THURSDAY, SEPTEMBER 11, 1879

OUR NEW PROTECTORATE

Our New Protectorate, Turkey in Asia; its Geography, Races, Resources, and Government. By J. Carlile McCoan. 2 vols. (London: Chapman and Hall, 1879.)

Narrative of a Journey through Khorassan and on the North-west Frontier of Afghanistan in 1875. By Col. C. M. MacGregor, C.S.I. Bengal Staff Corps. 2 vols. (London: Allen and Co., 1879.)

WHATEVER other interests may have suffered through the late convulsions in the East, those of science, and especially of geography, have at all events been largely benefited. The cession of Cyprus to England and the Anglo-Turkish Convention, which brings a large part of Western Asia within the British political system, could not fail to direct general attention to those regions, thus giving occasion to a number of more or less comprehensive treatises on their physical conditions, natural resources, ethnical, social, and political relations. Of these works, those whose titles are here given, while differing widely in their scope and treatment, are each in its way very favourable specimens. Of the two, that of Mr. McCoan is perhaps on the whole the most satisfactory, as from its purpose and nature it is likely to prove of the greatest permanent interest. Within the compass of two moderately-sized octavo volumes it deals with an immense variety of topics. Yet such is its admirable arrangement, and so thoroughly master is the writer of his subject, that there is nowhere any crowding or confusion, and the result is a most convenient and reliable handbook of "Our New Protectorate." Nothing is omitted that comes fairly within the scope of such a treatise, and a twenty years' personal experience of an intelligent observer of men and things will be sufficient guarantee of the accuracy of his statements, if not always of the justness of his conclusions. In the first volume separate chapters are devoted to each of the five great divisions of Asiatic Turkey, whose orography, hydrography, climate, natural products, present economical conditions, trade routes, political divisions, are treated in detail. These are followed by more comprehensive chapters on the history, races, religions, resources, and government of this eastern section of the empire. The second volume is occupied chiefly with questions of an economical and social character—public works, public instruction, trade centres, agriculture, slavery, polygamy, the Ulema, the capitulations, abuses, necessary reforms.

The chapters on natural resources, products, and agriculture, convey a vivid picture of the inexhaustible latent wealth of these regions.

"On both sides of the Bosphorus Nature has fitted Turkey to be a great agricultural country, but in Asia the geological and climatic conditions of successful husbandry combine in a degree seldom equalled in Europe. Hence nearly every kind of agricultural produce known to commerce may be raised on a scale of abundance limited only by the labour and intelligence employed. The present condition of the country, it need hardly be said, supplies no measure of its full capabilities, but even as it is, the merest bird's-eye glance at its chief products, under all the existing disadvantages of gross fiscal abuses, the most primitive rudeness of culture, and the want of outlets for everything grown beyond the actual needs of local consumption, will show how rich and wide is the field awaiting only better government and a moderate infusion of western skill and capital to become again one of the most productive in the world" (vol. i. p. 203). Nothing, perhaps, gives a better idea of the immense variety of these products, than a glance at the export trade of Smyrna, including, as it does, such varied items as rice, maize, and other cereals, opium, tobacco, silk, and cocoons, valonea, madder, gall nuts, yellow berries, mohair, sponges, besides large quantities of dried figs and raisins of prime quality.

Yet, boundless as they are, these surface-products are represented as scarcely exceeding in importance the vast mineral treasures that lie still almost untouched in the bowels of the earth. "The soil of Anatolia, especially, is largely composed of those earlier rocks which are known to be the most rich in minerals, rocks, in fact, to which some of the most valuable of these are altogether confined. The country is said, indeed, to possess almost every sort of metal except platina. Not only, too, are most of the mineral districts near either the sea or navigable rivers, but—what is even of more importance—the metallic and carboniferous beds are found close to, or within practical distance of, each other. We have thus, in many instances, the proximity of coal and iron which has made the fortune of Staffordshire, and the absence of which in Spain has rendered the rich mines of the Asturias nearly valueless. According to the official records of the Porte, in all some 250 mines of various ores have been discovered throughout the Empire, three-fourths of which are in Asia. Most of these latter were formerly worked, but the great majority have been abandoned through want of capital or for other reasons, leaving only about thirty now at work, and not one of these to the full limit of its producing capacity" (vol. i. p. 209). Detailed accounts are given of some of the more valuable of these deposits, including the famous coal-fields of Erekli, which form part of the Sultan's private domain, but which are so badly worked as to be almost unremunerative.

The rival schemes of railway communication through Turkey with India are briefly but clearly explained, and their merits impartially balanced. In the large map of Turkey in Asia accompanying the work the several routes are laid down, together with the proposed extensions, and all the highways actually completed. In future editions this map might be advantageously supplemented by another, showing the administrative divisions, vilayets, sanjaks, kazas, which are so necessary to a full comprehension of Turkish geography, and which are yet so difficult to procure.

Col. MacGregor's work appears somewhat late in the field, but is none the less welcome as a valuable contribution to our knowledge of a region still but little known, notwithstanding its daily increasing political importance. It is somewhat of the nature of an itinerary, in which the towns, distances, elevations, water and mountain systems, and all other points of interest along the route traversed by the enterprising explorer are carefully described. From the title it might be supposed that the ground thus sur-

veyed was restricted to the province of Khorassan. But the whole of the Iranian table-land was actually crossed from Bushire, on the Persian Gulf, through Shiraz and Yezd, in a north-easterly direction, to the Afghan frontier. Here it was the traveller's intention to break fresh ground by penetrating from Herat along the Hari-rud valley, and through Bamian, direct to Kabul. But this scheme, which would have opened up an entirely new region, was thwarted at the outset by two insurmountable difficulties.

The immediate consequence was that instead of an able and much-needed work on the Perso-Afghan highlands, we have one limited mainly to the north-eastern districts of Persia. On this region much additional light is thrown, and an attempt is made to remove the obscurity still attaching to the water-system of the country between the Bakharz and Ghaïn ranges. "The drainage of the space between the northern face of the Doroh hills, the eastern slope of the Ghaïn range, and the southern side of the Khaf range, I believe to be as follows:—First, it does not enter the Hari-rud by the Karat-rud, cutting the Dushakh ridge, as is shown in our maps, nor does it drain to the Harût-rud, or to the Hari-rud direct. All the drainage of this space is absorbed into three great depressions, called 'daks,' that is, the drainage of Nibolûk, of Ghaïn, and of Khaf Païns, goes to the Dak-i-Diwalan; that of the Zirkoh tract, which includes all to the east of the Auguran range, including Gulwarden, Yezdun, and Kaland, drains into the Dak-i-Khurshab, close to the Koh Kabuda; while that of Fûrg, Daramian, Ahwaz, &c., drains to the Dak-i-Tundi, fifteen farsakhs from Ahwaz, and a portion from Mogulbackhe to Pahre runs direct into the Hari-rud. This may seem at first sight a rather startling statement, but it is not so in reality. In the first place, it must be remembered that the process of denudation of the surrounding hills, which is constantly going on, must have a tendency to create the low ridges which cause these depressions; and as there is not sufficient water to keep a way open for itself, and, moreover, the soil is salt, what there is is rapidly evaporated and sucked in, and it is easy to see how these drainage beds have lost the power of discharging themselves to what, no doubt, should be their proper exit, the Hari-rud" (vol. i. p. 204).

Elsewhere some useful information is given regarding the "kavirs," "rigs," "lûts," and "beyabûns," which occupy such a large portion of the Iranian tableland; but the existence is denied of one continuous "kavir" (salt desert) stretching from Kûm to Bejistûn, though "there are a great number of smaller kavirs due to local drainage"[1] (vol. ii. p. 138). A graphic description is given at p. 101, vol. i., of one of these dreary kavirs twelve miles long on the route between Kûr and Tabaz. "It is rather difficult to suggest anything that will give an English reader an idea of what this kavir is. It is not sand, nor is it in the least like the desolate plains of India, which, burnt up as they may be, are luxuriant in their vegetation compared with kavir. It has, speaking quite literally, not one blade of grass, nor one leaf of any kind, not a living thing of any sort. It is composed of dark soil, which looks as if it had been turned up by the plough a year before, but which is covered with a thick salt efflorescence, which glitters painfully to the eyes. All round, as far as the eye can reach, there is nothing to be seen but this glare of white, which seems to stare piteously on you as you pass by, crunching over its dry crust. Every here and there is a dark patch, which, on getting up to, you find to consist of moist earth which seems, as it were, to have sweated up from beneath. These patches also dry up, and then the salt shows. The surface of the kavir is not smooth, but is so honeycombed with small holes about nine inches deep and the size of a man's head, that it is very difficult walking for animals; but as the soil of the kavir binds very well, a good road could doubtless be made over it."

Altogether, what with kavirs, stony wastes, rough roads, brackish water, filthy serais with little accommodation beyond foul air and noxious vermin, it is not astonishing to learn that the writer did not find travelling in Persia much more pleasant than others have done before him, and it is depressing to hear that there is little prospect of any improvement in the future. "The worst of this country is that, bad as it is, one cannot conceive how it could be improved in any single way. There is no water, it produces absolutely nothing, and there is no possibility of water being collected for irrigation" (vol. i. p. 84). Worse still, the sands are in many places visibly gaining on the arable land, and even on the inclosed cities themselves. "The country is, in fact, in the process of changing from a series of rocky ridges to one of undulating sandy wastes. Yesterday's march showed the sand triumphant; to-day the rocks are still fighting on. This process of burying is most peculiar, and may be witnessed on a small scale in almost any village between this and Yezd. You see the sand blown against the wall, gradually getting higher and higher, till it blows over and then forms a mound in the field beyond, which gradually increases its height till all trace of wall and field is lost, and you have before you a sand-heap. I can quite believe now the stories of towns being buried, having myself seen the thing on a small scale" (vol. i. p. 147).

In the caravanserai of Bandar Gaz on the Caspian, acquaintance was made with what would appear to be "a new specimen," which may interest entomologists. "It had a head all made up of eyes, a body like an ordinary fly, and a tail like a gimlet. It never made any noise, and it always attacked to the rear, and once it had got its gimlet into you, it seemed to afford it such pleasure that it invariably parted with its life sooner than let go. But its effects were not realised till after death; then came on an itching pain that nearly drove one mad" (vol. ii. p. 166).

In case a second edition should be required of this work, attention may be directed to the peculiar spelling of proper names, with a view to introducing some kind of law and order where all is now sheer chaos. It would probably be too much to hope for a uniform adherence to some scientific or at least intelligent system of transliteration; but a moderate degree of consistency might at least be expected from a writer who has some knowledge of the Arabo-Persian writing system. But here we have neither consistency, nor uniformity, nor anything but the wildest confusion, and the accompanying map at

[1] Originally *kavir*, or rather *kabîr*, was an adjective, simply meaning *great*, the full expression being *Darya-i-kabîr*, "the great ocean," *i.e.*, of salt, and it may be added that, notwithstanding Col. MacGregor's view, the natives invariably apply this expression collectively to the whole of the vast region stretching from the Ghaïn highlands westwards to Yezd and Kashan. Further north this salt waste would seem to intersect the Ghaïn range west and east, here merging with the Khaf Desert, which joins the Dashti Na-ummed ("desert of despair") on the south, and the Ghorian wastes on the east.

variance with the text, the text with itself. Hence, to quote a few out of innumerable instances, such alternatives as Yezd and Yuzd, Dalaki and Dulukee, Mahamadan and Mahomedan, Geeach and Giach, Tabaz and Tubbuz, Ghain and Ghaeen. Then such old friends as Meshed, Bushire, Turcoman, Hari-rud, disguised as Mushud, Bushuhr, Turkmun, Hurri Rood, without any conceivable advantage. It may be stated that owing to these eccentricities the spelling in the passages here quoted has necessarily been reduced to system.

A. H. KEANE

OUR BOOK SHELF

Catechism of Agricultural Chemistry and Geology. By the late J. F. W. Johnston. An Entirely New Edition, Revised and Enlarged by C. A. Cameron, M.D. Seventy-eighth Thousand. (Edinburgh and London: Blackwoods, 1879.)

THIS popular and useful little book has been decidedly improved by the additions and alterations which Dr. Cameron has made. Since the author's death, about a quarter of a century ago, this catechism had been once revised (in 1863) by Dr. Voelcker, but the time had long since arrived for further changes. If the present editor had been less scrupulous in adhering to the original form and substance of Prof. Johnston's work, this issue would have justly merited the description on the title-page of "An entirely new edition, revised and enlarged." There are, it is true, two fresh pages in the present edition, corresponding to a few new tables of the composition of cattle foods, but we fail to find the numberless small changes and additions which the progress of science demanded. Every sentence of the book should have been rigorously scrutinised and thoroughly amended, or even excised, where necessary. All expressions such as these: "Rancid butter is said to be sweetened" (p. 73), "It is said that if a cow be liberally supplied with whey" (p. 74), "The feeding with whey thickened with meal is said" (p. 74), should be removed. Statements of which the teacher is not sure should not find a place in an elementary catechism. Again, the table, on p. 34, of the ash-constituents removed from an acre by various crops needs emendation. On turning to page 53 we find two other tables showing the produce of corn and straw in certain field experiments with various manures. We do not think the omission of these tables would entail any loss, while their place might be profitably occupied by a series of conclusions deduced from the really satisfactory experiments on crops made at Rothamsted or at some of the continental agricultural stations. For, indeed, what lesson can be learnt from the statement (p. 53) that in an unnamed locality, on an undescribed soil, during a season of which the rainfall and temperature are unrecorded, and by the use of a wheat manure the composition of which is not furnished to the reader, 42 bushels of wheat were produced per acre? Without duplicates and without repetition in different localities and in different seasons, field-trials of manures are positively misleading. But when once such tables as those on pages 34 and 53 have got into a popular work and remained there fifteen years, they have a good chance of remaining fifty.

The statement on p. 67 that parsnips contain no starch will not stand, while we conclude that it was by some oversight that a tabular account of the constituents of various root-crops has been omitted by Dr. Cameron in re-casting and amplifying the data given by Dr. Voelcker in previous editions on page 65. We note here that question 363 on page 63 is repeated in question 374 on page 67, and that the statistics (p. 74) of cheese production in the United Kingdom are no longer correct.

LETTERS TO THE EDITOR

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

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

Palisa's Comet

I INCLOSE an ephemeris of the comet which was discovered at Pola by Herr Palisa on August 21, thinking that it may be of interest to some of your readers.

The ephemeris is calculated from observations made at my observatory on the nights of August 26, 27, and 28, by Dr. R. Copeland and Herr Lohse.

The comet is easily visible in a 4-inch telescope.

Ephemeris of Palisa's Comet

Berlin midnight.	R.A. G^h h.	m.	Decl. G^o °	′	Log. Δ.	Log. *r*.	Brightness.
Sept. 5	11	43·6	+44	47·0	0·2219	0·0393	
6		50·4	44	15·8	·2191	·0362	1·7
7	11	57·2	43	42·7	·2163	·0331	
8	12	3·9	43	7·8	·2137	·0301	
9		10·6	42	31·1	·2112	·0272	
10		17·3	41	52·5	·2088	·0243	1·8
11		23·9	41	12·1	·2065	·0215	
12		30·4	40	30·0	·2043	·0187	
13		36·8	39	46·1	·2023	·0161	
14		43·2	39	0·5	·2004	·0136	2·0
15		49·5	38	13·3	·1987	·0111	
16	12	55·7	37	24·5	·1971	·0087	
17	13	1·8	36	34·2	·1957	·0064	
18		7·8	35	42·4	·1945	·0042	2·1
19		13·7	34	49·2	·1934	·0021	
20		19·5	33	54·8	·1925	0·0001	
21		25·2	32	59·2	·1917	9·9983	
22		30·8	32	2·4	·1911	·9965	2·3
23		36·3	31	4·6	·1907	·9948	
24		41·7	30	5·8	·1905	·9932	
25		47·0	29	6·2	·1904	·9919	
26		52·2	28	5·7	·1906	·9906	2·3
27	13	57·3	27	4·7	·1909	·9895	
28	14	2·3	26	3·0	·1914	·9885	
29		7·1	25	0·8	·1920	·9877	
30	14	11·9	+23	58·2	0·1928	9·9869	2·3

47, Brook Street, September 5 LINDSAY

Insect Swarms

IT may be worth mentioning in connection with Mr. J. Clarke Hawkshaw's interesting account of the wonderful insect-swarm at Trouville, on August 12 and 13, that the two species which composed it were noticed in immense profusion about the same time in the West of England.

On the 13th ult. (which was one of the very few summer days of the season) I was driving with a friend from Exmouth to Budleigh-Salterton, on the South Devon coast, when our attention was attracted by the enormous multitude of insects (moths and butterflies) which were fluttering over the flowery margin of the road. The butterfly was at once recognised as the "Painted Lady;" the moth was not determined, but from its general appearance, its companionship, and all the circumstances of the case, I have no doubt that it was the *Plusia gamma*. The swarm attended us, with little variation in the numbers, throughout almost the whole of our journey (a distance of five miles), and on reaching Budleigh we found *V. cardui* clustering thickly on the flowers in the brilliant little gardens facing the sea.

Along the road the moth was in the greatest profusion, the numbers being frequently so great as to form a perfect *cloud*.

The effect of the quick, restless, irregular movements of the great host, stretching on mile after mile, was very curious. The butterflies were, of course, less plentiful, but still their numbers must have been immense. They seemed to be finely coloured and in very perfect condition.

The direction in which the swarm was travelling was not specially noted; indeed if food was the object sought it might

well be content to linger in the rich and pleasant pasturage in which we encountered it.

I may add that our observations were confined almost entirely to the grassy and flowery borders of the road, and that the swarm which excited our wonder was probably only a single column of a countless host. THOMAS HINCKS

Budleigh-Salterton, September 2

"Rag-Bushes"[1]

A REMARKABLE instance of this custom existed (I am referring to twenty-five years ago) in Ceylon. On the West Coast, on the road between Chilaw and Jaffna, at a place—the name of which, after so many years' absence, I forget—was a vast collection of rag-offerings suspended to the bushes through which the road was cut. It went by the name of "Rag Fair," with those of us who had travelled in that direction: there were miles of it. They were said to be offerings to the goddess "Kali" (who, in the midst of them, had a temple and *well*), to propitiate her and obtain her protection against the dangers of the way, especially those of wild beasts.

Once travelling up that road, my horsekeeper, "Multu," watered my horse at the sacred well. Out rushed the priest, furious with wrath, and cursed Multu with all the vengeance of "Kali," assuring him that he would be eaten by leopards that very night.

Multu, who, I fear, was an atheist after his kind, merely laughed at the offended guardian of the shrine, and pointing to my rifle lying in the hollow of his arm, told him that while the master or himself carried *that*, he did not care a copper "chailly" (a "brass farden," vernacular) for "Kali," the leopards, or himself.

