THURSDAY, JULY 26, 1883

ZOOLOGY AT THE FISHERIES EXHIBITION

I.

THE manifold relations of zoological science to the various fish industries are, on the whole, fairly well illustrated in the Kensington Exhibition if we take together into consideration all the exhibits of foreign countries, of these islands, and of British colonies. Considered alone, however, the British department is remarkable for the extreme paucity and insignificance of exhibits having any scientific value. This is due to the fact that no attempt was made by those who organised the exhibition to obtain scientific advice and direction, so as to enable them to make application to the individuals or museums possessing objects illustrating the scientific aspects of fish and fisheries, and that no individual with authority and responsibility has attempted to bring together that class of objects—which are abundant enough in both private and public collections in England, and form, on the contrary, a large portion of the exhibits of foreign countries. Thus under the direction of a properly-trained zoologist—Prof. Spencer Baird—the Smithsonian Institute has been able to form a collection which is sent over to this country by the American Government as the official representative collection. It is not an exaggeration to say that this collection, both on account of the range and variety of its objects and the instructive way in which they have been disposed and treated by the American Commissioner, Mr. Brown Goode, has been the admiration of all visitors. Similarly the Swedish authorities have intrusted Prof. Smidt with the duty of bringing together objects illustrating the zoological aspect of fish and fisheries in Sweden. Collections from the museums of Gothenburg and Stockholm and from eminent Swedish zoologists are consequently exhibited in the Swedish department. So also in the case of the Netherlands, of British India, and of New South Wales, we find the well-known naturalists, Prof. Hubrecht, Dr. Francis Day, and Mr. Ramsay, specially charged with such responsibility.

There can be no doubt that the collections, both public and private, of this country, might have been brought into requisition and made to furnish such an exhibition of marine and freshwater fishes, of their food, of their parasites, and other enemies, and again of the like objects in relation to oysters (both edible and pearl-bearing), lobsters, sponges, and precious coral, as no other country could possibly bring together.

The exhibits of zoological specimens may be classed under three heads, viz. (1) those which are strictly zoological, that is to say, intended to illustrate either the aquatic inhabitants of a particular district, or the structure and life history of a particular species; (2) those of economic significance, illustrating the cultivation or modes of occurrence of an aquatic organism or organisms having a direct commercial importance; (3) those having an ornamental or personal value, and being of the nature of trophies, such, for instance, as Lady Brassey's case of corals, and the many cases of dried stuffed skins of large trout and pike exhibited by angling societies.

The most important collection of the first group is one comprising representatives of all classes of marine animals preserved in alcohol, and numbering nearly 400 specimens. It is sent by Dr. Anton Dohrn, the director of the Zoological Station of Naples, and is not placed in the Italian court, but in the Eastern Arcade, since it is sent by a private individual, and not through the Italian Government. The remarkable feature about this collection is the extraordinary beauty of the specimens in respect of preservation. Every naturalist is aware of the difficulty of getting such creatures as polyps, jelly-fish, and Salpæ to retain when placed in a preserving fluid anything like a satisfactory semblance of their living form and colour. To improve the methods of preserving marine organisms for museums and the workshops of comparative anatomists has been for some years one of Dr. Dohrn's objects in the work of his "Station," and this collection shows how far he and his assistants have succeeded in devising methods. To appreciate Dr. Dohrn's success, we have only to pass to some of the other collections—very good in their way, and showing the best state of the bottling-art out of Naples—and by the inferiority of the condition of the specimens in the latter we learn Dr. Dohrn's merit. Sudden killing with saturated solution of corrosive sublimate and gradual transfer to strong alcohol is one general method used at Naples for retractile polyps and fragile worms; brief immersion in weak chromic acid before transfer to weak spirit is another method used for jelly-fish and mollusks; narcotising by aid of tobacco-fumes another device. But the skilful application of such ingenious processes variously appropriate to this or that kind of animal can only be satisfactorily learnt in the Naples laboratory itself. Accordingly Dr. Dohrn has made arrangements for giving special instruction in this subject to naval officers and others, such persons being admitted for a fee paid by the Governments to which they belong, to a three months' course of instruction in the preservation of marine organisms for scientific purposes. Already, much to the credit of the naval departments of their respective Governments, both German and Italian officers and navy surgeons have been sent to receive such instruction at Naples, and a collection of coral-polyps and Siphonophora has been received from Monte Video, prepared by an Italian officer who had availed himself of the Naples course of instruction. This collection has been pronounced superior in condition and fitness for study to any collection from tropical waters hitherto brought to Europe. A second collection made by the same officer in Magellan Straits is on its way to Europe. There can be no doubt of the very great value of the new line of activity which Dr. Dohrn has traced for the Naples Station.

The Naples exhibit contains some interesting fish and a particularly fine series of Salpæ, of Mollusks, and of Anthozoa and Medusæ. It should not be allowed to return to Naples, and we believe is offered for sale. Dr. Dohrn also exhibits the publications, comprising many beautiful coloured plates, of the Naples Zoological Station. The series of volumes illustrating the "Fauna and Flora of the Gulf of Naples" should be in the library of every lover of natural history.

Second to Dr. Dohrn's collection, but of value as a complete *local* collection of all classes of marine animals, is that from the Gothenburg Museum exhibited by Mr. Oscar Dickson. The most interesting specimens here are several series illustrating the development of Pleuronectid and other fishes.

A very interesting general collection is exhibited by the Government of New South Wales, in spite of some mishaps to bottles in the course of a long journey. The Sydney Museum promises to become one of the grandest zoological institutions in the world, the colonial Government having appreciated the unique interest attaching to the natural history of the Australian continent, and wisely having determined that what money can do to build up in Sydney *the* great illustrative collection dealing with that subject, shall be done. Though not exhibited as examples of preservation as are Dr. Dohrn's series, nor labelled and identified with neat accuracy as are Mr. Dickson's, yet the Australian collection now at Kensington is of great interest to the professional zoologist, comprising many marine invertebrates as yet undetermined. It is under the charge of Mr. Ramsay, the accomplished curator of the Sydney Museum, who has brought over some of the reserve stores of the collection under his charge.

The American exhibit has the advantage of being the actual permanent collection of the National Museum of Washington, which has come into existence under the combined auspices of the United States Fisheries Commission and the Smithsonian Institute. The whole collection is not here, but we have a considerable part of it. For example, an admirable series of coloured casts of the fishes of the American waters, lifesize reproductions of the gigantic Octopus and Architeuthis, a complete series of the Crayfishes (Astacidæ) of North America and of the edible Crustacea generally, and samples of the more remarkable forms of life obtained in deep-sea exploration off the American coast.

In relation to the deep-sea specimens, we cannot but regret that no collection is shown in the Exhibition illustrating the results of the *Challenger* and other exploring expeditions conducted by the British Government. No such collection has, we believe, ever been presented to the inspection either of the general public or of professed zoologists, and the present would have been a very suitable occasion for such an exhibition. Whilst the Americans have taken the trouble to send across the Atlantic the newest dredging and sounding apparatus devised and employed by Agassiz, Sigsby, and others in their recent explorations of the deep-sea bottom, no such exhibit on the part of our own authorities is to be found.

In the Canadian department there is no general collection of any scientific importance, but amongst the zoological specimens, which (so far as the Invertebrates are concerned) are nearly all erroneously named, badly preserved, and unintelligently arranged, are some which are noteworthy. A bottle four feet high from British Columbia contains several specimens (nearly putrid) of the remarkable Pennatulid *Osteocella*, with flesh and polyps attached. Some ten years ago the calcified axes of these Alcyonarians excited considerable discussion in England, being mistaken by an eminent zoologist for the notochord of an unknown fish. In another bottle is a fine specimen (not labelled) of the very rare *Cryptochiton Stelleri*, whilst in one of the table-cases is a very large and probably new Hexactinellid sponge.

The collections from British India are remarkable, as comprising the important collection of Indian fishes belonging to Dr. Francis Day. The invertebrate collections are also extensive, but are not fully named.

As a general collection illustrating the British fauna of a certain size and important in relation to the food of fishes, should be mentioned the exhibition of living microscopic organisms by Mr. Thomas Bolton of Birmingham (in the Western Arcade). From day to day various living marine and freshwater Crustacea, Worms, Polyzoa, and Hydroids (also oyster-spat and newly-hatched fishes) are shown in small aquaria and under the microscope by this enterprising and meritorious naturalist. A complete collection of the drawings issued by Mr. Bolton to the subscribers to his weekly "microscopic tubes" (concerning which our advertisement columns may be consulted) is also exhibited.

Special collections dealing with particular groups of animals are to be found scattered in the various foreign and British courts. A collection (preserved in alcohol) of freshwater Crustacea of remarkable completeness is exhibited by Dr. Lilljeborg in the Swedish Court. It comprises most of the species of Cladocera and Copepoda, which inhabit the great Scandinavian lakes and serve as food to fishes. Recently some remarkable species of Cladocera identical with these have been discovered by Mr. Conrad Beck in the lakes of Cumberland, and the collection now under notice has been purchased by two English naturalists to assist them in identifying the species present in the Scotch lakes, which they intend to explore immediately.

Aquatic insects and their larval forms have a special importance for fishes, since the larvæ often feed on young fish or fish-eggs, whilst the adult insects are preyed upon by the adult fish. In the Swedish department there are two interesting collections of such insects, and in the American department are two sample cases from the great collection of Prof. C. V. Riley, which exhibit in the most complete way both by actual specimens and adjacent illustrative diagrams the various phases of life of a few insects the larvæ of which inhabit the water. There is no serious attempt by any English exhibitor to deal with this subject.

In fact most of the English zoological exhibits come under our Classes 2 and 3. There are most complete and valuable collections dealing with the growth of the oyster and the various conditions affecting it, as encountered by the oyster-culturist. The exhibit of Mr. Fell Woods is the most important of these. Mr. Henry Lee shows a very pretty series of oyster-shells and pearls in relation to their importance in the manufacture of ornaments, buttons, &c. As trophies, we cannot pass without a word of admiration the gorgeous cases of corals, sponges, starfishes, and sea-mats exhibited by Miss Gardiner. They include finer specimens and a greater variety than either the trophy exhibited in Lady Brassey's name, or in the series from the Bahamas, which are well worth inspection. It is only proper that a protest should be entered here in the pages of a scientific journal, in referring to the

Brassey collection. Some of the specimens appear to belong to a dealer, Mr. Bryce-Wright, and to these and others he has assigned names as though he were a serious zoologist. This travesty of science should not have been permitted. The names attached to the specimens are either incorrect applications of existing names or are gratuitous inventions (as for instance that of *Brasseya radians*), which can only mislead persons not specially acquainted with the history of corals.

Amongst the gigantic lobsters, clams, and stuffed fish there are some few small collections of scientific merit in the British exhibit. Dr. Francis Day shows a series of British fishes (alcohol specimens), Prof. McIntosh of St. Andrew's some coloured drawings of marine animals admirably executed by his sister, and a series of specimens of the salmon at various stages of development. Dr. Traquair of Edinburgh shows some exquisite drawings of fossil fishes, and H.R.H. the Duke of Edinburgh a collection of shells, scientifically named and arranged.

The parasites of fishes are not well represented in any part of the Exhibition. Dr. Spencer Cobbold shows a small collection of internal and external parasites, and a still smaller series (having, however, some special interest) is to be seen in the Russian court, where also the naturalist should not fail to study Dr. Grimm's important collection illustrating the fauna of the Caspian Sea. The most remarkable exhibit in the way of parasites is that of Dr. Antonio Valli of Trieste, who shows (in the Austrian Court) a collection of eighty-five specimens of Copepod Crustacea parasitic on the fishes of the Adriatic, accompanied by drawings and descriptions.

Curiously enough there is next to nothing in the Exhibition illustrating the diseases of fish. Some stuffed salmon with cotton-wool attached in patches to the head and fins do duty for the "Saprolegnia disease," and a not too accurate drawing of the Saprolegnia itself is exhibited in a part of the building which is about a quarter of a mile distant from the stuffed specimens. In a third locality is a cast of a salmon with cotton-wool also gummed on to represent "the disease," and near it an insufficiently stuffed skin of an old Kelt, which is offered as an example of the effects of "the arrow-headed parasite."

In the space occupied by Chili, China, and the Straits Settlements some specimens of fishes, and of shell-fish, corals, &c., are shown, which are not however scientifically named.

Finally, we would direct the reader's attention to two peculiarly interesting branches of fishery which are represented, though very poorly, in the present Exhibition. These are the sponge fishery and the coral fishery: the pearl fishery appears not to be represented at all. Collections of economic importance, showing the mode of diving for sponges in use in the Levant, and samples of Turkey sponges are shown in the Greek Court by Messrs. Marks and Son. By mistake (as seems probable) a specimen of Hyalonema, from another locality, has been placed in the case containing this fine collection of officinal sponges. From the Bahamas samples of commercial sponges are sent, and also (of very similar quality) from Florida (in the American Court). The propagation of sponges by cutting is illustrated by two specimens in the American collection, but no attempt is anywhere made to show the officinal sponge in its natural state, or to illustrate its life-history and distribution.

Similarly as commercial products we have the precious coral exhibited in the Italian Court by Signor Criscuolo. This exhibitor, however, also shows the method of dredging employed in the Gulf of Naples for obtaining the coral, and displays a number of the wooden cross-bars with stone weights attached, and hempen tangles depending, which constitute the instrument used in this fishery. Specimens of other corals and shell-fish found in association with the red coral are also exhibited.

In no exhibit is there any attempt to illustrate the natural history of the precious coral, although its interest is no less than its value.

A strange illustration of the chance uses of such an exhibition as the present may be found in the Japanese department. Nothing could be worse or more unworthy than the Japanese exhibit. It consists of some sardines, a large crab (*Macrocheira*), *three pieces of red coral*, and some silks and lacquer work. The three pieces of coral are the first commercial examples of a new species of precious coral which will henceforward form an important article of trade for Japan. They have been purchased by Signor Criscuolo at a high price, and are said to be of the very finest quality. The new Japanese coral fisheries are destined to make the fortunes of those who first set them going, and will very possibly seriously injure, if they do not ruin the Neapolitan fishermen. Similar precious coral may in all probability be discovered by dredging operations on the shores of one or more of the numerous British colonies.

On a future occasion we shall publish some notes by Prof. Giglioli of Florence, on the whales, seals, birds, and fishes now to be seen at the Exhibition.

PRECAUTIONS AGAINST CHOLERA

EARLY in the month the Local Government Board issued an Order to Port Sanitary Authorities conferring upon them special powers with a view of preventing the importation of cholera into this country. But cholera is a disease having many degrees of severity, and although "choleraic-diarrhœa" is to be regarded by the Port Authorities as synonymous with the fully developed affection, yet it is at times so mild that it may at any moment escape detection, and those suffering from it may make their way into our towns and villages. To meet such emergencies, and by way of aiding inland authorities and private individuals to rid their districts and their homes of the conditions favourable to the propagation of the cholera infection, a Memorandum on the Precautions against the Infection of Cholera has just been issued by Dr. Buchanan, F.R.S., the chief medical officer of the Local Government Board. The document, whilst expressing no opinion as to the channels of infection and the means of favouring the spread of the disease in other climates, declares with confidence that in England cholera is not infectious in the same degree and manner as are small-pox and scarlet fever, but that the matters which the patient discharges from his stomach and bowels contain the poison, and that their peculiar infectiveness is favoured by special local conditions which give the disease facilities for spreading by "indirect infection." To get rid of these conditions should be our special aim at such a moment.

We have already pointed out how the poisonous discharges infect all receptacles into which they may be received and which tend to retain them, such as cesspools, sewers, and drains; how, when these receptacles are leaky, the soil around them becomes infected, leading to the pollution of air and of the water-bearing strata; and to a less extent it must be remembered that clothing and linen which have become soiled by these discharges are in a similar way liable to retain the infection. But of all these sources of infection none are so dangerous as those which are liable to infect our public water-services; indeed single attacks of cholera in its slightest form may, if the discharges can by means of streams or otherwise reach our water-sources or reservoirs, "exert a terribly infective power on considerable masses of population." Measures of cleanliness, taken beforehand are, according to the Memorandum, of far more importance for the protection of a district against cholera than removal or disinfection of filth after the disease has actually made its appearance, and even if cholera fails to spread to this country all action taken in this direction will, by preventing disease and ill-health from other causes, in the long run turn out to be remunerative.

Immediate investigation as to the wholesomeness of water-services should be made. The sources and the reservoirs should be examined by the authorities; intermittent services should, as far as possible, give way to constant supplies; cisterns should be kept scrupulously clean, and above all the waste-pipes leading from them should be so contrived as to flow in the open air. All accumulations of filth and house refuse should be removed regularly and at frequent intervals from the proximity of dwellings; house-drains and waste-pipes should be well ventilated, and so disconnected from the main sewers as to prevent the possibility of air from the public culverts from making its way into them. Action in these directions will do more to save households from infection than all the quarantine measures ever devised, and it is the absence of such action that has enabled cholera to spread itself broadcast throughout Egypt, notwithstanding the rigid measures of quarantine that have been adopted in that country.

THE LIFE OF EDWARD HENRY PALMER

The Life and Achievements of Edward Henry Palmer. By Walter Besant, M.A. (London: Murray, 1883.)

THE tragedy of Palmer's death gives his biographer the right to look to a wider circle of readers than would in ordinary cases feel interest in the life of an Oriental scholar and explorer. Mr. Besant has used his opportunity with the skill of an accomplished story-teller. Those who have dipped into the author's imaginative works will quickly recognise the familiar methods of art by which the reader's interest is sustained and carried on, the whole narrative disposed so as to lead up to the final catastrophe, and the figure of the hero invested even from childhood with something of an unearthly glamour. This method of treatment is a little disappointing to those who do not need to have their interest in Palmer stimulated, but only wish to learn as much about him and his work as possible; but it is fair to remember on the one hand that Mr. Besant is no Orientalist, and so naturally looks at Palmer's linguistic achievements through a mysterious haze, the effect of which is very artistically imparted to the reader's mind, and on the other hand that the exceptional nature of Palmer's powers, and the exceptional course of education in which these powers found their fitting development, are really calculated to stir the sentiment of wonder which the biographer has chosen to make the keynote of his book.

Palmer's linguistic talent was not analytical but mimetic; it was associated in his youth with histrionic tastes; and the love of mimicry, as Prof. Nicholl has well observed in his appendix on "Palmer's Work as an Oriental Scholar," had a large part in his literary compositions in Oriental tongues. It was through the mimetic faculty—not of course by mere vulgar superficial mimicry, but by a child-like gift of sympathy and imitation—that Palmer learned languages. His teachers were men, not books; and when he learned Arabic, for example, he did not merely learn grammar and vocables, but acquired the power of thinking and expressing himself like an Arab. When he spoke or wrote an Eastern tongue he seemed to be for the time a real Oriental; to hear him recite Arabic was to feel one's self carried back to a camp in the desert. The talent, or rather the type of mind, which all this implies is very rare in the West; in the East it is more common, though hardly in the perfection in which Palmer possessed it; and this perhaps is the reason why Oriental languages ultimately became the study of his choice. His gifts put him in thorough sympathy with the tastes and aims of modern Oriental scholarship; it was the later models of Eastern literature, themselves imitative and full of dexterous variations of fixed themes rather than of original ideas, that fascinated him and called forth his powers in not unsuccessful rivalry with the best native writers of the day. The precise character of Palmer's scholarship cannot be expressed by a single Western term. He was more than a linguist and yet less than, or other than, a scholar of the Western type; for he was singularly destitute of the critical faculty which we esteem inseparable from scholarship. He was in a word an Oriental *Adîb*, a man who loved language for the feats that could be done with it, and not for the ulterior scientific purposes which are the chief concern of most Western Orientalists.

