-flowered rhododendron, bearing rich orange flowers two inches in diameter, and twenty flowers in a cluster." The forests and gardens of Borneo are equally rich in native and naturalised kinds of edible fruits, the mango, pine-apple, durian, rambutan, &c., being all alike plentiful and luxuriant, and, as Mr. Burbidge remarks, in some favoured districts in Malaya the forests almost become orchards on a large scale, so plentifully are they stocked.

Zoology was naturally less followed than botany, but still a collection of birds was made, notices of which, contributed by Mr. Sharpe to the Zoological Society, are appended to the volume. We however regret to find the word "alligator" still constantly occurring, whilst the word "boa" is equally misleading. Crocodile and python are words which do not seem to find a home in the East, nor moreover in many books of Eastern travel. It is also quite erroneous to say that Borneo "is the only habitat of the wild elephant in the Malay Archipelago"; certainly so, at least, if we are not to exclude Sumatra from that region.

Many ethnological facts are scattered about the volume; the account of the Jakuns of Johore is taken and fully acknowledged from Maclay's memoir on the subject in the "Journal of Eastern Asia"; but the author contributes an interesting account of the method pursued by the Kadyans in playing the game of football. No one but the student of games knows how difficult it is to find much or any information on this point in most books of travel.

Tasmanian Friends and Foes: Feathered, Furred, and Finned. By Louisa Anne Meredith, Author of "My Home in Tasmania," &c. With Coloured Plates from Drawings by the Author, and other Illustrations. (London: Marcus Ward and Co., 1880.)

IT will probably be granted that there is developed in most people a fondness for certain of what we are pleased to call the lower forms of animals. Such are made pets of for various reasons: the sweetness of their song, the brightness of their plumage, the splendour of their scales—these phenomena act as causes that attract the senses. Their sometimes fond and gentle ways make of some, prime favourites, while a sense of their usefulness makes again of others indispensable companions to man.

Most of man's dumb companions have been taken from groups of animals with a more or less world-wide distribution; and it will no doubt be new to some of our readers to learn that in Australia—a country where the aborigines, for want of native pets, had to import at some time or another a dog—that there, such forms as brush kangaroos, wombats, bandicoots, and even great forest kangaroos—animals only known in these parts—can also become nice, quite gentle, mannerly things, doing a little damage now and then, it is true, by leaving long dirty tracks to bother the housemaid, like a boy home at Christmas time, or pulling up tulip-bulbs, or, worst of all, getting into the children's beds because they are comfortable. The beautifully got-up volume whose title heads this notice is written by a well-known and respected lady who has often before written pleasantly about her Tasmanian home and the bush friends she found or made there. In the present volume she writes an able defence of some of her dumb "marsupial" acquaintances, showing that they too have intelligence, and that they exhibit at times a very respectable amount of common sense. The stories about them are strictly true, and from their very nature strictly new. But the volume tells also of many a two-footed friend, and the last few chapters almost exclusively treat of the fishes of the coast. There is much in this portion of the volume of interest to the scientific worker; there is much in every part of it to make it of value to those who care to learn something of the habits of Tasmanian beasts, birds, and fishes. One feature of the volume must be specially noticed—the eight coloured drawings, excellently chromolithographed from the water-colour drawings of the author. From a personal knowledge of the splendid colouring often present in freshly-caught tropical fishes, these plates are, we should say, by no means too brilliant. Four are devoted to some of the strange, wondrously-coloured fishes, and four to flowers, fruits, and insects.

This volume would be an excellent and not over-expensive Christmas present, which may lie on any table however select, and be read by any person however critical.

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 ensure the appearance even of communications containing interesting and novel facts.]

Mr. Spencer and Prof. Tait

PROF. TAIT'S explanation itself shows that the word commonly applied to products of imagination, was applicable to his statements; for the only justification he assigns is that he "assumed," that is to say, imagined, that his substitution of "definition" for "formula" must have been the ground of offence. How inadequate a plea this is, will be seen on re-reading the questions I put, which were these:—

"He [Prof. Tait] says that because he has used the word 'definition' instead of 'formula,' he has incurred my 'sore displeasure and grave censure.' In what place have I expressed or implied displeasure or censure in relation to this substitution of terms? Alleging that I have an obvious motive for calling it a 'formula,' he says I am 'indignant at its being called a *definition*.' I wish to see the words in which I have expressed my indignation; and shall be glad if Prof. Tait will quote them. He says:—'It seems I should have called him the *discoverer of the formula!*' instead of 'the inventor of the definition.' Will he oblige me by pointing out where I have used either the one phrase or the other?"

Every reader would infer that, for these specific statements made by Prof. Tait, there are specific foundations, which could be named when asked for. He does not name them, for the sufficient reason that they do not exist. Unable, as he says, to see in the passages I quoted from him, anything else to call for "censure" (a strange inability!), he "of course" assumed that this change of terms was the ground of censure. And the assumption thus made, is the only warrant he assigns for these positive assertions.

This is not all, however. Prof. Tait says:—"I could not have ventured to suppose that Mr. Spencer '*did not even know that he was in the habit of saying formula rather than definition.*' This *naïve* confession cannot but be correct." Of Prof. Tait's motive for putting this statement of mine in italics and calling it *naïve*, the reader may judge for himself. How entirely correct it is, and how well Prof. Tait might have "ventured to suppose" it, will quickly appear. For there is proof that I am *not* in the habit of always saying formula rather than definition; and Prof. Tait had the proof before him. In the note on page 565 of the Appendix forming the pamphlet in question—a page which Prof. Tait must have read, since it concerns Mr. Kirkman and himself —I have used the word "definition." So that not only had Prof. Tait no evidence on which to base his distinct statements, but there was under his eyes positive evidence which negatived them.

Very possibly it will be said that the question about my uses of these words is a trivial one. But this is not the question. The question is whether it is allowable to make an opponent look absurd by ascribing to him, in a quite positive way, things which he has neither said nor implied; and that, too, when he has implied the contrary. HERBERT SPENCER

Criterion of Reality

WILL you kindly allow a learner to ask for the criterion according to which Kinetic Energy and Work are real things, while Momentum and Force are unreal? Prof. Tait says $\frac{1}{2}mv^2$ and wh express real things, but mv and wt unrealities (NATURE, vol xxiii. p. 82).

If wt be "as unreal as is the product of a quart into an acre," how is it that wh is real? The illustration of quart and acre is as applicable or inapplicable to the one as to the other. In both cases we take the product of two numbers, not two concrete magnitudes, which of course it would be absurd to speak of multiplying together. In one case the product is the number of units of Momentum, in the other case it is the number of units of Kinetic Energy. If it be said that a thing is real if its quantity cannot be altered, and *vice versâ*, why is mv^2 said to be real, and mv unreal? They vanish together. When Prof. Tait asserts "there is no such *thing* as Force," "it is merely a convenient expression for a certain *rate*" (NATURE, vol. xiv. p. 459), he seems, if I may venture to say so, to confound the measure of Force with Force itself, and to lay himself open to Mr. Spencer's comment that "a relation changes the state of a body." Certainly mv is not a *thing*, but neither is mv^2 a thing: yet the latter is the measure of something which Prof. Tait asserts to be "as real as matter itself": why is not that of which the former is the measure equally real? E. G.

Bardsea

[What Prof. Tait asserts may be correct or not, but it is self-consistent. He asserts in his lecture on "Force" (NATURE, vol. xiv. p. 462) that matter and energy must be looked on as real things, *because we cannot change the amount of either*. Such expressions as $\frac{1}{2}mv^2$, and wh, are to be considered as *wholes*, not as products of two or more factors. This separation into factors (where one is mv, or w, for instance) he asserts to be a relic of the old erroneous belief in the trustworthiness of the impressions made on the "muscular" sense.—ED.]

Landslips

IN NATURE, vol. xxii. p. 560, I pointed out that landslips often occurred in the Salt Districts. I did not then expect that I should so soon be able to refer again to the subject; but on December 6, at an early hour in the morning, one of the largest subsidences and landslips ever known in Cheshire occurred. I pointed out that whenever fresh water reaches the rock salt it dissolves it. In certain districts in the immediate neighbourhood of Northwich the ground is completely honeycombed with rock-salt mines that had been worked out and abandoned. Into many of these fresh water had penetrated, and had become by solution strong brine. This brine has of late been extensively pumped up, and many of these extensive cavities had become nearly empty. The thin crust of rock salt forming the roof of these old mines had become gradually thinner, owing to its solution by water, and on Monday morning the roof of one pit gave way, and let the superincumbent earth down into the mine, rifting and opening the ground to the surface. The surface rift passed across the bed of a large brook, and the water of the brook ran through the crevice into the mines below. In a short time the water made a more extensive cavity, and as the brook was cut in two about 200 yards above its entrance into a large lake that was drained by the Weaver River, the water in the lower portion of the brook and of the lake, as well as of the Weaver, commenced to return and run down the enlarged cavity. For four or five hours this return stream increased in velocity, pouring down the crater-like hole. Notwithstanding the water of the brook and the return water, as well as a large body of water from another small lake entering this cavity, the water standing in the funnel-shaped hole gradually lowered. The velocity of both portions of the brook increased, and such was the force of the water that the bottom of the brook for 100 yards was scooped out from 2 feet in depth to 10 feet, and the banks were washed away, making the brook from 30 to 40 feet wide instead of 20 as at first.

The quantity of water thus rushing down for twelve hours from the commencement would be fully 600,000 tons. The water in one direction over a surface of 160 acres was lowered one foot in the space of three hours. Shortly after this water commenced to rush below it made its way through a weak portion of a barrier wall into a rock salt mine that was being worked. This mine, extending over fifteen acres, and having a worked-out depth of eighteen feet, was completely filled and all the tools, materials, waggons, tramways, &c., entirely lost. It will be quite impossible ever to pump out the water. Besides this mine, all the old abandoned mines were filled, and the brine, which stood at 100 yards from the surface on the Sunday, stood at 24 yards on Monday night. The water being fresh, great damage was expected by the solution of the salt. This soon occurred, for an old mine that fell in forty-two years ago, and the cavity of which had been filled with water, gave way, and suddenly the whole land over a circle of about 500 feet in diameter sank, and a large portion of water escaped into neighbouring pits. The ground cracked and rifted and subsided, and a length of road of 160 yards was destroyed, as also pipes conveying brine to the salt works. A large reservoir holding brine was split across and all the brine let out; the rending of the earth passed through two kilns of bricks, dropping one-half of the kilns at least 2 feet. On the Monday afternoon a tall chimney 90 feet in height became affected, and in a few hours fell with a great crash. The air that had filled the cavities below was forced out by the inrush of water, and caused all the pits and brooks near to bubble and boil violently, whilst in some of the rifts where water occurred miniature mud geysirs were formed, throwing up mud 10 or 12 feet high. These appearances extended over a district between two brooks for the space of 2000 feet. On Wednesday night a large hole 30 yards in diameter and 30 yards deep fell in, and more subsidences are daily expected, as the fresh water will eat away the pillars supporting the roofs of the abandoned mines.

The cavity formed on Monday is full of water, and the brook now runs through it. Some idea may be formed of it when I mention that it is crater-like, and of about 200 feet in diameter. On sounding it on Wednesday I found a depth of 78 feet of water in the centre, and various depths from 70 to 60, 50, and so on to about 12 feet at the margin. On Sunday, on the spot which is now 78 feet, there was a sandbank with its surface above the water.

Serious injury has been done to one set of salt works, and five sets are stopped for want of brine, the pipes being broken and the road destroyed.

As the salt trade increases these enormous sinkings keep increasing, and become more alarming in their character.

Brookfield House, Northwich THOS. WARD

The Geology of East-Central Africa and the Subterranean Forest in Bombay

IN Mr. J. Thomson's very interesting "Notes on the Geology of East-Central Africa" (NATURE, vol. xxiii. p. 104) he remarks that doubtless the immense development of volcanic rocks described by myself (and I may add by several previous explorers) in Abyssinia is of the same age as the volcanic rocks at the Cape of Good Hope, assigned to the Trias.

Mr. Thomson has, I think, overlooked the circumstance that whatever may be the age of the Cape volcanic rocks, the teaks of Abyssinia cannot be older than Jurassic. As I have shown (*Quart. Jour. Geol. Soc.*, 1869, pp. 403, &c., and "Geology and Zoology of Abyssinia," pp. 184, &c.), there are in the Abyssinian highlands two groups of bedded dolerites and trachytes, the upper of which rests unconformably on the lower, while the latter overlies limestone with Jurassic (Middle Jurassic) fossils.

I trust that Mr. Thomson will pardon my suggesting the possibility of the Tanganyika sandstones being river valley deposits, like the Gondwana series of India, rather than lacustrine. I may be mistaken, but the description appears to me to indicate beds coarser than those usually deposited in an extensive lake basin.

In the same number of NATURE, p. 105, is a brief notice of a "Subterranean Forest in India." As I understand the account given, the forest should perhaps rather be termed submarine than subterranean. My object in calling attention to this notice however is to point out that a previous description of the same formation was published in the *Records* of the Geological Survey of India for 1878, vol. xi. p. 302. This account is by Mr. G. E. Ormiston, Resident Engineer, and agrees in all essential particulars with the note in NATURE. I appended a few remarks on the geological bearing of the discovery. The "forest" has clearly been depressed, whilst neighbouring tracts in Bombay island appear to have been elevated in comparatively recent times.

W. T. BLANFORD

Dr. Siemens's Gas-Grate

HAVING endeavoured for some years past to heat my study by gas appliances, and having utterly failed in obtaining a comfortable temperature of 60°, as a last effort to accomplish my object I had fitted into an ordinary grate Dr. Siemens's arrangement of copper and iron, the construction of which was communicated to the public in the pages of NATURE, vol. xxiii. p. 25. Before giving the results of the trial of Dr. Siemens's gas-grate I may mention in what way my former gas-stoves failed. My first gas-fire consisted of gas and asbestos, but this gave out fumes which were quite intolerable; my second trial was with a gas-stove reflecting heat from a copper lining; this not only failed to warm the room, but was a cheerless and grim apology for a fire, and to obtain even a moderate degree of temperature a constant and expensive consumption of gas was necessary. With Dr. Siemens's gas-grate all that is required to produce a good cheerful fire radiating heat to all parts of the room, and maintaining a temperature from 60° to 62°, is to turn on the gas full for about twenty minutes, and as soon as the lower stratum of coke becomes incandescent, the gas may be quite turned off, the fuel, whether coke or anthracite, continuing to burn for five or six hours without any further expenditure of either gas or fuel.

If the fire is required for a longer time, or if at any time a more rapid combustion is wanted, it is only necessary to turn on the gas again for a few minutes and add more fuel. This is my experience of Dr. Siemens's gas-grate, and I consider it a great boon to householders who desire well-warmed rooms combined with economy. After the lucid description of the gas-grate given by Dr. Siemens in NATURE, it would be presumption in me to discuss the scientific explanation of its action; I shall only, in conclusion, venture to claim for it the following advantages which I believe it to possess over every other kind of gas-stove yet invented:—

1. It gives a clear, smokeless, cheerful fire.

2. It is most economical, and very soon pays the cost of the construction.

3. Being absolutely smokeless, contributes nothing to that constituent of our London fogs which renders them injurious in so many ways.

This last advantage, if multiplied by every householder at an outlay of 25*s.*, adopting a cheaper modification than the copper and iron gas-grate, we should before very long observe a marked change for the better in our London atmosphere; and the darkness, dirt, and destruction of property with which we Londoners are annually afflicted, would be things of the past.

December 13 R. DOUGLAS HALE

Geological Climates

I HAVE just read Mr. A. R. Wallace's letter in NATURE, vol. xxiii. p. 124, but as I have not yet seen his book, "Island Life," although my bookseller had promised it, I shall defer my reply in NATURE until I shall have made myself master of his ideas.

For the present I shall only say:—1. That Mr. Wallace's proposal would benefit the Polar regions but not Bournemouth. 2. Mr. Wallace omits all mention of the *return cold currents* which the admission of two new Gulf Streams into the Arctic regions would produce. These currents would seriously lower the temperature of China and Japan; and also of the Ural Mountains and east of Europe.

SAMUEL HAUGHTON

Trinity College, Dublin, December 10

SOME weeks since the Rev. Prof. Haughton took exception to a brief letter of mine, in which I suggested that as a bamboo flourishes in Cooper's Hill College garden, in a northern aspect winter after winter, it could be used effectually in an argument relating to geological climates. The bamboo being found in torrid India now, that at Cooper's Hill, if found in a future period, would, according to some geologists, indicate that the valley of the Thames was tropical formerly. My letter was written because the Rev. Professor had written a very long one, in which he applied this kind of bad reasoning in relation to a bit of a leafy part of a tree found at Bournemouth in an Eocene deposit. The leaves of his bit resemble those of *Araucaria Cunninghami* squashed; nevertheless a thermometric virtue is given to the fossil because this Araucaria is native in districts in Eastern Australia.

Self-satisfied with his recognition of the similarity of the leaves, the Rev. Professor coolly assumes that he has made out his species, and therefore demands the name of mine, giving me a scolding before I could possibly let him have it.

It is curious that the Rev. Professor should not have seen the point of my letter, and the only explanation is that he was so taken up with the incomparable value of his delicate "self-registering plant thermometer." I did not believe in his discovery, and my bamboo—never mind whence it came—was quite as good in the method of argument as his so-called Araucaria. No botanist would feel satisfied with the coneless evidence of the Rev. Professor, and his genus is in doubt as well as his species. With regard to this, Lindley stated years since that *Araucaria Cunninghami* is a "supposed species" in relation to the Norfolk Island *C. excelsa*. So the "self-registering thermometer" has neither bulb nor stem, and the spirit or the mercury represents the Rev. Professor's genius. He bids me plant the bamboo in the sunny south-west. Not so; it is the damp soil and the shade which have permitted the stems to grow up to 10 feet 6 inches. He tells me that the bamboo grows in China: that fact I had heard of before, and it has been strikingly impressed on many generations of Celestials. Last week, but too late for my purpose of immediate publication in NATURE, I learned that the bamboo is of the sub-genus *Arundinacea*, and the species is *falcata*. Its natural habitat is in the temperate Himalayas, where frosts, fogs, and north-east winds, such as plague the Thames Valley, are unknown.