I soothed the irate old humbug by hanging a strip of rag, which I carried in my pocket for gun-cleaning, on a branch, but especially with a trifling bit of silver—I believe this latter portion of an offering is usually, with miracle- and charm-makers, the most efficacious—and went my way.

Multu had his triumph that night. A wretched coolie travelling along the road—one of the class that supply the chief abundance of the rags—after hanging up his offering and doing "pooja," was, while sleeping in the "maddam," or porch of the temple, of his protecting goddess, actually seized and carried off by a leopard. He was rescued—how, I forget—and brought to the "Rest-house" where I was, but was so dreadfully lacerated about the hips and lower portion of the body that he died in a few hours. E. LAYARD

British Consulate, Noumea, July 5

Signalling by Sunshine[2]

THOUGH I fear by the time this reaches you the subject will have been exhausted, I send you this "note;" you can but throw it into the paper-basket if not wanted.

While at the Cape of Good Hope, my dear old friend Sir Thomas Maclear, then Astronomer-Royal, told me that while measuring the arc of the meridian to verify Lacaille's work, he signalled with the heliostat enormous distances, the clear atmosphere of the Cape being eminently adapted for the purpose. If my memory does not play me false, I think he said one station in connection with his cairn on the top of Table Mountain (3,800 feet) was ninety-five miles distant.[2]

His means of directing the flash was as follows:—A tiny hole is scratched in the quicksilver in the centre of the heliostat, and a board with a larger hole is planted in front of the station, some few feet from the instrument.

The corresponding station is brought in view through the two holes, and all three are consequently "in line." The flash is then directed through the hole in the board, and is thus sent straight to the desired point. Of course telescopes were used for long distances.

Another old friend, Admiral Trotter, used to converse from Admiralty House, Simon's Bay, with friends staying at "Kalk" Bay, some eight or nine miles distant. E. L. LAYARD

British Consulate, Noumea, July 4

[1] NATURE, vol. xx. p. 595. [2] NATURE, vol. xx. p. 508.

[2] An amusing coincidence may be noted here. I was returning from Graham's Town by a steamer, and when we came in sight of the old mountain, I happened to mention Sir Thomas's signalling. My hearers on board jeered at the possibility of making signals with "a piece of looking-glass," when suddenly we were half blinded by a flash of light from the top of the mountain. "What on earth is that?" was the general exclamation! "Only Sir Thomas signalling," was my triumphant reply, "Perhaps you will some of you now believe in a 'bit of looking-glass.'" Sir Thomas' son had, for fun, sent a flash or two down to the steamer.

Bag-like Fabrication exhibited by Sir Sydney Saunders

AS much the "production of a large species of spider in Fiji" as a lady's silk dress is the "production" of a worm in China!

A large spider, of a genus common all over Polynesia, and here also in New Caledonia (where formerly much eaten by the aborigines) produces a very strong, thick web. On Sundays generally, when no work is going on in the plantations, the imported Pacific Islanders amuse themselves by wandering about the bush, armed with a frame-work of cane in the shape of an elongated cone, affixed to a long stick. This they twist and twist, round and round in the spiders' webs, till it is coated, sometimes half an inch thick, with the viscous fabric. They then untie the fastenings and draw out the strips of cane, when the bag becomes like a long night-cap (old pattern). I have one before me now, over a yard long, a foot across, and pretty thick, which does not weigh one ounce! It is yellow; the New Caledonian ones are usually grey. I do not think the Fijian natives had the custom originally. Some of the New Caledonian are stretched tight enough to resemble an Indian suspension "tom-tom," and really emit a slight sound on being "tapped." This will give some idea of the strength of the thread, for which see also *The Field* ("My Trip to Lifu"), wherein I notice the impromptu butterfly nets made by some boys stretching the web of this spider across the loop of a bent twig. E. L. LAYARD

British Consulate, Noumea, July 5

Observations on a Wind-Whirl

WHILE making magnetic determinations at Schell City, Mo., a wind-whirl of some violence passed near our tent, moving with the characteristic swaying and halting motions of the tornado. Its base was quite pointed, and about two feet in diameter.

Unlike those seen last year, and described in NATURE about a year ago, there were no surface-winds strong enough to bear dust along the suface of the ground, but the dust carried up in the vortex was collected only at the vertex of the whirl. The dust column was about 200 feet high, and perhaps 30 or 40 feet feet in diameter at the top. The direction of rotation was the same as that of storms in the northern hemisphere. Leaving the road, the whirl passed out on the prairie, immediately filling the air with hay, which was carried up in somewhat wider spirals, the diameter of the cone thus filled with hay being about 150 feet at the top. It was then observed, also, that the dust column was *hollow*. Standing nearly under it, the bottom of the dust column appeared like an annulus of dust surrounding a circular area of perfectly clear air. This area grew larger as the dust was raised higher, being about 15 or 20 feet wide when it was last observed. This whirl could be observed half a mile, finally disappearing over a hill.

This observation, in connection with the one given by me a year ago, has a very important bearing on the theory of "waterspouts" and tornadoes. FRANCIS E. NIPHER

St. Louis, Mo.

Transportation of Seeds

IN a recent number of NATURE which has lately reached my hands, I observe a letter from Consul Layard on the above subject, to which let this note be an addendum.

In my daily expeditions I am exceedingly troubled by the seeds of the *Andropogon acicularis* (Retz), not only adhering on the slightest touch to my clothes, especially to my trousers and socks, to the daily annoyance and occupation of much of the time of my servant in their obstinate removal, but even penetrating my limbs and adhering there to my great discomfort, for the itching that they cause is sometimes intolerable; and my limbs consequently present somewhat the appearance of those of a scarlet-fever patient. HENRY O. FORBES

Kesala, Bantam, Java, July

Shark's Teeth

I WOULD draw attention to the operation of the teeth of the shark on the seizure of its prey. I recollect in Nicholson's "Zoology," a statement to the following effect: "The sharks have teeth arranged in several rows, of which only the outermost is employed, the other rows seeming to replace the outermost when worn out." In a recent visit to the Cocos Islands I had many opportunities of observing these animals in the use of their formidable weapons. In the act of seizure the whole jaw is protruded to a distance (varying according to the size of the fish) of several inches, the innermost teeth coming into position erect

or semi-erect, but as far as I could observe nearly *all* the teeth came into play. When on fishing excursions in the lagoon, the sharks which constantly carried off the bait, were often caught, and in order to extract the hook, a large log, constantly carried in the boats for this purpose, was threateningly presented to its face, and [of course instantly seized and held on to for as long as it took to perform the operation of extraction. If, when the fish is quite recently dead, pressure be made on the angle of the jaw, it is easy to observe the action of the rows of teeth.

Kesala, Bantam, Java, July HENRY O. FORBES

A Lunar Rainbow

LAST evening, September 3, at 10.40, a lunar rainbow was visible at Llanfairfechan, in a north-west direction. The arc was continuous, and of a brilliant white light. It appeared to stretch across Anglesey from Beaumaris to Puffin Island. The bow did not last more than 2′ from the time it was first observed by us. F. E. KITCHENER

Llanfairfechan, September 4

A Habit of Cattle

IN the colony of Natal the cattle have an extraordinary liking for bones. They will stand for hours with a bone in the mouth quietly munching, sucking, or perhaps more correctly speaking, levigating the bone with the tongue. I have not heard that cattle have the same habit in the other colonies of South Africa, but I have been told that cattle exhibit the same taste in some parts of South Australia.

In Natal there is, I believe, a scarcity of chalk and limestone in the geological formation. Will this fact account for the habit? Do the cattle lick bones in search of lime?

Can any of your readers account for this strange taste in cattle?

I may mention that horses and other herbivorous animals in Natal do not exhibit the same taste. H. C. DONOVAN

Delagoa Bay, July 20

THE AUGUST PERSEIDS

THIS remarkable meteor shower recurring annually on August 10 is looked for every year with increasing diligence. To Quetelet belongs the credit of having first (in 1835) ascertained the epoch of its maximum display, though the month of August had long been known as one in which there was an abundance of falling stars. As early as 1762 Muschenbroek, in his work on "Natural Philosophy," stated that, according to his own observations, there were more shooting stars in August than at any other period of the year, and his remark is perfectly true applied to the first half of that month, though it is questionable whether the last half of August will bear comparison with that of July, when meteors fall very plentifully, and constitute a periodical display of special note on the 27th-31st. Since Quetelet determined the date of the Perseids, they have been expected every year with great interest, and from the time that Heis first began systematically to register the paths of meteors (nearly half a century ago) to the present day, observers have continued to record the successive apparitions of this prominent star-shower, so that multitudes of its meteors are now accumulated in the catalogues of British and foreign astronomers.

These Perseids appear to have belonged to our system at a very remote epoch, and to have been observed in considerable intensity as far back as the ninth century of our era. They form a continuous ring or zone of particles. The stream may vary in richness, that is to say, the particles may be very unequally distributed along the orbit, but it seems unbroken and manifests itself every year with more or less intensity from its accustomed point, yielding many bright meteors of great swiftness, and almost invariably accompanied by phosphorescent streaks. It was from careful observations of the Perseids that Schiaparelli, in 1866, was led to his theory of the connection or identity of comets and meteors, and the first orbital coincidence found was that of the Perseids with Comet III. 1862, which seems to have been merely the nucleus or condensation of the particles forming this remarkable meteor system.

The annual returns of this shower as observed and described by various observers, when compared together, show that in certain years the display is exceptionally brilliant; in others it is far less imposing. Eduard Heis, at Münster, counted 155 meteors per hour on August 10, 1863, yet on the same night in 1867 the figures had fallen to 24 per hour. He gives the following as the horary numbers derived from observations between 10h. and 12h. at several stations in Germany on August 10 in different years:—

Year.	Station.	Hourly number.	Year.	Station.	Hourly number.
1841	Aachen	47	1863	Münster	155
1842	Aachen	60	1863	Gaesdonck	215
1847	Aachen	55	1863	Peckeloh	109
1850	Aachen	37	1864	Gaesdonck	106
1852	Münster	89	1864	Rom	63
1853	Münster	56	1867	Münster	24
1858	Münster	88	1867	Peckeloh	39
1861	Münster	78	1867	Papenburg	44
1861	Gaesdonck	102	1871	Peckeloh	93
1861	Peckeloh	102	1872	Rom	64
1861	Rom	89	1874	Rom	110

Maximum in 1863, minimum in 1867 and 1850. There were also many Perseids in 1839, when Heis counted 160 per hour. The displays of 1863 and 1871 were of considerable intensity. On August 10, 1863, 9h. to 13¼h., Heis, assisted by several other observers at Münster, registered the paths of 602 shooting stars, and at Gaesdonck on the same night, 563 were recorded between 9h. 17m. and 12h. 9m. It may be mentioned as a curious anomaly, showing how much "personal equation" may have to do with the estimation of meteor magnitudes, that at the two stations referred to, the meteors were classified as follows:—

	1st mag.	2nd mag.	3–6 mag.	Number with streaks.	Total meteors.
Münster	224	226	151	300	601
Gaesdonck	37	84	442	158	563

The Münster observers evidently overrated the magnitudes to an enormous degree.

The display of 1871, though less decided than in 1863, was still a very rich return of these meteors. On August 10 in that year, Signor Bassani, at Cosenza, in Italy, assisted by Signor Scrivani, counted 674 meteors from 9h. to 16h., and at Boston, Mass., Messrs. Sawyer and Stephens, watching the sky from 10h. to 15h. on the same night, recorded 567 meteors. Since that year the displays have not been of special brilliancy, though on August 10, 1874, 281 meteors were counted at Bristol by the writer in a watch of four hours, from 10.45, to 14.45, and on August 10, 1877, 354 meteors were seen in the five hours, from 9.30 to 14.30, giving an hourly number (for one observer) in both years of about seventy.

Dr. Phipson suggested[1] it was to be inferred from the observations that a maximum occurred at intervals of eight years. There had been considerable showers in 1839, 1847, and 1863, and he pointed out that a similar manifestation was due in 1871. In that year we had, as already described, an unusually numerous return of these meteors, and if the suspected periodicity held good, there would be another rich shower in 1879. Perhaps on that account the Perseids of the present year were anticipated with a little more than ordinary interest, but the night of August 10 was generally overcast in England (though at several stations a few meteors were discerned through breaks in the clouds), and thus the chief display has escaped us, though we may yet receive favourable reports

[1] See his "Meteors, Aerolites, and Falling Stars," p. 159.

from foreign observatories. The nights of August 9 and 11 were partly clear, and a few observations were obtained. Mr. H. Corder, in Essex, saw 166 meteors on the 11th, between 9.30 and 15.30, and found the radiant point very distinct at 45° + 57°. On August 4 a few meteors were seen from one of the earlier radiants at 33° + 51°, and on the 6th from another at 36° + 58°. On the 9th he watched from 9h. 30m. until 13h. seeing only 33 meteors (23 Perseids), but the moon was up and there were a few clouds. On the 10th it was cloudy except between 12–12.30, but a few meteors were seen later, in all 21, 18 being Perseids. The horary number cannot have been much over 30. On the 12th in 2h. he recorded 22 meteors (14 Perseids). Two fine meteors were seen on the 10th, the first, at 12.25, gave a vivid flash low down in Cetus, but only the streak was well seen. It was one of those instantaneous meteors often seen amongst the Perseids. Another was noted earlier (at 10.30) in Ursa = Sirius, and leaving a fine streak.

At Welling, in Kent, 50 meteors were counted by two observers from 10.15 to 11.15.

At Debenham, Suffolk, on August 10, 12 meteors were seen between 10.30 and 11.5, but the sky was much clouded. On the 11th, 10 to 11.30, 95 were recorded by one observer. These figures indicate a somewhat numerous return of the Perseids on August 11. The radiant point was deduced as at 46½ + 57½.

At Blackheath, S.E., Major Tupman found the normal radiant at 45° + 56° on August 11, and describes the Perseids as a poor display between 10.15 and 12.

At Bristol, on August 9, 33 meteors were seen by the writer between 9.30 and 12, but there was much interference from clouds. On August 11 20 meteors were noted in the half-hour preceding 10.10, and 15 of these were Perseids. Radiant point fairly well defined at 46° + 58°.

It will be seen that the four determinations of the radiant here given almost coincide at 45½° + 57°, and prove the meteors to have exhibited an exact and distinctly marked centre of divergence this year. Mr. Greg's average position for the Perseids, derived from a large number of former observations, is at 44° + 56°, and the writer found, in 1874, 1876, and 1877, a sharply defined radiant at 43° + 58°, but has more recently detected the existence of two other simultaneous showers from χ and γ Persei.

Signor Denza reports (*Gazetta Piemontese*, August 27 and 28) that a total of 1,155 shooting stars were observed on the nights of August 9-12 at seven Italian stations, chiefly at Volpeglino, by Signor Maggi and his assistants. The greatest number were recorded on August 11. The Italian observers also succeeded in registering 295 meteors on twelve nights in July.

The apparent diffusion of the Perseid radiant point, often noticed by observers, is explained by the activity of many concomitant showers. Observations of the paths much foreshortened and close to the centres upon which they converge are the best to rely upon in getting accurate radiants. The vast number of simultaneous or contemporary systems in operation is shown by a discussion of a portion of the mass of observations which have been collected on the night of August 10. There are certainly more than 60 distinct meteor streams visible on that single night alone, and evidence of many others whose feebleness allows them to elude discovery. The extreme tenuity of some showers is such that no indication of their existence may be detected in a persistent watch of several hours' duration.

The true Perseids are characterised by the swiftness of their flights (the theoretical parabolic velocity being 38 miles per second) and by the bright and often enduring streaks left in their courses. They are sometimes very brilliant, ending in green flashes of remarkable lustre, and the luminous wands they leave behind guide the eye unerringly back to the point of space whence they are directed. They may be most favourably seen in the morning hours, when the radiant has attained considerable altitude; and the observer should take up a position commanding an uninterrupted view of the north-eastern constellations.

The limits of duration of this shower have not been definitely ascertained, but very few Perseids are visible before August 5 or after August 15. It is certain that they open as early as August 5, because Heis, in 1864, saw a stationary meteor on that date, as brilliant as Venus, exactly in the radiant point at 44° + 57°. None of the real Perseids are visible as late as August 21, 22, or 23, for of many shooting-stars seen on those dates this year, not one could be certainly attributed to that stream. It was formerly considered probable that the shower began at the end of July, but from the paths of hundreds of meteors recorded by the writer at Bristol during this epoch, there is little if any indication of the true Perseid radiant point. There is, however, a very rich display of swift streak-leaving meteors from a point below χ Persei, or more exactly at 32° + 53°, with which the old Perseids have been confounded, and given that shower an apparent duration far beyond the actual limits.

In addition to August 10 there are other nights in that month when shooting-stars should be looked for and their horary numbers and radiants ascertained. Large meteors have been recorded in exceptional frequency on the 19th–20th and 22nd, and a series of three fine nights, occurring consecutively this year, on August 21, 22, and 23, enabled the writer to obtain observations as follows:—

Date, 1879.	Time. h. m.	h. m.	Duration, hours.	Meteors seen.	Sky.
Aug. 21	9 30	13 30	4	68	Clear; stars very brilliant.
,, 22	9 0	15 15	6¼	70	Partly cloudy.
,, 23	9 15	15 0	5¾	73	Clear; clouds at 15h.
Aug. 21-23	9 0	15 15	16	211	

Not many large meteors were observed, but three of them were as bright as Jupiter. On the night of August 22 there was slight interruption from clouds, and the watch sustained for 6¼ hours under such conditions was not equivalent to more than about 5 hours of clear sky. Of the 211 meteors seen, no less than 52 belonged to a splendidly well defined and rich shower of Draconids from a point at 291° + 60°, which thus apparently constitutes a special display at this epoch, and one of far more than ordinary importance. On August 21, 21 of its meteors were seen; on August 22, 11; and on August 23, 20. They are slow-moving, bright meteors, sometimes trained, and almost invariably with short paths. The maximum occurred on August 21, when in ¾ hour before 10.15, 9 of the meteors were traced, though, singularly enough, during the next hour the radiant gave no visible sign. It is not a new system, for the same shower has been seen by many observers, and is No. 78 of Mr. Greg's Catalogue of radiant points (1876), in which the centre is given at 282 + 60 (12 obs.), and the duration from June 28 to August 25 (?). Major Tupman detected it in 1871, on August 20-25, at 280° + 58°, and Corder, in 1877, saw 11 meteors from 307° + 65°, on August 17, which may have been another manifestation of the same stream. In future years these Draconids should be anticipated as a rich and interesting periodical display. Though none of the true Perseids were visible on August 21-23 this year, there was a moderately strong shower near α Persei, at 46° + 47°, giving bright, swift meteors, with streaks, and other radiant points were indicated in Perseus at 61° + 50° and 62° + 35°, but no shower derived from the 211 meteors seen on August 21-23, would bear any comparison to that of the Draconids referred to.