Mr. Besant does not seem to have clearly grasped the peculiar type of Palmer's learning. He sees that he differed from most Orientalists; but he has the curious notion that the difference lay in a sort of grammatical pedantry which Palmer lacked, and to which other men give undue importance. That of course is purely imaginary. Palmer more nearly perhaps than any other Occidental who ever lived realised the Eastern ideal of literary culture. But the best Western Orientalists have been great just because they had a different and, it must be added, a more fruitful conception of the aims and uses of linguistic knowledge than the East has attained to. In criticism, in comparative philology, in the use o language to throw light on the past history of our race, Western scholars have solved problems which the most accomplished Oriental never even contemplates, and in this department Palmer, true to the masters and models from whom he drew his lore, never excelled and never even showed much interest. His history of Jerusalem, his introduction to the Koran, and writings of a similar class, on which Mr. Besant lavishes praise as freely as on his really marvellous exploits in other lines, are disappointing performances; and it is extremely unjust to his memory to speak of them as if they displayed any part of his real strength. The same want of discrimination appears in a more unpleasant form in the querulous tone which runs through the book and represents every honour conferred by his University on other Orientalists as a gratuitous insult to Palmer's reputation as a scholar. The University was certainly happy which possessed in its two Arabic chairs men like Palmer and Wright, so different from one another, yet each unrivalled in his own line. But it is absurd to fasten a charge of unfairness on the University because in the candidature for the Adams chair it preferred the senior scholar. For the maintenance of the scientific *diadoche* in the characteristic features of the modern European school of Semitic learning Dr. Wright had qualifications to which Palmer never pretended—*e.g.* a profound comparative knowledge of the dialects—and the choice which Mr. Besant ascribes to petty motives was made on principles obvious to all who knew the case, and received the unanimous approval of learned Europe. The personalities which disfigure this part of the biography are based on a perfect tissue of errors as to fact; and the groundless charge of intrigue brought against honourable names acquires all its plausibility from statements which with the smallest care might have been seen to be erroneous. The very year of the election is wrongly given—1871 for 1870—a somewhat important error, as in the earlier year none of Palmer's principal writings had appeared; the salary is given at 300*l.* instead of 70*l.*; the fellowship at Queens', subsequently conferred on Dr. Wright to facilitate the conversion of a non-resident into a resident chair, is represented as a bribe to induce Dr. Wright to be a candidate, whereas in point of fact the election took place without his knowledge or consent. That Mr. Besant's researches into the facts on which his interesting record is based have been very slight appears all through the book—he is for example unable to say positively whether Palmer wrote articles which have appeared *with another signature* in the "Encyclopædia Britannica"—but the carelessness of the bookmaker deserves a stronger name when it touches the honour of men who are still living, and with whom Palmer himself continued to maintain friendly relations after the "insult," as Mr. Besant calls it, which "never was forgotten or forgiven."

The life of Palmer, who learned so much from the living voice, and had a unique gift of adapting himself to every kind of human life, must have been rich in incidents of the most interesting and instructive kind. Unhappily he does not seem to have kept full record of these, and except in the account of his last wonderful journey from Gaza to Suez we seldom hear his own voice in this volume. The reviewer knows from his own intercourse with the gifted traveller that but a small part of Palmer's observations in the East was ever given to the world, and as he certainly had many jottings—at least in Arabic if not in English—there was some reason to hope that the biography might make important additions to our knowledge of a land and race in which science as well as literature has a deep interest. This hope has not been realised; little is added to our knowledge of Palmer's earlier travels except one or two striking anecdotes. Are there no note-books to be found which can still supply this blank?

One is sorry to find so many grave faults with a book which after all gives a brilliant if not a discriminating picture of a very remarkable and attractive character; and it would be wrong to close without a word of thanks for the history of the heroic task, undertaken in no foolhardy spirit but in a spirit of courageous patriotism, which cost Palmer his life and England one of her most brilliant sons. Many points in the tragedy still remain obscure; but enough has now been set forth to leave upon the reader a profound impression of the intrepid bravery, the ready resource, the genuine devotion to duty, which, still more than his rare gifts of intellect, will keep the memory of Palmer green in the hearts of a people which prizes true manhood above the profoundest learning.

W. ROBERTSON SMITH

ANTS AND THEIR WAYS

Ants and their Ways. With Illustrations, and an Appendix giving a Complete List of Genera and Species of the British Ants. By the Rev. W. Farren White, M.A., M.E.S.L., Vicar of Stonehouse, Gloucestershire. (London: The Religious Tract Society, 1883.)

ANT literature is now so extensive and the subject is so popular, that it was an excellent idea to give in a handy volume a *résumé* of all that is known of the economy and life-history of these interesting insects. The writer is well fitted for the work, having made ants his special study for more than twenty years, during which time he has observed in their native haunts nearly every species of British ant, and has been able to confirm some of the most curious facts of their social economy. Although full of detailed and interesting information, and containing the results of the most recent observations of Sir John Lubbock, Dr. McCook, Forel, and other writers, the book is written in a lively and gossiping style well fitted to attract the young and persons who are not usually readers of scientific works; but many will think that liveliness of style is carried too far when we find such sensational headings as "Political Demonstration in the Ant-world," "Funeral Rites," "The Ants at their Toilet," &c., &c.

Coming however to the original observations of the writer, we find him disputing the statement of Sir John Lubbock, that ants dislike light. He says:—

"That they prefer working underground is certainly true, and that they construct their chambers and passages out of sight is clearly established, and that they will not work against the sides of the bell-glass if exposed to the light is undoubted fact. But it is not, I believe, because they dislike the light, but because, for sanitary, educational, and protective reasons, it is necessary that their many chambers should be arranged at certain depths below the surface, and therefore at varying distances from the light of day."

He then goes on to record a series of experiments showing that ants are attracted to the sunlight and bring their young beneath its influence for the sake of the warmth which accompanies it, and that in the same way they are attracted by the light of a candle placed close to the sides of the *formicarium*; the glass being warmed and becoming a source of radiant heat. The elaborate experiments of Sir John Lubbock, showing that ants preferred the red end of the spectrum and avoided the violet end, are all explained by their preference for the greater warmth accompanying the red rays, though he also thinks they dislike the effect of the chemical rays. His general conclusion is, that there is no evidence that they distinguish colour or prefer one colour to another, but that they always prefer warmth, and dislike the action of the chemical rays of light, while to light itself they have no objection whatever.

Mr. White reproduces from the *Proceedings of the Linnean Society* for 1861 a remarkable account of some Australian ants burying their dead in a methodical manner strongly resembling our funerals, and supports it by some curious observations of his own. In one of his newly procured nests there were many dead ants, which were carried up from below and placed against the glass. Three small card trays containing honey for the ants were placed in the *formicarium*, but instead of eating the honey the trays were used as cemeteries, and in two days 140 dead ants were placed in one tray and 180 in each of the others. In another case he observed the ants burying the dead in subterranean cemeteries, the bodies being covered with earth and the passage leading to the vault being stopped up.

A good account is given of the various creatures found in ants' nests, such as the crustacean *Platyarthrus Hoffmanseggii*, the various species of beetles, some of which are never found elsewhere, and seem to depend on the ants for their subsistence, and the aphides which the ants actually breed for their own use just as we do cattle. Some ants have small colonies of other ants domiciled with them, apparently as guests or lodgers, while others capture the pupæ of distinct species and bring them up to work for them like veritable slaves. This extraordinary habit of slave-making is fully described in two very interesting chapters, and Mr. White is one of the few Englishmen who have been so fortunate as to witness the slave-hunters at their work.

We cannot better illustrate our author's style and his mode of viewing the subject of ant-economy than by quoting the passage in which he sums up the result of his observations and inquiries :—

"And now, surely enough has been said, ample evidence has been brought forward, my own personal testimony having been confirmed when necessary by the experience of others, to warrant me in earnestly demanding for my little clients a favourable verdict. When you bear in mind the self-devotion of the queen for the commonwealth ; the loyalty of her subjects, their affection towards their youthful charges, preserving as they do a happy medium between undue severity and over-indulgence ; their liberal system of education without the aid of privy councils and revised codes ; their plan of drainage, most effectual before boards of health and city corporations had ever been heard of ; their public works and national enterprises, planned and executed with the most surprising promptitude, uncontrolled by parliamentary committees, orders in council, and circumlocution offices ; their social institutions, their provident clubs and savings banks, gathering as they do their meat in the summer—the continental and foreign ants grain and honey, the British ants their aphides for future use ; when you bear in mind their perseverance under difficulties, that no poor-house or assessment committee or sanitary authorities are needed, for all live as brethren, all sympathise with each other in trouble and difficulty, and share everything in common as members of the same happy family, 'he that gathers much having nothing over, and he that gathers little having no lack ;' when you remember their habits of early rising, of cleanliness, of moderation, of economy, of temperance, their love of fresh air, their skill and industry in their many trades, the magnificent scale on which they construct their houses ; their language, which, though more difficult to acquire than Chinese, yet is to them so intelligible that there are no misunderstandings, all speaking it fluently, and by means of its mysterious agency communicating their ideas to each other ; when you recall how they carry out concerted plans thoroughly, noiselessly, uninterruptedly, not resting till their work be finished, animated by one spirit, pursuing thus the end, fulfilling thus the law of their brief existence—you must allow that surely this 'little people' are 'exceeding wise.'"

Though somewhat anthropomorphic and highly coloured, this passage brings before us in a striking manner the many marvellous characteristics of the habits and instincts of ants, and also serves to show the thorough and enthusiastic study which the writer has bestowed upon them.

The book is well illustrated with numerous woodcuts from original drawings ; and in an appendix is given a complete list of British ants with careful descriptions of all the species, forty-one in number. It will therefore be of great assistance to any entomologist wishing to commence the study of our native ants ; while as an interesting volume for the general reader, or as a gift-book for children with a taste for natural history, it may be safely recommended as among the very best of its kind.

ALFRED R. WALLACE

LETTERS TO THE EDITOR

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

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

The Matter of Space

IN his letter on this subject in NATURE (vol. xxviii. p. 148), Prof. Morris strikes, I believe, a keynote of very great interest in the general theory of motion, when he lays it down as a primary principle that all motion naturally tends to attain a condition of stationariness in which, though it still constantly springs or swings hither and thither, it is yet permanently localised in some fixed field, contained within definite inclosing boundaries.

Singular as the law appears that motions, bound and hemmed in as we see them everywhere around us, are only ostensibly confined to their spheres by combinations of directed forces, while they are really inclosed in them by a governing principle in matter which constantly models its directed courses either by contiuuous or by interrupted stages into forms of stationariness ; and strange as the statement sounds, that all matter thus tends constantly to form *in situ* veritable universes[1] externally re-

[1] A pamphlet, "The Universe, or the Science of the Twentieth Century," maintaining exactly this microcosmical theory (by what course of reasoning arrived at I cannot guess), reached me not long ago from a writer, Mr. John Tate of Portadown, in Ireland, with another ("A New Theory of Electricity,") describing electricity as a kind of twisting power, both of which, from the independent practicality of their treatment, seem to have been entirely prompted and suggested to the author by exact meditative study and by clear original reflections.

posing and quiescent, and internally passive, neutral, and indifferent to all surrounding material universes, yet I am disposed to concur with Prof. Morris in his emphatic enunciation and very appropriate and varied illustrations of this law, because the idea of established boundaries, prescribing fixed terms and limits to motor-vigour's local actions, has, in an investigation of the principles of thermodynamics which lately occupied me, already presented itself to me as an indispensable foundation for a theory of heat, in which temperature was identified with motor-couple's dual power of dispensing motor-vigour between ordinary and ether masses, partly by opposing undulatory, and partly by contending diffusive motions of ether's and gross-matter's aërilian parts.

Easily as that theory lent itself in other respects to a deductive establishment of the laws of heat, it yet stumbled abruptly upon this blank presumption, or frowning precipice, *of how* boundaries of the kind (to such forms of aërilian action) come to be established and imposed between ether and gross matter, as well as between material bodies generally, wherever superficial contact between their substances takes place?

Granting indeed, provisionally, that we may freely accept Prof. Morris's somewhat too simple, and in fitness for its purpose much too meagre and unassuming supposition (which I should also say that he errs in describing me at the beginning of his letter as being just as willing and contented to accept and conform to as he is himself), that "particles of ponderable matter consist of aggregations of ethereal substance," or that "ether is a substance whose condensation yields particled matter," it would then be making a step of inference which would neither be a positively ungrounded one, nor (supposing that nature's system were really such a simple one as this hypothesis assumes) at all a likely one to conduct us to any embarrassing or perplexing consequences, to describe the "excessively disintegrated matter" which in his *aperçu* of the retinues of space "replaces ether," as ordinary matter in a "fourth state" of attenuation; because we would immediately reflect that the boundaries between the solid, liquid, and vaporous forms of such a multistructured substance as ethrogenous matter would then be, are themselves well known to be the seats of a certain diffusive and undulatory struggle and balanced equipoise, the real nature of which, beyond what is known of its laws of relation to pressure, heat, and temperature, cannot be accurately described. The fact that temperature and tension regulate it does, indeed, assimilate it to the similar dual balance of motor-couple's diffusive and undulatory actions at the borders between ether and ordinary matter which I found to be indispensable as a first starting-ground for basing a mechanical theory of temperature, heat, and entropy on mathematical properties of motor-couples; and our ignorance of how the boundaries are established in each case is not only no greater, but it actually appears to be of precisely the same nature and description in one of these cases as in another.

The parts which collision and vibration play in distributing motor-vigour in solids, liquids, gases, and in ether, are abundantly well-instanced and described in Prof. Morris's letter; and it again affords me extreme gratification to note the exact parallelism which his views present with those furnished by a systematic and not perhaps altogether unmathematical treatment of the subject which I have pursued, if, as I surmise, undulation and diffusion are kinds of motor-action (both active in a motor-couple) of such primitive simplicity of construction in their agitational or motor-type, that, in virtue of their elementary mathematical character, one single mechanical explanation really suffices for and applies with equal exactitude to all those instances of material conflict just considered, which occur at the boundaries between the several gross and ethereal states of matter.

But both physical and mathematical considerations have besides this led me to suppose, as I trust that they may also in the end influence Prof. Morris's decision, that the title of the "fourth state" of matter which we might thus quite fairly at first sight and provisionally apply to ether, is in the all-essential meaning of the words an undeniable misnomer; because mutual conversion of the two substances composing the first three and the last of the forms in question one into the other is *bonâ fide* shown by the clearest evidence of experience, and equally by theoretical proofs based on the two substances' motor relations, to be, even more certainly than making gold out of copper, an impossible physical proceeding. With such plain reasons as I will try briefly to produce for pronouncing ether and ordinary matter to be perfectly distinct and totally untransmutable fellow-occupants of space, it is really more consistent with simple fact, and a more precise and correct use of language, to speak of ether as "matter of the second class" or of the second grade or order, than it would be to call it either dubiously matter "in a fourth form," or to give it the still more erroneous title of a "fourth state of ordinary matter."

While, in fact, we know innumerable chemical and physical forces capable of altering to any give-and-take extent the boundaries between liquids and their vapours, between similar and dissimilar solids and liquids, and like and unlike gases and molecules, so as to change entirely all their physical and chemical states, or groupings, yet no force of art or nature can make any portion of gross matter change its weight by condensation or escape of ether. Even chemistry, to whose reactions Prof. Morris assigns the greatest power of altering molecular groupings, although tested in this direction with the delicacy of a vacuum-balance in Mr. Crookes' researches, has been found to be powerless to do so. It is true that its reactions only employ the sedatory tendency of motion in order to produce new groupings, and the electric current, which first disclosed the existence of the elements sodium and potassium, and whose arc of light gives us glimpses of chemical dissociations scarcely less complete than those detected by the spectroscope in the sun, overcomes and reverses the power of chemical affinity to form combinations in this way more effectually than any other force, and breaks up all chemistry's compound productions more completely than any other force can do. Yet, while no dissipation of weight of ordinary materials by electric currents has yet been detected, it is just as certain that ponderable matter has never yet to our knowledge gained or increased in weight in virtue of the exertion of any possible chemical affinity which it may have for ether, although this affinity, if it exists, must yet be of extraordinary strength, since it can successfully resist every effort that has yet been made to loosen it! Either imponderability of ether or immutability of its boundaries of junction with gross matter, or both of these together, must therefore be assumed to account for the sum of this experience; and whichever of the alternatives we are led to choose, distinctly differentiates the two substances from each other as regards this particular character of mutual convertibility of substance, for no known ordinary matter arising from ether's condensation is imponderable, or, on the other hand, if ether has weight, experience still shows that no condensation of it into ponderable ordinary matter is possible.

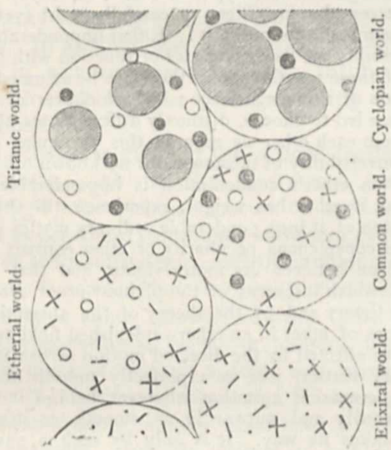
Another conspicuous peculiarity of ether consists in a special independence between its motor-vigour and that of ordinary matter, of which instances of the plainest proof are afforded by Doppler's theory and by the theory of the aberration of light. The motions of ether in an ether-replenished field are not in the least degree affected by the directed motion across it of a mass of ordinary matter, just as a perfectly smooth anchor would leave no permanent agitation whatever behind it in water or liquid inwardly and outwardly as smooth as itself, through which it takes its way. It is only by such a passing body's aërilian or undirected motions that ether can be disturbed, and with those it harmonises or collides, mutually receiving from and imparting to the body it so touches motor-vigour (which may either take the form of actual heat or of stresses in the ponderable body) by the primitive aërilian processes of wave-impact and diffusion-blows of the two substances at the boundary between them. With the absence of these (if we could imagine the privation to exist) the bodily or directed motion of the two substances, like those of a smooth anchor swinging in a stream of frictionless water, would all the while be wholly unaffected by, indifferent to, and independent of each other. The ether therefore stands in such motor-relations to gross matter that the two can only exchange motor-vigour with each other by means of the aërilian impulses of their touching parts.