Finally I believe that the so-called *A. Cunninghami* has grown of late years in the south of England.

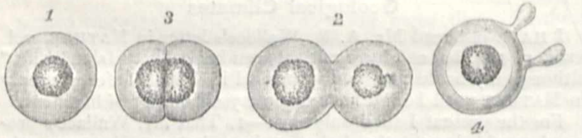
December 9 P. MARTIN DUNCAN

Hailstorm in Dorsetshire

AT about 1.30 on the 25th of last November, with a strong wind from the south-west, this place was visited by a hailstorm which lasted about five minutes, accompanied by rain and violent gusts of wind, and by a single vivid flash of lightning which was followed with scarcely more than an appreciable interval by the thunder.

The character of the hailstones which fell on the occasion, and which I examined before they could have undergone any important change induced by the higher temperature of the surrounding air, may be worth noting; for though they were not of very unusual size, and in most respects scarcely departed from what may be regarded as the typical condition of hailstones, they exhibited some features not generally met with in so well-marked a form.

In their simplest condition their shape was that of a sphere, and in every such case they consisted of a spherical nucleus of



opaque white ice enveloped by a concentric shell of ice perfectly transparent and homogeneous, showing none of the radial striæ often met with in hailstones (Fig. 1). The largest measured about half an inch in diameter, the nucleus having a diameter of about a quarter of an inch. The appearance of the opaque white nucleus surrounded by its thick crystal-clear envelope was very striking and beautiful.

In many cases two such hailstones were united firmly to one another, doubtless by a process of regelation after contact. In some of these the transparent envelope was continuous around each of the nuclei in the plane of contact (Fig. 2). In others it was here deficient, and the two nuclei were then in immediate contact with one another (Fig. 3). The difference thus presented is not without significance as affording evidence that there are two distinct conditions under which the union of hailstones by regelation may occur; for it is probable that in the former case the contact and regelation had taken place directly between the nuclei while as yet free from the investing shell of clear ice which had afterwards formed around the twin nuclei; while in the latter case the envelope had already existed before the contact and regelation of the hailstones.

Another frequent occurrence was the presence of one or two little piriform offsets, which projected from the surface of the hailstone, and were, like the envelope itself, formed of clear homogeneous ice (Fig. 4). In a paper published in the *Proc.* Asiatic Society for June, 1880, to which my attention has been called by Mr. Scott of the Meteorological Office, very similar club-shaped projections of transparent ice are described by Mr. Blanford in large hailstones figured by Col. Godwin-Austen as having fallen at Calcutta in March, 1877.

It is possible that in these cases the projections had originally the form of crystals, and that their faces and angles had been rounded off in passing through a warmer region of the atmosphere, such radiating crystals of ice not being unknown. In a memoir by Abich ("Ueber Kugel Hagel im Unterem Kaukasus," Vienna, 1879), for a knowledge of which I am also indebted to Mr. Scott, an account is given of certain very large hailstones which fell at Tiflis in Georgia, and had large ice crystals radiating from the surface. GEO. J. ALLMAN

Ardmore, Parkstone, Dorset, December 11

Sargassum

I FIND in NATURE, vol. xxiii. p. 70, a short report on my paper, "Revision von Sargassum," with several objections, which I believe to be erroneous. It is said that the fragments occurring sometimes on the open sea, the so-called *Sargassum bacciferum*, should have a bright yellow colour. Not long ago I received fresh samples thereof from the Sargasso Sea, which are not yellow at all; these fragments are never bright yellow, but of the same brown, varying to yellowish colour as decaying *Fucus vesiculosus*. I observed the latter, for instance, in this condition in several fjörds of Norway, where I found broken Fucus in greater quantities than ever I did Sargassum in the open sea between England and the West Indies.

Macrocystis pyrifera shows always stem and leaves entangled in a ball, if broken and swimming in the open sea (*vide* p. 235 of my treatise), and the Sargasso fragments of the open sea are also often entangled in compact balls, as Sir Wyville Thomson states ("The Atlantic," i. 194), and as it may be seen on my phototypic table, Fig. 1.

If the floating Sargassum should have no reproductive organs, this would be no difficulty, but rather a confirmation of my views on the fragmentary nature of swimming Sargassum, for a particular pelagic species could not be without reproductive organs. Besides there have been found "with certainty" sometimes samples in the open sea with reproductive organs, and I gave an explanation of their seldom occurrence by want or breaking off of the air-vesicles. The writer on my paper is mistaken in comparing Macrocystis and Fucus with Sargassum, for the air-vesicles and reproductive organs of Sargassum are separate from the leaves and isolated on thin stalks, which break off easily, while those of Fucus and Macrocystis are never separate, but in the middle of the leaf or on the base, or on the broad end of the leaf or thallus. Therefore swimming Sargassum is found often without reproductive organs, and its air-vesicles are often broken off, whilst on Macrocystis and Fucus such a separation is not possible. Having refuted those objections, and having also brought in my paper many more arguments against the existence and vegetation of *Sargassum bacciferum* than there are mentioned in the short report, I hope that my results on Sargassum will now generally be accepted.

Leipzig-Eutritzsch, December 4 OTTO KUNTZE

Note on an Acoustical Constant

THE number of vibrations executed in a second by a stretched string is generally represented in the text-books by a formula expressing the method of its variation with the determining circumstances, such as—

$$n \propto \frac{1}{dl}\sqrt{\frac{T}{s}},$$

where d is the diameter, l the length, s the specific gravity of the string, and T the tension or stretching force, but the absolute number of vibrations is not generally given by the formula.

Now if we write instead of the above—

$$n = \frac{k}{dl}\sqrt{\frac{T}{s}},$$

where k is some constant, it is evident that k will not depend on the nature of the string but solely on the system of units employed to express d, l, and T.

If C.G.S. units be employed, we have, as stated in Prof. Everett's translation of Deschanel—

$$n = \frac{1}{2l}\sqrt{\frac{T}{m}},$$

where m is the mass of unit length; and as we may write instead of m, $\pi r^2 s$, r being the radius of the wire, we shall have—

$$n = \frac{1}{\sqrt{\pi}} \cdot \frac{1}{2rl} \cdot \sqrt{\frac{T}{s}}, \text{ or } \frac{1}{\sqrt{\pi}} \cdot \frac{1}{dl} \cdot \sqrt{\frac{T}{s}},$$

so that here $k = \frac{1}{\sqrt{\pi}} = \cdot 5642$ approximately.

With any other system of units we may of course determine k from the value just given, by multiplying or dividing by the ratios of the new to the C.G.S. units; for example, if d be expressed in millimetres, l in metres, and T in kilogrammes, our new constant would be—

$$k = \frac{1}{\sqrt{\pi}} \cdot \frac{10}{1} \cdot \frac{1}{100} \cdot \sqrt{981000}$$

$$= \frac{99 \cdot 04}{\sqrt{\pi}} = 55 \cdot 87.$$

But we may also determine k directly for any system of units in the following manner:—If, in the formula—

$$n = \frac{k}{dl}\sqrt{\frac{T}{s}},$$

we make d, l, T, s, each unity, we shall have—

$$n = k.$$

Imagine then a wire of water, 1 mm. diam., 1 metre long, stretched by a weight of 1 kilo.: its weight would be ·7854 grm., and H, the "tension length," or length which would be equal in weight to the stretching weight, would be $\frac{1000}{\cdot 7854}$ = 1273·2 metres. The velocity v of transmission of a pulse along the wire would be $\sqrt{gH} = \sqrt{9 \cdot 81 \times 1273 \cdot 2} = 111 \cdot 76$ metres per second, and the number of vibrations per second—

$$n = \frac{v}{2l} = \frac{111 \cdot 76}{2} = 55 \cdot 88 = k,$$

the same figure as that obtained above.

If the units in which d, l, and T are expressed are respectively the tenth of an inch, the foot, and the pound, k becomes 48·66.

In the later editions of Ganot's "Physics" we find the formula—

$$n = 9 \cdot 8257\sqrt{\frac{c}{l}}$$

given, where c is the "tension length," and l the length of the string, both expressed in inches. This formula would of course be of more easy application than those given above when we know the weight per foot of the string, but does not directly show the relation of n to the diameter and specific gravity.

W. J. GREY
J. T. DUNN

Newcastle-on-Tyne

The U.S. Weather Charts

I SHOULD be much obliged if you would inform me whether the United States Monthly Charts of Meteorological Data, in continuation of the series published in NATURE, can be procured in London, and if so where.

H. M.

6, Charles Street, Grosvenor Square, December 7

Climate of Vancouver Island

MR. ALFRED R. WALLACE asserts in his letter published in NATURE, vol. xxiii. p. 124, that the climate of Vancouver Island is not so mild as that of London.

For three years I commanded a gunboat on those shores; speaking from recollection, and not from recorded observations, and with great deference to so distinguished a naturalist as Mr. Wallace, I should have said that the climate of Vancouver Island was a good deal milder than that of London.

EDMUND H. VERNEY

Travellers' Club, Pall Mall, S.W., December 11

Meteors

ON the evening of November 20 at about 8 p.m. my attention was attracted by a number of meteors appearing as often as once per minute in different quarters of the heavens, but pursuing courses apparently radiating from a point near the constellation Andromeda.

M. A. VEEDER

Lyons, New York, November 22

THE PROBABILITY OF PHYLLOXERA CROSSING THE TROPICS

MUCH alarm has been felt by the wine-growers of South Africa at the possibility of the phylloxera being introduced into the Cape vineyards. Very stringent regulations have been framed in consequence, prohibiting the importation of living plants or vegetables in any form; and so rigidly have these regulations been carried out that it is stated that, in accordance with them, a cargo of potatoes from New Zealand was destroyed on its reaching Capetown.

It is generally conceded by the experts who have been consulted that the importation of vines, on the tissues of which the phylloxera would be able to live in transit, must be prohibited. The phylloxera can however, it is admitted, feed on no other plant but the vine, and the important question for the South African Government to decide is whether it is really needful to exclude other plants or vegetables besides the vine. In order to obtain the best opinion upon this point, Dr. Maxime Cornu was consulted. He accordingly drew up several reports, in which he expresses the opinion that, though extremely unlikely, it is still theoretically possible that the phylloxera should be conveyed from Europe to South Africa by means of other vegetable products than the vine, and he therefore supports the prohibitive action taken by the Cape Government.

The inconvenience to the community which such a policy involves is necessarily considerable. The grounds of Dr. Maxime Cornu's decision have therefore been carefully considered by an entomologist who has studied the subject and who has drawn up the following notes. The question is of great importance to all wine-growing countries in the southern hemisphere, and as these doubtless contain many readers of NATURE, I think the publication of these notes in its columns will give them the best opportunity of being fairly considered.

W. T. T. D.

Notes on Dr. Cornu's Reports on the Phylloxera, and on the Protective Measures against its Introduction.

Among the "truths" laid down in the first report, No. I. is, "The *Phylloxera vastatrix* lives only upon the vine." This is emphasised in the third report ("Memorandum on Laws of Protection, &c."), Paragraph No. IV., stating, "they (the insects) can, moreover, subsist only upon the vine."

Notwithstanding these unreserved statements of this fundamental fact in the life history of phylloxera, the same "Memorandum on Laws of Protection, &c.," proceeds (in its "General Conclusion") to recommend, "if such a course were possible," the imitation of "the example set by Algeria, and to forbid the introduction of all vegetable products whatever, with the exception of those which are absolutely required for consumption."

It may well be asked on what ground such a recommendation is based. After stating (Third Report, Paragraph IV.) that the phylloxera cannot live when dissociated from the vine for more than four or five days, and requires protection from dessication in any case, Dr.

Cornu proceeds (Paragraph V.) to sketch "the most favourable conditions for the introduction of the insect" as follows:—"A phylloxera is removed in the soil, say a pregnant mother, which survives for a period of five days; it lays an egg before dying; the egg takes fifteen days to hatch (at the mean temperature of 59 deg. Fahr.), and the young insect which is produced five days to die. This makes in all twenty-five days." That is to say, that the maternal phylloxera, when in *articulo mortis* at the end of her five days' dessication and starvation, is to lay an egg; that this egg, produced under such extraordinary conditions, is to hatch in due course, and, after undergoing total starvation from its birth, is to live out the normal term of five days allotted to the mother (presumably well fed until she started on the dolorous voyage), and after all this is to land at the Cape and propagate its species in the nearest vineyard at hand! If these are "the most favourable conditions" under which the phylloxera would be introduced, we may surely say with Dr. Cornu in another part of the same report (Paragraph VII. *a*) that "it would require a concatenation of circumstances which it is difficult to imagine to bring about the misfortune of the insect's introduction." It is as well also to note that the writer expressly states (Paragraph V.) that the egg's hatching is accelerated when the temperature exceeds 59 deg. Fahr., so that in the supposed case, if the starveling progeny ever did see the light on the voyage, it would probably emerge in a tropical temperature long before the normal fifteen days allowed, and so resign its life of total abstinence before reaching the promised land of plenty at the Cape.

Let us now turn to the "winter egg," which, as Dr. Cornu states (Paragraph VI.), "is particularly to be dreaded." This is the rarest condition of the insect, each female of the generation which includes both sexes laying only one egg (Paragraph VI.).

"It is to this egg alone that the introduction of the phylloxera in packing-cases, straw, &c., could be attributed; this would however require confirmation; in fact I am not aware of any well-authenticated instance of the introduction of the phylloxera resulting from the transmission of the winter egg" (Paragraph VII.).

This admission on the writer's part seems to reduce any apprehension about the winter egg to infinitesimal proportions, especially when it is noted that the "winter egg," as its title implies, is a state limited to cold weather, and "commences to develop at the return of the fine weather" (Paragraph VI.). If a specimen of this rare *œuf d'hiver* did by any chance (in the absence of the vine-stems or branches upon which it is laid) start on a voyage for South Africa, we may be very sure that in its passage through the whole extent of both tropics it would very speedily cease to merit its title, and become a miserable *phylloxèra d'été*, only to share the fate of its luckless relative, produced from the last dying egg of the *mère pondeuse*. It does not mend matters to find Dr. Cornu stating in italics (Paragraph VII.), "Such introduction is nevertheless possible from a scientific point of view." Impossibility can with accuracy be predicated of but very few propositions; as a rule it is safer to say of most matters apparently incredible that it is next to impossible, and this may very certainly be said in the present case; and when all known facts and conditions place every probability against a bare possibility, wise men will know how to act.

As long as vines and all parts of vines from abroad are kept out of the Cape, the requirements of the wine industry are fully met. This prohibition was put in force by the late Government, by Proclamation No. 88, of November 30, 1876, and has been in force ever since that date. As late as the 4th December last, attention was specially directed to this Proclamation, with the intimation that its provisions would be strictly enforced (in Government Notice, No. 1288, of 1879). The present superfluous and vexatious restrictions were added by Proclamation No. 14, of January, 1880, and all the facts adduced by Dr. Cornu point to their futility.

SONGS OF THE SCIENCES—I. ZOOLOGY

We must regard it as a noteworthy sign that science has begun to percolate so through society generally that it has reached the pages of *Punch*. Almost every week we find a bit of more or less telling waggery, and last week the first of a series of "Songs of the Sciences" appeared, which we reproduce:—

Oh! merry is the Madrepore that sits beside the sea,
The cheery little Coralline hath many charms for me;
I love the fine Echinoderms of azure, green, and grey,
That handled roughly fling their arms impulsively away:
Then bring me here the microscope and let me see the cells,
Wherein the little Zoophite like garden floweret dwells.

We'll take the fair Anemone from off its rocky seat,
Since Rondeletius has said when fried 'tis good to eat;
Dyspeptics from Sea-Cucumbers a lesson well may win,
They blithely take their organs out and then put fresh ones in.
The Rotifer in whirling round may surely bear the bell,
With Oceanic Hydrozoids that Huxley knows so well.

You've heard of the Octopus, 'tis a pleasant thing to know,
He has a ganglion makes him blush not red, but white as snow:
And why the strange Cercaria, to go a long way back,
Wears ever, as some ladies do, a fashionable "sac":
And how the Prawn has parasites that on his head make holes,
Ask Dr. Cobbold and he'll say they're just like tiny soles.

Then study well zoology, and add unto your store,
The tales of Biogenesis and Protoplasmic lore:
As Paley neatly has observed, when into life they burst,
The frog and the philosopher are just the same at first.
But what's the origin of life remains a puzzle still,
Let Tyndall, Haeckel, Bastian go wrangle as they will.

THE AUGUST AURORAS

As I had the pleasure of witnessing to great advantage at Christiania the superb aurora of August 12 last, as well as that of the 13th, it is possible that some account of these displays as seen in Norway may be useful for comparison with accounts of their appearance in England.

My attention was first drawn to the aurora on going into the open air at 11 p.m. At 10.30 p.m. a friend had remarked that the night seemed unusually dark, and that the stars were shining brightly. When first seen by me the aurora consisted of a wide arch of diffused light, the centre of which was about 30° in height. A few broad streamers were then beginning to appear. I walked as quickly as possible to a hill whence a good view could be obtained, but I had hardly got there before the aurora had already reached, about 11.10 p.m., its maximum splendour. Broad streamers had by this time covered almost the whole of the northern half of the heavens, converging to a point considerably south of the zenith, forming a grand corona. The arch was still highly luminous, and from its upper margin coruscations or waves of white light shot up every two or three seconds towards the zenith. At this time also there suddenly appeared to the east of magnetic north a splendid sheaf of rays proceeding from the horizon altogether beyond the auroral arch, and apparently in complete independence of it. These rays, through bright, attained an elevation of only some 35°, and belonged apparently to a distinct auroral discharge. At 11.15 the arch had already begun to fade, but a mass of rays shone out brightly near its eastern termination. Throughout the display I was struck by the tendency to the formation of compact bodies of streamers which seemed to flank each end of the arch. As the arch faded the pulsations of light increased in frequency and brilliancy, and at 11.25 they might be described as broad flashes overspreading a large part of the northern half of the sky, always travelling upwards, and sometimes passing the zenith. The main body of streamers had by this time mostly faded, after going through an extraordinary series of changes which I found it quite impossible to record. Every minute or two new rays would strike up to the zenith, or sometimes beyond, and every now and then a portion of an older ray would suddenly shine out with a kind of phosphoric light.