The night of August 24 was overcast, but on August 25, before midnight, 14 meteors were seen through openings in the storm-clouds. There were four Draconids, two of

which were brilliant. One was observed in the twilight and moonlight at 8.30 falling vertically in Delphinus, and the other, at 9.57, was as bright as Venus, and gave a succession of three outbursts. Path from 79° + 76° to 89° + 67°. There was a vivid flash at the end point which many persons who did not see the meteor itself mistook for lightning. W. F. DENNING

OUR ASTRONOMICAL COLUMN

BIELA'S COMET.—In the actual uncertainty with regard to the present condition of Biela's comet, the importance of an exhaustive survey of the eastern sky during the dark mornings, *i.e.*, the moonless mornings, of September and October, can hardly be exaggerated. The comet may possibly have been so disintegrated by this time that nothing further will be seen of it as such, but there must remain very great doubt as to such being the case. According to M. Otto Struve's observations of the two heads in 1852, their diameters were still considerable, that of A being upwards of 20,000 miles, and of B 37,000 miles, and the brightness of the latter was equal to that of a star of Argelander's ninth magnitude.

With respect to the most promising plan of search, not much, perhaps, can be said, but if a number of observers are available, as it is to be hoped there may be, sweeps in zones of declination between pretty wide limits of right ascension, appear likely to insure some justifiable conclusion as to the comet's present state or position. Prof. Winnecke, we believe, is in possession of a 6-inch refractor, mounted as an "Airy's orbit-sweeper," and if the comet, or what remains of it, be still moving in the old orbit, this instrument, in such hands, will be of the utmost value in the examination of the proper sweeping-lines for the particular dates. But if the orbit has been sensibly changed by further perturbation, the effect of which is wholly unknown to us, the necessary survey of the heavens will be, of course, only partially effected by this means, so that our only resource appears to be, as we have suggested, in a well-organised scrutiny of that portion of the sky wherein it is possible the comet might be situated, and there is yet time to provide for this, if arrangements have not been already made at those observatories which are occupied with cometary observations. To indicate the portion of the heavens in question, we subjoin the comet's places for the dates of new moon in September and October, according to different assumptions as to its distance from the perihelion, with similar places for five days subsequently:—

Days from perihelion.	September 15·5 R.A.	Decl.	Dist.	September 20·5 R.A.	Decl.	Dist.
	°	°		°	°	
0	144·3	+ 9·3	1·60	146·8	+ 8·3	1·56
−10	137·5	12·6	1·47	140·0	11·7	1·41
−20	130·1	16·3	1·33	132·7	15·5	1·27
−30	122·0	20·1	1·20	124·5	19·6	1·13
−40	112·8	24·2	1·08	115·1	24·0	1·00
−50	102·2	+28·2	0·98	103·8	+28·6	0·90
	October 15·5			October 20·5		
+20	170·5	− 3·2	1·65	172·9	− 4·4	1·60
+10	165·1	− 0·6	1·47	167·5	− 1·8	1·42
0	159·2	+ 2·5	1·29	161·7	+ 1·2	1·23
−10	152·8	6·2	1·11	155·3	4·9	1·04
−20	145·5	10·7	0·92	148·1	9·5	0·85
−30	136·7	+16·5	0·75	139·0	+15·8	0·67

THE CLUSTER ABOUT κ CRUCIS.—In a communication to the Paris Academy of Sciences on August 25, M. Cruls, Director of the Observatory at Rio Janeiro, states that on comparing the present appearance of the stellar cluster about κ Crucis, with the map and observations made by Sir John Herschel, he finds notable changes—confirmed by detailed micrometrical measures which he intends to publish. Three double stars are found to be certainly in orbital motion, and there is a rectilinear displacement of the star near the red one. M. Cruls also mentions that he has registered a star 6·5m., which he believes has not been previously remarked, and which he suggests may be variable; it follows B.A.C. 4308 = Lacaille 5293 by 1m. 4·26s., and is south of it, 4′ 14″·6; according to Mr. Stone's position of this star for 1875·0, the place of M. Cruls' object for the same year is in R.A. 12h. 44m. 58·52s., N.P.D. 149° 43′ 11″·0. We notice that the differences given by him are almost precisely the same as the differences between Lacaille 5288 and 5293, though that in declination appears to be in the wrong direction; thus, Mr. Stone's catalogue of 1875 makes the position of 5293 with reference to 5288, in R.A. + 1m. 4·72s., in Decl. + 4′ 10″·4. Is it possible that there can be any confusion here? Mr. Stone has not observed a star in M. Cruls' place.

This cluster is *h.* 3435, and Sir John Herschel's micrometrical details relative to 110 of its components, will be found at p. 17 of his Cape volume; it is remarkable for the various colours of the stars, an attempt to illustrate which is made in the last edition of Chambers's "Descriptive Astronomy."

GEOGRAPHICAL NOTES

THE news of the arrival of Prof. Nordenskjöld at Yokohama on the evening of September 2, will have been received with satisfaction by the whole civilised world. The long-looked for solution of the problem of the North-East Passage has thus been practically accomplished. After being imprisoned in the ice near the Tshuctshe settlement for 264 days, viz., from September 28, 1878, until July 18 last, the *Vega* was at last released, and passing the East Cape, Behring's Strait, on July 20, entered St. Lawrence Bay, which may be said to form part of the Pacific Ocean. Crossing to Port Clarence on the American coast, a short stay was made there, and then the Professor re-crossed to Komian, while all the time dredging operations were carefully made, the formation of the sea-bottom at this spot being particularly interesting on account of the meeting of currents from the Arctic and Pacific oceans. No doubt the *Vega* will bring home a rich collection of specimens. The voyage was then continued, and after touching at St. Lawrence Island, Prof. Nordenskjöld visited Behring's Island, off the east coast of Kamtchatka, where he received the first news from Europe through the resident agent of the Alaska Trading Company. It was here that the professor discovered the fossil remains of the gigantic marine animal *Rhytina stelleri*.[1] On August 19 he left the island and continued his journey towards Japan. On the 31st the ship encountered a severe gale, during which the maintop was struck by lightning, which also slightly injured several of the crew. Without further accident the *Vega* anchored at Yokohama at 10.30 P.M. on the 2nd inst., where she will remain for a fortnight. No deaths took place on board since the vessel left Sweden last summer, and thus the high-minded liberality of Herr Dickson, of Gothenburg, who supplied the means for the spirited enterprise of Prof. Nordenskjöld, is by the complete success of the latter deservedly rewarded.

In the August number of Petermann's *Mittheilungen* the narrative of journeys and voyages to Siberia is continued, with a map showing the most recent voyages through the Kara Sea. A special map has also been issued in which a portion of the course of Nordenskjöld in the *Vega* is laid down. The new coast-line of North-East Siberia is also laid down from the data supplied

[1] This animal was a species of Sirenia, and was exterminated by man within a comparatively recent period. It was discovered about the middle of last century upon the island in question, which has its name from the celebrated traveller who was wrecked there in November, 1741, and who found the place inhabited by large numbers of these enormous animals. They were first described by Herr Steller, who was one of Behring's party. The discovery, however, seems to have been fatal to Rhytina, none having been seen later than the year 1768.

by the Italian naval officer, Lieut. Bove. *Apropos* of recent troubles between Chili and Bolivia is an article, with map, on the desert of Atacama. Among the information in the *Monatsbericht* are a number of important data as to the heights of various places in Japan.

AT the last annual meeting of the Swiss Alpine Club the following resolutions were adopted:—(1) The club determines for six years the field of its excursions as follows:—The high Alps between the cantons of Berne and Valais to be explored from west to east in three parts: the Lenk with its neighbourhood, the Blumlis-alp, and the glacier of Aletsch and the Jungfrau as far as Grindelwald; (2) A series of lectures will be opened for the guides; (3) The central committee will publish all interesting documents collected until now as to the motion of glaciers, with bibliographical notes on former publications on this subject.

THE new number of the Geographical Society's monthly periodical contains Mr. Keith Johnston's "Notes of a Trip from Zanzibar to Usambara, in February and March, 1879," illustrated by an excellent little map, which has been reduced from the original drawing sent home by him. These and the other reports and maps connected with his preliminary work, and published in a previous number, were, as the editor very truly remarks, "a sure promise of great things to come when he should have traversed the unknown regions of the interior," and show very clearly how great a loss geography has sustained by Mr. Johnston's premature death. Notes on the geology of Usambara, collected during the same journey, are by Mr. J. Thomson, the geologist and naturalist of the East African expedition, who has now taken Mr. Johnston's place. The "Lecture on the Origin of the Flora of the European Alps," by Mr. John Ball, F.R.S., occupies a considerable portion of the present number. The geographical notes do not this month contain anything very striking, but some of them are good, especially those relating to Col. Grodekof's and M. Oshanin's expeditions, and to the exploration of the Sanpo River and Count Szechenyi's further attempt to reach Lob-Nor from China. We would also call particular attention to the obituary notice of Mr. Keith Johnston. The rest of the number is chiefly occupied with the presidential address in the Geographical Section of the British Association.

A PROPOSAL similar to the often-ventilated plans of a sea in the great Sahara has been recently made by the Governor of the State of Arizona, in North America. It is suggested that a short canal should be constructed which would admit the waters of the Pacific to a large and low-lying area of land situated between Arizona and Southern California. The district is quite a desert at present, and is believed to be the bed of an ancient lake. It measures some 200 miles in length and 50 miles in breadth; its level is estimated to be about 300 feet below that of the Pacific. Its western boundary is at only 45 miles distance from the Gulf of California, and as on this part, where the canal would have to be built, there is already a lake of 20 miles length, the length of the actual canal would be reduced to 25 miles. The cost of the undertaking would amount to about 200,000*l.*, and the work could be completed in six months. The importance of an undertaking of this kind need not be pointed out.

WE learn by telegram from New York that Commander Lull, U.S.N., has read a paper before the American Science Association, on his recent explorations in connection with the proposed ship-canal through the Panama Isthmus. He considers that the only practicable routes are those *viâ* Nicaragua and Panama, and that locks will be indispensable. Commander Lull gives a decided preference to the Nicaragua route.

THE last number of the *Isvestia* of the Russian Geographical Society contains much interesting information as to the meetings of the Society and of its sections. Unhappily, all the proceedings are very old, as we do not find anything more recent than from February 6 to May 30 of last year. It is a pity that the Society does not publish its interesting proceedings immediately after the meetings.

M. HOEVERT has undertaken a valuable work, the compilation of a complete bibliography of all works relative to the geography of Russia published till now. He has already finished the revision of the libraries of the Geographical Society of the Academy of Sciences (which receives *all* Russian works published), and of the General Staff.

WITH a view to turning the island to profitable account, a Saghalien Fishing Association has been established under licence from the authorities at St. Petersburg, and vessels for the purpose are being built or chartered in Japan. The business is expected to prove a very lucrative one.

THE caravan of Capt. S. Martini, whilst on its way to convey supplies to the Italian African expedition, has been attacked by the Somalis tribe and robbed of all its merchandise at a distance of some six day's march from Zeila.

NOTES

THE eighth general meeting of the German Astronomical Society took place at the lecture hall of the Royal Academy of Sciences at Berlin on the 5th inst., under the presidency of Prof. Krüger, Director of the Gotha Observatory. Numerous guests from England, France, Belgium, Holland, Russia, Sweden, Denmark, and Austria were present. The Minister for Public Instruction, Herr von Puttkammer, welcomed the assembly in the name of the German Government. We shall refer to the meeting in a future number.

A SMART shock of earthquake was felt in the neighbourhood of Szegedin (Hungary) on September 3.

AN announcement made by the Society of Arts states that the Society offers the Fothergill gold medal for the best means of protecting ships from loss by fire and by sinking, and a silver medal for the protection of ships from either calamity.

A PAMPHLET containing a collection of necrological notices of the late M. Victor Masson, formerly principal of the eminent Paris publishing firm, has recently been published in Paris. The deceased died at his country house of Chassagne (Côte d'Or) on May 3 last, at the age of seventy-two years. His name was well-known in all scientific circles, as he held the highest place among scientific publishers of the French capital. Personally he was greatly esteemed by all who knew him, his relations with men of science were ever of the most liberal, friendly, and upright character, and the care and elegance with which he brought out the scientific works entrusted to him always deserved special praise.

ON the 25th inst. the Pompeii celebration, to which we referred some time ago, will take place. The director of archæological excavations in Italy, Prof. Michele Ruggiero, will deliver a historical address to the assembled guests in the basilica of the ruined city. Hereupon he will lead them through the entire area hitherto laid bare, and afterwards some excavations will be made in presence of the guests.

THE Clothworkers' Company have voted 3,500*l.*, beyond the 10,000*l.* previously voted, to cover the complete cost of that portion of the buildings of the Yorkshire College of Science, Leeds, which will be required for the teaching of the sciences applied to the textile industries and dyeing. They have further agreed to maintain the buildings and the operations in full effect for a period of five years from January 1 next, at a cost of 1,200*l.* per annum.

PROF. A. H. CHURCH commences a course of ten lectures on the Chemistry of Food next Monday, the 15th inst., at five o'clock, at the National Training School for Cookery, Exhibition Road, South Kensington. Mr. Church has been appointed Professor of Chemistry at the Bedford College (for ladies), York Place, Portman Square.

THE sixth Congress of Russian Naturalists promises to be very interesting, not only as to the scientific communications expected, but also as to its practical results. It is proposed to form a permanent Commission of representatives of all Russian scientific societies for the exploration of little-known parts of Russia as to their natural history and geology, with the special aim of the applications of science to agriculture and mining industry. Another Commission will be nominated for the diffusion of science among the masses of the people by means of a series of systematical lectures. A group of Russian explorers of the North proposes to form at the Congress of Naturalists a special section for all questions connected with the exploration of the North of Russia and Siberia.

THE *Courier de Tlemcen* (near Algiers) describes an interesting if somewhat fabulous discovery. It states that some miners occupied in blasting rocks in the vicinity of the picturesque cascades, discovered the entrance to a cave, the floor of which was covered with water. They ventured upon the subterranean river on a raft, and followed it for some 60 metres' distance, when it disappeared in a vast lake. Here the vault of the cave was very high and covered with stalactites. In many parts the miners had to steer their raft between colossal stalactites which reached down to the surface of the water; eventually they reached the end of the lake, where they noticed a canal extending towards the south, and into which the waters of the lake flowed. The workmen estimate the length of the lake to be 3 kilometres, and the breadth about 2 kilometres. They brought out a quantity of fish, which, they say, surrounded the raft, and which were found to be blind.

THE optical structure of ice forms the subject of a recent paper by Herr Klocke, in the *Neues Jahrbuch für Mineralogie* (1879, p. 272). He confirms M. Bertin's observation, that in formation of ice the optic axis of the crystal is placed at right angles to the surface whence the cooling proceeds; and this was the case with water at rest in a freezing mixture. Only the ice-flowers which first cover the sides of the vessel have their principal axis parallel to these. M. Bertin affirmed that the first thin ice-layer forming on water which freezes in an open vessel in cold air has a confused crystallisation, and only after thickening takes a determinate orientation. Herr Klocke differs from him here. He shows that the first needles shooting over the surface are formed parallel to the principal axis, and that then ice-plates are added to their sides, whose optic axis is at right angles to the surface of the water. In the enlargement of these lateral plates to the table of ice extending over the whole water surface, this orientation is preserved from the commencement. Tables of ice quickly formed under disturbing influences or in great cold, as also various plates of sea-ice, showed, on the other hand, aggregate polarisation. Various other observations are described.

WE hear that the preliminary operations for opening the coal-mines in the Kaiping department of the Chinese province of Chihli, to which we have before referred, are proceeding satisfactorily. From borings made last winter it would appear that six seams of good coal can be reached, and the construction of two shafts has been commenced. Good clay has been found close at hand, from which bricks will be made for lining the lower parts of the shafts, the upper portions being faced with stone already prepared for the purpose. Machinery and some miners were shortly expected to arrive from Europe, and the work would then be rapidly pressed forward.

THE temperature of the polar extremities of carbons giving the electric light has been recently investigated by M. Rossetti (*Journ. de Phys.*, August), using the same method and instruments as he used in measuring the temperature of the sun. (The face of a thermo-electric pile is placed at suitable distance to receive rays from a radiating surface of determinate size, and the thermal effect is measured by a very sensitive Wiedemann reflecting galvanometer; the temperature is deduced by means of a formula previously established.) We give, briefly, the author's conclusions:—(1) The positive carbon pole, at the moment of production of the light, has always a higher temperature than the negative. (2) These temperatures vary according to variation of the current's intensity. (3) They are higher the smaller the radiating surface, provided, of course, it comprises the extremity of the point. (4) For the negative pole the minimum temperature was 1,910° C., the radiating surface being large and, in part, of small brilliancy; the maximum 2,532° C., the radiating surface being half the preceding. (5) For the positive pole, the minimum temperature was 2,312°, the carbon being very large and the radiating surface very extensive; the maximum 3,200° when the carbon was thin and the radiating surface nearly a quarter of that corresponding to the minimum temperature. (6) We may consider the temperature of the extreme negative polar point as equal to 2,500° at least; that of the positive polar extremity is not less than 3,200°.

ON Saturday last a system of telephonic communication highly promising for the convenience of business men and others was successfully inaugurated in London. The telephone used is that of Edison (the loud speaking telephone), with the nature of which our readers are acquainted. A central station called the Telephone Exchange, in Lombard Street, is put in connection at present with ten private offices furnished with telephones in various parts of the city. The switch-board at the central office might be connected with twenty-four different stations, this being the most that can be attended to by one person. Any number of switch-boards, however, might be added in the same room, and any station on one board connected with any one on another board. An attendant, who may be a boy, sits in front of the board. Supposing No. 2 wishes to speak with No. 6, the person at No. 2 calls the attention of the central attendant by means of an electric bell, while a falling shutter on the switch-board shows the number of the applicant. The attendant responds, and No. 2 then says, "Connect me with No. 6." The shifting of a pin effects this, and Nos. 2 and 6 are left to communicate with each other. When the conversation is closed, No. 2 signals by the bell that he has finished, and the attendant, removing the pin, separates the two stations. And so with any other numbers. Of course only one station can be connected with another at the same time, but the process of coupling and uncoupling is effected very quickly. Edison's instrument, though known as the loud-speaking telephone, is also suited for conversation almost in whispers, and this was tested on Saturday with very satisfactory results. The telephone is said to have been worked in America without difficulty between stations 100 miles apart. It is considered that up to about five miles distance there is no loss of power; and in practice of the above system even five miles would probably be found an exceptional distance. The utility of the system seems fully demonstrated, and we may look for an extensive application of it in our large towns.