Now this theory of ethereal action, suggested to me by an accidental consideration of the well-known mathematical equation of stationary motion, which was at once seen to furnish, on closer examination, a very consistent interpretation of the second law of thermodynamics, and of its several thermal quantities, led me to describe in my former letter (NATURE, vol. xxvii. pp. 458 and 504) some of the necessary postulates or maxims of the new theory in its integrity of fitting enunciation for such applications.

If the mutual motor-relations between ether and gross matter are indeed (as I have very full grounds for confident assurance) of the extraordinary nature and description there set forth, there seems to be no room to pause or to waver and hesitate over nicely raised but unavailing protests of prejudice and predilection in their contemplation. In the ocean of universal ether are described baric points and masses "nestling" together, and "nestled" in their attendant or "bound" ether ones, which themselves cluster or "nestle" like atmospheres about them. Each such ethrobaric assemblage is a universe, when in repose, independently of the unbound and unbounded ether-ocean, which alone stands aloof as a universe by itself. And among all these the instantaneous as well as the hare-and-tortoise-footed paces of time take effect, and swiftly or gradually, along with many other actions, cluster the island-masses together more and more.

By what rigid cord the clustering tendency to establish certain boundaries is controlled, what struggle for existence gave their present forms to elements and suns and planets and to the ether atmospheres belonging to them, appears to be a question of just the same cyclopean vastness, and in some measure of the same description, as that which presents itself to our inquiries in animated nature. And since it is exactly this ruling rein which sets the boundaries to bodies, no harder problem can perhaps be contemplated than that of defining how, at a point of contact, the boundary between two dissimilar physical bodies is preserved.

In particular the contact of our physical world of ethrobaric alliances with universal ether, where to us complete and perpetual silence reigns, and in the other direction of inconceivable hugeness instead of smallness of integration, common ethrobaric matter's contact with a universe just as conservative as ether is of suns' and galaxies' corporeal struggles, but in this case beyond the ken and vision of the most gigantic telescopes, are probably *par excellence* the seats of strife and contest of all or at least of many more orders and successive grades of matter than take part in



Chain of Matter's Motor-actions.

those between spheres of ponderable matter and their ether atmospheres, or between the alliances of these that constitute our world of physics. The arena of graphic space for all these universes is the same, and there appears to be no difference in their geometry but this, that the scales of magnitude of their disintegral parts proceed *by absolute infinities* in their proportions to each other. But this difference is of such an essentially strict mathematical kind, corresponding to precisely equivalent analytical and geometrical relations wherewith, sooner or later, there can be very little question that it will be possible to express it, that the "excessive disintegration" contemplated by Prof. Morris is really one of infinite disintegration. And what it is which sets bounds to the universal ether by itself, so as to make it a third party to the exchanges of motor-vigour between the bound intergroupings of gravitating and ether-matter (and perhaps a shaping and forming link of these to the larger-statured universe out of reach of telescopic vision), unless it is a substance of more infinite disintegration still than ether, an elixir of ether as we may style it, shaping and forming both that ether itself and its alliances with baric matter, it would certainly be exceedingly difficult to say.

Thus in the above figure it will be seen how boundless graphic space (denoted by the inclosing circles) may all be filled and occupied at the same time by a continuous chain of matter-triads consisting of matter in innumerable different untransmutable grades of fineness of disintegration, of which only three adjoining ones are physically concerned together in any one of the linked world-systems of the chain's horizons, in producing that world-system's or horizon's natural phenomena. The functions of ether and "elixir," for example, can be traced in the figure in giving inanimate nature its form and stature, and in producing its physical phenomena in the world of ordinary or common matter; and that of common matter and ether, again, in doing the same in the larger-statured or "Titanic" world; and so on for worlds of vaster, or *per contra* of finer, textures than our own.

But as I reasoned at some length to show in my former letter, a proper branch of geometry must be specially developed and explored to describe even the space-relations of these several material horizons to each other clearly; and there is besides this the part which time plays in the control and evolution of motor-actions by their transmission from one horizon to another, to be investigated and considered, of which it can hardly be foreseen that the research will be easier, although sure in due course to be prosecuted successfully, than the investigation of the geometrical relations.

It cannot therefore be expected that the beginnings of physical phenomena like those of light, heat, magnetism, and electricity (and of chemical phenomena in addition), due to motor-vigours of imponderable substance, should all be easy to fathom and unveil at once. But very grateful reception and approval must yet be freely and fairly accorded in the meanwhile to such able and successful attempts as Prof. Morris makes and proffers in his letters to unravel them, as being unquestionably of very great present, and of incalculably greater prospective use and value to assist in pointing out the right road and in paving the way towards their final elucidation. A. S. HERSCHEL

Newcastle-on-Tyne, June 25

P.S.—A little more inquiry shows me that it is not essentially in absolute size, *but in volume-density* of the integrant parts, that "titanic," "ethereal," and other kinds of matter differ by infinity, and by infinity beyond infinity, from common ponderable matter. An integrant part or "atom" of common matter, for instance, becomes by infinite expansion[1] an infinite-sized network of extremely far-separated (countlessly numerous) titanic matter-atoms, whose expansion will have rendered them all ordinary substance and will have raised all their internal constituent atomic parts, like themselves, one grade in attenuation; while the original common-matter atom itself will not in the least degree lose its individuality by its enlargement of stature, but will become at the same time an infinitely large common-matter, and an infinitely large ether-atom. The titanic members also, although an infinite-fold larger and less dense than titanic atoms of a mean size, do not lose their proper relativities with their normal-sized fellows, although they acquire a new consociation by assumption of a lower density, with atoms of common matter; so that exchange of energy or of motor-vigour by the ordinary processes of diffusion and wave-motion can in these circumstances subsist between ordinary and titanic matter on a footing of equality. And it is the same, in the common-matter atom's state of ethereal hyper-attenuation for its exchanges of energy and momentum with ether-atoms of the next higher order *of magnitude* than those which we call mean-sized.

To how many successive grades such hyper-attenuation may be carried there is no actual evidence to show, but in the system's theory itself there is nothing to restrict it. We must only remember that each successive grade is an infinite step onwards in expansion or contraction; and since common-matter's atoms or first integrant parts are known (as Sir W. Thomson has most clearly shown, NATURE, vol. xxviii. pp. 203, 250, 274) to be of finite, though of excessively small dimensions, their hyper-attenuated forms are of an immensity whose size is mathematically infinite, and we cannot therefore point to them. A single common atom's transition-form to ether-density pervades all visible space. Its transition-form to "titanic" density occupies no visible space at all, and is graphically a material point, although entropically it is infinitely composite; and the motions of each of these forms are absolutely invisible to us, but not less real and effective in their contributions of motor vigour to ordinary matter at the confines of its contact with ether megaspheres, and with titan micro-points in graphic space.

[1] If time is allowed any homogeneous assemblage of matter-atoms to equalise their temperatures, the whole assemblage and its parts, consisting of common and of remoter matter-grades, will, I conceive, all have one and the same common rate of volume expansion (as described above) to whatever extent, finite or infinite, the expansion or contraction is continued at one settled temperature.

However many times material atoms may be hyper-attenuated or condensed, their substance no doubt retains its original material *status*, although removed by numbers of grades or orders of attenuation from it to which the mathematical principles of the theory assign no limit; and boundless space is thus strewn at once with a grade of common-matter atoms, which in their original *status* may have properly belonged to any other grade of unknown remoteness. But this fixity of matter's original grades of size and density with only infinite insulations from other grades, is not more notable than the unrotativeness or fixed directions of some coordinate axes of mechanical motions in space which does not prevent the motions from being just as perfectly describable by the selection of any other equally fixed ones. We are in the same way unable to say by how many revolutions the hands of a clock have reached a certain position on its dial, unless we examine and properly employ to estimate it the state of wear and attrition of the wheel-work of the clock's driving train, or unless we know the number of times that the clock had been wound up.

The solution of some very bewildering physical questions is offered by this hypothesis[1] when we reflect, as I have before endeavoured to explain, that the expansions here considered are all of them variations of a quantity ϕ (or "entropy" of a homogeneous body at the same temperature throughout), which, by its mathematical description, is obviously the ratio index of a describing point's place upon a hyperbola, and which therefore passes continuously through an endless series of values 0 and ∞ (which revisit each other in graphic space, just as a circle-radius revisits its former place after every passage through four successive right angles), while the describing point pursues the curve continuously.

There is enough evidence in geometry to show that this hyperbolic variable of position, and the angular one on the hyperbola's auxiliary circle of a certain configurated point on that circle, cannot pursue their geometrically configurated course together through more than a quadrant of the circle and hyperbola from the two curves' common apex without violating the axioms of ordinary geometry. Thus it is clear that in the transition state of the measure ϕ through infinity from one "grade" of a mass's state of attenuation to another, there is needed a new law of geometry (or at least of continuous material motion) allowing a new pair of tracing-points supplanting the disused former pair at each dead-point of the two curves, to describe a new quadrant of the hyperbola and of its auxiliary circle from that point, with a constant geometrical configuration to each other without violating geometrical axioms.

This transition law and the nature of the configuration which it frees from geometrical contradictions while giving it continuous validity round the whole circuit of the circle and hyperbola together, is so exactly what has just been described of the nature of material points' or of physical integrant-parts' compositeness while still remaining points in their motor properties, that almost all reason for doubt and question seems to be excluded that it is the sought-for law and mode of motor connection between θ and ϕ (or angle- and entropy-position of a point or homogeneous body), which links universal heat-motion of matter to all those other, no doubt therefrom derivable but otherwise unaccountable descriptions of matter's motions which we see in physics.

[1] In particular, as will be easily gathered from the above brief comments, of the law of dissipation or of a fixed tendency to gradual reduction and to universal uniform diffusion of all forms of energy *in a given link* of matter's grades in one common form of the energy of heat, or of the work of entropy-expansion.

On Lord Rayleigh's Dark Plane

IN NATURE, vol. xxviii. p. 139, was printed a communication from Lord Rayleigh to the Royal Society on the subject of the dark plane which is seen above hot bodies in dusty and illuminated air, and which had long been used by Tyndall, and after him by science teachers generally, as an illustration of the fact that light which does not enter the eye cannot be seen.

It had never occurred to me to doubt the validity of the commonly-received explanation of the dust-free space, viz. that the dust in the dark region had been either burnt up or dried up by contact with the hot body, and I was struck and greatly interested in the definite character of the phenomenon as described by Lord Rayleigh in your pages, and in his conclusive shattering of the old explanation by the simple device of using a cold body instead of a hot, and so getting a down-streaming dust-free space instead of an up-streaming.

I was however quite unable to accept Lord Rayleigh's very tentative hypothesis that the curvature of the stream-lines and consequent centrifugal actions might possibly account for the phenomenon, nor do I imagine that he himself ever regarded this as anything more than a guess thrown out for want of a better.

I mentioned the matter to Mr. J. W. Clark, whose services as Demonstrator I have lately had the good fortune to secure, and he proceeded to make a few simple experiments with a view first of repeating the observation, and next of testing an electrical hypothesis which suggested itself.

The hypothesis is one that has failed to verify itself, but it may be just worth stating. The difference of temperature between the solid and the air causes convection currents, the air thus made to stream over the surface of the solid electrifies itself by friction, and the dust particles are expelled from the electrified air.

We were early led to doubt whether the insignificant amount of friction which alone was acting in some cases could possibly produce the effect; and in fact it was soon found that though electrification modified the phenomenon it pretty certainly did not cause it.

A doubt then arose whether the space was actually dust free or only optically so; whether anything like mirage due to unequal densities could account for the darkness. These ideas, however, would not bear consideration, and we soon convinced ourselves that the region is really transparent air free from dust, though its extreme sharpness and blackness render it difficult at times to refrain from thinking of it as a black opaque film.

Irregular dark striæ obviously allied to the regular dark plane are to be perpetually observed in any dusty air disturbed by convection currents; and nothing but the want of the necessary illumination prevents our commonly observing what must be one of the most universal appearances, viz. dust-free regions streaming from every solid body.

We are now pretty well convinced that differences of temperature have nothing to do with the real nature of the phenomenon; *we find that solid bodies have sharply-defined dust-free coats or films of uniform thickness always surrounding them*, and that these coats can be continually taken off them, and as continually renewed, by any current of air. The slightest elevation of temperature of the solid causes its dark coat to stream upwards; the slightest depression of temperature below that of the atmosphere causes the coat to stream downwards; but the coat is there all the time, independent of convection currents, though I believe it gets thicker as the body gets warmer. *Why* the air near a solid is free from dust we are not prepared to say.

A few of our earlier experiments might readily enough have suggested the old exploded explanation that the smoke was either burnt up or dried up or otherwise temporarily rendered invisible by heat. Take for instance a long piece of ordinary quill glass tubing; blow it half full of tobacco-smoke, and hold it horizontally in a beam of light. The first thing to notice is the curious way the end of the stream of smoke draws out to a point with a sharply defined edge, and how it falls about inside the tube when the tube is rotated. Next warm a part of the tube gently: a space clear of smoke at once appears and widens. Next heat the tube in the flame of a Bunsen and blow smoke gently and continually through it: the smoke narrows down to a mere thread as it passes the hot place, or it may disappear altogether in a pointed cone; but it reappears on the other side of the hot place, and it issues from the end of the tube.

Our experiments have been mostly conducted in a glazed cigar-box with one or more horizontal copper rods passing into it through insulating glass tubes, the ends of the rods carrying binding-screws into which could be clamped scraps of sheet copper of various shapes. The illumination was either sunlight or an oxyhydrogen lamp, or more usually, and far the most conveniently, a Serrin arc-lamp in its lantern, fed by a secondary battery. The smoke employed was nearly always tobacco, for we soon satisfied ourselves that the nature of the smoke or dust did not affect the essence of the phenomenon, and we consequently used that which was the easiest and for which the implements were always at hand. Sal-ammoniac was, however, occasionally used instead.

It was wholly unnecessary to heat the rod in order to start the dark up-current, for if it is not infinitesimally warmer than the air to begin with, the beam of light will warm it sufficiently in an instant. Still the rods can be heated by a lamp outside the box if desired, or on the other hand their projecting ends can be bent down and immersed in a freezing mixture when a cold dark plane is wanted.

The transition from the cold down-current to the warm up-current is a thing I specially wished to observe, and it can be readily seen by first letting the rod get thoroughly cold in the dark and then turning on the light without removing the freezing mixture. The down-current is now visible, and it persists for a short time, varying from a second or two to a minute; but as the rod is warmed by the beam, it soon visibly slackens, turns round, and establishes itself as an up-current; the transition from a strong down- to a strong up-current only occupying a few seconds altogether. If the light be now interrupted for a short time, and then renewed, the down-current will be observed as before, and in fact one may make the alternations with great rapidity, permitting now the freezing mixture and now the hot beam to gain the mastery.

The turning bodily round of the dark plane is doubtless due to a general convection current produced by the warming of the glass of the box by the entering beam. The beam was, however, always filtered through water in order to bring its heating powers within manageable limits.

To witness the effect of a diminution of pressure on the phenomena, a thick platinum rod with its end beaten into a narrow spade, was sealed into an old lamp chimney closed by plane glass ends, and connected with a water air-pump on one side, and with a $CaCl_2$ tube, a tobacco pipe, and pinchcock on the other. A little exhaustion and an intermittent opening of the pinchcock was able to smoke the pipe in the orthodox mannner, and the exhaustion was then proceeded with further; an accumulation of vacuum being often quickly turned on. At low pressure the dust-free space surrounding the spade became large and ill-defined, and the convection-currents were lazy and ineffective; the exhaustion was not pushed to extremes, because it was difficult to keep any smoke still suspended, but the general fact that the dark region broadened considerably under diminished pressure was fairly well made out. The coat is enormously thicker, however, than any Crookesian or free-path layer.

When examining the effects of electrification we sometimes brought electrified rods near to the dark plane, and sometimes we electrified the rod from which the plane was streaming. The latter is by far the most effective, and the results are very striking and interesting. It is not sensitive to minute differences of potential however, and it required from fifty to one hundred Leclanché's to exhibit distinct effects. We then found that positive electrification of the rod rendered the coat and the stream broader, but made their outline hazy. Connecting the rod to earth instantly sharpened it up again, making it beautifully clear and distinct. Negative electrification sharpened the outline still more, and narrowed it down still further, but the effect of positive electrification was more marked than that of negative.

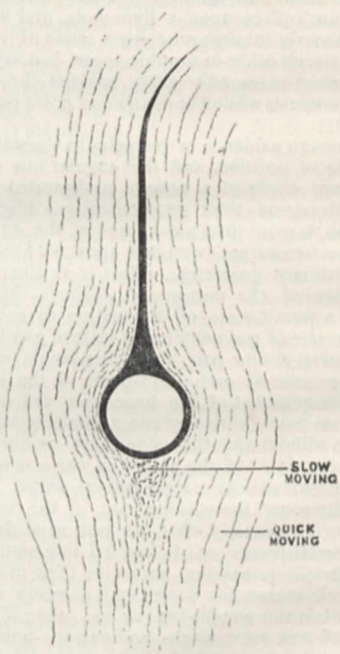
When comparatively high potentials were used, such, for instance, as would give millimetre sparks if permitted, the effects were violent. As the potential rose, the dark coat and stream broadened, and ultimately disappeared; reappearing again and closing in from each side in a curious way, so as to reestablish the clear dark plane depicted by Lord Rayleigh in his paper above-mentioned, the instant an earth contact was made. Violent negative electrification exhibits somewhat similar effects. If any brush discharge took place, there was a violent black chimney-like rush, and the whole box rapidly cleared of smoke.

The electrical effects are not easy to describe, but they are worth seeing. We sometimes used two solid brass cylinders with rounded edges screwed on to brass rods and insulated from each other, cylinders say three centims. by one; sometimes we used a cylinder and a point, sometimes two flat spades, and so on. Connecting them with the poles of a Voss-Holtz machine and turning very slowly, the change from two well defined and sharp Lord Rayleigh planes through an interval of indistinctness to vigorous and curiously-shaped black streamers is very striking. But in a few seconds all the smoke has gone; it has not been driven out of the box, it has been condensed on the box surfaces and on the electrodes, which latter soon look as if they had been lacquered by an amateur, and make yellow greasy marks on one's fingers.

Moderate positive electrification of the rod, then, widens and renders hazy the coat and the dark stream; earth connection, or still better weak negative electrification, narrows it and renders its outline beautifully sharp and distinct. The stream itself does not show signs of electrification. Obstacles in its path deflect it, and it curls round them, forming rather a pleasing stream-line illustration.

As soon as we had made out that the dark plane was continuous with a dark coat surrounding the body, we paid more attention to the coat than to the plane. It seems to me a somewhat important fact that solids have surrounding them a layer into which dust particles do not enter, of a thickness which we estimate as comparable with 1/100th of an inch, though it certainly varies with temperature, pressure, and electrical potential. We first observed the dark coat as a lining to a semi-cylindrical scrap of copper sheet held in the binding screws formerly spoken of, with the hollow turned towards the light. It can be seen quite well, however, on a simple round rod or straight thick wire; and for many reasons this is preferable. To avoid the shadow of the rod and to see the coat all round it we return the light on its path by a mirror, often also illuminating from above by means of a 45° mirror.