The display now rapidly faded, and though at 11.35 and again about 11.45 there were minor reappearances of rays, the aurora seemed to be near its end, and I returned home.

The brightness of the phenomenon was somewhat delusive; for when a superb corona of rays covered the northern sky, I could only just read my watch by its light, and could not read what I endeavoured to write down on paper. The light was either white or of a greenish yellow tinge. There was no trace of the redness or other colours seen on other occasions.

By very good fortune I was able to watch the aurora of the next night (August 13) under the most favourable possible circumstances, namely, while steaming down the Christiania Fyord, in the steamship *Angelo*, during a beautiful calm evening. The aurora began at 10.20 p.m. with a very faint uniform arch, or rather line of white light, appearing 8° or 10° above the horizon, with difficulty distinguished from the twilight. This soon faded away entirely; but at 10.35 reappeared as a very distinct luminous arch, separated by a dark space from the twilight. Some slight signs of rays now also appeared.

At 10.45 the arch seemed to be rising somewhat, without ever attaining a height of more than about 15°. The lower edge became indented by ray-like notches. There was a tendency to the formation of streamers at the flanks. At 10.50 a fine single ray shot up from the horizon right through the arch, at 10° to west of true north. Streamers also began to appear above the arch, and especially at its eastern end; but the streamers were in no way comparable to those of the previous night. The arch now began to lose its previous regular form, and to go through a remarkable series of gradual changes and contortions, which it is impossible to describe. By degrees the eastern end became incurved in the manner of a folded curtain (like the pictures of auroras in the Polar regions which we see in books), and a few fragments of rays tended to form an inferior arch.

For more than an hour the light of this aurora was steady; but about 11.30 p.m. pulsations first began to appear faintly, soon increasing in frequency and width. As the pulsations grew the arch almost insensibly disappeared, but patches of light and fragments of rays occupied the sky above where the arch had been, and were every instant lighted up, as it were, by the passing coruscations. These flashes of light became more and more frequent, following each other every second, or even several times in a second, so as to produce at last a kind of rustling or dancing appearance. They were most intense upon the rays and patches, but were not confined to them. At 12.30 the display was failing, the waves being less frequent. At 1 a.m. there remained only a few irregular patches of faint, steady light, with occasional flashing waves. The light was again white, or greenish yellow. On neither occasion did the aurora seem to have the slightest relation to the ordinary vaporous clouds of the atmosphere, nor did the dark space beneath the arch seem to be more than might be explained as the effect of contrast.

Mr. Thomas Bennett, who is well known to all Norwegian travellers, and has resided many years in Christiania, informed me that the aurora of the 12th was probably the finest he had ever seen among the many grand displays which occur in Norway. Though I have witnessed several fine auroras, including some of those seen in the United States in August and September, 1859, and two fine displays of the Aurora Australis (September 14 and 16, 1854), I cannot call to mind that I ever saw coruscations or waves of electric light at all approaching those seen at Christiania on this occasion. The books say comparatively little about these coruscations, nor do the letters in NATURE, vol. xxii. p. 361, mention them as seen in England. Yet they probably represent the most important part of the phenomenon, the active discharge of electric energy.

I neither saw nor heard anything in Norway of an aurora on the night of August 11. About the dates I give there can be no possible mistake, because the steamboat from Christiania to Hull departed as usual on Friday evening (August 13). The times mentioned are the local times by the public clock at the Christiania University Buildings. W. STANLEY JEVONS

P.S.—The above account was mostly written a few days after my return to London, according to notes taken at the time. I print it now for what it may be worth. After thinking the matter over for three months, and comparing the auroral coruscations above described with the exquisite discoveries of Mr. Crookes, taking into account also some remarks in the article on auroras in the new edition of the "Encyclopædia Britannica," I venture to make the suggestion that these coruscations arise from highly tenuous matter (in what Mr. Crookes calls the *radiant state*) projected through the higher parts of the atmosphere. It is not possible by words to give an impression of such a phenomenon in the least degree approaching to that naturally acquired by watching it under favourable circumstances for several hours. My bélief is, that during the auroras described, *puffs*, as it were, of radiant matter were discharged at a great elevation above the earth's surface, and the luminosity of these puffs perhaps arises from conflicts between the projected molecules and those already spread about the almost vacuous space. The arch and most of the streamers probably belong to a lower, though still a very high part of the earth's atmosphere, but certain of the streamers, as well as patches of luminous matter seen on the night of the 13th, certainly exist in the lofty regions through which the radiant matter is projected. The explanation of the streamers must probably be approached through that of the coruscations, but they are effects of a very different kind. W. S. J.

November 22

THE INFLUENCE OF A TUNING-FORK ON THE GARDEN SPIDER

HAVING made some observations on the garden spider which are I believe new, I send a short account of them in the hope that they may be of interest to the readers of NATURE.

Last autumn, while watching some spiders spinning their beautiful geometrical webs, it occurred to me to try what effect a tuning-fork would have upon them. On sounding an A fork and lightly touching with it any leaf or other support of the web or any portion of the web itself, I found that the spider, if at the centre of the web, rapidly slews round so as to face the direction of the fork, feeling with its fore feet along which radial thread the vibration travels. Having become satisfied on this point, it next darts along that thread till it reaches either the fork itself or a junction of two or more threads, the right one of which it instantly determines as before. If the fork is not removed when the spider has arrived it seems to have the same charm as any fly: for the spider seizes it, embraces it, and runs about on the legs of the fork as often as it is made to sound, never seeming to learn by experience that other things may buzz besides its natural food.

If the spider is not at the centre of the web at the time that the fork is applied, it cannot tell which way to go until it has been to the centre to ascertain which radial thread is vibrating, unless of course it should happen to be on that particular thread or on a stretched supporting thread in contact with the fork.

If when a spider has been enticed to the edge of the web the fork is withdrawn and then gradually brought near, the spider is aware of its presence and of its direction, and reaches out as far as possible in the direction of the fork; but if a sounding fork is gradually brought near a spider that has not been disturbed, but which is waiting as usual in the middle of the web, then instead of reaching out towards the fork the spider instantly drops—at the end of a thread of course. If under these conditions the fork is made to touch any part of the web, the spider is aware of the fact and climbs the thread and reaches the fork with marvellous rapidity. The spider never leaves the centre of the web without a thread along which to travel back. If after enticing a spider out we cut this thread with a pair of scissors, the spider seems to be unable to get back without doing considerable damage to the web, generally gumming together the sticky parallel threads in groups of three and four.

By means of a tuning-fork a spider may be made to eat what it would otherwise avoid. I took a fly that had been drowned in paraffin and put it into a spider's web and then attracted the spider by touching the fly with a fork. When the spider had come to the conclusion that it was not suitable food and was leaving it, I touched the fly again. This had the same effect as before, and as often as the spider began to leave the fly I again touched it, and by this means compelled the spider to eat a large portion of the fly.

The few house-spiders that I have found do not seem to appreciate the tuning-fork, but retreat into their hiding-places as when frightened; yet the supposed fondness of spiders for music must surely have some connection with these observations, and when they come out to listen is it not that they cannot tell which way to proceed?

The few observations that I have made are necessarily imperfect, but I send them, as they afford a method which might lead a naturalist to notice habits otherwise difficult to observe, and so to arrive at conclusions which I in my ignorance of natural history must leave to others.

C. V. BOYS

Physical Laboratory, South Kensington

THE MINERALOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND

THERE was a time, now almost beyond the memory even of the oldest inhabitant, when the stillness of our learned halls was unbroken by the wrangle of contending geologists, when the science of geology could not be said yet to exist, when those who occupied themselves with stones found a congenial atmosphere of solemnity in the quiet domain of crystallography, whence with the boldness of adventurers they made little excursions into the more open and dangerous waters of chemistry. Days of slumberous peace as they now seem to one who turns over the ponderous dusty pages in which their records are duly chronicled! To the mineralogist of those days the interest and importance of rock-masses was measured by their richness or poorness in mineral specimens. Surrounded by his cases of minerals—the reward of years of patient toil and judicious expenditure, with what tender interest would he survey his treasures! We knew him in old times, yea and loved him. Enthusiastically would he describe how he had contrived to secure that priceless unique crystal; how day after day he had searched the rocks in vain, till at last one lucky stroke of the hammer laid open that magnificent druse; how he had bought that matchless group from a sailor who used it to keep down the lid of his tobacco box. Kindly too he was, and all the more if you took interest in his favourite pursuit. Ask him to tell you the difference between two resembling minerals, and he would launch out with evident relish into his "external characters." Lovingly would he handle the specimens, as if they were the children of his old age. Eagerly would he descant upon the difference between "lamellar distinct concretions"; how some were "indeterminate curved lamellar," others were "fortifications-wise bent." And then would follow the whole string of characters—"semi-hard," "not particularly difficultly frangible," "supernatant," "pretty cold," "not particularly heavy," between "aurora-red" and "hyacinth-red," or between "mountain-green" and "celandine-green." Such jargon it seemed to youthful ears! One could not but admire indeed its methodical precision, but the questions ever forced themselves on one's mind—What is the living truth underlying it all? Were minerals really created merely as a basis for our old friend's systems of classification? Or can they not be made to yield up some intelligible record of their own history and of the planet of which they form a part?

When the discoveries of William Smith drew off the attention of students to the marvels revealed by stratigraphical geology, mineralogy rapidly sank into neglect in this country. By a curious revulsion of opinion rocks were now appraised as of importance in proportion as mere mineral specimens were absent from them, for where these occurred organic remains were usually not to be looked for; and organic remains now took the place of minerals. Men who would formerly have trudged cheerfully a whole day with a 14-lb. hammer on their shoulders to secure a few minerals were now to be seen as enthusiastically hunting for ammonites, gryphaeas, belemnites, echini, fossil fishes, and other buried treasures of the stratified formations. Unmeasured was the scorn of the veteran mineralogist for this new-fangled pursuit. To neglect such attractive objects as minerals, with their exquisite forms and colours, for the dingy and fragmentary relics of extinct whelks, lobsters, and other pre-adamite vermin seemed to him an utterly unaccountable form of madness. And so his beloved cabinet became dearer to him than ever. In its quiet retreat he lived with his specimens in the past, and allowed the strong rising tide of palæontology to rush and roar past him unheeded.

But cycles appear in scientific as in political opinion. For some years past there has been a growing conviction that palæontology has had a long enough monopoly of power in the geological commonwealth, and that the mineralogical side of the science has in this country been unduly neglected and discouraged. The attention now bestowed among us upon petrographical research is a pleasing proof of the reality and steady progress of this reaction. Another token of the same change is supplied by the foundation and encouraging growth of the Mineralogical Society of Great Britain and Ireland. This society was instituted in the early part of the year 1876. It counts among its members a large and increasing number of the best geologists in the three kingdoms. But its operations are carried on so quietly and unostentatiously that its work and aims are probably not yet so widely known as they deserve to be. A body gathered under the leadership of Sorby and Heddle is one which may count on support from all to whom the advancement of mineralogy and mineralogical geology among us is an object of interest. As a rule our scientific societies are bodies with a local habitation, gathering most of their effective members from the district in which their rooms are placed. But the Mineralogical Society, as its name denotes, embraces the whole United Kingdom. It has no buildings of its own nor any one special home. Its meetings, like those of the British Association on a large scale, are held from time to time in different towns throughout the country, its object being to form a bond of union among those who cultivate mineralogy or who wish to see this science restored to the place which it ought to hold in a land where so much sound geological work is being done. The Society publishes a "Mineralogical Magazine," of which three volumes and part of a fourth have already appeared. This publication contains numerous papers by Dr. Heddle and the indefatigable secretary, Mr. Collins, also some by Mr. Sorby, the late Mr. J. C. Ward, Prof. Bonney, and other well-known writers. No one need fear to encounter in its pages the resuscitated ghosts of the old mineralogical "Dryasdusts." Peace to their manes! They did good though limited work in their day, which deserves our respect for its thoroughness. But, with affectionate reverence for these early masters and their crabbed lingo, we breathe a more open breezy atmosphere now. The mineralogist's ken sweeps far beyond the limits of his cabinet and laboratory. Hand-in-hand with the geologist and palæontologist, being elder brother to both, he takes his share in the task of unravelling the structure and history of the earth. Towards the attainment of this union the Mineralogical Society aims, and it deserves the heartiest wishes for its success.

ARCH. GEIKIE

SMOKELESS LONDON

I WRITE for the purpose of expounding a scheme which, if adopted, would make London a smokeless city.

When taking upon myself to explain a subject in a few minutes which has taken many years to develop in my own mind, there is a great temptation to put the reader in possession of the steps which led to the conclusion. The conclusion itself however has so much to recommend it that I will confine myself to the results of my reasoning only. It is enough to say that they were arrived at to a great extent by an exhaustive exclusion of less feasible plans.

First then I propose to take advantage of the existing plant of the gas companies. I find they are amply sufficient for the purpose.

Instead of taking 10,000 cubic feet of gas per ton from the coal, I propose to take 3333 cubic feet, and to pass three times the quantity through the retorts, or any other proportion that may be found most convenient. The result of doing so is startling.

The companies will have double the quantity of by-products they have at present in the shape of tar and ammoniacal liquids; the community will have 24-candle gas instead of 16-candle gas; the fuel resulting from the process will light readily, and it will make a cheerful fire that gives out 20 per cent. more heat than common coal; London would become a smokeless city.

In dealing with the figures I shall take them roughly, but in such a way that by including a few outlying corporations they could be made absolutely correct.

I take the total annual consumption of coal in London to be 6,000,000 tons. Of this I take 2,000,000 tons to be the annual consumption of the gas companies. The total quantity of fuel used for general purposes I take to be 4,000,000 tons of coal and 1,000,000 tons of coke sold by the gas companies.

We shall now see what would be the result if we treat the whole of the 6,000,000 tons in the retorts on an extraction of less than three hours, instead of the six hours at present prevailing.

The total quantity of 16-candle gas consumed in London may be taken at 20,000,000,000 cubic feet. This would be at the rate of 3333 cubic feet per ton upon 6,000,000 tons, the total quantity of coal consumed in London. The residual smokeless fuel would amount to 5,100,000 tons. Of this 1,000,000 tons would be required for the extraction of the gas, leaving 4,100,000 available for the general uses of the community. This has to be compared with the 4,000,000 tons of coal and the 1,000,000 tons of coke already referred to as consumed at present. Now the smokeless fuel which results from an extraction of 3333 cubic feet of gas per ton has a heating capacity fully 20 per cent. greater than common coal, and 10 per cent. greater than coke. This gives us the exact equivalents of the 5,000,000 tons of fuel at present in use.

So far the account as regards the fuel available for the community balances. We may now deal with the difference in value between 16 and 24-candle gas. As the value of the gas varies directly as its illuminating power, the calculation is very simple. If we take the average price of 16-candle-gas to be 3*s*. 6*d*. per thousand cubic feet we shall find the total value of the 20,000,000,000 consumed in London to be 3,500,000*l*., but as we have by my scheme the same quantity of 24-candle-gas, the value will be increased to 5,250,000*l*.; here then we have an annual sum of 1,750,000*l*. to place to the credit of the system.

Turning now to the by-products: seeing the gas companies by the new arrangements would subject three times the quantity of coal to the heat of their retorts during the period when the tar and ammoniacal liquors pass off most rapidly, I do not think I am wrong in estimating the yield at double its present amount. Taking this upon the tar and ammonia to yield 3*s*. 9*d*. per ton of coal, we find the total value of these by-products to be, at present, on the supposed consumption by the gas companies of 2,000,000 tons of coal per annum, 375,000*l*. This being doubled under my scheme, an additional sum of 375,000*l*. must be placed to its credit.

But the basis upon which we have hitherto been arguing is that the gas companies under the proposed scheme are getting their coal for nothing. We have been supposing that the community become the purchasers of 6,000,000 tons of coal and hand it to the gas companies. At present London only pays for its general consumption on 4,000,000 tons of coal and 1,000,000 tons of coke. Let us now suppose that the companies pay the same sum annually that they do at present for their coals; if so, they would pay upon 2,000,000 tons, or an annual amount of 1,600,000*l*., if their coals cost 16*s*. per ton. From this falls to be deducted the money they at present draw from their sales of coke, which, when taken at 6*s*. yer ton of coal carbonised under the existing system, still leaves a sum of 1,000,000*l*., which they could afford to pay per annum for the use of the 6,000,000 tons of fuel as proposed in my scheme. We will now take the total payments of the community for their coal to be upon 6,000,000 tons, for which we will further suppose they pay at the rate of 16*s* per ton first cost. This would amount to 4,800,000*l*. per annum. From this falls to be deducted the 1,000,000*l*. contributed by the gas companies for the use of the fuel, also the 1,750,000*l*. charged on the difference between the 16- and 24-candle gas already referred to, also the sum of 375,000*l*. of additional income from the by-products. This would leave a net sum paid by the community for its fuel under my scheme of 1,675,000*l*. Under the present system they have to pay, say 16*s*. per ton on 4,000,000 tons of coal, and say 12*s*. per ton on 1,000,000 tons of coke. This makes in all the sum of 3,800,000 per annum. Here then we have a balance in favour of my scheme of 2,125,000*l*. annually. This may be taken as the yearly value of London smoke, which I propose to convert into useful products by *the plant at present in use*.