THE common form of speaking telephone relies for its action on currents of electricity developed in helices by the varying strength of magnetic induction when an armature moves in the magnetic field. A second genus of telephone is that which Edison has developed out of his motograph, and which depends solely on the varying friction between two surfaces, one of which is an electrolyte, when a varying current is passed between them.

Prof. Dolbear has recently (*Journ. of Frankl. Inst.*) described a third genus of telephone quite unlike the other two. A short, straight bar electro-magnet is furnished with a crank, so that it may be rotated within its coil. Lying on the poles are the ends of a bent armature (of horse-shoe form), the back of which is fastened to a plate of mica, or paper, or thin iron, mounted as in ordinary receivers, so that any motion of the armature poles will be imparted to the plate. When a current traverses the bobbin, the straight bar becomes a magnet, with strength proportionate to the strength of the current, and the armature adheres to the poles of it with a certain strength of adhesion. Now let the crank be turned slowly, and the adhesion of the armature will result in stretching the plate, and the cessation of the current will let the plate regain its former position through its elasticity. A varying current will result in varying adhesions and consequent vibrations of the plate, and talking may be plainly heard with an instrument constructed thus. Prof. Dolbear calls it the *Rataphone*. Of course there are various ways in which the principle may be utilised.

In the last number of the *Astronomische Nachrichten* Dr. Hermann J. Klein, of Cologne, publishes some further remarks regarding the new formations near the lunar crater Hyginus, which were first noticed by him, and about which there has been so much discussion in astronomical circles of late. Dr. Klein, after giving some valuable selenographical details (for which we must refer our readers to the serial mentioned), observes that for the present it must remain undecided whether the new formations near Hyginus are due to volcanic action. As far as his knowledge extends, only one observation of lunar changes may be ascribed to phenomena of a volcanic nature. This observation was made by Schröter and Olbers on July 2, 1797, and referred to a mountain, V, in the Mare Vaporum. The mountain was found to be 3,450 feet in height, and has never again been seen; it was probably only a mass of vapour. Almost at the very spot where this mysterious object was observed a crater is now visible. Dr. Klein is of opinion that at the surface of the moon masses of vapour are formed now and then and are of considerable duration, and he lays particular stress on the fact that for certain processes taking place upon our satellite all analogy with terrestrial phenomena is completely wanting. As an instance he points to the occasional occurrences at the double crater Messier. Those who are acquainted with the entire materials collected by observations of this formation, from Gruithuisen down to Schmidt, and who have themselves for some time observed the crater and its appendages, will own that here they stand before an unsolved enigma, and that, for the present, at least, it is the wisest course to abstain from any attempt at explaining the wonderful phenomena which are taking place in those regions.

The Austrian geologists are very busy at present with the excavations which are being made in the Moravian caves of Stamberg and Brünn. A few miles from the latter town the celebrated Vypustek cave is situated. This is now being investigated by order of the Imperial Academy of Sciences of Vienna, and has been repeatedly visited by Prof. von Hochstetter. The Imperial Museum at Vienna has quite recently received a collection of bones of the cave-bear, of the cave-hyæna, and of other prehistoric inhabitants of the Vypustek cave.

In a recent number we referred to the tides observed in the subterranean waters of a coal mine at Dux, Bohemia. A similar phenomenon is reported from America, where it was observed in an artesian well some months ago. A Vienna geologist therefore recommends that observations should be made at the artesian wells in Europe, to ascertain whether similar phenomena would show themselves.

In an article in the August number of the *Entomologist's Monthly Magazine*, on the recent abundance of *Vanessa cardui* over a great part of Europe, Mr. McLachlan suggests that possibly "the insect may be able to rest quiescent in the perfect state over a series of years, until the accumulated numbers simultaneously wake up."

The Russian Commercial and Technical Societies propose to send to the Berlin International Fishing Exhibition several collections of living fishes and detailed descriptions of the fishing in Russia.

In the last (August) number of the *Annali di Chimica applicata alla Medicina* of Dr. G. Polli of Milan, an interesting note by Dr. Finardi Sante of Salara (Rovigo), reports the discovery of a new method of conserving chloride of lime unchanged, *i.e.*, free from carbonate or moisture. It consists in placing into the jars containing this substance a small vessel containing a mixture of salicylic acid and salicylate of potash, then closing the jars with a non-porous stopper and preserving them in the dark.

We have received the *Anuario del Observatorio de Madrid* for 1876 and 1877; it contains much useful astronomical and statistical information. We have also received the meteorological publications of the same observatory for 1875–8; these we hope to notice at length.

During a thunderstorm at St. Cergues, in the Jura, the rare phenomenon known as St. Elmo's fire was observed. A pine forest in that neighbourhood is reported to have appeared as if on fire, presenting a magnificent aspect.

A step in the right direction has been taken by the citizens of Colorado in the formation of a Historical and Natural History Society at Denver. The leading citizens of the State have become members of the new society, the main object of which is the preservation of records, documents, relics, &c., referring to the State of Colorado. The accumulation of works on natural history and of specimens illustrating the natural wealth of the State is another object the Society has in view.

In a note to the Berlin Physiological Society, Herr Fritsch, after remarking on the difficulty of rendering bacteria in infected tissues visible, recommends Abbé's illuminating arrangement for the purpose. This consists of a hemispherical lens-system, the plane surface of which is placed close under the object. To the middle point of the system is directed a considerable quantity of daylight by means of a plane mirror, and the intensity is so regulated that, with different combinations, differently incident cones of rays are obtained.

The additions to the Zoological Society's Gardens during the past week include a Tiger (*Felis tigris*), two Indian Leopards (*Felis pardus*), from India, presented by His Excellency the Right Hon. Lord Lytton, G.C.B., G.M.S.I.; a Macaque Monkey (*Macacus cynomolgus*), a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mr. B. Raver; two great Bustards (*Otis tarda*) from Andalusia, presented by Mr. Forster; two All Green Parrakeets (*Brotogerys tiriacula*) from Brazil, presented by Dr. A. Stradling; two Common Chameleons (*Chamæleon vulgaris*) from Cyprus, presented by Mr. Alfred Ely; a European Bearded Vulture (*Gypaëtus barbatus*) from Spain, deposited; a Sœmmerring's Gazelle (*Gazella Sœmmerringii*) from Abyssinia, a Rock Cavy (*Ceredon rupestris*), a Crab-eating Opossum (*Didelphys cancrivorus*), an Ashy-headed Goose (*Bernicla poliocephala*), an Upland Goose (*Bernicla magellanica*) from South America, a Superb Tanager (*Calliste fastuosa*), a Black-shouldered Tanager (*Calliste melanonota*), a Palm Tanager (*Tanagra palmarum*), a Thick-billed Violet Tanager (*Euphonia crassirostris*), a Brazilian Blue Grosbeak (*Guiraca cærulea*), two Tuberculated Iguanas (*Iguana tuberculata*), two Horrid Rattlesnakes (*Crotalus horridus*) from Brazil, two Elegant Parrakeets (*Euphema elegans*), from South Australia, two King Crabs (*Limulus polyphemus*) from North America, purchased.

PROF. DODEL-PORT ON THE FERTILISATION OF RED SEAWEEDS BY INFUSORIA

IN a recent number of the excellent periodical *Kosmos*, Dr. Dodel-Port, the eminent Zurich botanist, has published the results of a series of observations made by him regarding the part played by some infusoria in the fertilisation of a certain species of red seaweeds or Florideæ, viz., *Polysiphonia subulata*, T. Ag. The paper is of biological importance, since it forms, as far as our knowledge extends, the first record of a possible participation of animals in the fertilisation of cryptogams, which in itself seems an interesting parallel to the relations existing between insects and phanerogams. We have pleasure, therefore, in presenting our readers with an abstract, the illustrations for which have been placed at our disposal through the kindness of the author and of the publishers of *Kosmos*.

In previous numbers of the same periodical Dr. Hermann Müller had sketched the history of the evolution of the floral world and had shown upon what basis rests the entire relation between flowers and insects. This basis is the passage from a state of things in which the male cells discharged their products in a medium of water to that in which this event took place in the dry atmosphere, which transition period occurred at the upper boundary of the cryptogamic flora of prehistoric times.

In almost all cryptogams, which are not agamic, the contents of the male sexual cells are actively movable; when they leave the male cell they move freely about in the water by means of vividly oscillating cilia. They therefore possess the faculty of moving to the distant female organ, and there to complete fertilisation. In the case of phanerogams, the independent mobility of the pollen-bodies has become an impossibility. To effect the union of pollen-grains with that particular part of the female flower which is destined to receive them, in most plants some external agent must interfere. In many cases, specially in the lower regions of the floral world, the wind, gravitation, or both together, are the agents in question; in the majority of the higher phanerogams, insects, or occasionally other animals, undertake the conveyance of the pollen.

Now there are a great number of cryptogams, in which the contents of the male cells which are emptied into the water do not possess the faculty of independent motion, as they are not endowed with cilia, and are therefore dependent on the action of external forces for their locomotion. To these belongs the great and highly differentiated order of so-called red seaweeds or Florideæ, chiefly marine plants which vary much in form and colour, and which no one who has ever attentively observed on the sea-coast will ever forget. Their antherozoids, which are generally spherical, are discharged into the water as motionless cells, and are yielded up to the play of currents in the same way as in our anemophilous phanerogams, the pollen grains pass as a dust into the air, and are moved to and fro by the winds. There are many analogies between Florideæ and higher phanerogams, regarding their sexual conditions. Thus, amongst the former we find many species which are dicœcious, similar to the lowest phanerogams amongst gymnosperms, and to others of higher order. The chances for fertilisation in their case are therefore quite similar to those applying to dicœcious phanerogams. Often the male plants grow at a considerable distance from the female plants of the same species. In the spring of 1878 Dr. Dodel-Port, during a series of microscopical examinations of the red seaweeds of the Adriatic, extending over four weeks, found only female and agamic (tetrasporous) specimens of *Polysiphonia subulata*, T. Ag., and looked in vain for male specimens, of which only at the end of his investigations he could obtain a few. Their respective localities of growth were evidently considerably apart, and yet at all times Dr. Dodel-Port found female specimens in all stages of fertilisation. The spermatozoids discharged by the male plants therefore found their way to the distant female plants in spite of their own immobility and general passive behaviour. The sea-water must therefore have frequently been in vivid motion.

These facts being ascertained, the thought easily suggested itself that possibly animals might take part in the fertilisation, particularly as there is never a want of small marine animals roaming about in the Florideæ forests, such as infusoria, crustacea, annelids, starfish, &c. But what particularly attracted Dr. Dodel-Port's attention was the regular occurrence of innumerable bell-shaped animalcules (*Vorticella*) on the shrub-like branches of *Polysiphonia subulata*. In the course of closer investigation of the phenomena of fertilisation in the female organ, during and after the adherence of the antherozoid with the trichogyne, Dr. Dodel-Port eventually arrived at the full conviction that in the case of Polysiphonia the little Vorticellæ facilitate the conveyance of the antherozoids to the trichogyne, and that they act according to a natural law in the same way as do the pollen-collecting bees when by visiting the willow-catkins they assist at their fertilisation. The investigation of the sexual conditions of Florideæ is as yet in its infancy; it is to be hoped that more numerous researches in this direction will shortly be made, and possibly relations may be found to exist between other species of this order and certain animals similar to those discovered by Dr. Dodel-Port in the case of Polysiphonia and Vorticella. The details of the interesting relations in this case are shortly as follows:—

Fig. 1 represents the male reproductive organ (antheridium) of *Polysiphonia subulata* magnified 480 times. These antheridia often appear in large numbers at the upper branch-ends of the male plant, laterally close to the apex which continues its growth, at the spot where, in the vegetative state, young branches would form. In their earliest stage the antheridia consist, like the young branches, of a single row of cells. By repeated longitudinal and lateral divisions a polycellular body is soon formed, which begins with a short stem-cell (*st*), and which, on the side furthest away from the maternal thallus-branch, is protected by a forked hair (*gh*).

The ripe antheridium in external appearance reminds one very strongly of a maize cone; a row of 4–6 cylindrical cells (*a*, *a*) in the axis of the whole organ represent the spine of the cone, while the surface is covered over by numerous antherozoid mother-cells (*sm*, *sm*) representing the grains of maize. Before the antheridium is ripe the latter are polyhedrical, but afterwards they assume a round shape, as the drawing shows. All parts of the male organ are colourless; the antherozoid mother-cells are filled by a finely granular plasma, which is soon differentiated into a round body, which subsequently is discharged from the mother-cell as an antherozoid (*s*, *s*). Thus within a short time the ripe antheridium discharges some 400–800 ball-shaped antherozoids into the surrounding sea-water. The single antherozoid is a little globule of protoplasm, without cell-wall or any locomotive organ. In the centre of this globular primordial cell a strong magnifying power shows a little nodule which strongly refracts light, and round which a few smaller colourless plasma granules are grouped. As it freely floats in the water, the antherozoid is analogous to a pollen-grain of an anemophilous phanerogam.

The female reproductive organ of *Polysiphonia subulata* is a polycellular carpogonium of relatively high differentiation. It originates upon the female plant closely below the apex of the thallus-branches, and generally there are several of them forming successively at varying intervals from the branch-end downwards.

Fig. 2 shows the carpogonium-bearing branch-end of a female specimen of *Polysiphonia subulata*. *cg'* is a very young carpogonium; *cg*, *cg* are two mature ones; *t'* and *t''* are two trichogynes; *Vort.* are two Vorticellæ. The whole is magnified 300 times.

In Fig. 3 a carpogonium (*ca*) is represented magnified still more (480 times). *Vort.* is a Vorticella; *s*, *s* are antherozoids. In the mature state the carpogonium consists of three essential parts, viz.:—

1. The basal portion *f* (Fig. 3).
2. The fertile spore-forming part *cg*.
3. The hair apparatus *t* and *gh*.

The basal portion consists of five tubular cells running parallel to each other, of which in Fig. 3 are seen only two. Then follows the fertile part, *c g*, which is an oval cellular body, consisting of some 20–26 cells. A central cell, copiously filled with granular protoplasm, is surrounded by a number of irregular, peripheric cells, and awaits fertilisation, in order afterwards to transform itself into the spore-forming apparatus, while the remaining 19–25 peripheric cells become the case of the spore fruit through further divisions (see also Fig. 4, *h h*). The uppermost part of the female organ is the hair apparatus, which, in Polysiphonia, consists of the forked hair, *g h*, and the trichogyne, *t* (Fig. 3). The forked hair forms very early upon the young carpogonium, and indeed long before the trichogyne is formed; its position is always upon the true apex of the whole organ, although at times it stands apparently laterally from the apex. The duration of its existence and its presence at the time of fertilisation (it disappears immediately

afterwards) prove it to be an organ of some use in that process. The most essential and important part of the hair apparatus, however, is the trichogyne (*t*, in Figs. 2 and 3), *i.e.*, the receptive organ, which in Florideæ has a similar signification to that of the elongated style in many phanerogams, while the central part, *c g*, of the carpogonium is the analogue of the closed

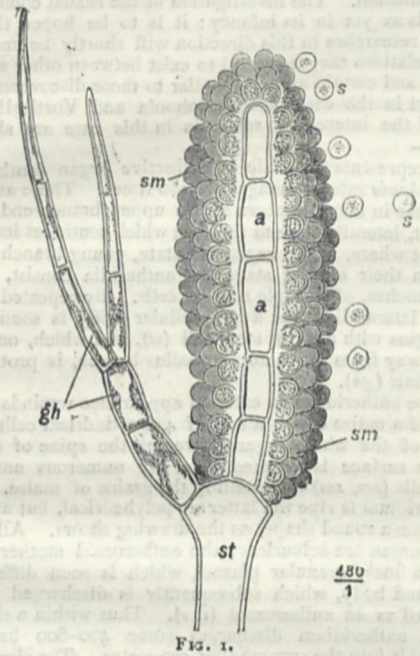


Fig. 1.

ovarium of angiosperms. The trichogyne is a slender, colourless hair, consisting of but a single cell, which rises from the carpogonium laterally from the apex of the latter, and does not quite attain the length of the forked hair, *g h*. It forms just about the time when all other parts of the carpogonium have attained that degree of differentiation which they possess during

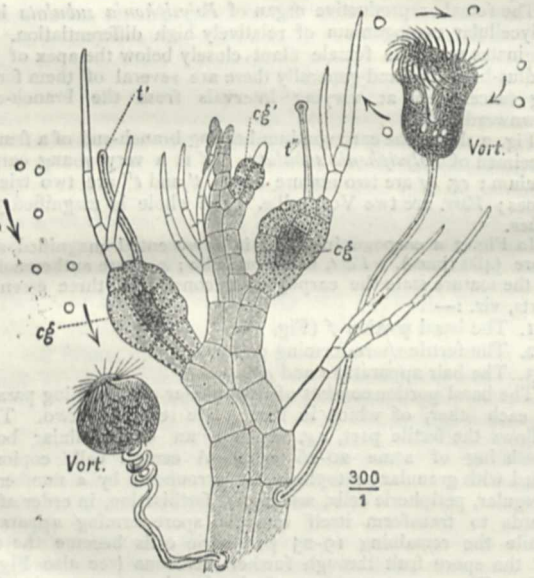


Fig. 2.

fertilisation. In the full-grown state the trichogyne is of the same thickness in its entire length, and rounded off suddenly at the upper end. The narrow canal of the trichogyne contains colourless, finely-granular protoplasm.

Now if antherozoids of *Polysiphonia subulata*, which were freshly discharged by the antheridia and have been accidentally carried near by currents, come into contact with the upper part of the trichogyne, they get firmly attached to the latter. It is particularly the apex of the trichogyne which possesses the faculty of retaining the globular antherozoids. Then the granular protoplasmic contents of the antherozoids pass into the

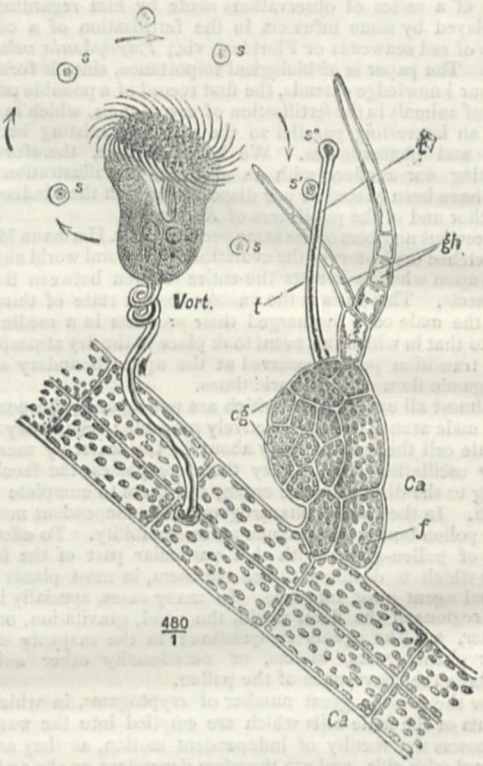


Fig. 3.

interior of the trichogyne (Fig. 3 *s''*). A part of it descends down the trichogynic canal into the carpogonium, giving the fertilising impulse to the central cell of the carpogonium. This process is quite similar to the corresponding one in phanerogams.