When the smoke is thick a feeble light is sufficient, but I prefer a thin smoke and a powerful light. After tobacco has been in the box some time, say half an hour, the smoke particles have aggregated together and can be individually seen. It is then very instructive to look along the end of the rod through a low-power microscope. The diagram attempts to illustrate the appearance.



The coat of dust-free air is perpetually being rubbed off and renewed; the attachment of it to the rod is not individual. I believe all dark striæ seen in a smoky sunbeam are the wiped-off coats of solid bodies, which, however, are now rapidly disappearing by reason of the general diffusiveness of the dust particles.

The transparent coat on the inside of a glass tube full of smoke can be seen, and when a point is heated the coat thickens and rises, making a clear dark space, and then it proceeds to roll itself up along with some of the dust into two distinct spirals one on each side of the hot place.

I have no hypothesis whatever ready to account for the dust-freeness of the film of air in contact with solids. But I believe the existence of this film, and its electrical modification, to have a close connection with various phenomena; for instance, the easier discharge from negatively electrified bodies than from positive—the dust-free coat is thinner: the convective discharge of electricity by hot bodies and its dissymmetry as observed by Guthrie, the dissymmetry of the Lichtenberg tracings, the abnormal dielectric strength of thin films of air as observed by Sir Wm. Thomson ("Reprint," chapter xix.). For I imagine that disruptive discharge would more easily commence in dusty air than in clear air, and consequently that when the sparking bodies are approached so that their dust free coats touch, the dielectric strength is likely to be great.

Maxwell indeed suggested ("Electricity," vol. i. p. 56) that a layer of extra dense air equivalent to an extra layer of ordinary air about 1/200th inch thick surrounding solids would account for Sir Wm. Thomson's remarkable and puzzling results; and this is a dimension of the same order of magnitude as the thickness of the dust-free coat on bodies at an ordinary temperature. I by no means intend to imply that the dust-free layer is not composed of extra dense air—I have no evidence on the subject—but the dust-freeness may *possibly* account for its greater strength without the hypothesis of extra density.

The dust-freeness itself remains to be accounted for. Numberless experiments suggest themselves. We have not yet tried other gases even, though that is an obvious thing to do.

It struck me some time ago that the motes in a sunbeam would be convenient weightless bodies for many purposes, to exhibit statical lines of force for instance, but the particles of the smoke we have hitherto used have not been sufficiently elongated for this purpose. But I anticipate that the examination of all kinds of electrical phenomena in the strongest possible light, instead of in the dark as usual, may lead to various fresh observations.

The rapidity with which an electrified point clears the box of smoke is so noticeable as to suggest several practical ideas. It is somewhat surprising considering the perfection to which electrostatic machines have been brought that they have not yet received any practical application. The electrical clearing of the air of smoke-rooms, or of tunnels, is perhaps not an impracticable notion. The close relationship between fogs, epidemics, &c., and the suspension of solid particles in the air, suggests the use of electrical means for sanitation, and for weather improvement. It has long been known that lightning clears the air, and though ozone may be credited with a portion of the beneficial influence, I fancy the sudden driving away of all solid particles and nuclei must have a great deal to do with it.

If the germs driven out of the air are condensed on the earth's surface, a partial explanation is suggested of the way in which "thunder turns milk sour," a fact which has always puzzled me, and which appears to be well established.

I cannot help thinking that the human race will ultimately acquire some means of artificially affecting the weather in a less injurious manner than that which they have hitherto attempted with only too great success, namely, the manufacture of solid nuclei in prodigious numbers for moisture to condense round, and of oily matter to cover the surface of such moisture with, in order to prevent its evaporation. As soon as this artificial pollution of the atmosphere has been decisively checked, it will be time to consider whether it may not be possible to keep off even natural mists and rain when they are not wanted, and to assume some sort of control over the weather at critical seasons, instead of halting between superstitious appeals to Providence on the one hand, and a helpless resignation to fate on the other, which are our attitudes at present.

Meanwhile is it not possible that a periodic optical examination of the atmosphere by a strong beam of light might convey useful meteorological information? OLIVER J. LODGE

University College, Liverpool, July 11

Antihelios

BY means of a current of air passed through an ice closet or a closet otherwise reduced in temperature the air of living-rooms might be gauged to any temperature, but say 60° or 70° F. if we pleased. If the air were driven through a preliminary water chamber arranged on the principle of the hubble-bubble pipe, mosquitoes and other flying pests would be excluded absolutely. Imagine the comfort of sitting down to a meal whereat one's food should not be hidden by flying vermin, of reposing in a cool chamber wherein these intruders should be excluded absolutely. When I lay ill of fever in West Africa the atmosphere about me felt simply like the blast from a furnace. What an element of recovery, of possible health and physical wellbeing, would it not prove in hospitals when poor fellows languishing in disease should be surrounded by pure, cool, insectless air instead of air at a hundred degrees or even higher. People—some people—say doctors do not feel, but I say that a doctor's heart is rent with anguish when he enters a chamber wherein the air is pestilential, where the sores of wounded men are maggot-infested and the men themselves are eaten up with vermin. All this cooler air would prevent or tend to prevent. The festive hall, the school-room, the living-room, the barrack, the church, would all experience, the occupants regarded, commensurate relief. It would be just as available in ships as on shore. The Red Sea transit and the blazing oceans of the tropics need no longer be things of terror. In steamships a small percentage of steam power would suffice for driving the cool air current. Wind, water, hand, and steam power could also be rendered available. The vans employed to supply blast-furnaces should suffice for anything, but there is the winnowing van which horse or mule, indeed any animal, could work. Even the simple circular bellows would keep an apartment cool. In towns or in a cantonment, a stationary engine with air-ducts leading to the different dwellings would satisfactorily replace apparatus adjusted to each separate house. HENRY MACCORMAC

Belfast, July 21

Disease of Potatoes

THE paragraph in NATURE, vol. xxviii. p. 281, regarding a "hitherto unknown" disease of potatoes near Stavanger, appears to be identical in every way with the disease which destroyed the "champion" potatoes in the West of Ireland in August, 1880, described and illustrated by me in the *Gardener's Chronicle* for August 28, 1880. The bodies described by Herr Anda, as about the size of a small black bean, are *Sclerotia*, or masses of highly condensed mycelium, and they have nothing to do with the potato fungus proper, *Peronospora infestans*.

It is a remarkable fact that neither horticulturists or botanists had ever noticed these large black *Sclerotia* in potatoes in Britain before 1880, and as far as I know no one has ever seen them since. There was a prodigious and destructive growth in 1880, and several botanists as well as myself tried to make the *Sclerotia* germinate, but a failure resulted in every instance. It appears that Herr Anda has seen the *Sclerotia* germinating; it is therefore to be regretted that he has not identified, or got some one else to identify, the perfect fungus.

WORTHINGTON G. SMITH

"Waking Impressions"

I HAVE before me now a record, written the following morning, of a waking impression of the same order as that told by Mrs. Maclear in NATURE, vol. xxviii. p. 270, but which I think shows more clearly the sort of duplexity of brain action that one sometimes detects in dreams.

I awoke with a clear vision of a pamphlet I was holding. The subject was cookery, and about four-fifths of the cover was occupied by an engraving of pots and pans, trussed chickens, and other culinary matters. Below this, in one line, printed in capitals all of the same size, was the title which I was reading at the moment of awaking, "FOOD, OR THE ASTROLOGY OF EVERY DAY."

My first waking impression was of the utter irrelevance of the alternative title; but on looking at it with closed eyes more carefully I saw that the paper in one place had been rubbed, and that a little bit was curled up, leaving a wider space between "the" and "astrology" than between the other words. The conviction then came to me that a letter was missing, and that the word in full must have been "Gastrology." This of course made sense of the title; but it is curious that one's waking intelligence should be needed to interpret the inventions of one's dreams. E. HUBBARD

1, Ladbroke Terrace, July 21

A Remarkable Form of Cloud

WHILE preparing to observe the moon on Sunday, the 22nd inst., at 10h. 20m. p.m., my attention was attracted to a peculiar patch of grayish white light a few degrees from the moon, which upon closer examination I found extended right across the heavens, from the north-north-west to the south-south-east point of the horizon, passing through the zenith. It had a breadth of about 2°, and was sharply defined on both sides, more especially the northern, excepting near the zenith, where it was broken up into three or four detached cloudlike masses. All other parts of the sky were perfectly free from clouds, so that this one appeared like a gigantic arch spanning the heavens; so much so that a person to whom I pointed it out compared it to a rainbow, which it very much resembled in form. At 10h. 45m. it was reduced about one-half in width and had shifted 20° from the zenith towards the north-east, though it still extended from the south-south-east to north-north-west. By 10h. 55m. it had broken up into four irregular streaks of clouds of various breadths and parallel to each other, the only portion of the original arch being a narrow streak extending from the south-east to the meridian, where it faded away. This was the "beginning of the end," for the remnant of the original arch and the other clouds in a short time disappeared below the eastern horizon, leaving the sky beautifully clear.

I should much like to know whether any other observer was fortunate enough to observe this remarkable cloud; I say remarkable because, though I have been a pretty constant observer of the heavens for the last eight years, I have never noticed anything of the kind before. B. J. HOPKINS

10, Malvern Road, Dalston, E., July 24

Triple Rainbow

IN the afternoon about 5.30 a week or ten days ago, I noticed a rainbow of the ordinary type, and quite complete, which lasted about five minutes; the portion to the right hand then faded away, as well as the upper and lower portions apparently of that part of the bow visible to the left hand; but the middle portion of the remainder of the bow divided apparently into three parts, each one complete in their prismatic colouring, and yet none of them parallel to each other.

There was a slight difference in size, possibly in favour of that portion belonging to the original bow, and which constituted the outermost of the three arcs.

This portion of the phenomenon lasted for about five minutes, and was also similarly observed by a gentleman walking with me at the time.

Unfortunately some large trees prevented us from seeing the lower portion of the three arcs, where presumably they should have been united into one. R. P. GREG

Coles, Buntingford, Herts, July 23

A Remarkable Meteor

IN regard to the meteor seen by your correspondent P. F. D. at Hendon on the 6th inst., at 8.53 p.m., in a clear sky and broad daylight, I have the following entry in my diary under the same date: "Meteor going south-east through Cassiopeia at seven minutes to nine; daylight." It was indeed a remarkable meteor. The sun had set about half an hour. I happened at the time to be looking intently at that part of the north-east sky in which it appeared. What struck me most was the brilliant sparkling silvery light given off by the fragments into which it divided just before disappearing. I estimated that it would strike the horizon about the south-east point. B. G. JENKINS

Dulwich, July 21

The Function of the Sound-Post in the Violin

MAY I be permitted to correct a careless expression in my letter appearing in your last issue on this subject? The passage I refer to is this: "If the bridge [of the violin] were placed near one end of the instrument, the case would be different," *i.e.* the tone would be louder. I ought rather to have said: "If the bridge were placed nearer to a firm support, the case would be different." The statement is perfectly true as it stands with a sound-board which is equally thin all over, or where the edges are thicker than the middle. It is not true with a construction like that of the violin, where the edges are extremely thin and flexible. A sonorous wave always transmits itself best from the stronger part of the surface to the weaker.

R. HOWSON

Sand

MR. MELVIN is at fault in assuming that my paper on sand was "an attempt to distinguish by the aid of the microscope whether sand had been formed by the action of wind or of surf." Its primary object was to show that chalk-flint had scarcely any place in its formation; but few particles of it appearing even from the midst of rolled shingle whether that be ancient or modern. Other problems of course may be determined or solutions suggested by an extensive examination of ancient deposits, compared with those now forming. I have shown that quartz is he great staple of "sand." The size of its particles, whether rounded by attrition or flat, rough, and angular, must be accounted for by observing the conditions under which it exists in modern formations. A large series is being examined by me, and a record will be made of the result. As yet I have no theory whatever. I simply record *facts*. J. G. WALLER

68, Bolsover Street, W., July 18

ON MOUNTING AND PHOTOGRAPHING MICROSCOPIC OBJECTS

WE have received from Mr. E. Wheeler of Tollington Road, Holloway, a collection of mounted microscopic objects, comprising anatomical, botanical, entomological, and other preparations, and we have much pleasure in testifying to the general excellence of the work. One of the objects—a vertical section of the human small intestine—deserves special mention. It shows the glandular cells especially well. The nerves and ganglia of Auerbach's plexus can be seen, and interspersed among the epithelial cells of the villi and Lieberkuhnian follicles are numerous goblet cells.

Space will not allow more than a bare mention of the other objects, including a large transverse section of the stem of Lepidodendron from coal, transverse sections of the stems of spruce fir (*Abies excelsa*) and mare's tail (*Hippuris vulgaris*), the former showing resin canals and sections of bordered pits in the wood cells; Spirogyra in various stages of conjugation, from the first modification of the conjugating cells to the maturation of the zygospores; various Diatomaceæ, including the rare *Coscinodiscus excavata*; injected preparations of intestine of cat and toe of white mouse, and various entomological objects. They are all well prepared, and represent a stock which Mr. Wheeler informs us amounts to fifty thousand objects.

Although the legitimate use of professionally-mounted objects such as these may tend in no small degree to the diffusion of scientific knowledge, the microscopist who employs his instrument for no better purpose than the examination of bought slides will derive little benefit from the pursuit. He should be able to prepare objects for himself, and although there is abundance of accessible information on every detail of the art, it is believed that there is yet a useful work to be accomplished. By showing the facility with which this can be done without resort to the multiplicity of processes usually considered necessary, we shall endeavour in this article to show how any possessor of a microscope may make for himself preparations which, though they may not equal by many degrees the productions of the best professional mounters, yet have a far higher educational value, as their preparation will afford information which could not be otherwise acquired.

The necessary materials and instruments are few and inexpensive. For the support of the objects a supply of the usual 3″ × 1″ glass slides with ground edges, and of thin cover glasses (preferably circular) of various sizes should always be at hand. These when bought will be dirty, and it saves time to clean them all at one operation.

For securing the cover to the slide various cements are used, but of these two only need be mentioned, as they will be sufficient for all ordinary purposes. Gold size is undoubtedly the most reliable cement, but it takes days or sometimes even weeks to harden. It is, however, exceedingly tenacious and tough, and does not become brittle with age. It should always be used in cases where objects are mounted dry or in liquid, but when viscid media are employed, the medium helps to secure the cover, and there is no danger of leakage. Under these circumstances the use of asphalte varnish is recommended. The Brunswick black of the oilshops is a common form of this varnish, but is not so good as the preparation supplied by the opticians. When the varnish is to be used, it must be warmed by standing it in a cup of hot water, and the slide should be warmed also if this can be done without injury to the object. The varnish should then be applied with a camel-hair brush. It dries in a few hours at the ordinary temperature, or in a few minutes at the temperature of a cool oven, but it has not the tenacity of gold size, and is liable to become brittle with age. To keep the cover in place during the hardening of the cement, spring clips will be required. One very useful form can be made by bending a piece of brass wire into the shape shown in Fig. 1, and fixing it by means of glue into the end of a piece of cedar (end of cigar box) a little larger than the slide.

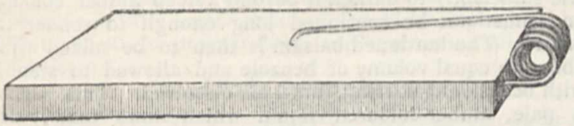


Fig. 1.

When the object is of considerable thickness or when it would be injured by the pressure of the cover glass, a wall or cell of some kind must be raised round it. In general a very shallow cell made by drawing a ring of gold size or asphalte on the slide is sufficient, and a stock of these cement cells of various sizes should be always ready for use. For their manufacture and for finishing the slides a turntable should be provided. This in its simplest (and in the writer's opinion its best) form consists of a heavy brass disk $3\frac{1}{2}$ inches in diameter, capable of rotation in a horizontal plane on a central steel pin. The slide is held in a central position on this table by two spring clips. Then on whirling the table round and applying to the slide a brush charged with varnish, a neat circle will be struck out.

When cells of greater depth are required, solid rings must be cemented to the slide.

For the performance of such dissections as are necessary, the mounter will require two or three small scalpels, one or two razors, a pair of small scissors with sharp points, and two pairs of forceps, one large, with its points roughened where they meet, and one small and slender, with smooth points. Small camel-hair brushes and common sewing-needles fixed in cedar handles like those used for the brushes are indispensable.

Pipettes of various sizes are useful for transferring small quantities of liquids or catching small aquatic animals. They are easily made from pieces of glass tube of various sizes, some being left widely open and others drawn off to a point at one end, which may be left straight or bent at a small angle. The most useful form of pipette is made by tying a piece of sheet indiarubber across the bell of a very small thistle funnel, the stem of which may be either left widely open or drawn to a point as with other pipettes. Pressure with a finger on the indiarubber will displace a quantity of air, and when the open end is placed under water and the pressure removed a quantity of the liquid will be drawn up and can be removed and delivered drop by drop or in a rapid stream. If (the indiarubber being pressed down) the open end of the tube be brought near any small animal in the water and the pressure suddenly relieved, there will be such a rush of water into the tube that the strongest swimmer can be easily captured.

Two or three section-lifters of various sizes and a dozen watch-glasses for holding staining solutions will complete the list.

The objects of mounting are twofold: (1) to render visible structures that could not be seen without such preparation, and (2) to preserve the bodies so prepared as permanent objects for future study.

Various fluid media are employed for the preservation of objects, and much of the mounter's success in his art depends upon a knowledge of the medium most suitable for each particular object. In Figs. 2 and 3 an attempt has been made to show how largely the visibility or invisibility of particular structures is determined by the nature of the medium in which they are mounted.

Both of these figures represent longitudinal sections of the stem of the spruce fir cut from the same shaving of a deal plank, the only difference being that the former (Fig. 2) was mounted in air, and the latter, after staining, was mounted in balsam. In the former case the bordered pits in the wood cells are perfectly shown, but the boundaries of the cells themselves and the medullary rays are indistinct and confused, while in the latter case the wood cells and medullary rays are clearly defined, but the penetration of the highly refractive balsam which has

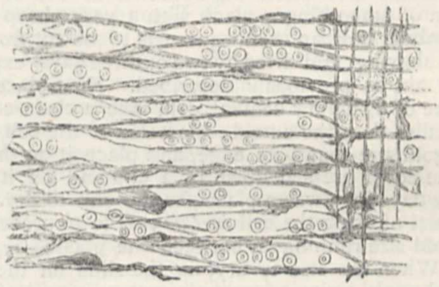


Fig. 2.—Longitudinal section of stem of spruce pine mounted dry, $\frac{1}{4}''$ objective.

affected this change has reduced internal reflection so far, and rendered the whole section so transparent, that the pits have become almost invisible.[1]

The same truth was forcibly brought home to the writer a few years ago in cutting some sections of fossil coniferous wood (siliceous), which during the latter stages of grinding down displayed the characteristic glandular cells, &c., admirably, but when mounted in balsam became almost perfectly invisible. They were too opaque to be mounted dry, and the only liquid in which they were well displayed was distilled water. The sections mounted in balsam were by no means spoiled though, for the transparency which obliterated all structure when viewed by ordinary light rendered them peculiarly suitable for examination

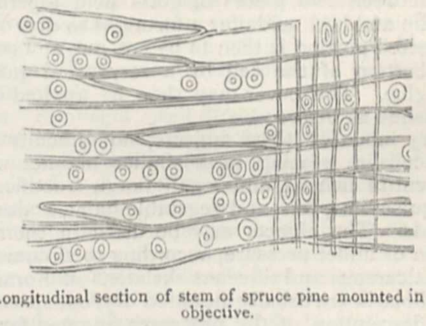


Fig. 3.—Longitudinal section of stem of spruce pine mounted in balsam, $\frac{1}{4}''$ objective.

by polarised light, and when so viewed all their structure returned and they became most beautiful objects.