I have only in conclusion to say one or two words about the efficiency of the scheme as regards the fuel. It lights easily, it gives off no smoke, it makes a cheerful fire, it gives out more heat than either coal or coke, it will be cheaper per heat-unit than the coal at present in use, London would become a smokeless city, and all that would fall to be deducted from the sum of 2,125,000*l*. per annum would be confined to a few items, such as the cost of additional workmen employed in charging the retorts, interest upon additional capital required for transit appliances, and the terms to be made with the gas companies for carrying out the scheme.[1]

I cannot close without acknowledging the help I have received from Mr. Wallace, the gas manager at Woolwich Arsenal, and the valuable information obtained from Mr. Field's tabulated accounts of the London gas companies. So far as I am aware my contributions to the *Builder* and elsewhere are the only writing on the subject of my scheme that has ever been made public.

W. D. SCOTT MONCRIEFF

Westminster, December 13

NEW GUINEA[2]

OF the few travellers who have attempted to explore the great island of New Guinea, Signor D'Albertis must undoubtedly be considered the chief, since he alone has made extensive and repeated journeys both in the north-western and the south-eastern parts of the island, and has thus been able to examine and compare some of the most distinct tribes or races which inhabit the country. The narrative of his travels has therefore been looked for with some interest, for though several of his journeys have been more or less fully described in newspapers and magazines, it was felt that much must remain to be told, and that so energetic a traveller would probably be able to throw some fuller light on the hitherto doubtful affinities and relations of the Papuan races.

Leaving Genoa in November, 1871, in company with the well-known traveller and botanist Dr. Beccari, and making short excursions in Java and the Moluccas, our travellers hired a small schooner at Amboyna in March, 1872, to take them to Outanata, on the south coast of New Guinea; and after some delays at Goram seeking a pilot and interpreter, on April 9 D'Albertis records in his journal: "A memorable day! At last I tread the mysterious land. At last, leaping on shore this morning, I exclaimed, 'We are in New Guinea!'"

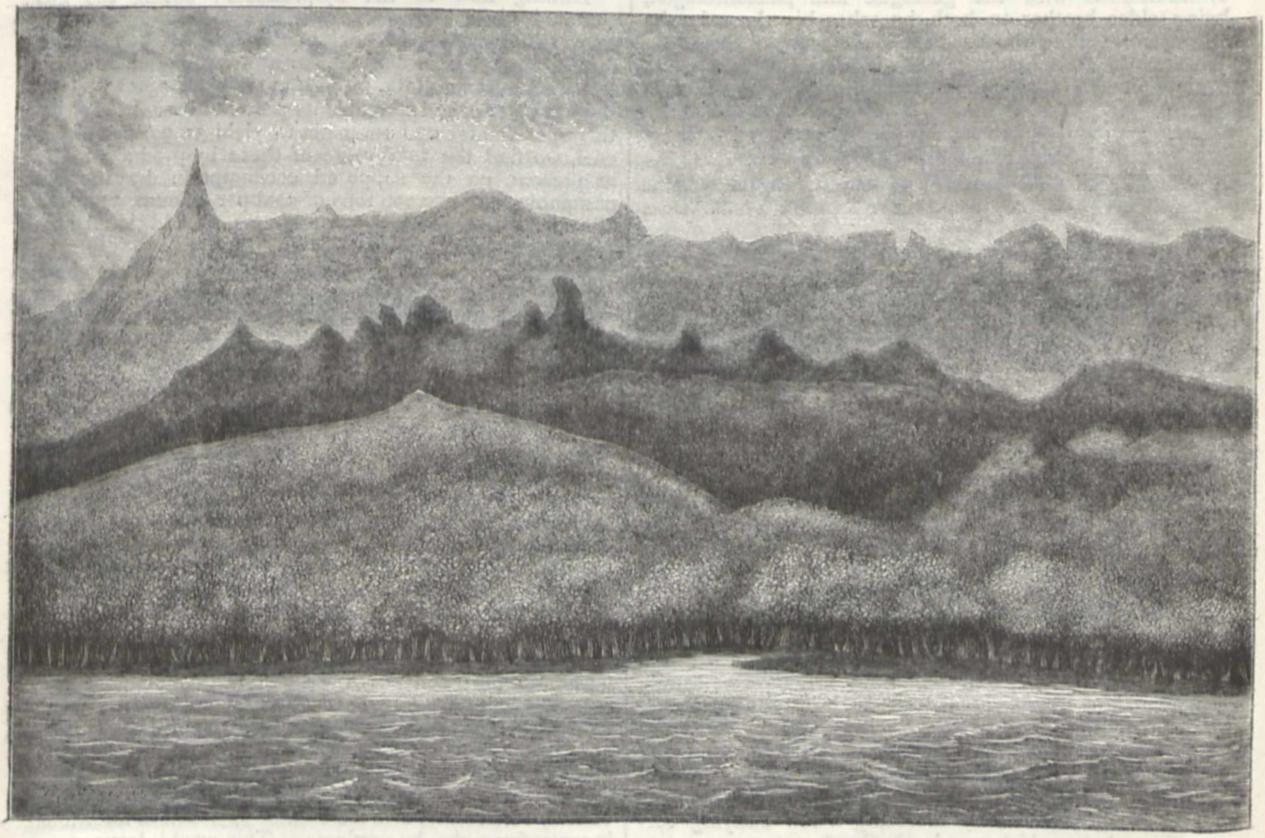


FIG. 1.—Mount Yule Range, seen from Yule Island.

Finding no safe or convenient place to stay at on the south coast, they proceeded to Salwati and fixed their abode for some time at Sorong, a small island close to the north-western extremity of the main land of Papua. From this point they made excursions into the interior, and D'Albertis resided some time at the inland village of Ramoi, where he was near dying of dropsy and fever. They then went in a native vessel to Dorey Harbour, where they arrived in August, and sttled themselves at Andai Village, where a German missionary resides. Here they had a house built, which was their headquarters till November, and D'Albertis succeeded in spending some weeks at Hatam, a village on Mount Arfak, about 3500 feet above the sea, and in the midst of the forests inhabited by the finest and rarest of the birds of paradise. On the very day after his arrival here he shot both the shielded and the six-shafted paradise-birds (*Lophorina atra* and *Parotia sexpennis*), two species which had certainly never before been seen alive or freshly killed by any European; and before he left this spot he obtained many other rare species, besides an altogether new and beautiful kind, which has been named *Drepanornis albertisii*.

Constant attacks of fever and dropsy, however, reduced him to such a state of weakness that it was absolutely necessary to seek a change of climate, and returning to

[1] By experiment I find that the greater heating power of the fuel in excess of the coke more than makes up for the cooling which takes place on account of the more frequent charging of the retorts.

[2] "New Guinea: What I Did and What I Saw." By L. M. D'Albertis, Officer of the Order of the Crown of Italy, &c., &c. In two volumes. (London: Sampson Low, Marston, Searle and Rivington, 1880.)

Amboyna he was taken by an Italian man-of-war to Sydney, making some stay at the Aru Islands and South-Eastern New Guinea on the way. Thence he went home by way of the Sandwich Islands, San Francisco, and New York, reaching Europe in April, 1874, and thus terminating his first voyage to the far east.

When leaving Dorey in the end of 1872 he had determined to return to the north coast and to penetrate further into its forest-clad mountains, but the subsequent journeys of Dr. Mayer, of which he heard at Sydney, and Dr. Beccari's intention to return to the same district, induced him to turn his attention to the south, where he had obtained from the natives the skin of a new bird of paradise, and where the lofty ranges of Mount Yule and Mount Stanley offered the prospect of an equally rich and still less known exploring ground. Accordingly, in December 1874, he reached Somerset (Cape York) by way of Singapore, with the intention of settling at Yule Island, which he had before fixed upon as convenient head-quarters for the exploration of Southern New Guinea. After some difficulty and delay he reached the island on March 17, and finding the natives friendly obtained permission to occupy some land and build a house. Here he stayed till November, having with him a young Italian, two Cingalese, and five Polynesians; making large collections of natural history, exploring the island and the shores of the mainland, but being quite unsuccessful in his attempts to reach even the foot of the great mountains of the interior.

This completes the first volume, which contains by far the most interesting matter both to the naturalist and to the general reader. The second volume is devoted to a detailed journal of three successive voyages up the Fly River, the first in the missionary steamer *Ellangowan*, the two others in a small steam-launch, the *Neva*, lent him by the Governor of New South Wales. On the second and most successful of these voyages D'Albertis penetrated to the very centre of the great southern mass of New Guinea, reaching the hilly country, but not the great central range of mountains, of which a few glimpses were obtained at a considerable distance.

The first impression produced by the careful perusal of these volumes is, that Signor D'Albertis has all the best qualities of an explorer—enthusiasm, boldness, and resource, a deep love of nature, great humanity, and an amount of sympathy with savages which enables him to read their motives and appreciate the good qualities which they possess. To the character of a scientific traveller he makes no claim, and those who expect to find any sound generalisations from the results of his observations will in all probability be disappointed. Let us, however, by a few examples and illustrative passages, enable our author to speak for himself.

While residing at the village of Ramoi he became prostrated by fever, and was besides almost starving, for the natives would sell him nothing neither would they carry his baggage to enable him to return to Sorong. Determining however not to die there without an effort, he sent for some of the chiefs to speak to him, and then grasping his loaded revolver assured them that unless they gave him men at once to assist him to leave the place not one of them should quit his hut alive. The plan succeeded. One was allowed to go and fetch the men, the others remaining as hostages, and the revolver never left his hand till his baggage was all on board the canoe. A little later when the travellers were on their way to Dorey, the native crew were very insolent, and boasted that when they reached their own country they would kill all the white men. D'Albertis, hearing this, asked the man if he dared to repeat it, and on his doing so suddenly seized him by the throat and pitched him overboard. He was, of course, on board again in a moment, and instantly seized a bamboo to attack our travellers, but they exhibited their revolvers, and so cowed the whole crew that they became quiet and submissive for the rest of the voyage. An admirable portrait of one of these Dorey Papuans (Fanduri) is given, and the present writer can almost believe that he recognises in it one of his own acquaintances at Dorey in 1858.

More amusing was the way in which Signor D'Albertis made use of the aneroid on his journey to Hatam. His porters, who had agreed to take him there for a fixed payment, stopped at a village to rest; and on being told to go on, said, "This is Hatam; pay us our wages." He knew however, both by the distance and elevation, that that they were deceiving him, and told them so, but they again said, "This is Hatam; pay us. How do you know that this is not Hatam?" He then took his aneroid out of his pocket, and laying his finger on a point of the scale, said, "Here is Hatam; this thing tells me where it is;" and then explained that when they got higher up the mountain the index would move, and when they reached Hatam it would come to the point he had marked. This astonished them greatly, but they would not believe it without

FIG. 2.—Fanduri, a Dorey Papuan

proof. So he let one of them carry it himself to the top of a small hill near, when they saw that the index had moved, and on coming down that it moved back againt This quite satisfied them. They acknowledged that the white man knew where he was going, and could not be deceived, so they at once said, "Let us rest to-day; to-morrow we will go to Hatam." Of course every man and woman in the village wanted to see the little thing that told the stranger where lay the most remote villages of the forest; and thus the traveller's influence was increased, and perhaps his personal safety secured.

In his second journey he provided himself with dynamite and rockets, which were very effectual in frightening the savages and giving him moral power over them. At Yule Island he was on excellent terms with the natives, on whom he conferred many benefits. Yet during his absence on an exploration his house was entered and a large quantity of goods stolen. In recovering these and firmly establishing his power and influence he showed great ingenuity. Calling the chiefs and other natives together—who all pretended great regret at his loss, though the robbery must have been effected with their connivance—he told them that he was determined to have his property back, and that if it was not brought in twenty-four hours he would fire at every native who came within range of his house, which fortunately commanded a great extent of native paths, as well as the narrow strait between the island and the main land. He then made his preparations for a desperate defence in case he was attacked, loaded some Orsini shells and mined the paths leading to his house, so that with a long match he could blow them up without exposing himself. At the end of the twenty-four hours, nothing having been brought, he commenced operations by exploding five dynamite cartridges, which made a roar like that of a cannonade, the echoes resounding for several seconds. He then let off rockets in the direction of the native houses, and illuminated his own house with Bengal fire. All this caused terrible consternation; and the next morning the chief arrived with five men, bringing a considerable portion of the stolen goods, and trembling with fear to such an extent that some of them could not articulate a word. He insisted however that the rest of the goods should be brought back; and the next day, to show that he was in earnest, fired at the chief himself, as he was passing at a distance of 300 yards, being careful not to hurt, but only to frighten him. A canoe was also turned back by a bullet striking a rock close by it. The effect of this was seen next morning in another visit from the chief, with five complete suits of clothes, axes, knives, beads, and other stolen articles. Much more, however, remained, and D'Albertis took the opportunity of impressing them thoroughly with his power. He first asked them to try to pierce a strong piece of zinc with their spears, which were

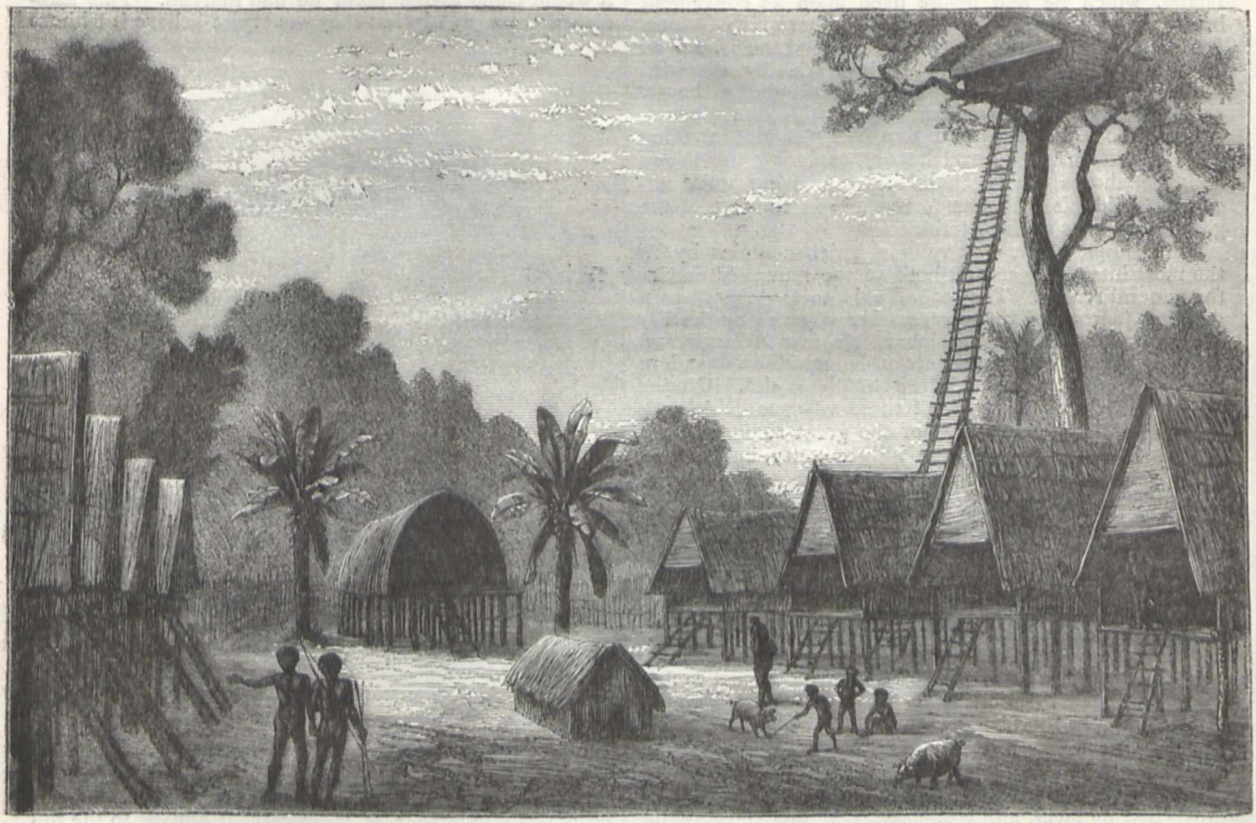


Fig. 3.—Epa, a Village of the Mahori-papuans.

blunted by the attempt, while he riddled it through and through with shot from his gun. He also sent bullets into the trunk of a small tree a hundred yards distant, showing that a man could not escape him. They had been seated on a large stone near his house, which he had mined. He now called them away, and having secretly lighted the match, told them to look at the stone. A tremendous explosion soon came, and the stone disappeared. The natives were too frightened to move, and begged him to have pity on them, promising to restore everything. A great hole was seen where the stone had stood, while some of its fragments were found a long way off. For twelve days more he kept up a state of siege, turning back all travellers and many canoes by rifle-balls in front of them, but never hurting any one. Then another large instalment of his goods was brought, leaving little of importance, and ultimately he recovered almost everything. During the whole of this time he never hurt a single person or did any damage to their property, but succeeded in getting back his own by impressing them with his, to them, superhuman power. The result was that after eight months' residence he parted from these people on the best of terms. They all embraced him, and most of them shed tears, while their last words were: "*Maria rau! Maria rau!*" "Return, Maria! Return, Maria!"—that being his second name, by which they had found it most easy to call him.