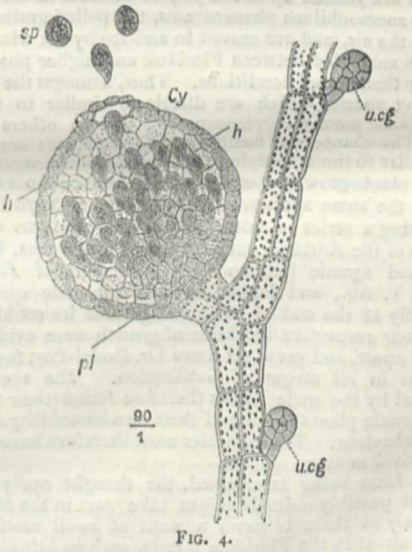


Fig. 4.

As the antherozoids of Florideæ are totally devoid of active locomotive organs, the possibility of fertilisation, *i.e.*, the coming into contact of the antherozoids and the trichogyne, of course rests entirely upon a lucky chance. The antherozoids reach the female organs passively, either by their own weight or through

the currents of the water, caused by waves, wind, or tides, and doubtless in many cases through the incessant movements of some marine animals. The greater the distance between the antheridia and the carpogonia, the smaller are, of course, the chances of fertilisation; the more violently the water is moved about in the vicinity of and between the separated organs, the more probably will the lucky accident of the union of both elements take place.

During a long series of investigations of the reproductive phenomena of Polysiphonia, Dr. Dodel-Port found regularly on the bushy thallus, and particularly upon the uppermost and youngest branches, an enormous number of the well-known stalked animalcules, Vorticellæ, which had settled there, and were, as usual, in incessant motion. Often they appeared in dozens in the field of the microscope, and, with the constant vibration of their cilia, they were very troublesome, at least up to the moment when Dr. Dodel-Port had directly observed their friendly co-operation in the fertilisation he was studying. He was a frequent witness of the process depicted in Fig. 3, where numerous antherozoids were whirled round and round in the whirl caused by a Vorticella, and where frequently antherozoids came into contact with the trichogyne, and remained attached to it (Fig. 3, *s'* and *s''*) for a longer or shorter period. It was entirely due to the motion caused by Vorticellæ that Dr. Dodel-Port was enabled to follow the phenomenon of the attachment of the antherozoids to the trichogyne from beginning to end. The motions of the Vorticellæ are particularly varied through the repeated contractions of their stalks into short spirals, and thus they cause various currents in the water, by all of which the antherozoids are carried along like any other small passive body that may be suspended in the water. (Compare Fig. 2, where one of the Vorticellæ is just contracting its stalk, the arrows in each case indicating the direction of the currents.)

The presence of numerous Vorticellæ thus imparts to the passive antherozoids a kind of motion much resembling that of the sperm-cells of other cryptogams which are endowed with active cilia. From this follows, with mathematical certainty, that the probability of the antherozoid falling on the trichogyne in the presence of Vorticellæ is immensely greater than that which would exist were there no animals present.

At the same time, it is evident that this probability is yet increased in the case of *Polysiphonia subulata* through the presence of the forked hair, *g h*, in the vicinity of the trichogyne, because the whirls caused by the animalcules will often be cleft by the forked hair, and thus secondary whirls will be produced. Often in Polysiphonia, carpogonia were found which were not fertilised. Thus Fig. 4 represents a ripe and spore-ejecting cystocarp, *c y*, and two carpogonia, *u c g*, which remained unfertilised. This was particularly the case on thallus-branches, which were less densely crowded with Vorticellæ—another, although negative, proof of Dr. Dodel-Port's theory. It is not particularly remarkable that Vorticella should inhabit Polysiphonia in large numbers, because these animalcules, as Dr. Dodel-Port observed, feed with predilection on the antherozoids of this plant. Thus we have here a condition of things similar to the relations between certain flowers and pollen-consuming insects. The consumption of antherozoids by the Vorticellæ is, of course, far too insignificant to merit any consideration, particularly if compared to the great advantages regarding fertilisation which the presence of the animalcules brings with it. Moreover, a comparison of the male plant of Polysiphonia with a female specimen shows that here also, as in most phanerogams, thousands more male cells are formed than are necessary for fertilisation.

After fertilisation the carpogonium develops into a cystocarp, *i.e.*, the spore-forming fruit (Fig. 4). Shortly after fertilisation the whole hair apparatus disappears. The wall-cells of the carpogonium now begin to grow quickly and to divide by membranes perpendicular to the surface. They form a cellular case (*h h*, Fig. 4), which has an orifice in the apex, long before the spores are ripe. In the meantime the central cell of the fertilised carpogonium begins to form a number of densely-packed short branches, which, as a series of cells radiating in all directions, fill the basis of the capsule-shaped fruit. The central cell is therefore called the placenta-cell. At the ends of the ramified cell-series which radiate from it, pear-shaped and dark red spores form (carpospores), which, as soon as they have attained a certain size, become detached and pass into the water through the orifice at the apex of the cystocarp. In this state they are perfectly capable of further development and soon begin to germinate.

Dr. Dodel-Port concludes his interesting treatise with the following suggestive sentences:—

"The total absence of active organs of locomotion in the antherozoids of Florideæ points to a common ancestor from which the different branches of the Florideæ have inherited the immobility of the antherozoids. No doubt that during the differentiation of the red seaweeds many forms have died out in consequence of the fertilisation not taking place through the passivity of the male cells, while other forms have retired to localities which through active water-currents favour the process of fertilisation in spite of the immobility of the antherozoids. It is well known that now we find most of the present species of Florideæ on the coasts of warmer seas, which are constantly washed by the waves, while the northern coasts, which are covered by crusts of ice during a great portion of the year, are very poor in red seaweeds. Future researches will have to show how far in many of these aquatic plants the differentiation of the genera took place in the sense of an adaptation to the small marine animals which inhabit them and favour their fertilisation in the way I have pointed out. If many seaweeds in their bushy shrub-like thallus harbour certain infusoria, bryozoa, hydræ, sponges, crustacea, annelids, and small starfishes, and offer to them excellent hiding-places or nourishment, so that these animals inhabit them with special predilection, then it is certainly possible that occasionally a correlation was formed or adaptation took place, which was mutually advantageous and which would find numerous analogies in the domain of the multiple cross relations between the higher flowering plants and insects. In this sense I consider it my duty to submit to the criticism of biologists a point hitherto overlooked in the biology of red seaweeds, and bearing upon the explanation of the morphological differentiation of submerged aquatic plants."

THE BRITISH ASSOCIATION

REPORTS

Report of the Committee appointed for the Purpose of Arranging for the Occupation of a Table at the Zoological Station at Naples, the Committee consisting of Dr. M. Foster, Prof. Rolleston, Mr. Dew-Smith (Secretary), Prof. Huxley, Dr. Carpenter, Dr. Gwyn Jeffreys, Mr. Sclater, Mr. F. M. Balfour, Sir C. Wyville Thomson, and Prof. Ray Lankester.—Since we submitted our last Report to the Association, the Zoological Station at Naples has continued to be successful in providing opportunity and appliances for naturalists studying the various forms of marine animals and plants. From September 1, 1878, to the end of July, 1879, twenty-six naturalists have occupied the tables at the Institution. A list of their names and the time of stay will be found appended. During the same period, packages of specimens have been forwarded to fifty-one different naturalists and institutions. A list of these is also appended.

Recently a new department has been added to the station. Through this naturalists will be enabled to obtain mounted specimens of microscopic animals, viz., sections of embryos of all kinds of fishes, &c., preparations of larvæ or other animals too small for being sent in alcohol or other preservative solutions. Next year a catalogue of these specimens will be published, and the station will be prepared to send the specimens to any naturalist requiring them.

Trials of diving by means of the new Scaphander apparatus have also recently been made with very satisfactory results.

The aquarium of the station is being in part reconstructed, with some important new features, viz., moveable rockwork, for saving and examining the different animals which thrive by themselves on these rocks. This will enable statistical notes to be established on the growth of these animals, and on such changes as may occur by changing their habitat, inasmuch as these rocks may be replaced in the sea at different depths.

The following monographs are in preparation by workers in the station:—Ctenophoræ, Fierafer, Balanoglossus, Sipunculoidæ, Capitellidæ, Planariæ, Nemertineæ, Pycnogonidæ, Caprillidæ, and on several families of Algæ.

Three parts of the "Mittheilungen aus der zoologischen Station zu Neapel, zugleich ein Repertorium für Mittelmeerkunde" have been published, containing sixteen papers illustrated with many very carefully executed plates. Further parts are in active preparation.

It is, moreover, intended to publish the following works:—

"Fauna und Flora des Golfes von Neapel und der angren-

zenden Meeresgebiete." Folio. Yearly, 1 volume with 10–20 plates. The first volume is already in the press.

"Prodromus Faunæ Mediterraneæ." A selection from the whole zoological literature of short Latin diagnoses of the animals found in the Mediterranean, with their habitats and local names.

"Zoologischer Jahresbericht." This will contain short notices on the various memoirs and papers published in various countries on the subjects of zoology, development, and comparative anatomy. It is under the editorship of Prof. Carus, with the assistance of four collaborateurs in different countries. One volume will appear yearly.

Two naturalists have occupied the table hired by the Association, viz., Mr. Walter Percy Sladen and Mr. Patrick Geddes. Mr. Sladen has sent in a report on his stay and his work, which is appended. In this report he proposes "a means by which the table might be even more frequently occupied than it has been, and its sphere of utility thus extended, by suggesting to the consideration of the Committee that a further additional grant might be made by the Association, which would serve as a travelling fund. This might be apportioned in moieties say of 25*l.* to naturalists who desired to avail themselves of such assistance, and it is not improbable that many a student would by this means be enabled to participate in the advantages of the table at Naples, who might otherwise be deterred by the expense of the journey. The plan, extended or modified according to circumstances, is one adopted by several of the foreign bodies having tables at the Zoological Station."

Mr. Patrick Geddes worked at the station from February 26 to April 4. He "repeated and extended certain observations on echinoderm histology, and made experiments on *Bonellia viridis* and *Idotea viridis*, with a view of ascertaining the function of their (supposed) chlorophyll." The results of these studies are at present being published in the *Archives de Zoologie expérimentale* of M. de Lacaze Duthiers, viz., "Etudes sur le Chlorophylle animale," "Observations sur le Fluide perivisc-érale des Oursins."

Mr. Geddes also gained information on the working of the station, in the hope (now realised) of helping to found a zoological station in Scotland. This station is now in working order at Stonehaven.

Mr. Arthur Wm. Waters, who worked at the Association table last year, intends again to apply for the appointment to occupy it, with a view of extending his researches on the bryozoa of the Bay of Naples, already published in the *Annals and Magazine of Natural History*, 1879.

Your Committee think that the above particulars are sufficiently encouraging to induce the Association to renew the grant of 75*l.* for the ensuing year.

Report on the Occupation of the Table, by Mr. W. Percy Sladen.—In conformity with the requirements of the Committee of the British Association appointed in connection with the Zoological Station at Naples, I beg to submit the following report concerning my occupancy of the table which I had the privilege of using.

In availing myself of the opportunity of working at Naples, the main object which I had in view was that of studying the premature stages of the echinodermata, and more especially the growth-phases which intervene between the period when the pluteus is resorbed and that at which the adult characters are developed—the range and significance of these changes being very important and remarkable throughout the group. In addition to this chief object, it is scarcely necessary to add that there were numerous points in the morphology of echinoderms upon which, as a specialist, I was anxious to direct my attention, should time and opportunity permit.

I arrived in Naples on December 3, 1878, and remained there until February 17, 1879. During the greater portion of the time the weather was very inclement and stormy; in consequence of which the pelagic larval forms that I had hoped to have met with, by use of the surface-net, were driven to too great a depth, and owing to their microscopic proportions became thus altogether inaccessible. For this reason I was greatly disappointed in my expectations, and the material which I was able to obtain, in any way available for my projected investigations, was unfortunately very scanty; nevertheless several premature forms of considerable interest were procured, and these I am hoping still further to elucidate, before the end of the year, by finding, if possible, the corresponding and intermediate stages on our own coasts, and which will then enable me to work out the development of at least one or two forms completely. I also endeavoured to contribute somewhat to this subject by means of the artificial fertilisation of ova in several different families, but was always unsuccessful in keeping the *plutei* alive beyond a certain stage; whilst the fact that those thus raised in confinement were subject to very considerable abnormality in their development and present unnatural modifications which require much care and skill in elimination, in order to avoid error in subsequent deductions, greatly diminishes the utility of such observations as a direct method of embryological study, although they are not without value as furnishing some indication of the plasticity inherent in a given form.

Better success rewarded what I may speak of as desultory investigations upon the general structure of echinoderms. I may mention that I have in hand a contribution to the knowledge of *Pedicellariæ*, which I consider will throw light (if not entirely, at least in part) upon the functions of these obscure appendages. It was also my good fortune to discover in certain asteroids an hitherto undescribed organ, most probably performing sensorial functions; an account of which I hope to publish shortly, as soon as time permits me to work up the material which I collected more exhaustively than I was able to do whilst staying at Naples. In addition to the above I am also hopeful of furnishing a communication upon the premature anatomy of certain young echinoderms, for which purpose I was able to preserve and bring back with me several very good series of specimens.

The general success and continually increasing prosperity of the Zoological Station at Naples are now so fully known from the reports and various publications emanating from the institution itself, that it would be presumption on my part to offer any remarks in such a direction. I consider, however, that it is a duty for me to bear my individual testimony to the admirable arrangements which characterise the working of the station, and which conduce so greatly to the comfort of naturalists engaged in studying there. The daily supply of fresh material, the tank and aquarium accommodation for keeping the same alive, are highly satisfactory, and leave little to be desired; whilst in the way of ordinary laboratory apparatus and reagents no reasonable requirement is unprovided for.

I also desire to record my indebtedness for the genial kindness and the ever-ready assistance which I met with not only from Dr. Dohrn and the acting director Dr. Eisig, but the same friendly spirit of courtesy and help was accorded me without exception by every gentleman connected with the staff.

The utility of the Zoological Station being now so thoroughly established, and its reputation world-wide, it is unnecessary for me to allude to the fact, except to point out that the maintenance of such an undertaking is very costly, and that of necessity the results can only be continued by keeping up the funds. So much good work has already emanated from the station at Naples that the institution has a fair claim not only upon biological specialists, but on every one interested in the advancement of science. Upon such an argument, therefore, the Zoological Station is particularly worthy of the support of the British Association, even if its members were not (as many of them have already been) individual participants in the advantages which the station provides; and on this ground I would strongly urge the continuance of the grant usually made by the Association.

I would further beg to propose a means by which the table might be even more frequently occupied than it has been, and its sphere of utility be thus extended.

In conclusion I desire to express my cordial thanks to the Committee of the British Association for the privilege of using the table at their disposal. W. PERCY SLADEN

Exley House, near Halifax, August 2

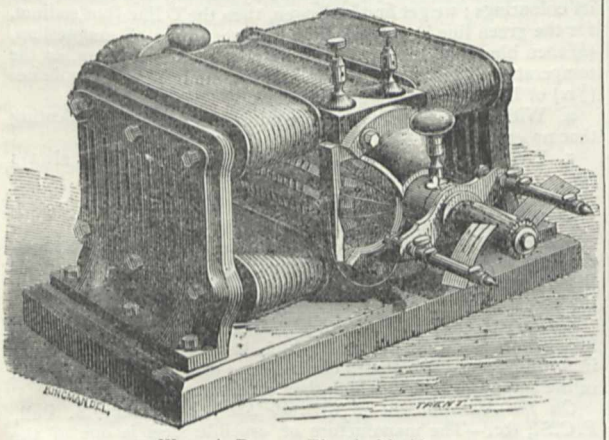
[A list of the naturalists who have worked at the Station, and of those to whom specimens have been sent during the past year, will be printed in the *Annual Report*.]

SECTION A—MATHEMATICAL AND PHYSICAL

On the Cause of the Bright Lines of Comets, by G. Johnstone Stoney.—Dr. Huggins and other observers had seen the bright lines of the carbon spectrum in the spectra of several comets. This established the fact that some compound of carbon was present in comets. In what had been hitherto written on this subject it had always been assumed that the compound of carbon was incandescent, and on that account emitted these bright lines. Mr. Stoney suggested, however, an alternative hypothesis which he believed to be entitled to much weight, viz., that these lines

were due to the sun's light falling upon the compound of carbon and rendering it visible, in the same way that light renders the moon, the planets, and other opaque objects visible, the vapour of carbon being opaque in reference to the particular rays, which appear as bright lines in its spectrum.

On Improvements in Dynamo-Electric Machines, by W. Ladd.—My object in this communication is to describe in a few words



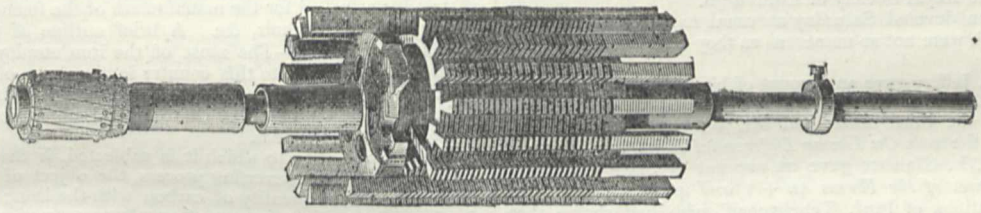
Weston's Dynamo-Electric Machine.

the peculiarities and improvements in the construction of Weston's dynamo-electric machine.

The Field Magnets.—The general appearance and arrangement of which may be seen in the illustration. The pole pieces are composed of iron plates, placed side by side in a mould, but separated a uniform distance from each other. The iron magnets, on which the wire is to be wound, are cast on to "lugs," or projections on the ends of the plates. The two cast-iron ends and uniting plates form one magnet; the upper and lower magnets are alike, and when joined together by the perforated vertical supports, the inner curved edges of the field plates embrace about two-thirds of the circle in which the armature is made to revolve.