It would be impossible in these articles to describe all the media employed in mounting microscopic objects, and all that will be attempted is to give instructions for mounting objects dry (that is, in air), in balsam, and in glycerine jelly.

The dry method is employed for such objects as are unaffected by air, and are either intended to be viewed as opaque objects by reflected light, or are sufficiently transparent without previous preparation to be examined by transmitted light. The object of this method is, in fact, simply to afford mechanical support to the object, and to protect it from dust and moisture.

It is necessary that the objects should be perfectly dry

[1] In Fig. 3 the pits are shown much too plainly.

before they are sealed down, or moisture will rise and dim the cover glass, and fungoid growths may make their appearance to the entire ruin of the specimen. A simple and efficacious mode of desiccation is to place the objects on a piece of blotting paper, cover them with an inverted tumbler or bell glass, and place the whole on the top shelf of a kitchen dresser or other warm place for a few days, or in extreme cases weeks. When an object has to be kept perfectly flat during drying, it may be placed between two ordinary slides held together by a letter-clip or American clothes peg.

To illustrate the general method of procedure, we will suppose that the first "mount" is to be a section of deal. Such sections can often be obtained in the ordinary operation of smoothing a plank with a very sharp plane. A piece about half an inch square is to be cut from the thinnest shaving, and dried by two or three days' exposure to warm air, as previously described. Next place it in the centre of a shallow cement cell, take a clean cover a little smaller than the outside diameter of the cell, apply a little gold size round its edge, and place it on the cell. Keep the cover pressed down by a clip and set it aside for a few days in a warm place for the size to dry. The only object of using the cell *in this case* is to prevent the liquid gold size running in between the glasses by capillarity. When the size is dry, fix the slide on the turntable and apply a ring of gold size extending a little way on to the surface of the cover and beyond the cell on to the slide. When this has dried a second coat should be given, and a final ring of asphalte will complete the sealing. It only then remains to label the slide.

We will consider in detail one more case—a preparation of sole's skin to show the overlapping ctenoid scales. As this object is of considerahle thickness, it must be mounted in a cell cut or punched out of a piece of thin cardboard and stuck to the slide with gold size or marine glue, and being opaque and intended for examination by reflected light, a black background should be provided for it by gumming a piece of black paper to the bottom of the cell or varnishing it with asphalte. A large piece of the colourless skin from the under side of the sole must be carefully washed with a camel-hair brush in several changes of warm water to remove the mucus, and then placed between two pieces of glass held together by a strong clip and laid aside for a fortnight to dry. A carefully selected portion is then to be cut out and cemented to the bottom of the cell by a very small quantity of marine glue. The cover may then be applied and the slide finished as before.

Having mounted these objects, no difficulty will be experienced in treating in a similar manner wings of insects, entire lichens, and small fungi, fructification of ferns, equisetums, &c., and vegetable hairs, scales, pollen, and seeds. The objects may be dried in their natural condition or under pressure, according to circumstances.

The calcareous and siliceous skeletons of Foraminifera and Radiolaria are usually mounted dry, but space will not allow a description of the processes adapted for freeing them from the dirt and debris with which they are usually associated.

Wood, bone, and hard vegetable tissues are sometimes mounted dry, but as they require to be cut into very thin sections, their preparation will be described in another place.

Heads of insects mounted dry to show the eyes, antennæ, mouth-organs, *i.e. in situ*, require very careful drying, and some support, such as wax, to secure them in the cell in the most favourable position for observation.

Objects of too perishable a nature to be mounted dry, or too opaque to reveal their structure when so mounted and viewed by transmitted light, are most commonly preserved in a thick liquid resin known as Canada balsam. This substance owes its value chiefly to its great penetrating power and high refractive index, by which internal reflection and scattering of light are greatly reduced, and bodies immersed in it are made remarkably transparent. These properties, however, render it entirely unsuitable for mounting objects intended to be viewed by reflected light.

Pure Canada balsam is now seldom used, it being much more convenient for most purposes to replace its natural solvent, turpentine, by a more volatile substance, such as benzole. To prepare the solution the balsam should be exposed to the heat of a slow oven for about two days, until on cooling it becomes hard. Its colour will darken during this process, but the temperature must never be allowed to rise sufficiently to darken it beyond a deep amber colour, and must not be continued long enough to render it brittle. The hardened balsam is then to be mixed with about an equal volume of benzole and allowed to stand, with occasional stirring, until all dissolved. This yields a pale, amber-coloured liquid which flows readily at ordinary temperatures and may be used cold. It should be kept in a wide-mouthed bottle with a large stopper ground accurately to the *outside* of the neck, and a glass rod should be left standing in it.

Before an object can be put up in balsam several preliminary processes are necessary to free it from air and water, and these will be best considered by describing in detail the preparation of some one object—say, a small insect—the common flea.

The creature must be killed without destroying any of its parts, either by immersion in boiling water or by covering it with a watch-glass, under which is then inserted a small piece of blotting paper soaked in chloroform. In a few moments it will be dead, and may then be placed in a 5 per cent. solution of caustic potash for ten or twelve days.[1] This will thoroughly soften and partly dis-

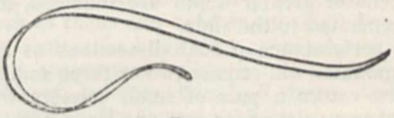


Fig. 4.

solve the viscera, the remains of which may be removed by placing the insect between two glass slides and squeezing it flat under water. The effect of this pressure is to squeeze the softened viscera out of the thorax and abdomen through the anus, and the spiracles on each side, or, if the pressure be violent, through an opening which is forced at the extremity of the abdomen, or between the thorax and first abdominal somite. The flattened flea should then be very carefully washed with soft camel-hair brushes, and soaked for two days in two or three changes of water to remove every trace of potash. It is then to be placed between two slides held together by a clip, and put aside in a warm place for a week to dry.

The water has now been eliminated, and the next process is to soak the flea for a day or two in spirit of turpentine, which will penetrate all its interstices and displace the air, thereby rendering it beautifully transparent, and preparing the way for the penetration of the balsam.

It only now remains only to mount it in the balsam. A small table, with a brass top 3½ inches long, 2 inches wide, and 3-16ths of an inch thick, is very useful for supporting the slide. On its centre should be engraved or scratched an oblong space 3 inches long by 1 inch wide with a central point and two or three concentric circles to serve as guides for centring the slide and cover respectively. A cleaned slide should be held in the centre of the table by a spring clip of the shape shown in Fig. 4, so placed in this case that its edge is a quarter of an inch to the left of the centre of the slide. The flea is then to be taken out of the turpentine by means of a section

[1] Common shallow earthenware ointment pots with lids are very convenient for holding solutions in which objects have to be soaked for any length of time.

lifter, and properly arranged on the centre of the slide. A drop of balsam is next taken up on the glass rod and allowed to fall upon the object and spread a little way beyond it. A half-inch circular cover glass, previously cleaned, is taken up with a pair of smooth-pointed forceps, and its lower edge allowed to rest against the spring. It is then slowly and very steadily lowered, guided by a mounted needle held in the left hand. In this way a wave of balsam will be driven before it, and will reach the edges of the cover without including any air. Very often the object is displaced by this wave, but this can generally be remedied by a slight pressure with a needle on the side of the cover to which the object has moved. When it is again by this means worked to the centre of the slide, a little firmer pressure should be applied to the centre, so as to press it down and squeeze out all excess of balsam.

(*To be continued.*)

ON THE OLD CALENDARS OF THE ICELANDERS[1]

THE old Icelandic system of measuring time, which to some extent still holds its ground in the island, has the peculiarity of being based on the week as its fundamental unit of measurement, although it recognises a year consisting of fifty-two weeks, the 364 days of which were included in twelve months of thirty days each. To the last of these months, which belonged to the summer, four days were added under the name of *Sumar-auke* or "summer addition." In accordance with this arrangement every given day of a month always fell on one and the same day of the week, as in the lunar year's calendar the first day of each month coincides with the period of new moon.

The Icelandic year was further divided into two half years, viz. summer and winter, known as "*misseri*," the former of which began on a Thursday in April, thence called "summer day," and the latter on a Saturday in October, the "winter day." These "*misseri*" were more used than the year itself to measure time, and Icelanders gave the name "*Misseristal*," or half-year's reckoning, to their calendar, while they habitually counted by the weeks of these winter or summer measures in referring to the everyday occurrences of the passing year, just as they spoke of *winters* and not years, the former being assumed to include the summers which directly followed them in the ordinary course of nature. By an analogous mode of reasoning they spoke of "nights" instead of days in referring to the twenty-four hours of night and day. This custom no longer exists among the modern Scandinavian nations, but traces of it still survive among ourselves in the expressions "fortnight" and "se'nnight," which are undoubted survivals of an ancient northern mode of reckoning time, unknown to southern peoples. This proof of the prevalence of a system of counting by nights among the common ancestors of the Icelanders and Anglo-Saxons makes it the more remarkable that the modern Scandinavians alone among European races should have a separate word to express the twenty-four hours of a day and night, as *dygn* in Swedish, and *dögn* in Dano-Norwegian, which have been derived from the O.N. *dagr*, day.

Each of the Icelandic "*misseri*" was divided into two parts, known as "*màl*," measures. Of these the second half of winter began on a Friday in January, distinguished as "midwinter day," while "midsummer day" fell on a Sunday in July, which was the first day of the second half of the *Sumar-māl*. This last of the four quarters contained ninety-four days, owing to the addition of the four nights of the "Sumar-auke," while the other three contained only ninety days each.

[1] "Om Islændernes gamle Kalendere." By Herr Geelmuyden. *Naturen*, No. 4, 1883.

The errors of this method of computation, which gave only 364 days to the year, were early detected, for, as we learn from an interesting manuscript of the twelfth century, known as the "Rimbegla," which is preserved in the Royal Library of Copenhagen, the first reform of the Icelandic calendar was effected by the learned Thorstein Surtr, who, as the grandson of Thorolf Mostrarskegg, one of the original colonists, could scarcely have belonged to a later period than the middle of the tenth century. In accordance with the naïve mode of narration common to the chroniclers of the time, the "Rimbegla" calls in dreams and visions to explain the introduction of a more correct method of counting time among the Icelanders. Thus we are told that when, after long pondering on the reason why the summer was falling back into spring, Thorstein Surtr bethought himself of a way by which the *misseri* might be brought again to their ancient courses, he dreamt that he was standing on the Law-Hill of the Althing, and that while all other men slept, he was awake, but when he seemed to himself to be sleeping, all others were watching. This dream was interpreted by the wise Osyv Helgason to imply that while Thorstein spoke at the Law-Hill, all men must keep silence, and that when he ceased speaking all must proclaim aloud their approval of his words. Accordingly, when he proposed at the Thing that in every seventh summer seven nights should be added to the four nights of the "Sumar-auke," all men agreed to the change without question or hesitation. By the adoption of Thorstein's suggestion, the Icelandic year acquired 365 days, similar to that of the ancient Egyptians, although by retaining the early mode of intercalation in the summer term, the old relations between the days of the month and week remained unchanged. From this time forth the expression "Sumar-auke" was applied equally to the original four annual intercalary days, and to the seventh year's week added by Thorstein, which has retained the term to the present age. In the modern calendar the word "aukanætr," added nights, has, however, replaced the older appellation of "Sumarauka."

Soon after the introduction of Christianity into Iceland in 1000, the national calendar was brought into closer relations with the Julian system, on which the clergy everywhere based their determinations of the festivals of the Church, and by adding a week to the old "Sumarauke" five, instead of four, times in twenty-eight years, the average year acquired an addition of one-fourth of a day, and was thus made to approximate more nearly to the Julian year.

In the "Rimbegla" full directions are to be found for comparing the periods of the beginning and ending of the ancient *misseri*, or seasons, with the divisions of the year observed in other Christian lands, while this authority is, moreover, the only source from which we obtain a clear insight into the methods originally adopted for determining for any given year the amount of the irregularities, known as "Rimspiller," which necessarily occurred in a system that took no account of the Julian leap-year. It is curious to observe that while in Iceland, as elsewhere in the middle ages, the fixed and movable festivals of the Church were made to regulate the divisions of time, and to fix the periods of political and social events, the old Icelandic modes of computing time were never eradicated. But although the people continued to count by "*misseri*," winters, weeks, and nights, the beginnings and endings of the "*misseri*" were fixed in Christian times by the dates of the great Church festivals, which similarly controlled all national events, and thus we find that the exact date of the annual "Riding to the Thing," and the duration of the session of the Althing, were regulated by the day of the week on which the Festival of St. Peter and St. Paul (June 29) happened to fall.

The twelve months are spoken of in the older Edda under their respective names, but from the earliest times the common usage in Iceland, as we have already observed, was to count by the weeks of each of the "*misseri*" instead of referring to months. According to Prof. Munch, the Northmen originally divided the week into five days, the so-called *Fimt* (Fifth), the later hebdominal week having been borrowed, like the names of the days, from the south. The latter, in spite of their apparent northern character, are in point of fact mere adaptations of the names of the Roman deities Mars, Mercury, Jove, and Venus, which reappeared in the old northern calendar as Ty, Odin, Thor, and Freja. Saturn alone failed to find a representative in this system of nomenclature, for to the genuine Northman it would seem that the last day of the week could have no other designation than that of "Laugar-dāg," or "Thvott-dāg," washing or bathing day. And this name has been retained through the intervening ages, being the only one that escaped the ban of the Church, when a century after the establishment of Christianity an episcopal ordinance interdicted the application of the names of heathen gods to the several days of the week, which were thenceforth known in accordance with their order of sequence, although *Sunnudāg* and *Mánadāg* in course of time replaced the older designations of "First Day" and "Second Day."

The new style was introduced into Iceland at the same time as in the foster- and mother-lands of Denmark and Norway, and in accordance with a royal edict, the day after February 18 in the year 1700 was reckoned as March 1. From that period to the present time the Icelandic calendars have given double tables based on the Gregorian, and the locally modified Julian system. A few modifications have, however, been made in modern times in the older national methods of intercalation, "summer day" falling on the Thursday between April 19 and 25, while in strict accordance with the past methods of computation it should fall on the Thursday between April 21 and 27. The intercalated week of the old "Sumar-auke" has also been shifted from midsummer to the close of the summer measure, and thus falls partly in September, "Haustmánadr," and partly in October, "Gormánadr."

THE ORFE, A FISH RECENTLY ACCLIMATISED IN ENGLAND

THE fine specimens of the "Orfe" presented by his Grace the Duke of Bedford to the International Fisheries Exhibition, and exhibited in one of the tanks of the Aquarium, fully deserve the notice of all interested in the culture of our freshwater fishes. They are some of a number which Lord Arthur Russell succeeded in importing from Wiesbaden in March, 1874, and which were placed in a pond at Woburn Abbey in Bedfordshire. Owing to the succession of cold summers these "Orfes" did not breed until last year, and we may hope that this season will also prove favourable. This species may now be considered as acclimatised, and will become a permanent acquisition to our ornamental waters.

The Orfe, whose bright yellow or golden colours resemble those of the Goldfish or Golden Tench, is, like these two latter fish, a permanent variety of a wild and much less brightly coloured race, belonging to the same genus as, but specifically distinct from, the Chub, with which it was confounded by some writers. Its systematic name is *Leuciscus idus*; of vernacular names those of "Aland" and "Nerfling" are those most generally used in Germany, whilst the Swedes know it by the name of "Id." The name "Orfe" refers to the golden-coloured variety only, which has been cultivated for centuries in inclosed waters in Bavaria. Willughby knew it well; he says in his "Historia Piscium" (Oxon, fol. 1686), p. 253:—"At Augsburg we saw a most beautiful fish, which they call the 'Root oerve,' from its vermillion colour, like that of a pippin apple, with which the whole body is covered, except the lower side, which is white." As in the Golden Tench, individuals of pure golden-yellow tints are scarce, the majority retaining marks of their origin from a plain-coloured ancestry in brownish spots or blotches on some part of their body. The ordinary size of this species is ten or twelve inches (and this is about the size of those at the Exhibition); but it is known to have attained to double that size and to a weight of six pounds.

The Orfe will thrive in all inclosed waters suitable to Roach and Goldfish; as an ornamental fish it is preferable to the latter on account of its larger size, livelier habits, and rapid reproduction; it takes the bait, and is eaten in Bavaria. As an ornamental domestic fish the Goldfish will always hold its own, but for waters of any extent and free from Pike and Perch we know of no more ornamental fish than the Orfe, a worthy rival of the Golden Tench, which has been so successfully acclimatised by Lord Walsingham; and we trust that his Grace will soon rear a sufficient number to secure to the Orfe a home in many different parts of the country. A. G.

SNOW AND ICE FLORA[1]

THIS work, which is included in Baron Nordenskjöld's studies and investigations arising out of his travels in the extreme north, is quite as interesting and important as regards the snow and ice flora of the Alps and Arctic regions, as the great traveller had led us to expect (see NATURE, vol. xxviii. p. 39). It is, as far as the materials on hand permit, an exhaustive account of the subject of which it treats.

As might be expected, the first pages of the work are devoted to "red snow," than which there are few subjects that have more engaged the attention of scientific travellers in the Arctic districts. This little plant has been found in the Arctic regions of Europe and America, thereby suggesting, as Prof. Wittrock observes, the former union of the two continents. It also appears in the north of Scandinavia, on the high Alps, the Pyrenees, and the Carpathians. Various were the opinions as to whether it belonged to the animal or vegetable world, and many the names by which it was designated. The prettiest of these names is certainly that given to it by C. Agardh—"the snow-flower." While, however, "red snow" will probably continue to be its trivial name, Prof. Wittrock has restored to it the scientific name of *Sphærella nivalis*, bestowed on it by Sommerfelt in 1882.

Until Nordenskjöld's expedition to Greenland in 1870, this alga was thought to be the only living plant on the ice and snow; but during their wandering on the inland ice, Nordenskjöld and Berggren discovered several algæ, among which was one new to science, namely, *Ancylonema Nordenskjöldii*, which was seen in such abundance, that it gave to the adjacent ground a peculiar purple-brown colour. Other algæ seemed to be mixed up with the fine sand (ice-dust, *kryokonit*), which here and there spreads a thin covering on the ice, or lies in a thick layer at the bottom of the funnel-shaped holes which are formed in it. Baron Nordenskjöld lays great stress on the important part which these algæ, and especially Ancylonema, play in the melting of ice. "The dark mass (algæ)," he says, "absorbs a larger portion of the sun's rays than the white ice, and therefore produces deep holes in the ice, which in a great degree conduce to its melting." He even thinks that this Ancylonema once performed the same office in Scandinavia, adding, "We have, perhaps, to thank this plant that the ice deserts which formerly covered Europe and America with a coating of ice, now give place to shady woods and undulating fields of corn."