As a fearless capturer of snakes Signor D'Albertis rivals, if he does not surpass, the celebrated Waterton; indeed he seems to like them rather than otherwise. At Yule Island the natives had found a large snake under a tree, and all ran away from it, crying out, and this is his account of what happened:—

"At last I went to the natives and tried to ascertain the cause of their conduct, and they made me understand why they had fled. I then returned to see the snake myself, which in fact I did, although two-thirds of its length were hidden in a hole in the earth. His size was such that I concluded he could not be poisonous, and I at once grasped him by the tail. While dragging him out of his lair with my two hands I was prepared to flatten his neck close to his head with one foot the moment he emerged, so that he should not have the power of turning or moving. My plan succeeded perfectly, and while the snake's head was imprisoned under my foot I grasped his body with my hands, and, as though I had vanquished a terrible monster, turned towards the natives with an air of triumph. They, struck with terror, had looked on at the scene from a safe distance. I must confess that the snake offered little resistance, although it writhed and twisted itself round my arm, squeezing it so tightly as to stop the circulation, and make my hand black. I remained however in possession of its neck, and soon secured it firmly to a long thick stick I had brought with me. I then gave the reptile to my men to carry home." This serpent was thirteen feet long, whereas the one Waterton caught single-handed was but ten feet, though it might have been equally powerful. This snake was kept alive and became quite tame, and when the natives saw D'Albertis kiss its head and let it coil round his legs they howled with amazement and admiration. Six weeks after the capture he writes :—"My snake continues to do well; it has twice cast its skin, is well-behaved and tame, and does not attempt to escape, even when I put it in the sun outside the house; and when I go to bring it in, it comes to me of its own accord. It never attempts to bite, even when I caress or tease it. While I am working I often hold it on my knees, where it remains for hours; sometimes it raises its head, and licks my face with its forked tongue. It is a true friend and companion to me. When the natives bother me it is useful in putting them to flight, for they are much afraid of it; it is quite sufficient for me to let my snake loose to make them fly at full speed." He kept this serpent for nearly six months, and latterly another of the same species with it, till at last both escaped, and he mourns their loss as of dear friends, adding, "for I loved them and they loved me, and we had passed a long time together."

The furthest village on the mainland visited by D'Albertis was Epa, where he lived five days, and of which he gives a very pleasing account. It is about 1500 feet above the sea, but a very short distance from the coast. The village is surrounded by a strong double stockade, and the people appear to be good specimens of the superior Mahori-Papuan race. By the aid of these people it would probably not have been difficult to penetrate to the mountains of the interior, but our traveller was drawn away by the opportunity of exploring the Fly River, and has left the exploration of this grand mountain range with its rich natural treasures for some future exploration or some other explorer. Having thus sketched the outline of Signor D'Albertis' eastern voyages and indicated his main characteristics as a traveller and an author, let us see what he has to tell us about the people among whom he travelled.

ALFRED R. WALLACE

(*To be continued.*)

PROF. J. C. WATSON.

WE regret to have to record the death of Prof. Watson, for many years director of the Observatory of Ann Arbor, Michigan, and later of the new Observatory established at Madison, Wisconsin, under the auspices of General Washburne.

James Craig Watson was born on January 28, 1838, in Elgin County, Canada West, of American parents who were residing in Canada at the time of his birth. While he was still a boy they removed to Ann Arbor, where at fifteen years of age he entered the University as a classical student, but his mathematical bias soon became evident. He studied astronomy under Prof. Brünnow, who was then in charge of the Ann Arbor Observatory, and Professor of Astronomy in the University, and while the latter was director of the Dudley Observatory at Albany, Watson occupied his place at Ann Arbor. In 1860, when Prof Brünnow returned there, he was transferred to the Chair of Physics, which position he held until Prof. Brünnow finally severed his connection with Ann Arbor in 1863, when Watson was again appointed director of the Observatory. From this time his attention was chiefly directed to the discovery of minor planets, with which view he formed charts of very small stars; he had also in view the possible detection of an ultra-Neptunian planet, and it has been stated that latterly he had been more particularly working with this object, and had removed from Ann Arbor to Madison, to avail himself of the more powerful instrumental means at the latter place, where the refractor has an aperture of 16 inches, that of the Ann Arbor telescope being 12½. Watson added twenty-three members to the group of small planets, his first discovery being that of Eurynome in September, 1863.

In 1870 Watson proceeded to Sicily at the head of a Commission appointed by the United States Government to observe the total eclipse of the sun on December 22, and in 1874 he went to Pekin in charge of a similar Commission for the observation of the transit of Venus. While at Pekin he discovered No. 139 of the minor planet group, and it was stated at the time that the discovery was effected entirely through Watson's extraordinary recollection of the configuration of the small stars in the neighbourhood where the planet was situated (R.A. 0h. 58m. 15s., Decl. $+ 10^{\circ} 44'$). A member of the Imperial family who had been asked to name the planet, called it the "Hope of China"; *Juewa*, the name by which it has since been known, being an Anglicisation of the Chinese term.

Watson's observations of two objects during the totality of the eclipse of July 29, 1878, which he considered to be intra-Mercurial planets, will be fresh in the recollection of the reader: there is no doubt that whatever opinion may have been entertained by other astronomers, he was himself convinced that he had met with planetary bodies, and he stoutly defended his opinion against the doubts raised in his own country.

Watson was the author of a valuable work upon Theoretical Astronomy, published in 1867, upon which his reputation as an author mainly depends. He was a member of the principal scientific institutions of the United States, and his merits were acknowledged by several of the European Academies; he received the Lalande Medal of the Paris Academy of Sciences in 1870 for his numerous planetary discoveries.

The death of Prof. Watson took place somewhat suddenly on the morning of November 23, at his residence on Observatory Hill, Madison, Wisconsin, and is attributed to intestinal inflammation, following upon a severe cold, in an overstrained condition of body: he had been working hard as usual at night, while superintending the completion of the Observatory buildings by day. He was buried at Ann Arbor on November 26; memorial services were held in the University hall, and were attended by a body of between seven and eight hundred students, and a large concourse of the general public, addresses being delivered by the President and several Professors of the University, of which the Ann Arbor and Detroit journals furnish lengthy reports.

NOTES

THE subscription opened by the Paris Academy of Sciences for raising a statue to M. Becquerel, the celebrated electrician, is almost closed, having produced 15,000 francs; only 1500 francs more are required. Those wishing to subscribe should send their contributions to M. Maindron, at the Academy of Sciences, as early as possible.

LAST week M. Moll, the *doyen* of the Professors of the Conservatoires des Arts et Métiers, died in Paris. He was the oldest teacher of agriculture and one of the first, having been one of the staff of the celebrated Rouville *ferme-école*, established about sixty years ago.

THE Nestor of German bryologists, Prof. Ernst Hampe, died at Helmstedt on November 23 at the age of eighty-five years.

ON Nov. 23 the first section of the St. Petersburg Academy of Sciences (physico-mathematical sciences) had to choose a member in chemistry, and an influentially-signed presentation recommended Prof. Mendelejef to the choice of the Academy. The Academy would certainly have done itself honour in choosing a man of such eminence in science, but we regret that Prof. Mendelejef was not elected. This is held locally to show that the Academy is influenced in its selection by other reasons than the value of a candidate's scientific work. The impression on the public in general, we believe, is very unfavourable to the Academy; not a day passes, we are informed, that Prof. Mendelejef does not receive letters and telegrams from men eminent in science expressing admiration for his works. Many scientific societies have made him an honorary member, and only the other day the University of Moscow did the same.

AN interesting collection is being made by M. Dumas of medals commemorative either of scientific men or scientific discoveries. The number already collected is far greater than had been expected.

LIEUT. JULIUS PAYER, one of the leaders of the Austrian North Polar Expedition of 1872-74, has settled at Munich with the intention of devoting himself exclusively to the art of painting.

THE central committee for the erection of a Spinoza monument at the Hague have, before their dissolution, resolved to utilise the remaining balance of funds in their hands for publishing a new and handsome edition of the complete works of the great philosopher. Doctors J. van Vloten and J. P. N. Land have been commissioned to prepare the new edition. In the interest of this laudable undertaking the friendly request is now addressed to all librarians and possessors of autographs to communicate with these gentlemen regarding any autographs of Spinoza which may be in their possession, in order to render the edition as complete as possible. Communications are to be addressed to the publishing firm of Martinus Nijhoff at the Hague.

A STRONG shock of earthquake was felt at Wiesbaden on the night of the 8th instant, at eleven o'clock; the shock was directed from north to south. A strong subterranean noise preceded it, and a violent wind of short duration was observed. Another shock is reported from Saxony. A fresh violent shock lasting two seconds occurred at Agram at twenty-seven minutes after midnight of the 7th. Subterranean rumblings followed the shock and continued to be heard throughout the night. As on the last occasion the shock was accompanied by distant storms and preceded by a slight vibration. On Wednesday night last week there was a strong earthquake shock at Agram which lasted six seconds. It was preceded by a loud rumbling. On the day previous the earth trembled for an hour together. That of Wednesday night was the strongest shock since the first. Two walls fell in and the houses shook. On Thursday evening last six slight shocks were felt at Vienna. At Agram there were two violent shocks at half-past two and half-past three o'clock in the morning. A shock of earthquake was felt at Brescia on the afternoon of the 10th, accompanied with a rumbling noise.

PROF. RUDOLPH FALB gave a lecture in the Vienna Gewerbe Museum on November 27, in which he said that earthquakes are subterranean volcanic outbreaks, produced by the cooling action of the hot liquid interior of the earth and the attraction of the sun and moon. In support of this view he urged that most earthquakes occur at the time when the sun is nearest us, viz., in January, fewest in June; also the number of earthquakes increases in the months of April and October, because of the stronger attraction of the sun on March 21 and September 23. He said further that in the period December 16-30 this year fresh earthquakes might occur at Agram.

A NEW and somewhat bold hypothesis as to the cause of earthquakes has been propounded by Dr. Novak in Pesth. He considers that, besides the rotation of the earth on its axis and its revolution round the sun, a multiplicity of motions of the earth appear in space, in virtue of which the earth's axis, and with it the equator, shift their position. This causes a variation of the forces influencing the earth's form (centrifugal and centripetal force), and the earth has the tendency to adapt itself to this change. He also considers a change of form of the earth to occur through the shifting of the pole and the equator, and that this may have effect some time afterwards, where the earth's crust is weak.

WE are requested by the Sunday Society to announce the following arrangements for the Sunday opening of the Winter Exhibition of Oil Paintings at the Hanover Gallery, New Bond Street, by permission of the proprietor, Mr. Weil. On Sunday, December 26, the Gallery will be open to the Members of the Society, and on the two following Sundays the public will be admitted by free tickets, which will be issued to those applying by letter and sending a stamped and addressed envelope to the Honorary Secretary, 8, Park Place Villas, W. On each Sunday ticket-holders will be admitted from 4 o'clock till 7.30 p.m., and the gallery will be closed at 8 o'clock. On the reassembling of Parliament the Society will press its claims upon both Houses of the Legislature by bringing forward the following resolution:—"That inasmuch as all opposition to the action of Her Majesty's Government in opening on Sundays the National Museums and Galleries in the suburban districts of London and in Dublin has entirely ceased, owing to the good results which have followed such opening, this House is of opinion that the time has now arrived for extending this action to all institutions of a like character, it having been most conclusively shown that large numbers of the people rejoice in every opportunity that is afforded them of spending Sunday intelligently and with due regard for its preservation as a day of rest and cessation from ordinary work and amusement."

SOME information regarding the observatory at Nice, now in course of construction through the munificence of M. Bischoffsheim, is given by M. Tissandier in *La Nature*. Some 35 hectares of ground have been acquired. The situation is a few kilometres north-east of Nice, near the road from Corniche over the Mont des Mignons (or Mont Gros), and 375 m. above the sea. There are to be two large dwelling-houses for astronomers and for accommodation of visitors. One is already finished, and M. Thollon has there done some excellent work in spectroscopy. More than 250 workmen are at present busy on the buildings. Some of the instruments will shortly be ready. The whole is being organised under the auspices of the Bureau des Longitudes.

The Observatory will comprise at first two equatorials, one meridian, and several accessory instruments. One of the equatorials will probably be the largest astronomical apparatus in the world. Its focal distance will be 18 metres, and its aperture 0·76 m. The cupola will have a diameter of no less than 22 m. The construction of the object-glass is entrusted to MM. Paul and Prosper Henry of the Paris Observatory. The instrument alone will cost about 250,000 francs, and the cupola will be correspondingly expensive. The total cost of the Observatory will exceed two million francs.

AN interesting pamphlet on the subject of the introduction of hypotheses in school education has been published by Dr. Hermann Müller of Lippstadt (Bonn, Strauss). Dr. Müller writes in self-defence and in reply to Prof. Virchow, whose controversy with Prof. Häckel on this subject some years ago will be remembered.

AMONG other useful matter in the "British Almanac and Companion" for 1881 is a summary of the science of the past year, by Mr. J. F. Iselin, which is good so far as it goes, but that is necessarily not very far. There is also an article on "Weather Forecasting," by Mr. R. H. Scott, and a "Sketch of the History of the Royal Observatory, Greenwich," by Mr. W. T. Lynn.

THE Report of Mr. Morris, the Director of Public Gardens and Plantations in Jamaica, on the financial results of the last consignment of Cinchona barks sent to the London market, is extremely satisfactory, inasmuch as it shows the superiority of Jamaica barks over those of Ceylon, as indicated by the prices realised. The consignment referred to in the present Report consisted of eighty-one bales, in which the several species under cultivation were represented, crown bark from *C. officinalis* and red bark from *C. succirubra* forming by far the largest proportion. The total amount realised for these eighty-one bales was 1313*l.* 11*s.* 7*d.* For all the different kinds, whether "quill," "trunk," "root," or "twig" bark, the prices realised were in excess of those obtained for the same kinds of Ceylon barks, to the extent even in some cases of 2*s.* 9*d.* per pound. Mr. Morris draws attention to the fact that from the recent sales the relative merits of the two principal species under cultivation, namely, the crown or grey bark (*C. officinalis*) and the red bark (*C. succirubra*) have become very distinctly marked. The first-named species has proved to be a most valuable product, and whatever changes and fluctuations may ultimately take place in view of the more extensive cultivation of Cinchona in different parts of the world, high-class bark of this nature must always command good and remunerative prices. The conclusion arrived at is that the conditions of soil and climate of certain parts of Jamaica are "eminently favourable to the production of the best qualities of these valuable products, and as large tracts of land and the necessary labour are now available, there are only wanting sufficient capital and energy to overcome the initial difficulties of this enterprise."

THE buds of the second vegetation in Paris which we noticed in October were killed by the frosty weather in the beginning of November, but a new vegetable phenomenon has been seen in the Champs Elysées. Owing to the exceptional hot weather prevailing in December new leaves have been observed on a few trees, and were flourishing at the date of our most recent observations.

THE Bill relating to the forthcoming exhibition of electricity in Paris has been presented to the Chamber. M. Cochéry asks for a credit of 300,000 francs—150,000 for the exhibition and 150,000 for the Congress and experiments. A guarantee fund of 20,000*l.* has been signed by fifty persons.

A USEFUL pamphlet on Bedroom Ventilation has been published by Mr. Lawson Tait of Birmingham.

THE *American Entomologist* has been incorporated with the *American Naturalist*.

THE rare phenomenon of an inverted rainbow was observed at Innsbruck on November 25 at 8.45 a.m. The end-points of the semicircle, the centre of which was the sun, rose and moved westwards with the latter for some thirty minutes. The phenomenon then vanished.

A VALUABLE discovery has been made at Jochenstein, near Obernzell (Bavaria). A farmer of Jochenstein had frequently noticed a stone plate, of some 1½ metres square, in the centre of a wood belonging to him. He had the plate raised recently, and under it were found six head-rings, four spiral bracelets, each showing nine twists, and two battle-axes. All the objects are of bronze and capitally preserved.

THE second part of "The Scientific English Reader (Leipzig, Brockhaus), edited by Dr. F. J. Wershoven, the first part of which we have already referred to, contains extracts relating to machinery and mechanical technology.

THE fourth part of Dr. Dodel-Port's excellent "Atlas of Physiological Botany" has just been published. The six plates it contains are in every respect equal to those of the former numbers. They comprise (1) *Volvox minor*, germ-history of the oospore (this plate forms the supplement of the *Volvox globator* plate in part 1); (2) *Equisetum Telmatega*, sporangia and spores; (3) *Passiflora cærulea* and *P. cærulea-alata*; (4) *Selaginella helvetica*, with macro- and microsporangia, macro- and microspores; (5) *Polytrichum gracile*, male and female plants, moss-fruit and its anatomy, spores and germinating spores; (6) *Narcissus poeticus*, seed-bud in longitudinal section at the time of fertilisation. These drawings are made according to the latest researches on the fertilisation of phanerogamic plants. Parts 3–5 of the same authors' "Illustrirtes Pflanzenleben" will also shortly be published.

AMONG the special papers in the *Annuaire* of the Brussels Observatory for 1881 are the following:—"What is the Climate most favourable to the development of Civilisation?" "Physical Phenomena accompanying the Transits of Mercury," by M. Niesten; "Nomenclature of existing Public Observatories"; "The Asteroids," by M. Niesten; "The Isthmus of Panama."

THE last Calcutta *Gazette* contains some official correspondence regarding the insect lately discovered in Monghyr, which threatens to become very destructive to the rice crops. The specimens forwarded to Mr. Wood Mason, deputy superintendent of the India Museum, have been identified by him as belonging to the genus *Cecidomyia* and as related to the Hessian fly which ravaged the wheat-fields in the United States. This genus, Mr. Mason says, has never before been found in India, and he proposes to call the species *Cecidomyia oryzæ*, or the rice-fly. He goes on to say that it is likely to prove a most formidable pest, and recommends that the district officers should be instructed to make further inquiries and carefully watch its progress.

A RECENT number of the *Golos* contains an interesting letter from Tiflis describing the enormous labour bestowed during the summer upon the destruction of the grasshoppers. The work was carried on for about three months, and occupied in one district (Gori) no less than 20,000 people per day. More than half these people had been summoned from the neighbouring districts of Achalzych, Ossetia, and Imeretia. Thanks to the colossal efforts thus made only 2 per cent. of the total crops of the district were destroyed by the grasshoppers. Many million roubles worth of hay and corn were saved by this work. On the other hand the organisation of the whole cost the Russian Government some 200,000 roubles, and many thousand acres of fields and gardens have been utterly neglected by the population to whom they belong.