The armature is built up of plates which are somewhat like a cogged wheel in shape (see illustration). These plates are stamped out of sheet-iron, and when mounted on the shaft are separated from each other at a uniform distance; the radial projections are then arranged in lines, so that the whole forms a very broad cogged wheel, or cylindrical structure having longitudinal grooves, with transverse spaces at regular distances. The longitudinal grooves are for carrying the wire, and it will be observed from the nature of the structure that the wire lies in channels three sides of which are iron; so that the mutual effect upon each other is increased as much as possible. The ends of the wires are connected to the field magnets and commutator in much the usual way, the currents travelling in one direction only. The commutator is fitted on a portion of the shaft which projects beyond the bearings. This admits of its easy removal and a new one being replaced in three minutes.

Another important feature in the construction is the arrangement for ventilation; the separation between the pole plates of the field magnets, the perforation in the vertical supports of the magnets, and the light frame-work of the armature, are all for this purpose. The air enters the centre of the armature, and is



Armature of Weston's Dynamo Electric Machine

driven out between the layers of wire through the spaces formed by the separated plates of the armature and the field magnets, and thus prevents any part from becoming unduly heated.

Machines of this description are made of various sizes and strengths, and give from one to sixteen lights in single circuit.

On the Direct Motion of Periodic Comets of Short Period, by Prof. H. A. Newton.—The periodic comets of short period, that is, the comets certainly seen at two returns, twelve or fifteen in number, have, all but one or two, small inclinations to the ecliptic; Halley's comet is an exception, being nearly retrograde in motion. Perhaps we may add the comet with which the November or Leonid meteors are connected (1866, 1), since it is, I think, almost certainly identical with the comet of 1836, and has an inclination of about 163°.

The direct motion of the periodic comets seems to give them a peculiar relation to the solar system, even suggesting for them an origin common in some way with the origin of the planets. The other comets apparently come to us from outside the solar system, and if in any cases they are permanent members of the solar system, they have become such by the perturbations of the planets. Can it be that such perturbations have also forced the periodic comets into their present orbits?

The ordinary perturbating forces are small, and would almost as frequently increase as diminish the inclination of a comet's orbit. To every comet passing on one side of a planet, and so having its inclination diminished, there should be among an indefinitely large number of comets a second comet passing on a symmetrically opposite side, and having its inclination increased. But if we state the question properly, we get a different answer. If an indefinitely great number of comets approach and pass a large planet, and if the directions and lines of motion are uniformly distributed, some of those coming near to the planet will be turned into orbits of short period. Considering only the orbits thus affected, will they have in general small inclination? I find that they will, and that therefore we are not required, because of their different motions, to consider the periodic comets of short period as different in genesis from those of long period, or from those having parabolic orbits.

The conclusion suggests the possibility of a common outside origin to the periodic comets and the asteroids. It also suggests the possibility of an outside origin for the matter that makes up the zodiacal light, since it would explain the near coincidence of the plane of this mass with the ecliptic, notwithstanding its outside origin.

If, in addition, we may admit a like origin for the satellites, and even for some of the smaller planets, we are rid of the difficulty that seems to me insuperable, of supposing, as is usually done, that the very small bodies become solid from a nebulous state in the immediate presence of the sun and large planets.

On Self-acting Intermittent Syphons and the Conditions which Determine the Commencement of their Action, by Rogers Field, B.A.—In an extensive series of experiments which the author tried some years ago on syphons, with their outer legs dipped in water, he was much puzzled by finding that the quantity of water necessary to put a syphon of given size into action varied in the most unaccountable way at different times. The only difference that could be perceived between the cases in which the syphon started and those in which it did not start was, that in the former case air-bubbles escaped freely at the mouth of the syphon, whereas in the latter case, under apparently the same conditions, very few bubbles came out. At last the idea suggested itself of making a portion of the syphon in glass, so as to see what was going on inside the pipe, when the course of the irregularity was at once discovered. Sometimes the water which ran over the bend adhered closely to the sides of the pipe, at other times a portion of it would fall more or less clear of the sides. When the water adhered to the sides it produced very little effect in displacing the air, so that only a small quantity of air was driven through the water at the mouth of the syphon. When on the other hand the water fell clear of the sides, it produced a great effect in displacing the air, and large bubbles of air at once escaped from the mouth of the syphon.

The investigation was pursued further by producing artificial irregularities in the pipe, and it then appeared that the more completely the water could be thrown clear of the sides of the pipe, the greater effect it produced in expelling the air and starting the syphon.

The author applied this and other principles in his intermittent syphon, of which a working model was exhibited, and which was illustrated by diagrams. Self-acting syphons have been used in emptying vessels for measuring water, as in Osler's and Bickley's self-recording rain-gauges; and the syphon described might be so employed and also in a more practical manner, such as for flushing sewers by water which usually runs to waste.

Mr. W. E. Ayrton read a paper by Dr. Muirhead *On the Constancy of the Capacity of Certain Accumulators*, and a note thereon by Mr. C. Hockin. The latter communication contained an account of observations which were first begun with the object of redetermining the capacity of certain condensers employed in the testing of cables, and in terms of which the capacity of many cables now submerged have been recorded and published. In consequence of these papers a committee was appointed by the Association, on the recommendation of Section A, for the purpose of deciding upon an authoritative standard of electrical capacity.

Prof. G. Forbes made some remarks upon *The Bursting of Firearms, when the Muzzle is closed with Earth, Snow, &c.*— This well-known fact was explained in a simple manner. If the charge moved slowly, of course very small pressure of air would drive out the obstacle, which offered a very small resistance; but in practice the charge travelled with a speed of more than the velocity of sound. The mathematical investigation showed that the pressure generated with a plug of the density of air is $7\frac{1}{2}$ tons. The complete investigation is to be found in the *Proceedings* of the Royal Society of Edinburgh.

The Section devoted Saturday as usual to the mathematical papers, which were not so numerous as they have been in recent years.

Mr. H. M. Jeffery gave an account of his work *On Plane Class Cubics with Three Single Foci*, which concluded his enumeration of curves of the third class; and Mr. W. H. L. Russell communicated a theorem *On Linear Differential Equations*.

Mr. J. W. L. Glaisher gave an account of *Some Enumerations of Primes of the Forms* $4n + 1$ *and* $4n + 3$, referring to the investigations of Prof. Tchebycheff, who had shown that primes of the form $4n + 3$ were more numerous than those of the form $4n + 1$, the difference in the numbers of primes of the two forms up to a certain large limit x being for certain values of x of the order $\frac{\sqrt{x}}{\log x}$. Mr. Glaisher also communicated an elementary method of summing the series

$$\tan^{-1} x^{2n} + \tan^{-1} \frac{x^{2n}}{2^{2n}} + \tan^{-1} \frac{x^{2n}}{3^{2n}} + \&c.,$$

and similar series, and also some formulæ in elliptic functions.

Mr. A. J. C. Allen read a paper *On some Problems in the Conduction of Electricity*, the principal object of which was to solve the problem of the conduction of electricity in a spherical current sheet, the electricity being introduced and carried off from the sheet at any number of points, called electrodes; and also to do the same for certain finite portions of a spherical sheet, bounded either by current or equipotential lines, the motion being in all cases steady. This was effected by means of a theorem, which was then applied to deducing solutions for a number of finite areas on the sphere. The case of one source and an equal sink on a complete sphere was discussed in detail, and the current and equipotential lines shown to be two systems of small circles. A similar theorem, though not quite so universal in its application, was shown to hold for a sheet in the shape of a circular cylinder. The paper concludes with a solution in singly infinite series of the problem of the conduction of electricity in a plane area, bounded by two concentric circles, and also in that bounded by two concentric circles and two radii, meeting at an angle $\frac{\pi}{n}$ (n integer).

SECTION B—Chemical Science

Notes on Recent Spectral Observations, by J. N. Lockyer, F.R.S.—The following results have been obtained by the method recently described to the Royal Society (*Proc.* R.S., vol. xxix. p. 266 :—

1. Carefully distilled sodium condensed in a capillary tube, and placed in the retort, gives 20 volumes of hydrogen.
2. Phosphorus carefully dried gives 70 volumes of gas, chiefly hydrogen, which, however, is not PH_3, although it gives some of the lines of phosphorus. It is not PH_3, because $CuSo_4$ is not touched by it.
3. Magnesium carefully prepared by Matthey is magnificent in its colourings; we get first hydrogen, then the D line [not sodium, for the green line is absent], then the green lines of magnesium, (*b*) then blue line, then various mixtures of all of them, as the temperature is increased, D being always the brightest, 2 volumes ($\frac{1}{2}$ *cc*) of hydrogen only were collected.
4. With gallium and arsenic the pump always clicks, indicating that no gas is given off.
5. From sulphur and some of its compounds there is always So_2.
6. From indium, hydrogen comes over before heating.
7. Lithium gives 100 volumes of hydrogen.

The conditions of the experiments have always been the same, the only variable being the substance. The volumes stated are those generally obtained; almost all experiments are ended by the cracking of the tube.

On large Crystals of Mercury Sulphate, by Philip Braham.— Mr. Braham exhibited crystals which had taken over two years in forming, and were due to the presence of a trace of nitric acid in the sulphuric acid in which they were formed.

On the Manufacture of Crucible Steel, by Henry S. Bell, F.C.S., &c.—The manufacture of crucible steel is one of the most important industries connected with the town of Sheffield, which boasts of not less than 120 firms engaged in the production of this material. Notwithstanding the enormous output of steel by the Bessemer and Siemens-Martin processes, this kind of steel is unrivalled for the manufacture of the finer varieties of cutlery and edged tools, &c. A brief outline of the process itself is as follows:—The most of the iron employed for this purpose is imported into this country in the shape of bars from Sweden, where it has been smelted from very pure iron ores, in a blast furnace, by the aid of charcoal, and subsequently puddled to free it from impurities.

The first operation to which it is subjected, is that known as the cementation or converting process, the object of which is to combine a certain quantity of carbon with the iron; this operation is performed in a furnace of peculiar construction, where the iron and charcoal are packed together in air-tight chests or converting pots, subjected to a high temperature short of the fusing point of iron, where it remains for a matter of three weeks.

After the conversion, when the pots are cold the bars are taken out and found to be covered with blisters, hence it is termed blister steel. In consequence of the various theories proposed to account for this peculiar formation, the writer was induced to make a series of investigations. For this purpose he was kindly furnished by Messrs. Seebohm and Dieckstahl, of the Dannemora Steel Works, with some samples of this blister steel, various portions of which he submitted to analysis, the results of which showed a marked increase of silicon where the blisters occurred.

On inspecting one of these bars of blister steel, it is found that it has undergone both a physical and a chemical change.

The iron has now assumed a crystalline structure, and has chemically combined with a certain amount of carbon. This latter change commences on the exterior, and extends itself to the interior of the bar, if the process be continued sufficiently long, thus showing that carbonic oxide never penetrates into the centre of the bar, until the whole is converted into steel.

The writer is indebted to the kindness of the above-mentioned firm for a sample of bar iron, before and after conversion, in order to ascertain the exact chemical change that took place during the process. The following are the results obtained:—

	Before Conversion	After Conversion
Fe	99·471	98·603
C	0·352	1·250
Si	0·050	0·035
S	0·027	0·022
P	0·025	0·018
Mu	0·075	0·072
	100·000	100·000

The decrease in impurities appears greater than it really is, owing to the fact that the bar itself has increased in weight by the addition of carbon.

One remarkable fact is that, after the conversion of the iron, a quantity of the charcoal, in the converting pots, is found in a pulverised state, so as to be unfit for further use.

Some of this waste charcoal the writer has examined, and from one sample, by the aid of a magnet, he succeeded in extracting 5 to 6 per cent. of iron scale, and small pieces of steel, these on being treated with dilute hydrochloric acid, evolved considerable quantities of sulphuretted hydrogen; in one case he estimated the quantity of sulphur, and found it to contain as much as 1·25 per cent. of this element.

The steel is now broken up into small pieces and melted in crucibles, and cast into ingots. These are sent to the forge, where they are heated and rolled. In this part of the process the chief difficulty with which the silter has to contend is the porous or "honey-combed" structure of the steel.

One of the characteristic features relied on by practical men as indicating the quality of a piece of steel is the appearance of its fracture; but this is by no means an infallible test, as the fineness or coarseness of grain can be produced by mechanical treatment or chemical means.

The characteristic property possessed by steel is its capability of being hardened and tempered. The temper of cast steel may be said to range from 0·75 to 1·50 per cent. carbon. The temper of steel is an important question in connection with the purpose for which it is required; thus a steel containing 1·50 per cent. of carbon is the class employed for razors. 1·25 per cent. is that known as "tool temper." Steel containing 1·00 per cent. carbon is termed "chisel steel," and this temper is extensively used in the arts.

The latter part of the paper is occupied with the consideration of the manner in which bodies such as carbon, silicon, sulphur, phosphorus, and manganese, affect the quality and mechanical properties of the steel.

A Lecture Experiment in Illustration of the Hollway Process of Smelting Sulphide Ores, by Alfred H. Allen.—By causing oxygen gas to bubble through molten antimony sulphide contained in a V-shaped piece of combustion-tube, combustion takes place with such rise of temperature as to soften the glass, while a sublimate is obtained of antimonious oxide, and sulphurous acid gas is evolved. The sublimate is collected in an empty globe, and the sulphurous acid is absorbed by passing it into a large vessel containing lumps of wood-charcoal. At the conclusion of the experiment the contents of the combustion-tube may be poured out, when a button of metallic antimony free from sulphur is obtained.

By passing oxygen over lumps of pyrites contained in a heated combustion-tube, vivid combustion takes place, much free sulphur sublimes, and sulphurous acid gas is obtained and absorbed as before described.

On the Presence of Nitrogen in Steel, by Alfred H. Allen.—The author made some preliminary experiments on the subject in 1872, but has only recently obtained any definite results. The method adopted has been to dissolve the steel in hydrochloric acid, by which means any combined nitrogen may be presumed to be converted into ammonia. The solution obtained was then distilled with excess of lime, and the distillate examined for ammonia by Nessler's method. The employment of this extremely delicate test enabled the author to operate on a much smaller quantity of steel than was employed by previous investigators. Very special precautions were taken to obtain the hydrochloric acid and other materials free from any trace of ammonia or nitrous compounds, and the air was entirely expelled from the apparatus before commencing the operation. The hydrogen evolved was freed from any traces of ammonia by passing it through a tube filled with glass beads moistened with hydrochloric acid. It was proved by blank experiments that no source of ammonia existed in the reagents or apparatus.

When absolutely pure materials were used, and every precaution taken to get rid of the contained air and other sources of error, the addition of Nessler's solution to the liquid obtained on distilling with lime caused a very marked yellowish-brown coloration.

The author then gives the amount of nitrogen determined by his method in different varieties of steel.

In order to obtain ammonia in quantity sufficient for its recognition by other reactions than that with Nessler's test, the following plan was employed :—

Steam, generated by boiling water in a flask, was passed over a considerable quantity of steel borings contained in a combustion tube which was bent beyond the furnace, and prolonged so as to form the inner tube of a Liebig's condenser. To the further end, a tube filled with glass beads and furnished with a glass stopcock was attached. A rapid current of steam was driven through the apparatus for a considerable time to expel every trace of air. On condensing the steam it was found free from any trace of ammonia. The steel borings were then heated to redness by a combustion furnace, and a rapid current of water passed through the condenser. The condensed steam, when tested by Nessler's solution, was found to contain abundance of ammonia, which did not diminish in amount till the borings were almost entirely oxidised. On redistilling the condensed steam, a distillate was obtained, having a distinctly alkaline reaction to litmus paper, and on treating it with hydrochloric acid and platinic chloride a sensible amount of yellow precipitate was obtained, having the characteristic crystalline form of ammonium chloroplatinate. The amount found was larger than could possibly have been produced had the whole of the nitrogen of any residual trace of air been converted into ammonia.

The author regards the results now recorded as preliminary merely, and proposes to extend the research to various classes of steel and iron, and especially to such specimens as have been found to possess anomalous characters. Of these, the evolution of ammonia from freshly fractured surfaces is the most striking.

On the Separation of Phosphorus in Steel Manufacture, by Thomas Blair.—He said the complete removal of phosphorus from pig-iron is of the utmost importance to this country, as the greater portion of ores raised and iron made here is unfit for the manufacture of steel by the Bessemer processes. A history of the various processes made use of for the purpose were examined in detail, especially the processes of Messrs. Bell, Thomas, and Gilchrist. The writer concluded that this latter process was in a fair way to succeed commercially, and that it seemed only necessary to effectually remove a few remaining difficulties.

SECTION C—GEOLOGY

On the Coal Fields and Coal Production of India, by V. Ball, M.A., F.G.S., of the Geological Survey of India.—The coal-bearing rocks of Peninsular India are all included within the limits of the great series of plant-bearing rocks to which the term Gondwana has been applied, and they are further limited to two groups of rocks which occur in the lower portion of that series.

By some authorities the age of these Gondwana rocks is supposed to be equivalent to that of the European formations which range between and include the lower oolite and the base of the trias (Buntsandstein). By others the lower measures, including the coal, are believed to be palæozoic. The author proceeded to give an outline of the recent discussions on this subject, referring particularly to Mr. W. T. Blandford's judicial summary of the evidence in the lately issued "Manual of the Geology of India."

The distribution of the coal-bearing areas was then pointed out on a series of maps which were exhibited, and the number of distinct coal-fields was stated to amount to about thirty. Some details were then given regarding these fields, of which five only are worked at present, namely, Ranigunj, Kurhurbali, and Daltongunj in Bengal, and Mopani and Warora in the Central Provinces.

The total area of the Indian coal-fields is estimated by Mr. Hughes at upwards of 30,000 square miles. Three countries alone contain larger areas, viz., the United States 500,000, China 400,000, Australia 240,000.

In quality the Indian coals are inferior to the average of English and Australian; but they are capable of accomplishing good work in locomotives, and for this purpose they are largely employed on the main lines of railway in India—Indian coal mixed in equal proportion with English.

The author proceeded to give further details as to the quality of the coal, stating that the anthracite varieties were rare, the general character being bituminous and the structure laminated—bright and dull layers alternating.

In round figures it may be stated that at present 1,000,000 tons of coal are consumed in British India *per annum* in locomotives and factories, the quantity employed in the form of coke for domestic purposes being inconsiderable; and that of this 1,000,000 tons, about one-half is raised from Indian mines, the other coming from England, France, and Australia.