[1] "Om Snöns och Isens Flora, Särskildt i de Arktiska Trakterna." Af Veit Brecher Wittrock. Ur "A. E. Nordenskjöld, Studier och forskningar föranledda af mina resor i höga Norden." (Stockholm, 1883.)

Subsequent investigation proved that the ice and snow flora was richer than had been anticipated. Dr. Kjellman found at Spitzbergen not only "red snow," but "green snow." Some of the "material" was brought home in a dry state; on being afterwards examined, it was found to contain above a dozen other plants, some of which were of a class even lower than "red snow"; others belonged to plants of higher organisation. Mosses also in the protonemata state were met with, but of very diminutive size. The ice and snow vegetation of this and other localities is described in detail. Special interest invests the kryokonit[1] with which all the specimens from South Greenland were mixed, because it was found to contain a number of germinating spores of *Sphærella nivalis.* During the winter of 1880-81 Prof. Wittrock was fortunate enough to enable some of these spores to develop themselves, hence it was considered that they were resting spores. They endure, without taking any harm, to be during the greater part of the year, frozen up in the ice and snow of the Arctic regions, and also to be dried up for some months by the heat of the sun. The author's observations on the conditions of plant life in the Arctic regions and on the glaciers of high northern tracts are particularly interesting. He observes that these tracts are certainly not entirely deprived of the powerful and life-giving influence of the sun's rays. They are, it is true, during a great part of the year (in winter) enveloped in continual darkness and gloom; but at another period (in summer) they are in the enjoyment of perpetual light. During this period the sun's rays, although oblique, may exercise a powerful influence. At midday the heat may be surprisingly strong. Nordenskjöld found that the warmth of the air a short distance above the surface of the ice at midday in July rose to 25°–30° of Celsius. It is evident that a great melting would take place on the surface of the glaciers and snow-fields. There is then formed a layer of snowy and icy water, which, though not much above the zero of Celsius, is enough to satisfy the demands for warmth of this portion of the simplest organisations of the vegetable kingdom. That they thrive under these hard conditions of life is evident from the immense multitudes in which they occur. "Probably," adds the author, "there is no other species on earth which is richer in individuals than red snow."

Prof. Wittrock gives a full description of the structure and fructification of these minute plants; then follows a summary of their characteristics. The latter may be thus briefly stated:—The flora of the ice- and snow-fields consists almost entirely of algæ of microscopical size and of extremely low organisation; the greater part of the plants are unicellular; they are sometimes solitary, sometimes in colonies. The fructification is very simple, asexual, and of one kind only. These algæ are generally of bright and full colours. The "snow-flower" is blood-red, *Ancylonema Nordenskjöldii* purplish-brown; many Conferveæ and Desmidieæ are bright green. The land vegetation is represented entirely by mosses, which appear to be nearly in the same low state of development as the algæ.

The orders, families, genera, and species of which the Arctic flora is composed are well arranged in tabular form at pp. 112, 113. In this table the flora of the snow is distinguished from that of the ice. It will be seen that the most common plant is "red snow;" the next in frequency is *Ancylonema Nordenskjöldii.* The snow flora is richer than that of the ice. The former includes thirty-seven species; the latter ten only. The mosses and Conferveæ belong exclusively to the snow flora. Ancylonema is the only plant which is limited entirely to the ice flora. Of Phycochromophyceæ the ice flora has two species only, while that of the snow possesses ten. The snow flora of Spitzbergen is rich in Conferveæ, that of Lapland in Desmidieæ. In the middle north the Phycochroms prevail. It is stated that *Bacteria termo* is occasionally found within the limits of the ice and snow flora. *Chytridium hæmatococci* may also, observes the author, belong to the Arctic flora, as it was found parasitic on *Sph. nivalis* on the Berner glacier in Switzerland.

[1] Analyses of kryokonit will be found at pp. 95, 96.

It appears that the Arctic regions possess a microscopic fauna as well as flora. The limits of this notice will only permit a reference to p. 116, where the small animals of which this fauna consists are described. One fact connected with these little creatures may be mentioned. With the object of a further study of the algæ, Prof. Wittrock put a portion of the dried material brought from Spitzbergen into distilled water. He found that not only the algæ came to life again, a fact which he had before observed with respect to red snow, but what was more astonishing, even the little worms revived, and ate a great deal of food, which could be distinguished under the microscope as the reddish-yellow contents of the intestinal canal of these transparent, colourless creatures.

The work is illustrated by two woodcuts and by five lithographic plates, one of which contains figures from drawings by Prof. Wittrock of some of the plants; the others consist of views from drawings by Dr. Berggren, of the inland ice of Greenland, representing localities from whence portions of the material containing the ice and snow flora were obtained.[1] The view of the intermittent spring which the travellers met with about 45 kilomètres from the coast, and which, bursting from a cleft in the ice, throws up a jet of water to a great height, is of special interest from the indications it gives of the probable existence of warm conditions in the interior of Greenland. It will be observed that the "sky-line" of the distance in some of the views shows an undulating outline, suggesting a hilly country in the interior.

MARY P. MERRIFIELD

NOTES

THE Lords of the Committee of Council on Education have, by a recent minute, decided to withdraw the prizes hitherto given to candidates in the Science Examinations who obtain a first class in the elementary stage of the various subjects of science, substituting certificates of merit, and retaining only the prizes given in the advanced stage. The money hitherto devoted to prizes will be employed in providing thirty-six National Scholarships—twelve each year—which will be offered in competition to students of the industrial classes, and awarded at the annual examinations of the department. The National Scholarship will be tenable, at the option of the holder, either at the Normal School of Science, South Kensington, or at the Royal College of Science, Dublin, during the course for the Associateship—about three years. The scholar will receive 30*s.* a week during the session of about nine months in the year, second-class railway fare to and from London or Dublin, and free admission to the lectures and laboratories. This is a most important step in advance.

WE have already announced that the Thirty-second Annual Meeting of the American Association for the Advancement of Science will be held at Minneapolis, Minnesota, from August 15-21 next. A Local Committee has also been formed to carry out the arrangements at Minneapolis, and members expecting to attend the meeting are requested to send a notification to that effect to its secretary, Prof. H. N. Wurchell, Minneapolis, without delay. Full titles of all the papers to be read at the meetings

[1] Those who are interested in these algæ may like to know that specimens of fourteen of them are included in the Fasciculi of dried freshwater algæ distributed by Prof. Wittrock and Dr. Otto Nordstedt, of which ten parts have already appeared. The 11th fasciculus, containing other portions of the Arctic flora, will shortly be issued at Lund, Upsal, and Stockholm, under the following title:—"Algæ aquæ dulcis exsiccatæ præcipue Scandinavicæ quas adjectis algis marinis chlorophyllaceis et phycochromaceis distribuerunt Veit Wittrock et Otto Nordstedt."

must be forwarded to the permanent secretary as early as possible, accompanied by an abstract of their contents and a statement of the time which they will occupy in delivery. By the kindness of a member, provision will be made for the illustration of papers by means of a lantern if the authors bring their slides to the meeting. Altogether the arrangements are very complete, and a cordial welcome will, we doubt not, be given to any foreign members or visitors who are making arrangements to attend this meeting of the American Association.

THE Council of the Yorkshire College announce that the Cavendish Professorship of Physics has been established as a memorial to the first President of the College, the late Lord Frederick Charles Cavendish, M.P. The fund required to endow this chair was 7500*l.*, and 7560*l.* 13*s.* has been contributed. Prof. Rücker retains the position he has occupied with much distinction from the foundation of the Yorkshire College, as Professor of Physics, but his title will in future be "Cavendish Professor of Physics."

DR. CARGILL G. KNOTT, F.R.S.E., Secretary of the Edinburgh Mathematical Society, has been recently appointed Professor of Physics in the Imperial University of Tokio, Japan.

ENGLISH chemists may be interested to learn that an election to fill the Chair of Chemistry, including General and Industrial Chemistry, in the University of Virginia, vacant by the resignation of the present incumbent (J. W. Mallet, Ph.D., F.R.S.), will be held by the Board of Visitors of the University of Virginia, on September 11, 1883. The salary of the professor is 3000 dollars, with a commodious house, rent free. Applications, with testimonials, must be addressed to "The Rector and Visitors," P.O. University of Virginia, Albemarle County, Va. We understand the Chair is open to English competitors.

WE regret to announce the death, at the early age of thirty-seven years, of Mrs. Chaplin Ayrton, the wife of Prof. W. E. Ayrton. Mrs. Ayrton was in many ways a remarkable woman. As Miss Chaplin she was one of the first to take up the practical question of women's professional education, and it is in part due to her exertions that the medical career is now opened to women. Her long struggle, from 1869 to 1873, to obtain the necessary permission to present herself for examination told seriously on her health. In addition to attending all the medical classes open to women in Edinburgh, and gaining honours at all the examinations held in connection with them, Mrs. Chaplin Ayrton studied at the hospitals and the Medical School of Paris, and there took her degree of M.D. in 1879. Her graduation theses, "Researches on the General Dimensions and on the Development of the Body among the Japanese," is full of valuable scientific experiments.

THE Queen has been pleased to confer Baronetcies upon Dr. Andrew Clark and Mr. Prescott Hewett.

A BLUE-BOOK just issued contains reports on the mineral wealth of Corea. The explorers found numerous veins of iron, copper, lead, and also some gold. These were worked in the rough native fashion, and it is noticeable that no indications of coal were found. In twenty days' journey ten mines were seen, and many of them, especially those of iron and copper, are said to be of great richness.

IN NATURE, vol. xxvi. p. 15, will be found an illustrated description of Negretti and Zambra's patent deep-sea thermometer. This firm have now adapted their inverting thermometer for recording variations of atmospheric temperature at any desired interval of time. Twelve of such thermometers are arranged on a suitable frame in connection with a clock, a galvanic battery, and a series of small electromagnets in such manner that at every hour the galvanic circuit is completed by the clock, this releasing a detent and allowing one of the thermometers to reverse and record the temperature at that moment. In the present form of the apparatus twelve thermometers have been mounted to record hourly temperatures; this period can be easily altered to half-hours or less, or on the other hand to longer intervals, say, of two hours or more. This apparatus differs, it is claimed, from all other registering or recording thermometers in the following important particulars:—1. The thermometers contain only mercury, without any admixture of alcohol or other fluid. 2. They have neither indices or springs, the registrations being by the column of mercury itself. 3. These thermometers may be carried in any position, and cannot be disarranged except by actual breakage. 4. They will record exact temperature at any given hour of the day or night.

THE Berlin Academy of Sciences has granted the following amounts from its Humboldt Fund: 5000 marks (250*l.*) to Dr. Otto Finch, for working at the collection he made during his journey in Polynesia; 6000 marks (300*l.*) to Dr. Ed. Arning (Breslau) for researches on the leprosy epidemic in the Sandwich Islands; the same amount to Dr. Paul Güssfeldt to enable him to continue and extend his exploring tour in the Andes of Chili.

THE Anthropological Museum of Leipzig has been presented with an annual grant of 6000 marks (300*l.*) from the Grasse Fund by the town authorities.

THE sixty-sixth meeting of the Swiss Natural History Society will take place at Zürich on August 6 to 9 next.

THE German Society of Analytical Chemists met at Berlin on June 16–18 last; the most important transaction at the meeting was the adoption of certain uniform methods in the analysis of wines.

THE 27th of June last seems to have been remarkable for earthquakes in various parts of Europe. At Corfu a violent shock was felt at 11.25 a.m. on that day, and at Darmstadt a moderate shock was observed at 11.18 a.m. At the last locality three other shocks occurred in the night following, and a number of oscillations on June 28 at 11.38 p.m. On July 6 at 3.20 a.m. Constantinople and its environs were visited by an earthquake.

IN Sardinia phylloxera is ravaging the vineyards to such an extent that the inhabitants are beginning to despair of being able to overcome the plague.

THE half-yearly general meeting of the Scottish Meteorological Society is to be held in Edinburgh to-day. The business will be—(1) Report from the Council of the Society; (2) The Meteorology of Ben Nevis, by Mr. Alexander Buchan, Secretary.

W. H. EDWARDS announces, according to *Science*, that he will not, at present, complete the synopsis of species commenced in the tenth part of his "Butterflies of North America," but substitute for it a mere list of species, which will be issued with the next (concluding) part of the second series.

THE municipality of Algiers has established a chemical office, on the pattern of the similar Parisian institute, for analysing alimentary substances and discovering adulterations.

AT the last sitting of the French Société d'Hygiène M. Marie Davy, who was in the chair, gave an account of the results of his analysis of the water of the Seine; he found that the impurity is five hundred times greater below Asnieres than at Paris.

THE April number of the *Chrysanthemum* magazine of Yokohama contains a continuation of Capt. Blakiston's notes on Japanese ornithology; also an article by Mr. Eastlake on the ornithology of Hong Kong, and the continuation of a history of Japanese keramics by Capt. Brinkley. The numerous possessors of pieces of "real old Satsuma" in England will hear with annoyance from this skilled authority that large quantities of

Kioto ware have been fraudulently placed on the Western markets as genuine Satsuma. The former is less dense than the latter, and its colour is as a rule darker. In truth, this writer says, not more than a fraction of the ware which has been attributed to the Satsuma workshops was ever manufactured there. The outcome of the factories was always comparatively small. They worked to order, and nine-tenths of their productions were cups, tea-jars, and other small articles. Large vases and portly incense-burners were exceptional; and in the matter of old Satsuma Western collectors have among Japanese *virtuosi* rivals who are at once more competent judges and very much more liberal purchasers than themselves.

THE city of Rouen is to establish at Pont de l'Arche on the Seine large waterworks for the generation of the electric light. A lamp is to be placed on the top of the Cathedral, and directed by a reflector on the surrounding streets.

THE largest display of electric light in Paris is probably at the Hippodrome, where, in the large hall, sixteen regulators and 142 Jablochkoff lights are used, exclusive of those in other parts of the building and outside. The dimensions of the arena are about 45 metres by 120, and the height about 30 metres. The effect is really splendid.

THE past month has brought with it its annual science examinations, and we have been especially struck with the questions of the City and Guilds examination papers in the electrical subjects. One fact that we notice is that there seems very little difference between the pass and honours grades, two or three of the questions being similar, if not identical in each; secondly, in the electric lighting and transmission of power papers there seems to be a great paucity of questions on these topics, and one or two rather prominent questions on theoretical electricity. Are not papers of this kind somewhat misleading to teachers who are preparing classes for these subjects?

A VERY interesting legal case has just been decided by the Solicitor-General in the matter of the Lane-Fox disclaimer. Mr. Lane-Fox sought to be allowed to disclaim from his patent of 1878 for incandescent lamps and storage batteries, all except the use of secondary batteries as a means of storage, and regulation of a supply of electricity. This is a very broad claim, and, to judge by present appearances, of vast importance. Although not the first to use accumulators, yet Mr. Lane-Fox is the first man who worked out a system in which they played the part of regulators for a steady supply. The disclaimer was allowed by the Solicitor-General after a protracted discussion.

ANOTHER so-called "God's waggon" has been discovered in the Deibjerger Moor near Ringkjöbing (Jutland). Our readers will remember our reporting the discovery of the first some two years ago. Dr. Petersen, the keeper of the Copenhagen Museum, has proceeded to the spot to superintend further researches.

TWO further volumes of Hartleben's "Elektrotechnische Bibliothek" have just been published. They are entitled "Die elektrischen Leitungen und ihre Anlage," by J. Zacharias, and "Die elektrischen Uhren und die electrische Feuerwehr Telegraphie," by Dr. A. Tobler.

OF the "Encyclopädie der Naturwissenschaften" (Breslau, Ed. Trewendt) we have received the 14th part of the second division and the 33rd part of the first division. The latter contains the continuation of Wittstein's "Handwörterbuch der Pharmakognosie der Pflanzenreichs," and the former of Dr. Gobel's "Vergeleichender Entwicklungsgeschichte der Pflanzenorgane" in the "Handbuch der Botanik." Both works will, we are informed, be soon brought to a conclusion.

DR. MACGOWAN of Wenchow is endeavouring to procure records of earthquakes in China from the residents in various parts of that country, and with that object has addressed a letter to the local journals. He directs attention especially to Formosa, where earthquakes are most common in November and December, confirming so far Mr. Mallet's observations. A Chinese record thus describes the effects produced on the sea by submarine causes—among them probably earthquakes:—"Peculiar noises of the sea are sometimes heard which are commonly regarded as indicative of change of weather, sounds coming from the foreboding rain, those from the south being followed by wind. Hissing noises are heard; at times they are low, at others loud. When low they resemble the beating of a drum or the dropping of beans on the same instrument. Now the sounds are near, and now distant; stopping suddenly, or continuing for hours. When the noise is loud, it is more noisy than a hundred thousand men, and the sea bubbles up; in very protracted cases the noises continue day and night for half a month, and when of short continuance the sound lasts three or four days. During the sounds the sea is agitated by fearful billows and furious waves."

SEVERE tornadoes are reported as having occurred in Southern Minnesota and Wisconsin (U.S.) on Monday. A railway train was overturned and many of the passengers killed.

DR. H. REUSCH, who last year took part in the geological investigations of the west coast of Norway, made under the direction of Prof. Kjerulf, has given to *Naturen* the results of his examination of the fossils of the fjelds and islands near Bergen. The richest find was discovered on the little island, Stordö, outside the Hardangerfjord, where numerous well preserved remains of crinoids, a great variety of corals, graptolites and shells of mollusks were obtained which belonged to the Silurian period. The rocks of this district were mostly of compressed conglomerates. The small group of islands beyond Espevær, and the neighbouring Siggen Fjeld, exhibit the most strongly marked volcanic character, and owe their origin to the eruption of streams of molten rock and layers of ash and scoriæ, which probably belong to the Silurian age. These products of eruption have, however, not remained *in situ*, for the once horizontal deposits have been so powerfully crushed, twisted, or upheaved at various points, that the masses of rock of which the great Siggen Fjeld is composed have now a vertical inclination trending north. The accidental discovery in 1862 of a small nugget of pure gold embedded in white quartz, in the so-called Storhaugens mine on Bömmel Island, has attracted the attention of prospectors, and a French company has opened extensive works at Viksnes, where copper pyrites are found in considerable quantities. A fine specimen of the auriferous quartz of Bömmel Island may be seen in the museum of the Christiania University.