A RHENISH Fishery Society has just been founded at Cologne. It will direct its attention not only to the Rhine fisheries, but its programme is a most universal one, comprising even the furtherance and support of ichthyological research as well as the establishment of ichthyological stations in various countries.

MR. BALLER of the China Inland Mission has lately made a journey in the little-known province of Kweichow at the time when the people were engaged on their opium harvest, and he thus describes the process :—A small three-bladed knife is used to make an incision in the poppy-head as soon as the petals fall off. The drop or two of milky juice that oozes out is after a little while scraped off with a small curved knife into a bamboo tube, and a fresh incision made. The process is repeated until the supply is exhausted. The juice thus collected is dried in the sun, when it turns jet black, and is then ready for the market.

OUR ASTRONOMICAL COLUMN

THE COMETS OF HARTWIG AND SWIFT.—MM. Schulhof and Bossert have investigated the elements of comets 1880 *d* and *e*, discovered respectively by Dr. Hartwig at Strasburg on September 29, and Mr. Lewis Swift at Rochester, New York, on October 11. Prof. Winnecke had conjectured that Hartwig's comet might have been identical with the comets of the years 1382, 1444, 1506, and 1569, with a period of revolution of 62⅓ years. MM. Schulhof and Bossert formed six normal positions between September 30 and November 29 from observations at Paris, Strasburg, Berlin, Leipsic, Kiel, Kremsmunster, Lund, Florence, Marseilles, O'Gyalla, Clinton, and Washington, and on varying the distances from the earth at the first and fifth place until the other normals were represented as closely as possible, arrived at an elliptical orbit, but with a period of 1280 years: this result is necessarily uncertain under the circumstances, but it nevertheless appears to render so short a revolution as 62⅓ years in the highest degree improbable.

With respect to Swift's comet, taking as the fundamental data the Odessa observation on October 31, a mean of Dunecht, Paris, and Strasburg on November 9, and an observation at Paris on November 27, it is found that, assuming only one revolution to have been accomplished between 1869 and 1880, or that the period is 10·96 years, the middle place cannot be represented with sufficient precision; when the error is diminished in longitude, it is increased in latitude. On the hypothesis that the period is 5½ years, or that two revolutions are included in the above interval, the error in latitude is greatly diminished, but still exceeds thirty seconds of arc. This, while indicating that the second hypothesis is more probable than the first, is regarded by MM. Schulhof and Bossert as rendering so short a period as 3⅝ years possible, though it is admitted that it may well be due to errors of observation. It must be borne in mind that the comet has always presented itself as a faint diffused object, without that degree of condensation necessary to insure precise observation. The following is the ellipse of 5½ years' period:—

Perihelion passage, 1880, November 8·00011 G.M.T.

	° ′ ″	
Longitude of perihelion	43 4 33	M. Eq. 1880·0
,, ,, ascending node	296 51 33	
Inclination	5 23 32	
Angle of excentricity	41 3 25	
Logarithm of semi-axis major	0·492684	

With these elements the perihelion distance will be found to be 1·0671, and the aphelion distance 5·1518, and the heliocentric latitude at aphelion $-$ 4° 6′·6, whence we find the distance from the orbit of Jupiter to be 0·53.

MM. Schulhof and Bossert propose to continue their investigation when further observations are available: meanwhile it may be remarked that their ellipse of five and a half years is likely to afford positions sufficiently near the truth to insure the observation of the comet as long as it is within reach of our telescopes, and it may be suggested to those who are in possession of powerful instruments that they will render an important service in determining places of this comet as long and as accurately as practicable.

THE NOVEMBER METEORS.—Notwithstanding much interference from clouds the observers at Moncalieri, who watched for meteors during the nights of November 12-14, consider that they obtained evidence of the increasing density of the Leonid-stream, thus confirming observations made last year in England and the United States. One of these meteors appeared larger than the planet Jupiter, with an intense blue light, and a bright train of the same colour. It is added: "La lumière zodiacale d'opposition était très brillante vers l'orient, sur le fond pur de ciel, s'élevait jusqu'au delà de la queue de Lion."

NEAR APPULSE OF JUPITER TO A FIXED STAR.—On the evening of November 20 Jupiter must have approached very near to the star B.D. + 2° No. 97, rated 7·7 in the *Durchmusterung*, and 7·9 on December 17, 1856, when it was observed on the meridian at Bonn, indeed the resulting place of the star would bring it almost into contact with the limit of the planet about the time of conjunction in right ascension (9h. 4m.), but small errors of the star's position and tables of Jupiter may have combined to leave it at an appreciable distance from the limb; perhaps some reader of NATURE may have determined micrometrically the nearest approach. The apparent place of the star on November 20 was in R.A. 0h. 38m. 49·44s., Decl. + 2° 32′ 59″·9.

BIOLOGICAL NOTES

ANABÆNA LIVING IN BOTRYDIUM.—It is now well known that many plants belonging to the group of the Nostocs flourish within the cells of other plants. Thus they are to be found in the petioles of the leaves of Gunnera, in Lemna, in Anthoceros, in Blasia, and in Azolla; and it was to be expected that they would equally find themselves at home in the cells of even more lowly organised plants. An instance of this latter, not without interest, has been noticed by Dr. L. Marchand, who recently collected a Botrydium at Montmorency, which, on being examined under the microscope, was found, instead of containing the usual mass of granular chlorophyll, to be filled with a chain of moniliform filaments, presenting all the characters of the chaplets of a Nostoc or Anabæna. These filaments were composed of cells, some oblong with yellowish heterocysts, and they did not fill the entire cavity of the Botrydium cell, but seemed to adhere to its inner walls. The Botrydia plants were perfect; the root-like prolongations, as well as the rest of the plant, were perfectly closed. How then did these foreign bodies get in? This is not a question easy to answer, but it is one well worthy of being investigated. Dr. Marchand calls attention to the remarkable figure of Mr. E. Parfitt in "Grevillea" (vol. i. p. 103, pl. vii.), in which there is now little doubt, with the light thrown on the subject by Dr. Marchand's specimens, that there is represented our common species of Botrydium with a parasitic, or better, an endophytic Anabæna. No doubt the cells of the Anabæna in Parfitt's figure are badly represented, but the observation made in Parfitt's paper would seem now not to be without a special interest of its own.

MESEMBRIANTHEMUM NOT MESEMBRYANTHEMUM.—Prof. Asa Gray, in the *Botanical Gazette* (Indiana), vol. v. Nos. 8 and 9, p. 89, thus writes:—This word is properly written Mesembrianthemum, by Jacob Breyne, who made the name, and by Dillenius, who took it up, both giving the derivation from *Mesembria*, mid-day, alluding to the time in which the blossoms open. But both Breyne and Dillenius themselves very often wrote it Mesembryanthemum; Linneus, adopting this latter, became consistent by making a wrong and far-fetched derivation to match the orthography. Among systematic writers Sprengel almost alone keeps to the correct orthography, but Webb insists on it. The younger Breyne, in his edition of his father's "Prodomus," has a note about it (p. 81). He mentions an excuse for changing the orthography, namely, "that some species do not open their blossoms at noontide," but intimates that Linneus' derivation from the insertion of the corolla around the middle of the germ is open to the same objection. Prof. Asa Gray adds, "if heeded, this kind of objection would be fatal to very many generic names."

CHLOROPHYLL IN THE EPIDERMIS OF PLANTS.—Adolf Stohr contributes to the *Scientific Proceedings* of the Vienna Academy a very interesting paper on the occurrence of chlorophyll in the epidermal tissue system of the leaves of flowering plants. He sums up a detailed account as follows:—While the epidermis of the aquatic submerged Phanerogams is usually regarded as containing chlorophyll, the epidermis of the green organs of the terrestrial Phanerogams is, on the contrary, considered to be destitute of chlorophyll. This at least is the most prevalent view. Exceptionally, submerged Phanerogams are found with an epidermis destitute of chlorophyll, and there are also some exceptions to the general rule quoted about the leaves of terrestrial Phanerogams. Now it happens that the at present prevailing view is only right in one respect, for up to the present, observations prove the regular appearance of chlorophyll in the outer layer of submerged Phanerogams. The second half of the prevalent view should be completely reversed, for the appearance of chlorophyll in the epidermis of the green organs of Phanerogams is the rule, and with few exceptions. The results of Stohr's researches lead to the following:—1. The epidermis of the green organs of the broad-leaved Gymnosperms, and of by far the most of the terrestrial Phanerogams, contains chlorophyll. 2. Chlorophyll appears regularly to be absent from the green organs of the needle-leaved Gymnosperms and the terrestrial Monocotyledons. 3. Chlorophyll is in most cases only to be found in the under surface of the leaves, but is also to be met with in the leaf-petioles and stipules. It remains in such position during the whole life of the organ. 4. Chlorophyll is seldom to be found in the upper and lower surfaces of the leaves at the same time. In most cases one can see that the chlorophyll of the cells of the epidermis of the upper surface of the leaf is quickly destroyed upon its formation, by the effect of a too intense light. 5. So far as the process of the evolution of the chlorophyll bodies was observed, the latter showed themselves as starch-chlorophyll bodies. M. Stohr gratefully acknowledges that these investigations were undertaken at the suggestion of Prof. Wiesner, the author of a memoir, "Ueber die natürlichen Einrichtungen zum Schutze des Chlorophylls der lebenden Pflanze." The leaves of nearly one hundred species of plants were carefully examined, and full details of these examinations are given in the tables that accompany M. Stohr's memoir. The investigations were carried out in the botanical-physiological laboratory of the University of Vienna. (*Sitzungsberichte d. k. Akad. Wissenschaften—mathem.-naturw. Cl.*, 79 Bd., S. 87.)

BLOOD-VESSELS OF VALVES OF THE HEART.—Recent researches by Dr. Langer (Vienna Acad. *Anz.*) prove that several mammalian genera (pig, dog, bullock) have a fully-formed blood-vascular system both in the semilunar and the atrioventricular valves. On the other hand an examination of about 100 human hearts (of children and adults) discovered blood-vessels in the heart-valves only in one case, that of a woman of sixty, in whom they were evidently the result of a pathological process. Dr. Langer explains the difference by a difference in the mode of formation of the valves.

LIGHT AND THE TRANSPIRATION OF PLANTS.—Dr. Comes (Naples Academy) finds, *inter alia*, that light favours transpiration; that a little after midday transpiration is at its maximum; that, other things equal, that organ transpires most which is most intensely coloured, and it emits most water when exposed to that part of the solar spectrum where it absorbs most light; and that only those luminous rays which are absorbed favour transpiration of an organ (not the inactive rays); so the transpiration is minimum under the rays coinciding in colour with that of the organ, and maximum under the complementary rays.

PINGUICULA ALPINA.—Prof. Klein of Buda-Pesth publishes in the last part of Cohn's *Beiträge zur Biologie der Pflanzen* an interesting memoir on this plant. 1. It appears in two forms: one has bright green leaves; the other has more or less reddish-brown coloured ones. These forms however appear only to possess the value of local varieties. 2. *Pinguicula alpina* is, like the other species of Pinguicula, an insectivorous, *i.e.* flesh-eating plant, but is partly also a plant-eating one. 3. Its roots are simple, *i.e.* they do not branch, and they possess notwithstanding a pericambium. The cells of the bast layer have handsome, for the most part doubly-ridged longitudinal walls, and are the first formations that differ from the primary meristem of the end of the root. The greatest part of the root remains in respect to the tissue formation in an undeveloped and almost embryonic condition. 4. The caulome contains between the pith and bark a vascular ring which is characterised by very short-jointed vessels: these joints are bound together at the points of contact, and their cross walls are broken through by one single circular opening. The bundles of vessels belonging to the roots spring partly out of the caulomic vascular ring, partly out of the leaf-spur. 5. The original bending in of the edges of the leaves can be regarded as an advantageous arrangement in respect to the catching of insects, as insects cannot easily get over the edge of the leaf, and can therefore also be generally caught under it. 6. The cells of the epidermis of the leaf contain no chlorophyll, but the green-leaved specimens contain a colourless sap and the red-leaved ones a reddish sap. Besides they always possess a cell nucleus in which crystalloids are to be found. 7. The edge of the leaf is transparent, and consists of a single row of epidermis cells. 8. The epidermis of the leaves contains as well on the upper as on the lower side tolerably numerous stomates, which are only wanting on the outermost edge. Their manner of formation corresponds mostly to that observed in Thymus; it shows however some deviations. The stomate is surrounded by a narrow edging which is more strongly cuticularised than the outer walls of the epidermis cells. The cells of the stomates contain no crystalloids, but only a few very small chlorophyll bodies. 9. The epidermis of the upper surface develops two kinds of glands with and without stalks. The glands with stalks consist of a basal cell projecting above the epidermis; out of this proceeds a one to four-celled half spherical columella, on the top of which a glandular body, consisting of a layer of radially-placed cells, is placed cap-like; the stalkless glands are similarly built, only the stalk is wanting, the columella is conical, and the glandular body does not as a rule project more than half over the epidermis. The process of development is similar in both glands. 10. Stalkless glands appear also on the lower side of the leaf. They are only feebly developed, and their cap portion hardly projects over the epidermis. From their presence it can be deduced that the various kinds of Pinguicula once only possessed stalkless glands; from which in process of time both the stronger developed stalkless glands and those also with stalks became developed on the upper-side of the leaf, by which the capacity of the leaves for catching and digesting insects was at the same time perfected. In connection with this, one can infer a somewhat similar theory about Utricularia and Aldrovanda, and even about Dionæa and Drosera. 11. The bundles of vessels belonging to the leaves are branched out in netlike veins, and anastomose chiefly with one another. The veins at the ends unite near the edge of the leaf into a sympodial layer, from which numerous veins go out directed to the edge of the leaf and end in enlarged spirally thickened cells, which cells sometimes border directly on the epidermis cells belonging to the edge of the leaf or are separated from them by one or more cells. 12. The tracheal vessels of the leaves, as well as of the other parts of *Pinguicula alpina* never contain air, but either a watery fluid or a yellowish-brown resinous-looking substance. This circumstance, together with the strange branching of the tracheal vessels in the edge of the leaf particularly adapted to catching insects seem to prove (or show) that the tracheal vessels serve for the transport of a substance that stands perhaps in direct connection with the function of the leaves. 13. The mesophyll cells form among one another tolerably large interstices filled with air, and contain generally chlorophyll bodies in abundance. 14. Starch is to be found in the chlorophyll bodies of *P. alpina*, and also in the small stems and roots of the hybernating plants, when it appears in small compressed nuclei. 15. Glands with and without stalks appear in the flower stalks as well as in the flowering parts.

GEOGRAPHICAL NOTES

AT a meeting of the Geographical Society on Monday evening Capt. T. H. Holdich, R.E., of the Survey of India, read a very interesting paper on the geographical results of the Afghan campaign, in which, after giving a sketch of the features of the country, he summed up the additions lately made to our knowledge. These are very considerable, for in the last two or three years he and Major Woodthorpe with their staff have surveyed and mapped from 25,000 to 30,000 square miles of country. Some of the more important facts ascertained are the facility with which practicable roads can be made through the passes of Afghanistan, and the comparatively low elevation of those of the Hindu Kush, which, according to Capt. Holdich's view, would offer no real barrier to the advance of a properly-equipped army. Capt. Holdich hinted that the further mapping and survey of the country were being continued by native explorers attached to the Survey of India, and he thought that in a few years' time it would be known from end to end, and that our surveys would then join on to those of the Russians north of the Hindu Kush. Capt. Holdich remarked also on the curious intermingling of races in some parts of Afghanistan, and in the ensuing discussion Mr. Blanford, late Director of the Geological

Survey of India, made some valuable observations on certain points connected with soil-formation, &c., in Central Asia.

UNDER the title of "Die geographische Erforschung des afrikanischen Continents von den ältesten Zeiten bis auf unsere Tage," by Dr. Philipp Paulktschke, Messrs. Brockhausen and Bräuer of Vienna have published a volume of 320 pages, containing a brief but full sketch of the progress of African exploration from the earliest times down to the present day. Its special value consists in the detailed bibliography of the subject contained in the footnotes on every page, which must be of the greatest service to the student of African exploration and geography. There are occasional slips, as when Mr. Monteiro's book on "Angola and the River Congo" is entered under "Monteiro," as published in New York in 1875, and again under "J. John," as published in London in 1876. But such blunders are wonderfully few. About 1500 names are referred to altogether.

DR. LENZ, on November 22, was at St. Louis, whence he was going to Tangier.

As a memorial of the work performed in the *Vega*, a "*Vega* Fund" has been raised by subscription in Sweden to encourage further geographical research. The sum raised is 35,000 crowns, which will be intrusted to the Swedish Academy of Sciences, and the interest either employed at once or be allowed to accumulate for a term of years. Only natives of Sweden, Norway, Denmark, and Finland will be entitled to receive the benefit of the fund.

Two important expeditions are soon to be sent into Central Africa, under the auspices of the Algerian Missionary Society, which already has stations at the northern ends of Lake Tanganyika and the Victoria Nyanza. One will go from Zanzibar, and the other will ascend the Congo.

THE INFLUENCE OF PRESSURE AND TEMPERATURE ON THE SPECTRA OF VAPOURS AND GASES[1]

IN the course of my inquiry last year into the homology of the spectral lines of chemically-related elements I occasionally made the observation that the two strongly-marked red lines which bromine in the fluid state gives when the spark is taken from it in De la Chanal's fulgurator grow very feeble or entirely disappear in the spectrum of the rarefied vapour in the Geissler-tubes, while other lines not previously seen become visible. It appeared to me of interest to inquire more particularly into the changes of the spectrum of one and the same element, as these changes are naturally of the greatest importance in the comparison of chemically-related elements; and with this view I addressed myself to the problem of the changes of spectra at higher pressures.