On the Keuper Beds between Retford and Gainsborough, by F. M. Burton, F.G.S.—After describing the general position of

the beds in relation to the triassic system, and remarking on the absence of the upper mottled sandstone, as well as the "Muschelkalk," in this part of England, the author described the various strata of the district, as shown on the line between Retford and Gainsborough, and pointed out the want of any division in the beds of the lower keuper sandstone, as in other localities, and the absence of any boundary line between this series and the "red marls" above.

On a Northerly Extension of the Rhætic Beds at Gainsborough, by F. M. Burton, F.G.S.—At the meeting of the British Association at Nottingham in 1866, the author announced the discovery of beds of the rhætic age at Gainsborough, a full account of which will be found in the *Quarterly Journal* of the Geological Society for 1867. These beds occur to the south of Gainsborough, on the Great Northern line between Doncaster and Lincoln, and were discovered through the lowering of the gradients of that line in 1866. The author has since found them in a cutting of the Manchester, Sheffield, and Lincolnshire Railway at Blyton, about five miles to the north of Gainsborough, where they must have been exposed since the making of that line in the year 1848, though hitherto they have remained unrecorded.

The Age of the Penine Chain, by E. Wilson, F.G.S.—In this paper the author combated the generally accepted view of the post-Permian origin of the Penine chain, and contended for a pre-Permian upheaval. In support of this opinion the following facts were cited: The Yorkshire coal-basin was admittedly pre-Permian, for north of Nottingham the magnesian limestone everywhere overlaps the coal measures; but the axis of this basin is parallel with the Penine chain, and was evidently determined by the same series of movements that upraised that chain. The Permians disappear on the west in approaching the Penine chain; in this direction also the marl slates attenuate, and these and the magnesian limestone become more sedimentary, as if approaching a margin. Mountain limestone pebbles occur in Permian breccias on one or both sides of the Penine axis. Many fragments of carboniferous rocks occur in lower Bunter sandstone (breccias) on the borders of Notts and Derbyshire; but the author finds no fragments of Permian rocks in these breccias. No outliers of Permian rocks are found at any distance west of the magnesian limestone escarpment between Nottingham and Northumberland. The character and succession of the Permians on the two sides of the Penine chain are very dissimilar.

On Geological Episodes, by J. F. Blake, M.A., F.G.S.—Geological nomenclature was first founded on the theory of universal deposits; then the idea of lateral changes was introduced, with the necessary misuse of lithologically descriptive names; ultimately all deposits were seen to have their boundaries. Beds deposited in distinct areas can thus be proved only homotaxial, and these are by no means necessarily synchronous. The object of this paper is to show that a somewhat similar principle ought to govern all our geological classification. A single area is defined to be one over which we can trace one or more related formations consecutively, and which formations contain identical characteristic fossils. Deposits in single areas may be compared as to time and divided into life zones; but these in different areas are homotaxial only. In each single area the outlines and characters of the several deposits must first be determined and denoted accordingly.

In studying any group of rocks in a single area it is seen that some members have a much wider range than others. Such differences in range are accompanied by marked differences in character and point to differences in the circumstances of deposit. The wide-spread formation indicates uniform changes of level over the area and a mixture of deposits—such circumstances may be called normal. But mere local changes may bring more restricted areas into peculiar physical conditions. Such local changes may be called "geological episodes," and they will result in the formation of deposits of marked character easily distinguishable from the normal.

The first point is to determine the characters by which an episodal deposit may be differentiated from a normal one. The supreme test is that derived from its definition, *i.e.* its local development; but if it be very small, it may be insignificant; if relatively very large, the distinction may be of no consequence. As a rule argillaceous rocks are normal, and arenaceous and calcareous episodal; but this is by no means universal. When the normal formation of a period is determined, the episodes are marked by their differing mineral nature. The two kinds of deposits may also be determined by the nature of their fossils, after we have first discovered what kinds of fossils are usually episodal. For this purpose those fossils which are found in all kinds of rocks, and therefore appear to have been indifferent as to their physical surroundings, may be called *invariant*, and those found only under particular conditions, and which change their locality as these conditions change, *covariant*. Invariants only are suited for zonal classification; covariants are characteristics of episodes. A table is drawn up showing the classes, families, and genera which may be covariant, according to the imperfect observations of the past. The chief covariants are a few foraminifera—the sponges—a large number of hydrozoa and actinozoa, some crinoids, the blastoids, a few lamellibranchs, and at least half the gasteropod families.

The main proposition is that *similar, but distinct episodes, in a normal series of strata are neither necessarily nor probably of the same age*. The true method of geological classification is therefore to arrange only the normal deposits in a series by their stratigraphy and their invariant fossils, while the episodes are put in their place as such.

These doctrines applied to British strata yield the following results: No episodes are recognised in Cambrian or pre-Cambrian rocks. In the lower Silurian, the Durness limestone, the Llandeilo flags, the Bala limestone and the Caradoc sandstone, and the May Hill and Llandovery beds are characterised as such. Hence the term "Caradoc" is inapplicable as a name for the normal portion of the series. The "Colonies" of Barrande may be episodes recurrent on the same area. In the upper Silurian, the Wenlock and Aymestry limestone, the Denbigh grits, and tilestones are episodes. The carboniferous series present us with the Coomhola grits, Burdie House limestone, Millstone, and Pennant grits, while the mountain limestone is merely a gradually changing normal deposit. The episodes of the Permian are the fossiliferous limestone and underlying marl slate. The absence of the Muschelkalk from England is not regarded as due to its being an episode, but to our deposits as a whole being formed in a distinct area, the true episodes of the period being the Hallstadt, St. Cassian, and Dachstein beds. The lias is remarkable for its great freedom from episodes, which accounts for the success of its zonal classification, the only exceptions being the Sutton series, and some of the middle lias rock beds. The lower oolites, on the contrary, are almost entirely episodal, none of the beds having a wide range. The Yorkshire deposits were formed in a distinct area, and may cover the period of the great oolite as well as the inferior oolite, the deposits supposed to connect them with the latter being episodes. The rocks above the Cornbrash formed one connected series, as recognised by all German writers and some French, in which the Kelloway rock, the Corallian, and the Portland rocks are well-marked episodes in this country. It is therefore suggested that the term "middle oolites" should be abolished from the classification of British strata, and the whole be known as upper oolites. The various episodes in this series on the Continent and in England will never be truly located until their real character is seen, and it has been by the study of these rocks that the doctrine of episodes has been suggested.

In the cretaceous series the wealden, the Tealby series, and parts of the lower greensand are episodal, the ironsands being the nearest approach to a normal formation. The upper greensands are also episodes; but the chalk, though calcareous, is normal.

The lower tertiaries, like the lower oolites, scarcely present any normal deposits, the London clay being, though argillaceous, episodal in character.

In the result, the series of sedimentary rocks should be represented not by so many parallel lines, but in many cases by lenticular masses, whose age is denoted by their position—according to a table which presents their true character. It is urged, therefore, that the names proposed—or else some better—be used to distinguish the different kinds of strata and fossils, in order to give definition and importance to truths which must have long been floating in the minds of geologists.

The Surface Rocks of Syria, by J. Perry.—The paper was suggested by an examination of the sandstone quarries at Baalbec. The rock is composed of a mixture of the particles of limestone from the coast, and drift-sand. The mixture is consolidated layer by layer, and fresh rock of the same nature is now in process of formation. The author explained how the consolidation is produced by water dissolving the particles of carbonate of lime and by alternations of temperature. The author then gave some explanation of the veined and apparently cracked appearance of certain limestones.

On the Bone-Caves of Derbyshire, by Prof. W. Boyd Dawkins, M.A., F.R.S.—The first cavern discovered was that at Wirksworth in 1820, accidentally come upon in the workings of a lead-mine. Elephants, rhinoceri, &c., were found there. In 1875 the Rev. J. M. Mello explored the caves at Creswell Crags, which have yielded most important results. Amongst the bones found are those of hyæna, bison, reindeer, lion, hippopotamus, and bear, together with implements of flint and chert, and an engraved bone showing a sketch of the horse. The caves yield evidence of improvement in the manufacture of implements in succeeding dates. In 1876 Prof. Dawkins and Mr. Rooke Pennington explored the Windy Knoll, near Castleton. From the mode of occurrence of bones here, it seems clear that the bison was a summer or late-spring resident; the reindeer a winter one. A cavern near Matlock Bath was explored in 1879.

There is no evidence as to the age of these caverns; nothing to show that they existed before or during the glacial period. The author deprecated any attempt to place before the public a greater definiteness as regards the date of geological events than the facts warrant.

On Ammonites and Aptychi, by C. Moore, F.G.S.—The author gives evidence which renders it probable that the aptychus is not an operculum. It often occurs associated with numerous minute eggs; and the author suggests that, with the siphuncular tube, it probably represents an ovarian sac.

On the Classification of the British Pre-Cambrian Rocks, by Dr. H. Hicks, F.G.S.—The author divides the pre-Cambrian rocks into four groups under the following names, in ascending order:—1. Lewisian; 2. Dimetian; 3. Arvonian; 4. Pebidian.

1. *The Lewisian.*—So named by Sir R. Murchison to indicate the crystalline rocks of the Hebrides and north-west Highlands of Scotland, is retained to indicate the oldest group at present recognised in Britain, and largely developed in the Hebrides. It is found also in parts of the Malvern Chain, the north-west of Ireland, and possibly also in Anglesey. The prevailing rocks in this group are massive gneisses, in which hornblende and felspar are the chief ingredients, and quartz chlorite and mica but sparingly present. They are usually of a dusky red, grey, or dark colour. Sometimes almost a pure hornblende rock is found. The strike in these beds is usually east and west, or some point between that and north-west and south-east.

2. *The Dimetian.*—This group is largely developed in Wales, as at St. Davids, Caernarvon, Rhos Hirwain, and Anglesey. It has been found by Dr. Callaway in Shropshire, and I have recently seen it with him also in the Malvern Chain, especially in the Worcester Beacon. I noticed it also, last year, in large development at Ben Tyn, Loch Maree, and near Gairloch, in Ross-shire, as well as at several other points in the north-west Highlands of Scotland. The prevailing rocks in this group are granitoid and quartzose gneisses with pinkish, flesh-coloured, or white felspar, and with limestone, micaceous, and occasionally chloritic and hornblendic bands. Brecciated beds also occur, in which bits of the older Lewisian gneiss are sometimes found. The strike is generally north-west and south-east, or from this to north and south. It evidently overlies the Lewisian unconformably in the areas where both have hitherto been found associated; and its highly quartzose character and lighter colour generally, are in marked contrast to most of the members of that group.

3. *The Arvonian.*—At the last meeting of the British Association I mentioned, for the first time, the discovery, or rather the separation, of this group. It is largely developed in Pembrokeshire and Caernarvonshire. It occurs also in Anglesey and Shropshire, and I have recently found it at the base of the Harlech mountains. I have seen masses of it also from the Orkneys, and it probably occurs both in the Western Islands and in the Grampians of Scotland. It is the great hälleflinta group of the Swedish geologists, and the petro-silex group (Hunt) found so largely developed in North America. It is chiefly made up of quartzo-felspathic rocks, sometimes porphyritic, frequently brecciated, and of compact quartzose rocks or hälleflintas, which on microscopical examination have the appearance of incipient gneiss. The strike is usually about north and south, and it overlies the Dimetian unconformably.

4. *The Pebidian.*—This being the newest group in the pre-Cambrian rocks, is the least altered in character, and most nearly approaches in strike to the overlying unaltered or Cambrian rocks. It resembles that group in many of its rocks, and on that account was for a time supposed to be identical with it, only that it had undergone alterations. Now we know that it underlies the latter unconformably, and that the apparent similarity in character is to be attributed to the fact that most of the Cambrian rocks were derived from the denudation of this group. That it was also in a high state of alteration before the Cambrian rocks were deposited upon it is evident from the fact that an abundance of pebbles and masses of it occur in the conglomerates at the base of the Cambrian. It consists for the most part of chloritic, felspathic, talcose, and micaceous schistose rocks, alternating with massive and slaty greenstone bands, dolomitic limestone, turpentine, lava-flows, porcellanites, breccias, and conglomerates. It is traversed also frequently by dykes of granite, dolerite, &c. It is a group of enormous thickness, and is largely distributed over Great Britain. It occurs in many parts of Wales, in Shropshire, and in Charnwood Forest. I found it also last year in the north-west of Scotland, and I have seen specimens of it collected by Mr. Jas. Thomson and others from Islay, and others of the Western Islands. Dr. Hunt recognised it also along the Crinan Canal, and in the vicinity of Lough Foyle in Ireland. It is probably represented in America by the Huronian group. The prevailing strike is north-north-east to south-south-west, or from this to north-east and south-west. The conglomerates at its base are largely made up of masses derived from the Arvonian, and, at most of the points examined, it is undoubtedly unconformable to that group.

SECTION D—BIOLOGY

Department of Anatomy and Physiology

On a Visual Phenomenon and its Explanation, by Wm. Ackroyd, F.I.C. Abstract of the paper (A).—Visual phenomena are of general interest and are often described, but seldom explained. The phenomenon in question may be seen under the following circumstances. Face the breeze and without winking allow a small rain-drop to fall on the surface of the cornea, all the while keeping your gaze fixed on a lamp light some hundred feet away. As the raindrop alights on the cornea, several rings of light appear to surround the luminous source and *they gradually contract in diameter*. Explanation:

In sunshine, the moving ring-crest of water, produced by dropping a pebble into a still and shallow pool projects a ring of light on the bottom, which gradually increases in size. The moving ring-crest, by its refractive action, produces a hollow cylinder of rays of ever-increasing diameter, and we see a section of it on the bottom of the pool. The rain-drop falling on the cornea spreads out on its surface in several ring-crests, and would similarly produce a series of outward travelling rings of light were it not for the combined action of the refractive media of the eye. Under the influence of these two hollow cones of light are formed within the vitreous humour directly upon impact of the raindrop. The first of these has for its base a small circular area of the hind surface of the lens, and its prolongation; the second cone has the retina for its base. As any individual ring-crest spreads out on the cornea, the first cone increases in size, the common apex advances towards the retina, and consequently the section of the second cone projected on to the retina decreases in size and appears as a contracting ring of light.

Department of Zoology and Botany

Prof. Ray Lankester read a paper, *On a Case of Disputed Identity—Haliphysema.*—The different views of Haeckel and others on this remarkable form were discussed, and its history traced. Prof. Ray Lankester, from a careful examination of recent specimens forwarded by Mr. Savile Kent, has no hesitation in stating that it is not a sponge but a curious rhizopod-like amœba with a test of sponge spicules curiously constructed like that of a caddis worm.

Prof. Westwood, M.A., read a paper *On the Insects which Injure Books.* Referring to an address delivered by Dr. Hagen, on July 2, 1878, before the American Library Association on the same subject, Prof. Westwood passed in review the life-history of the different species of insects which have been found to destroy books and printed papers, several of which were not noticed by Dr. Hagen. The caterpillars of the moth *Aglossa pinguinalis*, and also of a species of *Depressaria* often injure books by spinning their webs between the volumes and gnawing small portions of the paper with which to form their cocoons. A small mite, *Cheyletus eruditus*, is also found occasionally in books kept in damp places. A very minute beetle, *Hypothenemus eruditus*, forms its tiny burrows within the binding of books.

Lepisma saccharina also feeds on paper, of which a very curious example was exhibited of a framed and glazed print of which the plain paper was eaten whilst the parts covered by the printing ink were untouched. White ants, Termitidæ, are a constant source of annoyance in warm climates; and Prof. Westwood also noticed the ravages committed by the cockroaches, *Blatta orientalis*.

The insects that do the greatest injury are *Anobium pertinax* and *A. striatum*, commonly known as the death watches, burrowing through the books, even, it is recorded, drilling through 27 folio volumes.

Various remedies for the destruction of these insects were mentioned and especial notice was directed to a "Report of the Commission appointed to inquire into the Decay of Wood-Carvings, and the Means of Preventing and Remedying the Effect of such Decay," issued by the Science and Art Department in 1864.

Prof. Westwood then detailed the various remedies proposed, as washing with solution of corrosive sublimates in alcohol, exposing the books to the vapour of benzine, or carbolic acid, or hydrocyanic acid, or fumigating with burning sulphur. Placing the volumes under the exhausted receiver of an air pump for an hour, has been found successful by Dr. Hagen.

The Occurrence of Leptodora in England.—Sir John Lubbock called the attention of the Section to the occurrence in England of Leptodora, a very interesting crustacean first found in deep lakes abroad, and more recently in a reservoir near Birmingham. Like many marine organisations it was as transparent as glass. This rendered the creature less conspicuous to its foes. Like other animals of the same group it laid two kinds of eggs. The young at first were quite unlike their parents, so unlike that they had been thought to be a distinct species. Sir John then entered into a description of the little animal, and by means of sketches illustrated the peculiar functions of the different organs, pointing out the difference of the organs in male and female.

On the Homologies of the Cephalopoda, by J. F. Blake.—The flexure of the intestine in Cephalopoda and Pteropoda is "pedal," and that of other Odontophora, "cephalic;" and the body of a cephalopod must be placed with the mantle cavity horizontal for comparison with a gastropod. The arms are not homologous with the foot, but form an "antivelum." The labial and tentacular processes, and not the individual tentacles of a Nautilus are shown to be homologous to the arms of an Octopod. The hood is associated with the aptychus of the Ammonite, the shell of an Argonaut, and the neckplates of a Sepia. The Ascoceras is cited to show the relations of the sepia-bone to the nautilus shell.

On Cyclops, by Marcus M. Hartog, M.A., B.Sc.—The nervous-cord of Cyclops is essentially copepodan in type, it is not dilated into special ganglia, and contains no cellular elements beyond the third thoracic segment. It bifurcates in the second abdominal segment, and the branches terminate in the furca. The sensory and motor nerves appear to be wholly distinct, the latter coming off at a higher or deeper level. All the sensory nerve-fibres pass through a bipolar ganglion cell near their distal termination. Minute rounded spaces in the hypoderm, especially one at the base of the last thoracic limb, appear to be auditory organs. Respiration in Cyclops is entirely anal.

On Mimusopeæ, a Section of the Order Sapotaceæ, by Marcus M. Hartog, M.A., B.Sc.—In this paper the genus Dipholis is merged in Bumelia, and the genera Imbricaria, Labramia, and Muriea in Mimusops: a review of the deferential characters hitherto relied on showing their inadequacy from every point of view—even convenience.