THE steamer *Germania* is on the point of sailing from Hamburg to Cumberland Sound, in order to bring home the staff of the German Polar station. Dr. F. Boas leaves with the *Germania* for the purpose of making ethnographical researches in Arctic America.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from West Africa, presented by Miss M. A. Waite; a Black-backed Jackal (*Canis mesomelas* ♀) from South Africa, presented by Mr. E. D. Thomas; a Philantomba Antelope (*Cephalophus maxwelli*), a Duyker-Bok (*Cephalophus mergens*) from South Africa, presented by Mrs. Macfarlane; five Martinican Doves (*Zenaida martinicana*), two Porto Rico Pigeons (*Columba corensis*) from the West Indies, presented by Mr. J. A Ward; a Ringed-necked Parrakeet (*Palæornis torquatus*) from India, presented by Mrs. Humphrey; a Macaque Monkey (*Macacus cynomolgus* ♀) from India, an Ocelot ((*Felis pardalis* ♂) from Demerara, a St. Thomas's Conure (*Conurus xantholæmus*) from St. Thomas, West Indies, deposited; thirteen Common Vipers (*Vipera berus*) from Hampshire, purchased; two Levaillant's Cynictis (*Cynictis penicillata*), two Wonga-Wonga Pigeons (*Leucosarcia picata*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

THE ELLIPTICITY OF URANUS.—It may be remembered that Sir William Herschel, who was at first under the impression that the disk of Uranus presented a perfectly circular outline, was afterwards convinced that there was an appreciable elongation in the direction of the major-axis of the orbits of the satellites, though he has not recorded any measures to test this conclusion. On October 13, 1782, about eighteen months after the discovery of the planet, he writes: "I perceived no flattening of the polar regions." On March 5, 1792, he used "a newly polished mirror of an excellent figure: it showed the planet very well defined and without any suspicion of a ring." With powers 240–2400, all which his speculum bore with great distinctness, he formed a different opinion, and remarked, "I am pretty well convinced that the disk is flattened." On February 26, 1794, he has an observation thus recorded, "20-feet reflector, power 480. The planet seems to be a little lengthened out in the direction of the longer axis of the satellites' orbits." Further, in a paper communicated to the Royal Society in December, 1797, wherein he announces his supposed discovery of four additional satellites of Uranus, he says: "The flattening of the poles of the planet seems to be sufficiently ascertained by many observations. The 7-foot, 10-foot, and the 20-foot instruments equally confirm it, and the direction pointed out February 26, 1794, seems to be conformable to the analogies that may be drawn from the situation of the equator of Saturn and of Jupiter." This ellipticity being admitted, he inferred that Uranus had a rapid axial rotation.

In September, 1842, Mädler, remarking that notwithstanding the statement made by Sir W. Herschel no measures of the planet existed which would confirm it or otherwise, instituted a series with the filar-micrometer of the Dorpat refractor. The measures were made on five nights, and the diameter of the planet was determined at every 15° of the circumference, the mean of each set being made to fall nearly at the time of meridian passage. The nights (September 16, 17, 19, 20, and 21) were of exceptional clearness, and permitted of a power of 1000 being used. Mädler found the greater diameter of Uranus 4″·249 at the planet's mean distance, and the compression $\frac{1}{10\cdot85}$; the angle of the greater axis was 160° 40′ counted from north towards east. At this time Uranus was less than 11° from the descending node of the orbits of the satellites, as determined by Prof. Newcomb.

Between August 24 and October 20, 1843, Mädler repeated his measures on seven nights: his results from this year's series were—

Greater axis of projected ellipse ...	4″·3274
Lesser axis ,, ,, ...	3·8910
Compression	$\frac{1}{9\cdot92}$
Angle of greater axis with declination circle	15° 26′·1

This ellipse is for September 28, 1843, when the distance of Uranus was 19·079. The greater axis for the mean distance of Uranus would be 4″·304.

An ellipticity comparable with that of the planet Saturn might have been expected to strike the generality of observers provided with the large instruments which have been available since the epoch of Mädler's measures; yet neither with the Pulkowa refractor, with the late Mr. Lassell's 4-foot reflector, employed by him and Mr. Marth in measures of Uranus at Malta in 1864–5, nor with the Washington 26-inch refractor, or many other instruments of adequate power, do we find that there has been any confirmation of the great inequality of diameters found by Mädler, up to 1877.

It now appears from a communication made by Prof. Safarik of Prague to the *Astronomische Nachrichten* in April last, that on March 12, 1877, he found Uranus "certainly elliptical, the greater axis in the parallel," and this impression he received on various occasions up to the date of his letter. On April 2 in the present year he records of the appearance of the planet: "Stets stark länglich; in den besten Momenten schätze ich die Elliptität stärker als jene Saturns"; the greater axis was at 190°. The instruments used were of very moderate capacity, being an achromatic of 11 cm. and a silver-on-glass speculum of 16 cm.

In consequence of a representation from Prof. Safarik, who laid stress upon the actual proximity of the planet to the ascending node of the orbits of the satellites, Prof. Schiaparelli has made, this year, an extensive series of measures of the diameter of Uranus, the results of which have appeared in No. 2526 of the above-named periodical. The measures are discussed on two methods giving for the ellipticity of the planet in the one case $\frac{1}{10\cdot98 \pm 0\cdot93}$, and in the other (perhaps the more preferable value), $\frac{1}{10\cdot94 \pm 0\cdot67}$. In addition to actual measures, Prof. Schiaparelli drew the outline of the planet, as it appeared to the eye, on thirteen nights, the drawings giving by measurement an ellipticity of $\frac{1}{11\cdot07}$. An assistant in the same way found $\frac{1}{10\cdot9}$. The Milan measures with the filar-micrometer were made between April 12 and June 7. For the equatorial diameter at the mean distance Prof. Schiaparelli found 3″·911.

PHYSICAL NOTES

IN the current number of *Wiedemann's Annalen*, Prof. C. Christiansen of Copenhagen resumes his researches on the indices of refraction of coloured liquids. The methods adopted consisted in the examination of the liquid in hollow prisms of very small refracting angle; a few drops of the liquid being placed between two small pieces of glass touching each other at one side, but separated about half a degree. Another method consisted in inclosing the liquid between a piece of very thin glass and a biprism made of a glass the index of refraction of which was known, the index of the liquid being calculated by taking the refraction as the difference of the two separate refractions of the glass and the liquid. Prof. Christiansen gives tables of results for water, alcohol, turpentine, and nitrobenzol, and also for solutions of permanganate of potash of various degrees of concentration. For the latter substance the results agree with the determinations of Kundt, but are probably more exact.

PROF. G. M. MINCHIN has greatly improved the form of the absolute sine electrometer invented by him some months ago. The first of the new instruments constructed by Mr. Groves of Bolsover Street is now complete, and is to be sent out to Prof. Anthony of the enterprising and wealthy Cornell University. We hope shortly to illustrate and describe this beautiful instrument.

PROF. EWING of Tokio prints in the *Proceedings of the Seismological Society of Japan* three valuable seismological notes. The first of these describes a duplex pendulum seismometer the principle of which is the following:—A common pendulum having its centre of gravity below the centre of suspension is stable; an inverted pendulum with pivoted supporting rod is unstable. By placing an inverted pendulum below a common one, and connecting the bobs so that any horizontal displacement must be common to both, the equilibrium of the jointed system may be made neutral or as nearly stable as is desired. A very sensitive seismograph is thus obtained. The instrument has not yet been put to the test of an actual earthquake.

PROF. QUINCKE has contributed to the *Proceedings of the Royal Prussian Academy of Sciences* an important memoir on the changes produced by hydrostatic pressure in the volume and refractive index of transparent liquids. The ratio of these changes exhibits, it appears, a definite relation. The compressibility in volume was measured by subjecting the liquids to pressure in glass vessels furnished with capillary tubes. The indices of refraction were measured by observing the number of interference bands in homogeneous light in an interferential refractometer. One of the most important results of this research is the light it throws on the disputed formula called the *constant of refraction*. According to Dale and Gladstone the name of *constant of refraction*, or *specific refractive power*, should be assigned to the quantity $\frac{\mu - 1}{s}$, where μ is the index of refraction and s the specific gravity of the substance. According, however, to Laplace the quantity $\frac{\mu^2 - 1}{s}$ is the true constant of refraction; whilst, according to Professors H. A. and L. Lorenz, that name should be given to the more complicated function $\frac{\mu^2 - 1}{(\mu^2 + 2)s}$. Now since with liquids that are subjected to pressure the density varies proportionally with the pressure within certain limits, the true constant of refraction should be that function of the index of refraction and of the density which is independent of pressure. In point of fact Prof. Quincke's experiments confirm the formula of Dale and Gladstone, since $\frac{\mu - 1}{s} = \frac{\mu_1 - 1}{s_1}$, where s_1 is the density under any given pressure, and μ_1 the observed refractive index under the same pressure. To put the matter in simple phrase, *the decimals of the refractive index increase proportionately with the density.*

IN a further paper in *Wiedemann's Annalen*, Prof. Quincke has given some details concerning the experimental methods pursued in his investigations, together with figures of the apparatus and tables of results for a large number of liquids under different conditions.

M. BLEEKRODE has lately described in the *Journal de Physique* a very convenient form of apparatus for projecting galvanic experiments on a screen. It consists of a glass bath (6 cm. long, 5 cm. high, 1 cm. broad), at either end of which is a metallic support which not only makes contact with the two plates that are immersed in the bath, but also are attached to a flat galvanometer which is placed on the top of the bath. The galvanometer consists of a light ebonite framework the same size as the top of the bath and 1 cm. thick, upon which is wound two or three layers of insulated copper wire ·3 mm. thick. A single needle is used, supported on a pivot in the centre of the coil. The whole apparatus is of such a size as to be easily used in any lantern.

IN a recent number of *Carl's Repertorium*, Th. Edelmann describes a very simple means of determining the specific weight of a gas. His method consists in taking a column of gas which presses on a membrane, then observing the displacement of the membrane. This is a somewhat analogous action to the aneroid barometer. The absolute arrangement being to have the membrane strained on a metallic box about 30 cm. diameter, this box is in direct communication with a tube 2 m. long filled with gas. Upon the membrane rests a light lever which carries a mirror at its point of suspension; thus by raising a scale at a considerable distance the slightest movements can be observed and therefore the density taken with the greatest accuracy.

M. MORIN has lately brought out a new electric candle, one great advantage in it being that the light may be extinguished or relighted at any time. This is obtained by the attraction of a piece of soft iron by a flattened solenoid; fixed on the same axis as the soft iron is a cam, upon whose position the proximity of the carbon depends. This motion is easier and not so noisy as the electromagnet as used by Wilde and others.

M. TOMMASI has brought out a new regulator in which he uses selenium, whose resistance varies considerably with variations in the intensity of light. At present it has only been adapted to regulating the position of the light of a Jablochkoff candle.

THE latest idea brought out for making incandescent lamps is by Messrs. Boulton, Soward, and Probert. They electrolyse a carbonaceous gas between platinum electrodes, in a globe; as soon as an arch of carbon is formed the globe is exhausted and the lamp ready for use.

MESSRS. J. ELSTER AND H. GEITEL have found that a Zamboni pile can be made to work as an accumulator by charging it from a Holtz machine. After ten minutes they obtained a spark with the poles 1 mm. apart. Peroxide of lead does not work so well when used ready formed.

M. REYNIER has published some figures concerning the work done by a Leclanché battery when used on a telephonic exchange. Two batteries of three cells each were used for thirty days of seven hours' duration. The loss of weight of zinc during that time was 64·5 grms., which represents 63,235 coulombs. This is equal to a current of 0·084 ampere during the month. Taking the E.M.F. of a Leclanché cell at 1 volt, the total work done is 189,705 watts, which is equivalent to 1 h.p. every 52 minutes.

GEOGRAPHICAL NOTES

THE new number (No. 1 of vol. iv.) of the German African Society's *Mittheilungen* gives a table of magnetic observations and temperature made at different points of his route from Kakoma to Karema by Dr. E. Kaiser, who unhappily died last November on the bank of the Rikwa lake. A copious list follows of Dr. Kaiser's altitudes between Zanzibar and Kakoma. On the basis of English maps of the Niger and the Binuë, Dr. Kiepert traces Herr Ed. Robert Flegel's route from Eggan to Bida in September, 1881, and thence by way of Keffi to Loko in November and December of the same year. Summing up Herr Flegel's topographies, Herr Stück determines the latitude of Loko at 7° 58′ 16″ ± 7″ N., and of Keffi at 8° 49′ 22″ ± 3″ N. In an interesting letter from Ngaundere amid the sources of the Logone, dated August 22, 1882, Herr Flegel claims to have discovered the source of the Binuë, or at least an important part of the territory from which this river takes its source. On July 31 last Herr Flegel proceeded from Jola to the watershed between the tributaries of the Faro and the Binuë, and on August 17 reached the first fountain-brook of the Binuë, passing it and two further heads of the river on the 18th. Ascending a steep mountain chain, the watershed between the Binuë, Faro, Logone, and Old Calabar system, he beheld the last stream, by the inhabitants unanimously named the Binuë in contradistinction to the Guzun-Binuë (beginning of the Binuë) he had first passed. From the back of the mountains close by their encampment on the first *rimchi* (farm) of Ngaundere, the source of the Binuë was pointed out by the natives. If not *the* source, it was undoubtedly one of the main sources. After a stay of four months at Ngaundere Herr Flegel returned to Lokoja, whence, in a letter of February 21 last, he projects an early exploration of the lands yet unknown to the south of the Benuë and of the watershed crossed by him the previous year. He also contemplates opening up the territories where the Tsad and the Niger have their sources, and investigating the relations between these two water-systems, examining Barth's hypothesis of a direct water communication between the Tsad and the Niger by means of the Mao Kebbi and the Jubori swamps. He will further make inquiry into the political and ethnographical relations between the Tsad and Niger territories. Astronomical topographies are given of places visited by Lieut. Wissmann between Malange and Kimbundu. There are two interesting and instructive reports by Dr. Pogge and Lieut. Wissmann on their expedition through the south-east of the Congo basin, between Kimbundu and Nge Njangwe, from July 31, 1881, to April 17, 1882. The Kioque, inhabiting the country along the Luelle and the Chikapa, among whom the two travellers journeyed for a month and a half, are described as an intelligent and enterprising people, expert smiths, hunters, and far-travelling merchants. Carrying on a large trade in gum, and soon exhausting a district of its gum produce by their inconsiderate method of going to work, they are in a state of perpetual movement towards the north. Almost all the ivory which reaches Loanda is forwarded thither by the Kioque from the Tuschilange country. The Tuschilange (sing. Kaschilange) or Baschilange (sing. Muschalange) are a mixed people, composed of the aborigines and the Baluba, who have entered the country from the south. Of the three divisions of them the central is the *Bena Riamba*, *i.e.* sons of wild hemp, so called from their excessive addiction to smoking that herb, which is smoked more or less in almost the whole of Africa, and produces an intoxicating effect combined with coughing. The *Bena Riemba* are forbidden to keep goats or swine, and the travellers during their stay among them suffered from the want of animal food. Crossing the splendid river of Lubi, the travellers passed from the land of the Baschilange to that of the Bassonge, who, according to Lieut. Wissmann, occupy the highest industrial position he had ever seen negroes hold. Artistic working in iron and copper, weaving, basket-making, carving, and pottery are all highly advanced among them. Living in fair villages with large clean houses, under the shade of palms and bananas, the men cultivate their trim fields, and leave only the lighter work to their wives—a relation in marked contrast to that existing among the peoples they had hitherto visited.

THE July number of Hartleben's *Rundschau für Geographie und Statistik* contains, among numerous others, the following original papers:—Researches concerning Madagascar, by J. Audebert.—On the Bedouins of Palestine, by R. Ranipendahl.—On the three first German "Geographentage," by Dr. Sigm. Günther.—On the United States of Columbia; these are remarks accompanying a good map of the States in question.

THE commander of the *Willem Barents*, now on her fifth North Polar expedition, has sent news to Amsterdam from

Solombola. Nothing had been ascertained regarding the fate of the steamer *Varna* or her crew.

AT the meeting of the Berlin Geographical Society on the 8th inst. some communications were made regarding the latest undertakings of the German explorers now at work:—Dr. Paul Güssfeldt had undertaken to ascend the Aconcagua, the highest peak of the Chili Cordilleras (6934 metres); he failed on account of the extreme cold, but succeeded in taking a number of interesting photographs. Dr. Steiner, a member of the Antarctic expedition had proceeded northward from Punta Arenas, and had drawn a remarkable geological map of the country he traversed. He intends to penetrate into Chile. Dr. Hettner is about to start on an exploring tour through Canada with a view of discovering coal deposits.

NEWS of the German African traveller, Dr. Fischer, has just arrived from Zanzibar. He was at some days' distance from Ngaren Erobi, had 800 followers, and had forced his way through the Massai district. He thus seems to have joined other caravans, as he had started with only 350 men himself. Ngaren Erobi is to the west of the Kilima Ngaro, and under $36\frac{1}{2}°$ E. long., and 3° S. lat.

LIEUT. BOVE is just starting on a second expedition to Terra del Fuego. Thence he intends to penetrate into Graham's Land. The Italian Geographical Society bears the cost of this expedition, which will sail from Genoa and go by way of Monte Video.

DR. OSCAR LENZ is now writing an account of his second great African journey. It will be published by Brockhaus (Leipzig), and will be entitled "Timbuktu, Reise durch Marokko, die Sahara und den Sudan, ausgeführt im Auftrag der Deutschen Afrikanischen Gesellschaft."