According to Wullner's well-known experiments, which only deal with the three permanent gases, hydrogen, oxygen, and nitrogen, the spectral lines of the second order grow broader with higher pressure, and at the same time a continuously illuminated background is to be observed. This phenomenon, however, presents even in the three permanent elements the greatest difference. Thus, while the lines in the hydrogen spectrum become easily broader even under moderate pressure, those in the spectrum of nitrogen do not expand. Therefore it occurred to me that a comparative investigation, which would extend to as many elements as possible, would be desirable, inasmuch as it encouraged the hope that by this means one could arrive at a law, perhaps even at an explanation, of these phenomena.

I now venture to present to the Academy a report of my experiments as far as they have gone, reserving a full account till their completion.

In my experiments I have treated the most volatile of the metalloids, and among the metals have included quicksilver and sodium. I will in due time give a full account of the apparatus and methods which I employed in my experiments, but at present I must confine myself to a statement of the results already ascertained.

The spectrum of the three halogens, at higher pressures, exhibits in each case the same peculiarities. The lines have the appearance of merging into each other, and without showing an expansion into bands, they become occasionally somewhat broader. There is a steadily luminous background which becomes brighter when the pressure is increased, and which is often more intense than the lines themselves. This latter circumstance is frequently seen in the case of iodine, where the continuous spectrum finally covers all the rest. In the case of chlorine and bromine single lines are always distinguishable from the continuous surrounding light. The appearance of certain lines in the red field in chlorine and bromine which always preserve their precision and delicacy is worth mentioning.

The changes in the intensity of the spectral lines as exhibited under different pressures are very interesting. If you compare the spectral lines of the halogens with each other, in order to ascertain their homology, and in doing so only employ the spectra of rarefied vapours in Geissler tubes, you meet considerable difficulties, for you can only compare the lines in groups, and these lines present frequently in each of the three elements such differences of intensity that you may be left in doubt as to the existence of a homology of their lines. But the apparent differences arise in reality out of the variation of intensity and the number of the lines with the pressure. By appropriate change in the density of the gas or vapour you can always produce spectra which exhibit the perfect homology of the lines. Thus, in the case of iodine you must employ that tension which iodine-vapour has at 50° or 80° C., while in the case of chlorine and bromine atmospheric pressure is required.

The spectrum of sulphur does not change at all at higher pressure, the lines maintaining their perfect sharpness, while in the red field a continuously illuminated background appears.

Phosphor and arsenic do not give any reaction, and even the continuous spectrum does not appear. With arsenic I observed what I think has hitherto been overlooked, namely, that it gives at a moderate pressure, and without the interposition of a Leyden jar, *a spectrum of the first order*. It is almost continuous, and with increase of pressure of interposition of the jar it gives to the spectrum of lines the spectrum of the second order.

Great is the difference between the metalloids of which we have hitherto been speaking and the metals; they show an expansion of their lines into bands, while the continuous light takes a less prominent place. In quicksilver the breadth especially of the green and violet lines is conspicuous.

With sodium I have only noticed the great width of the D-lines when they appeared reversed, for I could only examine the light after its passage through a layer of cooler vapour. Sodium gives at high pressures a continuously illuminated spectrum near the D-lines, which then appear reversed; at first one or two lines, but soon they widen and merge into each other, and the dark band of absorption gradually covers the whole illuminated part of the field.

[1] By G. Ciamician, in *Sitz. Ber. der k. Akad. der Wiss.*, Vienna, lxxvii. Band, v. Heft.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Prof. Stuart finds the progress of his School of Mechanism and Engineering again compels enlargement. Some pupils are now making small engines, and require more space for erecting them. A room for mechanical drawing is needed, and also an enlarged stove. The Museums and Lecture-rooms Syndicate think it best in the present condition of University funds to erect a new temporary building 46 feet long by 21 feet wide, adjacent to the present workshop, and this, with other rooms which can be added, will supply present necessities for about 360*l*.

The balance of 821*l*., being the debt on the last two years of the Museums Maintenance Fund, has been granted as an extra payment from the University Chest, and in future years 3000*l*. will be granted annually for the Museums and Lecture-rooms Maintenance Fund.

Prof. Stuart is to have the services of a Demonstrator of Mechanism and Applied Mechanics.

Clare College announces a scholarship of 60*l*. a year in chemistry and chemical physics, botany and geology, to be competed for on March 29 next, without limit of age. Jesus and Magdalene Colleges continue to offer no inducements to natural science.

BY a Royal decree, published last month, a museum will shortly be opened at Palermo on the plan of the one founded in Rome in 1874, with the object of making known the best scholastic materials and best didactic methods adopted with success by the most cultivated and civilised nations. This museum is styled the Pedagogic Museum, and will have its seat in the Royal University. Its aim is to collect, with a view to their recognition and adoption, all objects and publications connected with the mode of instruction in elementary schools, and in general all the new means and appliances which are being successively invented to insure greater efficiency and progress in the arts of instruction and education. All that has till now been collected by the Professor of Pedagogy in the present Museum of Palermo will henceforth belong to the new institution, which is dependent on the Minister of Public Instruction.

SCIENTIFIC SERIALS

THE *Journal of Anatomy and Physiology, Normal and Pathological*, vol. xv. part 1, October, contains:—Dr. C. Creighton, on an infective form of tuberculosis in man, identical with bovine tuberculosis, plates 1 to 6.—Dr. W. Allen, on a third occipital condyle in the human subject, plate 7.—Dr. J. Dreschfeld, some points in the histology of cirrhosis of the liver, plate 8.—Dr. S. Mortiz, a contribution to the pathological anatomy of lead paralysis, plate 9.—Dr. G. S. Middleton, vascular lesions in hydrophobia and in other diseases characterised by cerebral excitement, plate 10.—Dr. D. Macphail, an ether percolator, for use in physiological or pathological laboratories, plate 11.—Dr. D. Newman, the comparative value of chloroform and ethidene dichloride as anæsthetic agents.—Dr. R. Pinkerton, observations on the temperature of the healthy human body in various climates.—Dr. George Hoggan and Dr. F. Elizabeth Hoggan, the lymphatics of cartilage and of the perichondrium.—Dr. R. J. Anderson, a palatine branch from the middle meningeal artery.—J. F. Knott, muscular anomalies.

Journal of the Royal Microscopical Society, vol. iii. No. 5, October.—W. H. Gilbert, on the structure and function of the scale-leaves of *Lathrea squamaria*.—Dr. H. E. Fripp (the late), on daylight illumination with the plane mirror, an appendix to Part I. of the "Theory of Illuminating Apparatus."—W. Webb, on an improved finder.—W. A. Rogers on Tolles' interior illuminator for opaque objects, with a note by R. B. Tolles.—The record of current researches relating to invertebrata, cryptogamia, microscopy, &c.

THE *American Naturalist*, November.—F. M. Endlich, the Island of Dominica.—J. D. Caton, the Sand-hill Crane.—W. K. Higley, on the microscopical crystals contained in plants (concluded).—J. M. Stillman, on the origin of lac (regards it as a secretion of *Coccus lacca*).—Edward L. Greene, botanising on the Colorado desert.—The Editor's table: on the obligations of educational and charitable institutions.

Zeitschrift für wissenschaftliche Zoologie, Band 34, Heft 4, September, contains:—a very elaborate memoir by Dr. Ferdinand Sommer of Greifswald, on the anatomy of the liver-fluke, *Distomum hepaticum*, L., pp. 540-640, with six plates; also by Dr. H. Michels, an account of the nervous system of *Oryctes nasicornis* as it appears in the larval, pupal, and imago conditions of this beetle, pp. 641, 700, with four plates.

Revue Internationale des Sciences biologiques, October 15, contains:—M. Vulpian, a physiological study of poisons; fifth lecture, on curare.—M. Hanstein, protoplasm considered as the basis of animal and vegetable life; introduction.—M. Borodin, on the physiological characteristics of asparagine.—M. L. Portes, on the asparagine of the Amygdaleæ.—G. Thoulet, contributions to the study of the physical and chemical properties of microscopical minerals.

THE *Transactions of the Yorkshire Naturalists' Union*.—Three parts of the above have been issued to the subscribers. These contain reports on the birds of the district, pp. 1-48. On the land and freshwater mollusca, pp. 1-16. On the lepidoptera, pp. 1-80. Botany, pp. 1-51. These reports seem well and exhaustively worked out, and deserve every support from the naturalists of the Yorkshire district and others.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, December 9.—Mr. Samuel Roberts, F.R.S., president, in the chair.—Mr. William Ralph Roberts and Mr. Ralph Augustus Roberts were elected Members.—The following communications were made:—Note sur la Dérivation des Déterminants, Prof. Teixeira (Coimbra, Portugal).—Solution of the equation $xp - 1 = 0$; quinquisection, Prof. Cayley, F.R.S.—A general theorem in kinematics, Prof. Minchin.—On the solution of the inverse logical problem, Mr. W. B. Grove.—Motion of a viscous fluid, Mr. T. Craig.—On the electrical capacity of a conductor bounded by two spherical surfaces cutting at any angle, Mr. W. D. Niven.

Chemical Society, December 2.—Dr. Gilbert, vice-president, in the chair.—The following papers were read:—On the volumes of sodium and bromine at their boiling-points, by W. Ramsay.—On the volume of phosphorus at its boiling-point, by D. O. Masson and W. Ramsay. The authors have determined the atomic volume (the atomic volume = the specific volume × atomic weight) of the following elements in the free state. Bromine 27·135, sulphur 21·60, phosphorus 20·91, sodium 31·00. The authors discuss the formula of oxy-trichloride of phosphorus, and conclude that in that substance phosphorus is a pentad, and that the constitution of that substance is $O{=}P{\equiv}Cl_3$. The atomic volume of phosphorus in this compound is therefore 21·1.—On the specific volume of chloral, by Laura Maude Passavant. Great care was taken in purifying the chloral; the specific volume, determined according to the method of Thorpe, was found to be 107·37.—Note on the formation of carbon tetrabromide in the manufacture of bromine, by J. C. Hamilton. A quantity of a white crystalline substance was obtained as a residue, after distilling a quantity of commercial bromine, it melted at 90°, and contained 97 per cent. of bromine.—Researches on the relation between the molecular structure of carbon compounds and their absorption-spectra, by W. N. Hartley. Part i.—General conclusions as to the nature of actinic absorption exerted by various carbon compounds. Part ii.—Experiments which prove the diactinic character of substances constructed on an open chain of carbon compounds. Part iii.—The actinic absorption exerted by various closed chains of carbon atoms. Part iv.—The absorption-spectra of condensed benzen-nuclei. Part v.—The cause of absorption-bands in the spectra transmitted by benzene and its derivatives.

Geological Society, December 1.—Robert Etheridge, F.R.S., president, in the chair.—Wm. Heward Bell, Wm. Jackson, Peregrine Propert Lewes, William Libbey, jun., D.Sc., New Jersey, U.S.A.; David Morgan Llewellin, John Marshall, Cyril Parkinson, Cornelius McLeod Percy, Thos. John Robinson, Rev. Alfred Rose, Beeby Thompson, and Stuart Crawford Wardell were elected Fellows of the Society.—The following communications were read:—On remains of a small lizard from the Neocomian rocks of the Island of Lesina, Dalmatia, preserved in the Geological Museum of the University of Vienna, by Prof. H. G. Seeley, F.R.S. The author proposed to name this lizard *Adriosaurus suessii*.—On the beds at Headon Hill and Colwell Bay in the Isle of Wight, by Messrs. H. Keeping and E. B. Tawney, M.A. The authors criticised the views put forward by Prof. Judd in his paper published in the *Q. J. G. S.* xxxvi. p. 13, and supported those established by the late E. Forbes and the publications of the Geological Survey. The authors reject Prof. Judd's term Brockenhurst series, and revert to the classification and nomenclature of the Geological Survey.

Zoological Society, November 30.—Dr. Edward Hamilton, vice-president, in the chair.—Mr. Alfred E. Craven, F.Z.S., read a paper on a collection of land and fresh-water shells from the Transvaal and Orange Free State in South Africa, with descriptions of nine new species.—A second paper by Mr. Alfred E. Craven contained the descriptions of three new species of land shells from Cape Colony and Natal.—Surgeon Francis Day, F.Z.S., communicated a paper by Prof. A. A. W. Hubrecht, which gave an account of a collection of reptiles and amphibians made by Dr. C. Duke in Beloochistan.—A communication was read from Mr. J. H. Gurney, F.Z.S., containing a description of the immature plumage of *Dryotriorchis spectabilis* (Schleg.), a very scarce raptorial bird from Gaboon, now living in the Society's collection.—A communication was read from Mr. Roland Trimen, F.Z.S., on an undescribed *Laniarius* obtained by Dr. B. F. Bradshaw on the Upper Limpopo, or Crocodile River, in Southern Africa, which he proposed to name *Laniarius atrocroceus*.—A communication was read from Dr. G. Hartlaub, F.M.Z.S., containing descriptions of five new birds that had been collected by Dr. Emin Bey in Central Africa. These were proposed to be called *Tricholais flavotorquata*, *Cisticola hypoxantha*, *Eminia lepida*, *Drymocichla incana*, and *Musicapa* *infulata*.—Mr. W. A. Forbes, F.Z.S., read a paper on the external characters and anatomy of the Red Ouakari Monkey (*Brachyurus rubicundus*), describing more particularly the liver and brain, and made remarks on the other species of that genus and their distribution.

Anthropological Institute, November 23.—Allen Thomson, M.D., F.R.S., vice-president, in the chair.—The election of W. R. Huggard was announced.—A paper by Dr. Paul Topinard, entitled observations upon the methods and processes of anthropometry, was read. Anthropometry means the measurement of the entire human body with the view to determine the respective proportion of its parts:—1. At different ages, in order to learn the law of relative growth of the parts. 2. In the races, so as to distinguish them and establish their relations to each other. 3. In all the conditions of surrounding circumstances, in order to find out their influence upon the variations ascertained. The number of skeletons at disposal for this purpose being small, all our efforts should tend to make perfect the methods of operating upon the living, and to simplify them, so as to render them accessible to all, to travellers, officers of the navy, recruiting agents, schoolmasters, &c.; hence the number of measurements should be reduced to those strictly necessary, and only those insisted on which are really useful and lead to the knowledge of one of the natural morphological divisions of the body. Heights above the ground, breadths, some circumferences, and perhaps the facial angle—to these we ought to limit our demands. The dimensions to be obtained directly, or by the method of subtraction, relate to:—1. The trunk. 2. The head and the neck taken separately. 3. The lower limb as a whole. 4. The upper limb as a whole. 5. Each of the segments of the limbs, the hand, the forearm, and the arm in the one case; the foot, the leg, and the thigh in the other. 6. The intrinsic proportions of the head, of the trunk, of the foot, and of the hand. Three fundamental principles to be observed are, determination and marking the reference points *slowly*, taking the measurements quickly, and the possession of good instruments. The choice of reference-points is a matter of great importance, and the author explained his views upon this subject.—A paper by Mr. C. Staniland Wake on the origin of the Malagasy was read.

Physical Society, November 27.—Prof. W. G. Adams in the chair.—New Member, H. C. Jones, F.C.S.—Prof. Graham Bell exhibited his photophone, and explained the apparatus employed by Mr. Sumner Tainter and himself for transmitting sound by a beam of light. The form in use consists of a metal plate or mirror vibrated by the sound and reflecting a beam of light to a distance, where it is focussed on a selenium cell in circuit with a telephone and battery. The light undulates in sympathy with the vibrations of sound, and alters the resistance of the selenium in accordance with the vibrations, thereby reproducing the sound in the telephone. The electric light used was too unsteady to give articulate speech; but by means of a rotating disk perforated round its rim with holes the light could be occulted in such a manner as to give an audible note in the telephone. Different varieties of receivers were described, some of which have not yet been tried. One of these consisted in varying the rotation of the plane of polarisation of the polarised beam. A plan for transmitting the beam consists in making the vibrating plate vary the supply of gas to a jet or manometric flame. The farthest distance speech has been heard by a photophone is 800 feet; but theoretically it should operate better the greater the distance between the mirror and selenium. On interposing a sheet of hard rubber in the ray, the invisible rays passing through it conveyed the sounds in a lower degree, and sounds can be heard by replacing the selenium receiver by disks of different materials, such as hard rubber, metal, &c., and simply listening at them. All substances appear to possess the power of becoming sonorous under the influence of varying light. Hard rubber, antimony, zinc, give the best effects; paper, glass, carbon, the worst. Even tobacco-smoke in a glass test-tube held in the beam emitted a note, as also did crystals of sulphate of copper. When hard rubber was simply made into the form of an ear-tube and held in the beam, the audible effect was also produced, and in fact when the beam was focussed in the ear itself, without any other appliance whatever, a distinct sound could be perceived.—Prof. Adams thanked Prof. Bell in the name of the Society, and called on Mr. Shelford Bidwell, who exhibited a lecture photophone, in which the reflector for receiving the light was discarded and the beam focussed on the selenium by a lens. The two lenses used cost only 25*s.*, and the beam was sent fourteen feet. The selenium cell was made by spreading melted selenium over sheets of mica, and then crystallising it by heat. For mica Prof. Bell recommended microscopic glass. The resistance of the cell was 14,000 ohms in the dark, and 6500 in the light. Speech was distinctly transmitted by this apparatus. Mr. J. Spiller thought that since selenium probably alloyed with brass and the baser metals, it would be better to use gold and silver for the cells; but Prof. Bell said that he preferred brass, since (perhaps for the reason that Mr. Spiller gave) it yielded the best results.—Dr. J. H. Gladstone read a paper on the specific refraction and dispersion of isomeric bodies—an extension of his paper of last June. He concluded that the dispersion of a body containing carbon of the higher refraction is very much greater than that of a body containing carbon of the normal refraction 5, and that isomeric bodies which coincide in specific refraction coincide also in specific dispersion.

Entomological Society, December 1.—Sir John Lubbock, F.R.S., president, in the chair.—Mr. Pascoe exhibited a large series of *Arescus histrio* from Peru, to show the extreme variability of the elytral markings in this species.—Mr. Billups exhibited four species of *Pezomachus* new to Britain, viz., *P. Mülleri*, *P. juvenilis*, *P. intermedius*, *P. incertus*, and also exhibited twenty species of Coleoptera found in a small parcel of corn refuse. The president exhibited two specimens in alcohol of a species of *Phasmidæ* forwarded by a correspondent in St. Vincent. Mr. Cansdale exhibited a specimen of *Tischeria ganacella*, a species of *Tineina*, new to Britain; he also exhibited a remarkable variety of *Cidaria russata*.—Mr. J. Scott communicated a paper on a collection of Hemiptera from Japan.—Mr. C. O. Waterhouse read a paper entitled description of a new species of the anomalous genus *Polyctenes*, and exhibited a diagram illustrating the structure of this insect.

Royal Asiatic Society, November 15.—Sir H. C. Rawlinson, K.C.B., F.R.S., president, in the chair.—Sir W. R. Robinson, K.C.S.I., S. S. Thorburn, Capt. R. Gill, R.E., and the Rev. Marsham Argles, M.A., were elected Resident Members; and the Bishop of Lahore, Lieut. H. E. McCallum, R.E., S. W. Bushell, M.D., and Abd-er-rahman Moulvie Syed, barrister-at-law, Non-resident Members.—Prof. Monier Williams, C.I.E., read a paper on Indian theistic reformers, in which, after showing that Monotheism was not of recent growth in India, he traced the development of the modern Theistic churches there, from Rammohun Roy, who formulated a system which may be described as Unitarianism based on Brāhmanism, through his successor, Debendra Nāth, who improved on Rammohun Roy's work by founding the Adi Brāhma Samāj, to Keshub Chundar Sen, who threw off altogether both Brāhmanism and caste, and founded his new progressive Brāhma Samāj in 1866. In his present eclectic form of Theism, composed of Hinduism, Mahammedanism, and Christianity, he teaches the worship of God under the character of a Supreme Mother. Some of his followers, offended with him, chiefly for marrying his daughter before she was fourteen to the Mahārāja of Kuch-Behar, have recently set up a new Theistic Church called the Sudhārana Brāhma Samāj, or Catholic Church of God. There are now more than 120 Theistic churches in different parts of India.

Royal Microscopical Society, December 8.—Mr. J. Glaisher, F.R.S., in the chair.—Eight new Fellows were elected.—Mr. Wallis exhibited a new rotating substage; Mr. Mayall his form of spiral diaphragm, and Tolles' mechanical stage of extra thinness, and Mr. Crisp Crouch's histological microscope, Parkes's demonstrating microscope, Holmes's compressorium, and Atwood's rubber-cell.—A paper by Dr. Hudson was read, on a new *Œcistes* (*Janus*), and a new *Floscularia* (*trifolium*), found by Mr. Hood of Dundee in Loch Lundie. The trochal disk of the former formed a link between that of *Melicerta* and *Œcistes*. The latter was remarkable in having only three lobes and being much larger than any Floscularia hitherto known.—Mr. Stewart explained some peculiar structural features of the Echinometridæ, illustrated by specimens and drawings.

Institution of Civil Engineers, November 9.—Mr. W. H. Barlow, F.R.S., president, in the chair.—The paper read was on machinery for steel-making by the Bessemer and the Siemens' processes, by Mr. Benjamin Walker, M. Inst. C.E.

December 7.—Mr. W. H. Barlow, F.R.S., president, in the chair.—The paper read was on the different modes of erecting iron bridges, by Mr. Theophilus Seyrig, M. Inst. C.E., of Paris.

Royal Society of Literature, November 24.—Mr. Charles Clark, vice-president, in the chair.—Sir Hardinge Stanley Giffard, Mr. Ramchundra Ghose, Mr. Henry Allpass, Mr. Robert White Boyle, Capt. W. Deane Seymour, Dr. Altschul, were elected members.—Mr. F. G. Fleay read a paper entitled the living key to English spelling reform now found in history and etymology. The object of Mr. Fleay's paper was to show that the objections to spelling reform are principally founded on an exaggerated estimate of the amount of change required. This exaggeration has been caused by the revolutionary proposals of the leading reformers, who neglected the history of our language and the etymological basis of its orthography in favour of philosophical completeness. Mr. Fleay, on the other hand, proposed a scheme which was developed in two forms, one perfectly phonetic for educational purposes, the other differing from this only in dropping the use of the accents and the one new type required in the former. He showed that even in the vowel sounds not one-tenth would need alteration, while in the case of the consonants the alteration required would of course be much less.

Photographic Society, November 9.—J. Glaisher, F.R.S., president, in the chair.—Major Waterhouse, Bengal Staff Corps, read a paper "On a new method of obtaining 'grain' in photo-engraving." The method alluded to was to squeeze into the gelatine relief, while wet, sand- or glass-paper, previously waxed to ensure removal. The contraction of the paper while drying would force the granular substance into the relief more strongly in the shadows than in the lights, and thus a discriminating grain would be produced.—Capt. Abney, R.E., F.R.S., read a paper, "Notes on the gelatine process." The point insisted upon was that gelatine emulsions if kept some time before being poured upon the plates, extra sensitiveness would be the result; another matter was, that "frilling" could be prevented by the same long keeping of the emulsion; also that with emulsions where silver iodide is used, a few drops of hyposulphite of soda would bring out more detail in the image.

Cambridge

Philosophical Society, November 8.—Prof. Newton, president, in the chair.—The following communications were made to the Society:—On a new arrangement for sensitive flames, by Lord Rayleigh. A jet of coal-gas from a pin-hole burner rises vertically in the interior of a cavity from which the air is excluded. It then passes into a brass tube a few inches long, and on reaching the top burns in the open. The front wall of the cavity is formed of a flexible membrane of tissue paper, through which external sounds can reach the burner. The principle is the same as that of Barry's flame described by Tyndall. In both cases the *unignited* part of the jet is the sensitive agent, and the flame is only an indicator. Barry's flame may be made very sensitive to sound, but it is open to the objection of liability to disturbance by the slightest draught. A few years since Mr. Ridout proposed to inclose the jet in a tube air-tight at the bottom, and to ignite it only on arrival at the top of this tube. In this case however external vibrations have very imperfect access to the sensitive part of the jet, and when they reach it they are of the wrong quality, having but little motion transverse to the direction of the jet. The arrangement now exhibited combines very satisfactorily sensitiveness to sound and insensitiveness to wind, and it requires no higher pressure than that of ordinary gas-pipes. If the extreme of sensitiveness be aimed at, the gas pressure must be adjusted until the jet is on the point of flaring without sound. The apparatus exhibited was made in Prof. Stuart's workshop. An adjustment for directing the jet exactly up the middle of the brass tube is found necessary, and some advantage is gained by contracting the tube somewhat at the place of ignition.—Lord Rayleigh, on an effect of vibrations upon a suspended disk. In the British Association experiment for determining the unit of electrical resistance, a magnet and mirror are inclosed in a wooden box, attached to the lower end of a tube through which the silk suspension fibre passes. Under these circumstances it is found that the slightest tap with the finger-nail upon the box deflects the mirror to an extraordinary degree. The disturbance appears to be due to aërial vibrations within the box, acting upon the mirror. We know that a flat body, like a mirror, tends to set itself across the direction of any steady current of the fluid in which it is immersed, and we may fairly suppose that an effect of the same character will follow from an alternating current. At the moment of the tap upon the box the air inside is made to move past the mirror, and probably executes several vibrations. While these vibrations last the mirror is subject to a twisting force tending to set it at right angles to the direction of the vibration. The whole action being over in a time very small compared with that of the free vibrations of the magnet and mirror, the observed effect is as if an impulse had been given to the suspended parts. The experiment shown is intended to illustrate this effect. A small disk of paper, about the size of a sixpence, is hung by a fine silk fibre across the mouth of a resonator of pitch 128. When a sound of this pitch is excited, there is a powerful rush of air in and out of the resonator, and the disk sets itself promptly across the passage. A fork of pitch 128 may be held near the resonator, but it is better to use a second resonator at a little distance, in order to avoid any possible disturbance due to the neighbourhood of the vibrating prongs.

Paris

Academy of Sciences, November 29.—M. Edm. Becquerel in the chair.—MM. E. and J. Brongniart presented a work on the silicified fossil seeds of strata of Autun and Saint Etienne, to which their father had devoted the closing years of his life. These researches led, among other things, to observation of a pollinic chamber in some living as well as in fossil species of seeds.—Note relating to a memoir on vision of material colours in rotation, and velocities estimated in figures by means of the turning-plate apparatus of General Morin, for observation of the laws of motion, by M. Chevreul.—On the spontaneous oxidation of mercury and of metals, by M. Berthelot. He concludes from experiment that mercury, like iron, zinc, cadmium, lead, copper, and tin, undergoes, in contact with air, a superficial oxidation, very slight, indeed, and limited by the difficulty of renewal of the surfaces and the absence of contact resulting from commenced oxidation. This agrees with thermic data. The oxidation of mercury liberates per equivalent of fixed oxygen +21·1 cal. (iron 31·9, tin 34·9, &c.). Spontaneous oxidation is not appreciable in metals whose heat of oxidation is very small, *e.g.* silver (+ 3·5 cal.). The greater rapidity of the reaction where an agent intervenes, which is capable of combining (with liberation of heat) with the substance produced, *e.g.* an acid, is shown to be in agreement with thermic theory.—On the propagation of light, by M. Gouy. He examines the case in which the rays have a constant direction, but vary in intensity, the source undergoing variations or being eclipsed by a moving screen. There is not, for a given homogeneous source, a determinate velocity of light, independent of the manner in which the amplitude is varied. But in every realisable experiment this variation is effected in a gradual and very slow manner relatively to the vibratory period; here the formulæ are simplified and the amplitude is transported as in a non-dispersive medium (with a velocity which is indicated by formula). The index of refraction is connected with the velocity of light by a relation easy to establish.—On linear differential equations with periodic coefficients, by M. Floquet.—On a new electric property of selenium, and on the existence of tribolectric currents properly so-called, by M. Blondlot. To one pole of a capillary electrometer a piece of annealed selenium is attached with a platinum wire; to the other pole a platinum plate. If the selenium be brought (with an insulating handle) into contact with the platinum the electrometer remains at zero; but on rubbing the selenium against the platinum a strong deflection occurs (often equal to that produced by a sulphate of copper element). The thermo-electric current got by heating the selenium-platinum contact has an opposite direction to that of the current in question (which is from the unrubbed to the rubbed part of the selenium); thus the effect cannot be attributed to heat. On ceasing to rub, the deflection persists; the selenium, which let pass the high-tension electricity due to friction, opposing too great resistance for the weak polarisation of the mercury. Shock and even pressure produce the same effect as friction, though in less degree.—Action of phosphorus on hydriodic and hydrobromic acids, by M. Damoiseau.—On Waldivine, by M. Tanret. This is the active principle of the fruit of *Simaba waldivia*, which grows in Columbia. The composition of the crystals is represented by $C_{36}H_{24}O_{20}5HO$. The physical and chemical properties are described.—Direct analysis of peat; its chemical constitution, by M. Guignet. This relates to peat of very modern formation in the Somme Valley, formed under water in presence of carbonate of lime. Treated with water it yields *crenic* and *apocrenic* acid, also a little sulphate of lime. Alcohol at 90° produces a clear green solution, from which vegetable wax is got in abundance (the green matter has all the characters of chlorophyll). The presence of *glucosides* can also be proved. Part at least of the total nitrogen of the peat (amounting to 3 per cent.) enters into the composition of the brown matters.—On the geology of the Northern Sahara, by M. Roche. *Inter alia*, he found in the middle of the Great Erg, south of Ouargla, a broad plane region about 250 km. long, covered only with isolated parallel dunes lying along the magnetic meridian; an important feature for the Trans-Saharan railway. All the strata of the Northern Sahara are nearly horizontal.—On some phenomena of optics and vision, by M. Trève. Looking at a lamp-flame through a fine slit in a disk, the brightness and the diffraction effects vary much, according as the slit is vertical or horizontal.—M. Maumené in a note attributes the difference of experimenters as to absorption of oxygen by mercury to more or less silver contained by the mercury.—M. Dubalen announced the discovery of a prehistoric grotto in the Department of Landes.

December 6.—M. Edm. Becquerel in the chair.—The following papers were read:—On the development of any function of the radius-vector in elliptic motion, by M. Tisserand.—Spectral reaction of chlorine and bromine, by M. Lecoq de Boisbaudran. For detecting minute traces he fuses on the hooked lower end of a platinum wire some pure carbonate of baryta; places in the bend a drop of the liquid to be examined; then evaporates, heating momentarily to a nascent red (with partial fusion); another platinum wire is then brought near the bend from below, and the induction spark gives a spectrum with lines of $BaCl_2$ or $BaBr_2$. The $\frac{1}{5000}$ mgr. of chlorine or bromine may be thus detected.—M. Brioschi was elected correspondent in geometry in room of the late M. Borchardt.—On the action of water in applications of sulphide of carbon to phylloxerised vines, by M. Catta. He shows the injurious action of excessive humidity. The sulphide need not be in the liquid state if the ground be quite saturated with water.—On the swarming of phylloxera in 1880, by M. de Lafitte. This has been small, almost nil in some parts. The phenomenon is probably periodic, with a two years' period.—On mildew, *Peronospora* of vines (*Peronospora viticola*, Berk. and Curt.), by M. Cornu. This mildew will soon (perhaps next year) have spread over all France; and it is still almost unknown in regions where it prevails. The grape is not directly attacked, but the plant is injured, often disastrously.—New process for destruction of kermes of fig (*Ceroplastes rusci*, Lin.), by M. Gennadius. The insects may be got rid of by making a number of incisions on the trunk and branches, causing the plant to lose a large quantity of latex.—Observations of comet *d* 1880 (Hartwig) at Paris Observatory, by M. Bigourdan.—On the same comet and on Swift's comet (*e* 1880), by MM. Schulhof and Bossert. He obtains for the former a revolution of 1280 years (uncertain); for the latter, $5\frac{1}{2}$ years.—On the method employed by Aubuisson in 1810 for measurement of geodetic bases, by M. Laussedat. This is, in substance, the same as the method now recommended exclusively by the International Geodetic Commission.—On the calculation of heights by means of barometric observations, by M. Angot. He cites some figures as showing the precision of his new method.—On the distribution of temperatures in the lower strata of the atmosphere, by M. André. From observations on the north and south slopes of Mont Verdun (625 m. in height) he infers that in the same vertical the distribution of temperature up to a certain height is absolutely indeterminate, thin hot- and cold-air currents being superposed on one another. The mode of superposition is in direct relation to the centres of high and low pressures.—On radiophony, by M. Mercadier. This name he gives to the phenomenon lately discovered by Prof. Bell. He shows reason for thinking it is not an effect of the mass of the receiving plate vibrating as a whole. Also the nature of the molecules of the receiver and their mode of aggregation do not seem to have a predominant *rôle* in the nature of the sounds produced. These sounds (he thinks) are due principally to direct action of calorific radiations on the surface of the receiver. (He got the maximum effect with invisible vibrations in the red and infra red.)—On the existence of perboric combinations, by M. Etard. Boric acid in presence of oxygenated water acts like a different acid, though of little stability: perboric acid.—On cobaltamines, by M. Porumbaru.—Researches on the comparative anatomy of the nervous system in the different orders of the class of insects, by M. Brandt. He gives the results of his own observations on Coleoptera, Lepidoptera, Diptera, and Hemiptera.—On a new form of vesicular worm, with exogenous gemmation, by M. Villot. This is named *Urocystis prolifer*, is a parasite of *Glomeris limbatus*, and has the peculiarity of living in the same host in different degrees of development; in the vesicular state proper, in the visceral cavity; in the state of scolex, encysted in adipose tissue. Buds are successively formed (containing a scolex) and detached.—Habits of a fish of the family of Silures, the *Callichthys facratus*, Cuvier, by M. Carbonnier. Its mode of reproduction is peculiar.—New researches on saxifrages; applications of their products to the arts and to therapeutics; experiments on their cultivation, by MM. Garreau and Machelart. Attention is called to a new substance, *bengenin*, obtained from the stocks; in the free and crystalline state it is represented by $C_6H_4O_4$. It is a strong neuro-sthenic tonic (between quinine and salicine). The tannin and fecula also obtainable, further recommend the cultivation of saxifrages.—On a process of meat-preservation by means of dextrine, by M. Senre. Meat dried and preserved with dextrine has remained unaltered twenty months, exposed to air.—The meteors of November 14, 1880, observed at Moncalieri (Italy), by M. Denza. Four observers counted thirty-seven in three-quarters of an hour. More than a third belonged to the stream of the Leonides, and they were the most beautiful.

VIENNA

Imperial Academy of Sciences, December 9. Dr. Fitzinger in the chair.—Researches on Liverworts; 6. Marchantieæ, by Herr Leitgeb.—On the watercourses of middle Europe, and the importance of regulation of the Danube, with special reference to the stretch between Theben and Gönyö (Hungary), by Herr Lanfranconi.—On the formation of germinal layers in the hen's egg, by Herr Koller.—On combinations of chloride of calcium with fatty acids, by Herr Lieber.

Imperial Institute of Geology, December 7.—Geological map of the environs of Gratz, by Herr Hörnes.—On a new mineral, *schneebergite*, by Herr Brezina.—Tectonics of the dioritic eruptive rocks of Klausen (Tyrol), by Herr Teller.—Geological map of Gorlice, by Herr Trajnocha.—On Predazzo, &c., by Herr Reyer.

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