SCIENTIFIC SERIALS

Bulletin de la Société d'Anthropologie de Paris, tome vi. fasc. 1, 1883.—Presidential address.—Conditions to be observed by the competitors for the annual "Godart Prize" of 500 francs, founded in 1862; and for the "Broca Prize" of 1500 francs for the best memoir on a question of human or comparative anatomy, or of physiology referring to anthropology. This prize was founded by Madame Broca in 1881, and is biennial.—Report by M. Pozzi of a highly ornamented so-called medical pipe, found in an ancient mound in Kentucky. This fine specimen of the workmanship of the prehistoric mound-builders of the New World is identical with those found in California, and supposed to have been used for producing blisters and moxas.—M. Ball described the post-mortem appearances of the brain of the Batignolles cretin, whose abnormal condition had been brought to the notice of the Society last year.—On social instinct, by Dr. Prat.—On supposed human imprints found in clay beds at Carson in Nevada, by Dr. W. Hoffman.—An interesting paper on the superstitions and faith in sorcery still persisting in South Italy, by M. Maricourt.—On an anomaly of the brachial biceps, by M. G. Hervé.—On M. Hamy's Case of anthropometric instruments, approved of by the Society, for the use of travellers engaged in Anthropological determinations.—A case of hydrocephalus in a child of ten years, by Dr. de Grandmont, considered specially in reference to the ophthalmic lesions associated with this condition, and their probable joint dependence among other causes on too near relationship between the parents, as intermarriage between first cousins of degenerate constitution.—The reproduction in man of a simian muscle, the scalenus intermedius of the anthropoid apes, by Dr. Testut.—Observations on polyandry in Kouloo and Ladak, by M. Ujfalvy, based on personal investigations during his travels in the Western Himalayas. In Kouloo polyandry and polygamy subsist side by side; in Ladak with similar physical and economic conditions, polygamy, which necessitates a certain degree of material prosperity, is less frequent. The prevalence of polyandry among savage tribes in ancient times, and the organisation of matriarchy, or maternal supremacy, in tribal and domestic rule, were considered by M. Rousselet in the discussion which followed the reading of M. Ujfalvy's important communication.—A discussion on the anthropological study of the crania of great criminals, chiefly in reference to the connection of criminality with any fixed cranial malformation, by M. Manouvrier.—Considerations of the nature of the arterial sulci of the encephalon in man, by M. Danilo.—On the development of the human skeleton, by M. de Merjkowsky, with special reference to the embryological affinities between the higher and lower animals, the author believing that in the human fœtus we have a reproduction of a simian form, which gives support to the theory of development as applied to man.—An anomalous formation of the first rib, by M. G. Hervé.—On the brain of an insane person, by M. Rey, in which the frontal and antero-posterior circumvolutions were extraordinarily developed, together with an excessive weight of the brain.—On a successful attempt to inoculate a monkey with matter taken from an indurated chancre, by M. Pozzi.—On the substance used by the North American Indians to poison their arrows, by Dr. Hoffman.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, June 20.—J. W. Hulke, F.R.S., president, in the chair.—Henry Yorke Lyell Brown, Edward St. F. Moore, John Henry Nichols, and Henry Parker, were elected Fellows, and Baron F. von Richthofen, of Berlin, a foreign correspondent of the Society.—The following communications were read:—On the discovery of *Ovibos moschatus* in the forest bed, and its range in space and time, by Prof. W. Boyd Dawkins, F.R.S. The specimen described by the author formed part of the collection of the late Rev. F. Buxton, and was obtained by a fisherman from the forest-bed of Trimingham, four miles from Cromer. The edges are sharp, and the red matrix adhered in places, so that the author regards its geological position as satisfactorily established. It is the posterior half of the upper surface of the skull of an adult female *Ovibos moschatus*. The author describes the range in space and time of this animal, mentioning the different instances in which its remains have been found in Britain. These are, in some cases, undoubtedly post-glacial; but he inclines to consider the lower brick-earth of the Thames Valley, where the musk-sheep has been found at Crayford, as anterior to the boulder clay, which occupies the district to the north. This deposit at Trimingham, however, is certainly pre-glacial, and so *Ovibos moschatus* belongs to a fauna which arrived in our country prior to the extreme refrigeration of climate which characterised the glacial epoch, and afterwards retreated northwards to its present haunts, showing, with other evidence, that this epoch did not form a hard and fast barrier between two faunas.—On the relative age of some valleys in Lincolnshire, by A. J. Jukes-Browne, B.A.—On the section at Hordwell cliffs, from the top of the Lower Headon to the base of the Upper Bagshot Sands, by the late E. B. Tawney, M.A., and H. Keeping, of the Woodwardian Museum. Communicated by the Rev. Osmond Fisher, M.A. The authors, after a brief sketch of the literature of the subject and of the method which they have adopted in measuring the beds in the Hordwell section, passed on to describe these, viz. the freshwater Lower Headon series, and the so-called Upper Bagshot Sands of the Geological Survey. They make the whole thickness of the former $83\frac{1}{2}$ feet. The bed numbered thirty-two in their section they identified with the Howledge limestone on the other side of the Solent. It is almost the highest seen in the section, and underlies the true Middle Headon which is now no longer exposed. The authors pointed out that in their opinion the late Marchioness of Hastings and Dr. Wright have somewhat misapprehended the position of these several beds. Details were then given of the remainder of the section, and comparisons made with the details published by former authors; after which the authors described the underlying estuarine series, or Upper Bagshot Sands, which has a thickness of $17\frac{1}{2}$ feet.—On some new or imperfectly known Madreporaria from the Coral Rag and Portland Oolite of the counties of Wilts, Oxford, Cambridge, and York, by R. F. Tomes, F.G.S.—The geology of Monte Somma and Vesuvius, being a study in vulcanology, by H. J. Johnston-Lavis, F.G.S. The author, after referring to the vast amount of literature which has appeared dealing with the same subject, stated that his object was to lay before the Society the results of his personal observations. The external form and general features of Monte Somma having been described, the origin of the present condition of the volcano was discussed in some detail, and the geological structure of the mountain and of the surrounding plain, as revealed by well-sections, was carefully considered. As the result of his observations the author believes that he is able to define eight successive phases in the history of the volcano; and the events which took place during these several periods, with the products of the eruption during each, were discussed in detail. The earliest certainly recognised phase in the history of the mountain was distinguished by chronic activity exhibited in outflows of lava and the ejection of scoria and ash. Possibly, however, a still earlier and paroxysmal stage is indicated by some of the phenomena described. Phase II. was a period of inactivity and denudation, which was brought to a close by the violent paroxysms of Phase III., followed by the chronic activity of Phase IV. Phase V. marks the return of a period of inactivity and denudation, which was again followed by the paroxysms of Phase VI. and the less violent outbursts of Phase VII., the last subsiding into the chronic activity which is the characteristic of Phase VIII., the modern period of the history of the volcano. The products of each of these periods of eruption were described in great detail. The eruptive phenomena which are illustrated by these studies of Somma and Vesuvius were then considered, together with the nature and result of the denudation which alternated with eruptive action in originating the present form of the mountain. The paper concluded with a statement of fifty propositions on the subject of vulcanology which appear to the author to be established by the studies detailed in the paper.—Note on "cone-in-cone" structure, by John Young, F.G.S.—A geological sketch of Quidong, Manaro, Australia, by Alfred Morris, F.G.S.

Anthropological Institute, June 12.—Prof. Flower, F.R.S., president, in the chair.—Dr. E. B. Tylor, F.R.S., read a paper on old Scandinavian civilisation among the modern Esquimaux. Amongst other evidences of contact with European civilisation, the author made particular mention of the lamps used by the Esquimaux for cooking and for warming their dwellings: one of these primitive-looking lamps was exhibited by Dr. John Rae, F.R.S.; it consists of a flat semicircular dish of steatite or potstone about 18 inches in diameter and 2½ inches deep, with slightly sloping sides; in it the natives burn oil, using for wick fragments of sphagnum arranged along the edge of the lamp. Dr. Tylor considered that the metal lamps used in the south of Europe, and some of those used in Scotland at the present day, were exactly the same in principle as these Esquimaux lamps, and that they must all have been developed from the same original idea.—The director read a communication from Mr. J. H. Rivett-Carnac, describing some palæolithic stone implements found by himself and Mr. J. Cockburn in Banda, a hilly district of the North-Western Provinces of India. Specimens of these implements were exhibited, presented by Mr. Rivett-Carnac to the Institute.—Dr. E. B. Tylor read a paper by Mr. A. W. Howitt, on Australian beliefs.

June 19.—A special meeting was held at Piccadilly Hall, by invitation of Mr. Ribeiro, to view the Botocudo Indians brought over by him to this country. Mr. Hyde Clarke, vice-president, was in the chair, and Mr. A. H. Keane read a paper on the Botocudos. Mr. Ribeiro presented the Institute with a small collection of typical Botocudo weapons.

June 26.—Prof. Flower, F.R.S., president, in the chair.—The election of Ernest G. Ravenstein was announced.—Mr. Worthington G. Smith exhibited a collection of palæolithic implements from Leyton and Walthamstow.—Mr. R. B. White read a paper on the aboriginal races of the north-western provinces of South America. This paper referred to a strip of country about 600 miles in length by from 100 to 250 in width, bounded on the west by the Pacific Ocean, and extending from one degree north latitude to the eighth parallel. It is now embraced by the States of Cauca and Antioquia, two of the nine states of the Columbia Union, which was formerly called New Granada.—Mr. J. Park Harrison read a paper on the relative length of the first three toes of the human foot. The author adduced evidence to show (1) that a long second toe was a racial characteristic existing at the present day in Egypt (according to Pruner Bey), South-west Africa, and many of the Pacific Islands, including Tahiti. It appears also to have prevailed amongst the ancient Peruvians and Etruscans; (2) when met with in Europeans, excepting perhaps in Italy, it may be attributed mainly to narrow shoes, but sometimes to mixture of blood; (3) Mr. Harrison had ascertained by measurements that a second toe even slightly longer than the first was not, as generally supposed, common in statues of the best period of Greek art, nor in accordance with the rules laid down in Flaxman's lectures at the Royal Academy; (4) unfortunately the peculiarity was being perpetuated by casts of the feet of Roman or Græco-Roman statues, which in some cases, as for instance that of the left foot of the Farnese Apollo, were modern restorations. Travellers were asked to observe the respective lengths of the toes in foreign countries and especially in Italy.

Edinburgh

Mathematical Society, July 13.—Mr. J. S. Mackay, president, in the chair.—Prof. C. G. Knott read a paper on quaternions, and Mr. D. Munn one on radical axes and centres of similitude.

Sydney

Linnean Society of New South Wales, May 30.—Rev. J. E. Tenison-Woods, F.L.S., vice-president, in the chair. —The following papers were read:—Notes on a lower jaw of *Palorchestes Azael*, by Charles W. De Vis, B.A.—Synonymy of Australian and Polynesian land and marine mollusca, by John Brazier, C.M.Z.S.—On some Mesozoic fossils from Central Australia, by the Rev. J. E. Tenison-Woods, F.G.S. The author describes the nature of the deposit from qualitative analysis and microscopic examination, noticing the occurrence of various fossils too imperfect for specific identification. The author describes also the two new species, *Trigonia mesembria*, a clearly Cretaceous form of the section "Glabræ," and *Pecten psila*, which the author considers may only be a variety of *P. socialis*, Moore. He also described a *Belemnites*, probably *B. australis*, Phillips, of a very aberrant type of the section "Hastati." In conclusion, he considered that, as many of Moore's Wollumbilla (Jurassic) fossils were found in this formation, there was either a confusion of type, or that the Wollumbilla beds were part of the lower Cretaceous formation of Central and North-East Australia.—Contribution to a knowledge of the fishes of New Guinea (No. 4), by William Macleay, F.L.S. One hundred and thirty species of fishes are here recorded, chiefly from the extreme south-east of New Guinea, making, with those enumerated in the three previous papers, 409 species in all, collected by Mr. Goldie on the island. One new genus (Tetracentrum) and 33 new species are described, chiefly from fresh water.—A second half-century of plants new to South Queensland, by the Rev. B. Scortechini, F.L.S. The author enumerates 50 plants not previously quoted from Southern Queensland, and either belonging to the tropical flora of Northern Australia, or indigenous to the southern and temperate portions of the continent. He also notices some of the changes of nomenclature resulting from the fusion of the genera *Pithecolobium*, *Calliandra*, and *Enterolobium* with *Albizza*.

Paris

Academy of Sciences, July 16.—M. Blanchard, president, in the chair.—On the whirlwinds of dust observed by Colonel Prejevalsky in Central Asia, by M. Faye. Like those of Mexico, India, and the Sahara these sandstorms are shown to have the same origin and mechanical action as the tornadoes of the United States and all waterspouts. They are all alike spiral movements descending with vertical axis and invariably moving horizontally nearly in a straight line. The popular belief that the dust on land and water at sea ascends from the surface to the higher regions is due to an optical illusion.—Active or dynamic resistance of solids. Graphic representation of the laws of longitudinal thrust applied to one end of a prismatic rod, the other end of which is fixed, by MM. de Saint-Venant and Flamant.—On the cause of death in the case of freshwater animals plunged into salt water and *vice versâ*, by M. Paul Bert. In the case of freshwater animals the fatal effect is caused by the action of chloride of sodium, a conclusion already arrived at by M. de Varigny. In the opposite case death is caused by the absence of chloride of sodium, which it is found impossible to replace either by salts of soda or of magnesia, by glycerine, sugar, or any other substances calculated to give fresh water the consistency of the marine liquid. Several interesting attempts at acclimatisation are described.—On the puna, or "mountain sickness," experienced by travellers at great altitudes, by M. A. d'Abbadie. The symptoms are fully described, but M. P. Bert enters a protest against some of the suggested remedies, especially blood-letting.—On some of the results already obtained by the submarine explorations of the *Talisman*, by M. A. Gaudry. Amongst these results are several new species of mollusks, sponges, and crustacea.—On the separation of gallium from various substances (continued); separation from molybdenum, by M. Lecoq de Boisbaudran.—A fresh contribution to the study of intra-vascular sanguineous concretions, by M. G. Hayem.—Brief description of an electric indicator (one illustration), by M. J. Cauderay.—On the observation made by M. Gonneriat of the great comet of 1882 (one illustration), by M. Ch. André.—On the changes produced in the duration of the Julian year by the variations of the quantities on which this duration depends, by M. A. Gaillot.—On the longitudinal impact of a prismatic rod fixed at one end and acted on at the other, by M. J. Boussinesq.—Remarks on the calculus of a definite integral, by M. R. Radau.—On surfaces of the third order, by M. C. Le Paige.—On a new theorem of dynamic electricity, by M. L. Thévenin.—On the currents of emersion and the movement of a metal in a liquid and currents of emersion, by M. Krouchkoll.—A new pile made of oxide of copper, described by MM. F. de Lalande and G. Chaperon.—On the density of liquid oxygen, by M. S. Wroblewski.—The salts of protoxide of gold, by M. Ad. Carnot.—On the alcoholate of barytum, by M. de Forcrand.—The action of aldehyde on propylglycol, by M. Arnaud de Gramont.—Researches on the extraction of cinchonamine, by M. Arnaud.—On a new glycerine, "Mesitplenic Glycerine," $C_6H_3(CH_2.OH)_3$, by M. A. Colson.—On coal as a heat-generator and on the conversion of its azote into ammonia, by M. Scheurer-Kestner.—A contribution to the history of the development of the heart (four illustrations), by M. Vulpian.—A comparative study of echinoderms: on the organisation of crinoids, by M. Edm. Perrier.—On the structure and texture of the spleen in the common eel, by M. C. Phisalix.—Physiological researches on the secretion of the Morren glands in the earthworm, by M. Ch. Robinet.—Researches on the structure of the breathing apparatus in cephalopods, by M. P. Gorod.—Changes and migrations of plant-lice. Complete biological evolution of the *Tetraneura ulmi*, by M. J. Lichtenstein.—On the colouring function of the *Drosera rotundifolia*, by M. P. Duchartre.—On the physiological part played by the undulations of the lateral walls of the epidermis, by M. J. Vesque.—Cloudiness at Bourges, with meteorological tables of observations from 1867 to 1881, by M. Hervé Mangon.—On the culture of quinquinas in Bolivia, and on some other agricultural products of that country, by M. Sace.

BERLIN

Physiological Society, July 13.—Dr. Martius spoke on the nature of the heart's systole, more particularly as to whether it was a simple or a tetanic contraction of the heart's muscle. For some time many experiments have been made on this subject with the neuromuscular apparatus, but no secondary tetanus having been produced by the application of this physiological electroscope, it was concluded that the systole was no tetanic but a merely simple contraction. It was, however soon observed that other contractions, unquestionably tetanic, such as the voluntary tetanus, the strychnine tetanus, &c., generated no secondary tetanus, or at all events not in every case. The absence of secondary tetanus in the case of the heart's systole was therefore no conclusive proof of the simple nature of this contraction. Dr. Martius accordingly sought a more decisive means of settling the question, through the aid, namely, of the capillary electrometer, having first, however, made sure of the capability of the instrument he employed to follow with ease and certainty undulations of current of much greater frequency than occur in the case of the natural tetanus and reaching as high as forty per second. The capillary electrometer having then, by means of two needles thrust into a normal rabbit's heart *in situ*, been circularly closed, it was found that each systole responded by a merely simple displacement of the meniscus. The systole was consequently determined to be no tetanic but a purely simple contraction. Dr. Martius further described the following method towards an exact enumeration of very frequent vibrations of the capillary electrometer, which to the eye present merely the vanishing rim of the quicksilver cup. Let one fasten to the lever of a chronometric electromagnetic tuning-fork, instead of the pencil, a square piece of paper performing a known high number of movements per second. The square piece of paper will then appear to stand still and to have a gray border on its upper and under side. Let one next place this gray border between the ocular of the microscope and the meniscus of the capillary electrometer. Does the meniscus make just as many movements per second as the square piece of paper, the quicksilver cup will appear to stand still. Does, however, the number of movements not tally, the difference between the two will then be apparent and easily counted, and the number of movements on the part of the paper being known, the actual number of the movements of the quicksilver is also determined.—Prof. Kronecker gave a report on the experiments made by Dr. Jastrebow as to the mode, rhythmus, and innervation of the movements of the vagina of rabbits.—These communications were at the close illustrated by demonstrations.

VIENNA

Imperial Academy of Sciences, May 4.—R. Maly and R. Andreasch, studies on caffeine and theobromine (fifth paper).—A. F. Reibenschuh, on methyl-biguanidine and its compounds.—F. Emich, on ethyl-biguanidine and its compounds; contributions to a knowledge of biguanidine.—W. Biedermann, on the excitability of the spinal cord.—T. Gerst, on the method of determining the orbit from three complete observations.—St. Wolyncervicz, on the determination of the orbit of the *Isabella* planet (210).—S. Wroblewski and K. Olszewski, on the liquefaction of nitrogen and carbon monoxide.—M. Neumayer, on climatic zones during Jurassic and Cretaceous epochs.—T. F. Wolfbauer, on the chemical composition of the water of the Danube near Vienna in the year 1878.—E. von Fleischl, on the distribution of the fibres of the optic nerve over the cones of the human retina.

May 10.—C. von Ettingshausen, contribution to knowledge of Tertiary flora of Sumatra.—Dr. Steir, to the morphology and systematics of culmian and carbon flora.—F. Anton, definitive determination of the orbit and ephemeris of the *Bertha* planet (154).—Zd. Skraup and A. Cobenzl, on two chinoline bases, naphthochinolines, formed of naphthylamines.

May 25.—A. Adam Riewicz, on the theory of brain-pressure and on the pathology of brain-compression.—A. Delbovier, report on prophylaxis and therapeutics of typhus.—T. Kachler and F. V. Spitzer, on the formation of isomeric camphor bibromides.—G. Niederist, on Reichenbach's picamar.

May 30.—Anniversary meeting.—The meeting was opened by the substitute of the Curator, Herr von Schmerling.—An address was given by Prof. Zeissberg, of the Historical Class of the Academy, on the youth of Archduke Charles.—The reports of the past year were read by the General Secretary, Prof. Siegel, and the Secretary of the Mathematical Class, Prof. Stefan. Then the obituary notes on the members deceased during the past year were read by the secretaries.—In the Mathematical Class Prof. Senhofer (Innsbruck) was elected member, E. Mojsisowics (Vienna), corresponding member. Prof. Richard Owen (London), W. E. Weber (Göttingen) were elected honorary members, Julius Schmidt (Athens), Hermann von Abich (St. Petersburg), Prof. Ferdinand Zirkel (Leipsic), foreign correspondents.—The Baumgartner prize was awarded to Carl Exner for his paper on the scintillation of stars, and the Lieben prize to V. R. Ebner (Gratz), for his experiments on the causes of anisotropism of organic substances.

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