On Fruits and Seeds, by Sir John Lubbock, Bt., V.P.R.S. M.P.—Sir John commenced by calling attention to the difference presented by seeds, some being large, some small, some covered with hooks, some provided with hairs, some smooth, some sticky, &c., and after observing that there were reasons for all these peculiarities, proceeded to attempt to explain some of the more striking. In the first place, he said, many seeds required protection from birds and insects; hence the shells or husks of the beech, Spanish chestnut, horse chestnut, walnut, &c. In some cases, as in the common herb Robert, the calyx, or outer envelope of the flower opens, when the flower expands, and closes over the seeds when the flower fades, and opens again when the seeds are ripe. In other cases the flower-stalk changes its position. Thus in the dandelion, it is upright when in flower, lies close to the ground after the flower has faded, and rises again when the seeds are ripe. In the cyclamen again, the flower-stalk curls itself up into a spiral after the flower has faded.

He then called attention to the modes of dispersion by means of which seeds secure a sort of natural rotation of crops, and are also in other cases enabled to rectify their frontiers. Some plants actually throw their seeds. Thus in the common cardamine, the outer membrane of the pod becomes very tense, and when ripe, at the least touch it gives way at the base, and curling up with a spring throws the seeds three or four feet. The common geraniums also throw their seeds, and so do some of the cucumbers, but in these cases the mechanism is different. He then described the curious "elaters" of the equisetums, and other means of dispersion possessed by seaweeds, and other low organised plants. Among the higher plants, the seeds are in many cases transported by the wind. Sometimes, indeed, the whole plant is thus blown about, as in the case of the celebrated rose of Jericho, an annual inhabiting the sandy plains of Palestine, Syria, and Arabia, which when dry curls itself up into a ball, and is thus blown over the surface of the ground till it comes to a damp place when it uncurls, the pods open and shed their seed.

Many seeds are provided with a wing which catches the wind and thus aids in dispersion. Such seeds occur especially on trees, such as the pine, fir, ash, maple, sycamore, hornbeam, and many exotic species. In these cases the seeds are large, but many herbs have small seeds provided with foliaceous expansions serving the same purpose. These are sometimes so thin as to be transparent; and in *Thysanocarpus elegans*, the membrane is even perforated by a series of holes. In other cases the seeds are provided with hairs which catch the wind, sometimes forming exquisite fairy parachutes. Such for instance are the dandelion, &c., but it is curious that very different parts of the plant are modified into these hairs: thus in the dandelion and valerian it is the calyx, in the bullrush the perianth, in the willow-herb the crown of the seed, in the cotton-grass the base. In the true cotton the whole seed is covered with hairs.

Thus then, although the result is the same, the mode of arriving at it is very different. He then proceeded to the cases in which the dispersion of seeds is effected by the agency of animals. In many cases the seed is surrounded by a sweet fleshy pulp which is eaten, while the true seeds being surrounded by a tough shell, remain undigested. Such fruits are generally brightly coloured such as the strawberry, peach, apple, currant, &c., the colours like those of the flowers serving to attract animals. In other cases the action of animals is involuntary. These may be divided into two classes: those in which the seeds adhere to animals by hooks, and those in which this is effected by sticky glands. Various cases of both were cited, and specimens shown, especially the South African *Harpagophyton*, a plant whose seeds are provided with terrible hooks more than an inch long. These seeds are said sometimes even to destroy lions, they roll about on the sandy plain, and if one attaches itself to the skin, the wretched animal tries to tear it off, and getting it into its mouth, perishes miserably. Sticky seeds are also thus transported.

SECTION E

GEOGRAPHY

OPENING ADDRESS BY CLEMENTS R. MARKHAM, C.B., F.R.S., F.L.S., SEC. R.G.S., F.S.A., PRESIDENT OF THE SECTION.

I PROPOSE to open the proceedings of this Section by attempting to place in a clear light the objects and aims of geographers, and the position which their science holds relatively with reference to the other sciences, and positively as a distinct body of knowledge with defined limits.

Geography is a knowledge of the earth as it is, and of the changes which have taken place on its surface during historical times. These changes explain to us the laws according to which similar changes are now taking place around us. The subject may be considered from various points of view; but my present endeavour will be to introduce to you, through the remarks I propose to make, the papers that will come before you to-day and at our subsequent meetings. I shall try to do this by explaining the practical uses of geographical knowledge, and its importance to us in almost every occupation in which we may be engaged.

Our first work as geographers is to measure all parts of earth and sea, to ascertain the relative positions of all places upon the

surface of the globe, and to delineate the varied features of that surface. This great work has been proceeding from the first dawn of civilisation, and it will probably be centuries longer before it is completed. Geographers and explorers, surveyors and geodesists, of each generation, work their allotted time, gradually increasing the stock of human knowledge, by enabling other sciences and other branches of inquiry to make parallel advances. For they are all dependent on the accurate measurement and mapping of the earth. Locality is the one basis upon which all human knowledge must rest. Arts, sciences, administration, commerce, depend upon accurate geographical knowledge; and as that knowledge becomes more extensive and more exact, so will every other human pursuit gain increasing light and truthfulness.

We are still very far indeed from an accurate scientific geographical knowledge of even the most civilised countries, while by far the largest portion of the earth's surface is inadequately surveyed, and a smaller, though far from inconsiderable, part is unsurveyed or entirely unknown. In the division of labour, the geodesist produces the accurate large-scale maps which are necessary in thickly populated countries, the topographical surveyor furnishes less exact maps of more thinly peopled and less civilised regions, while the trained explorer forces his way into the unknown parts of the earth.

From the labours of these three classes of workers we, in this generation, and our descendants for many generations to come, must be content to derive our knowledge; but in the fulness of time the whole earth will be measured and delineated as Hallamshire is now. It is to the furthering of this great work that the geographers of each age devote their energies, and its advancement will increase in rapidity, because, as men become better instructed, there will be more geographers.

The construction of large-scale maps on rigorously accurate principles has as yet made inconsiderable progress. It is only in the countries of Europe, and India, and some of our colonies, and in the United States, that it has been commenced. But it is very far from being completed anywhere, and the people of Sheffield have had this fact brought home to them within the last year; for the Memoir on the Yorkshire Coal Field, published by the Geological Survey in 1878, was obliged to stop short with the limits of the county, an artificial and inconvenient line which leaves the southern portion of the field undescribed, entirely because the six-inch survey had not yet been extended over Nottinghamshire and Derbyshire. This circumstance strikes us in two ways. It reminds us that geographical work is far from being completed even in the most populous and civilised parts of our own country; and it also brings the fact home to us that the progress of other sciences is dependent upon the advance of geography.

Where the trigonometrical surveys have not been commenced, we have only those maps which are based on positions fixed by astronomical observations, on cross-bearings and chained distances, and which I call (to distinguish them from the results of trigonometrical surveys) the topographical maps. One of the oldest and most interesting of these maps is the famous atlas of the Chinese Empire constructed by the Jesuits between 1708 and 1718. But we are also dependent on such maps for our geographical knowledge of all Asia except India and Palestine, of the Eastern Archipelago, of all Africa and South America, and of the greater part of North America.

Accurate maps are the basis of all inquiry conducted on scientific principles. Without them a geological survey is impossible; nor can botany, zoology, or ethnology be viewed in their broader aspects, unless considerations of locality, altitude, and latitude are kept in view. Not only as the basis of scientific inquiry, but also for the comprehension of history, for operations of war, for administrative purposes, and for the illustration of statistics, the uses of accurate maps are almost infinite. M. Quetelet, in one of his well-known letters, declared that such graphic illustration often afforded immediate conviction of a point which the most subtle mind would find it difficult to perceive without such aid. Maps both generalise and allow of abstraction. They enable inquirers at once to detect and often to rectify errors, which, if undetected, would affect results and throw calculations into confusion. As an example of the use of maps for administrative purposes, the series constructed by Mr. Edward A. Prinsep, in India, is worthy of notice. They showed the agricultural tribes of a special district arranged according to occupancy of land, political and fiscal divisions, physical features and zones of fertility, productive power as influenced by rain or aided by irrigation, different kinds of soils, acres under different kinds of produce, and lines of traffic. Another most instructive series displays the State irrigation canals acting on improvable waste lands, the depth of wells, the rainfall and zones of drought, and the parts of the country already irrigated. As another noteworthy instance of the use of maps for statistical illustration, I may mention the interesting "Carte agricole de la France," by M. Delesse, which not only shows the extent of arable, meadow, and vine lands, and of woods, but the relative value of lands by shades and contour lines of equal revenue. The idea has been adopted by Mr. Ralph Richardson in his map of Mid-Lothian showing the annual rentals by colours; and of course the colours also indicate the positions of barren mountains, of fertile valleys, and of centres of population. Such maps ought to be far more extensively used than is now the case, for in no other way can economic and industrial facts be so lucidly and clearly, as well as so rapidly, impressed on an inquirer's mind.

The third division in which geographical delineation is classed is that comprised in the labour of pioneer-exploring and discovery. This branch of our subject excites the most interest, because the heroic devotion and gallantry of our travellers is a source of just pride to the nation; and because their perils and hardships, their adventures and discoveries surround them with a halo of romance. Yet these romantic associations are not confined to the pioneers of geography. Though less known, they equally belong to the more scientific geodesist. In the whole range of exploring narrative there is nothing more calculated to excite admiration, nothing more touching, than the devotion of Colonel Lambton, the first superintendent of the Great Trigonometrical Survey of India, the old man who was absorbed in his great work for half a life-time, who wasted away from exposure and hardship, but who, to the last, brightened up to renewed animation and vigour when the great theodolite was before him, and who died at his post in a wild part of Central India. This was sixty years ago, but quite recently the equally heroic death of Captain Basevi was recorded. At 17,000 feet above the sea, in a temperature below zero, and protected only by a light tent, this martyr to science was engaged in the delicate operation of swinging the seconds pendulum. One morning, when gallantly striving to rise from a bed of suffering and to recommence work, he died. Nor do these names stand alone. Assuredly, the more scientific surveyors run equal risks, and deserve equal recognition with their exploring brethren. Still the interest justly attaching to new discoveries naturally commands most popular applause, and the importance of opening up an unknown country cannot well be exaggerated.

In this glorious field there are still harvests to be reaped through the bravery and endurance of future travellers. In spite of all that has recently been done in Africa, there is a vast unknown tract to be discovered. In Asia, in New Guinea, in Sumatra and Borneo, in South America, wide regions also remain unexplored. Above all, the greatest problem of this age awaits solution in the far north, and will call forth the best scientific ability, and all the highest qualities of our naval explorers.

Every year new regions are brought within our knowledge, and we are able to welcome the adventurers home, and to add them to the list of geographical worthies. But, with regard to many explorers, there can be no doubt that much more valuable information might be obtained than is now the case. Men, with various avocations, traverse unexplored or little known countries, who, from want of previous training are unable to lay down their routes or to observe with scientific accuracy and intelligence. There are naval and military officers, missionaries, consular agents, colonial officials and planters, engineers, telegraphers, collectors, and sportsmen or persons merely travelling for pleasure, many of whom are led, by business or curiosity, to penetrate into regions of which little is known. It is most important that there should exist, in this country, the ready means of furnishing the necessary training to such explorers; and the subject has recently received serious consideration from the Council of the Royal Geographical Society.

It has been resolved that a course of instruction shall be supplied by the Society to all who are about to visit unknown or little known countries, and who desire such training. As a preliminary measure, the present arrangement is to give such instruction as will enable the pupil to fix positions by astronomical observations, and to lay down his route; but this is only a beginning, and it is to be hoped that, in due time, such a course of instruction will be provided as will enable an intelligent

traveller to observe with scientific accuracy, and to bring home really valuable results in various branches of inquiry. It is very desirable that this resolution of the Geographical Society should be widely known, and I trust that the local members of this section will co-operate so far as to bear in mind that this aid is offered by the Geographical Society, when the intention of any native of Hallamshire to visit a distant region comes to their notice. Incalculable good may be done to the cause of geography by a system which will have the effect of making every traveller a scientific and intelligent observer.

The surveying and mapping of the ocean is only second in importance to that of the land; and this work also divides itself into three sections, namely, the coasts surveyed, the coasts partially surveyed, and the unsurveyed coasts. Hydrography will not be completed until all the coasts in the world are included in the first section, which is now very far indeed from being the case. Yet this is not merely a question of science, of the study of the physical geography of the sea, interesting as this branch of our subject has become. Upon the accuracy and completeness of charts hangs the safety of thousands of lives, and the prosperity of commerce in all parts of the world. When it is remembered how much depends upon the work of marine surveys, it must be a subject of astonishment that so many hundreds of miles of coast line frequented by our shipping remain unsurveyed; and that even, in some cases, when the surveys have been executed and charts published by foreign governments, they are not accessible in an English form. In the interests of humanity and of the well-being of our trade, the efforts of geographers in urging the completion of marine surveys ought to be cordially seconded by Chambers of Commerce, and by all those whose material interests are concerned in the provision of accurate charts of all coasts visited by our shipping.

Hitherto I have invited your attention to the basis of geography, to the measurement of the surface of land and sea, and of their heights and depths; to the mapping of the world, and to the innumerable uses of maps and charts. But this only forms the skeleton of our science, which is endued with flesh and blood, with life and motion, by those who study the causes and nature of the changes that have taken place and are now taking place upon the earth; by comparative and physical geographers, by those who study and classify natural phenomena, and demonstrate their connection with each other and their places in the great scheme of nature.

Geography and geology are, from one point of view, sister sciences. The former treats of the earth as it now is and of changes which have occurred within historical times. The latter deals with the condition of the earth and the changes on its surface which went on during the cycles of ages before the dawn of history. The two sciences are quite distinct, while they aid each other. No geological survey can be undertaken without the previous completion of geographical maps, and the geologist is enabled to comprehend the condition of the earth in remote ages by studying the phenomena of physical geography. On the other hand, the geographer acquires a correct understanding of the present state of the earth's surface by considering the records of those marvellous changes which can be gathered from history and from the narratives of travellers and observers in all ages. Without their services, geography would lose half its interest.

Comparative geography (the study of the changes which have taken place on the earth's surface within historical times) is, therefore, a most important branch of our science; and it enlists the historian and the topographer in our service. It is a branch of geography which has not hitherto received the amount of attention it deserves.

The importance of the study of history and of early narratives for the elucidation of points in physical geography will appear from the consideration of a few instances. Take for example the great and fertile basin of the river Ganges in India. The Sanscrit historian finds reason for the belief that in 3000 B.C. the only habitable part of the alluvial plain of India was the water-parting or ridge between the Sutlej and the Jumna. The rest was a great estuary or arm of the sea. It has only been fit for man's occupation within the historical period, and hundreds of square miles of the delta have become habitable since the days of Lord Clive. The wonderful history of these changes can be traced by the student, who thus enables the geographer to explain the phenomena which he observes. Mr. Blanford, in his charming work on physical geography for the use of Indian schools, supposes a native of the country to be standing on the bank of the river that flows by his village, watching the turbid flood swirling past. The *chur* opposite, which the river left dry when its waters fell at the close of the last rainy season, and which, till lately, was covered by a rich green crop of indigo, is now more than half cut away, and buried beneath the water. Masses, many times larger than the house he lives in, from time to time detach themselves, and are swallowed up by the deep muddy stream. If the Hindu ponders over what he sees he will perhaps be led to make inquiries, and old people will probably tell him that half a century ago the river itself was a moderate-sized *khall*, and that the old channel, seven or eight miles off, now little more than a string of pools, was at that time a great river. These facts and their causes will open to him an interesting chapter in physical geography; which is made more complete and more interesting by the ancient records of his people. But geography is an applied science. This body of facts and their causes is not a subject for mere speculative study only. It is of practical utility; for the knowledge of the way in which Nature has worked in past ages discloses her present and future operations, and enables the enlightened administrator and engineer to work in harmony with them.

Again, to pass to another part of the world. The student of history reads of the great sea fight which King Edward III. fought with the French off Sluys; how, in those days, the merchant vessels came up to the walls of that flourishing seaport by every tide; and how a century later a Portuguese fleet conveyed Isabella from Lisbon, and an English fleet brought Margaret of York from the Thames, to marry successive Dukes of Burgundy at the port of Sluys. In our time if a modern traveller drives twelve miles out of Bruges across the Dutch frontier he will find a small agricultural town surrounded by corn fields and meadows, and clumps of trees, whence the sea is not in sight from the top of the town-hall steeple. This is Sluys. A physical geographer will seek out the causes which have brought about this surprising change. They are most interesting, and most conducive to an intelligent comprehension of his science, and he will find them recorded in history. Thus the historian and the geographer work hand in hand, each aiding and furthering the researches of the other.

Once more. We turn to the great Baie du Mont Saint Michel, between Normandy and Brittany. In Roman authors we read of the vast forest called "Setiacum nemus," in the centre of which an isolated rock arose, surmounted by a temple of Jupiter, once a college of Druidesses. Now the same rock, with its glorious pile dedicated to St. Michael, is surrounded by the sea at high tides. The story of this transformation is even more striking than that of Sluys; and its adequate narration justly earned for M. Manet the gold medal of the French Geographical Society in 1828.

Once again let us turn for a moment to the Mediterranean shores of Spain, and the mountains of Murcia. Those rocky heights, whose peaks stand out against the deep blue sky, hardly support a blade of vegetation. The algarobas and olives at their bases are artifically supplied with soil. It is scarcely credible that these are the same mountains which, according to the forest book of King Alfonso el Sabio, were once clothed to their summits with pines and other forest trees; while soft clouds and mist hung over a rounded shaggy outline of wood, where now the naked rocks make a hard line against the burnished sky. But Arab and Spanish chroniclers alike record the facts, and geographical science explains the cause.

There is scarcely a district in the whole range of the civilised world where some equally interesting geographical story has not been recorded, and where the same valuable lessons may not be taught. This is comparative geography.

The peasant of Bengal sees the mould falling into his turbid river, and learns the first lesson of a course which teaches him the history of the formation of the mighty basin of the Ganges. So should we, in England, to use the words of Professor Huxley, "seek the meanings of the phenomena offered by the brook which runs through our village, or of the gravel pit whence our roads are mended." Their meaning is equally significant, equally instructive, and it is thus that we should all begin to learn geography.

M. de Brazza read a paper *On his Exploration of the Ogové River*, details of which have already been published at various times in NATURE. After leaving the basin of the Ogové and crossing the watershed he came upon the Alima, a large river flowing eastwards, which he has no doubt is a tributary of the Congo.

Captain Gerald Martin had sent home, from the seat of war, a paper *On the Afghan War—the Kurum Valley.*—Captain Martin wrote from the Peiwar Kotal, and he reported on the survey operations conducted by officers of the Indian Survey Department attached to the "Kuram Column" of the Afghanistan expeditionary force. The area comprised the whole of the Kuram Valley and the district of Khost to the south, representing an addition to our geographical knowledge of 4,500 square miles. The paper concluded with a very interesting account of the botany of the Kuram Valley and of its forest-clad slopes (which was furnished by Dr. Aitchison), and with a detailed account of the Hill tribes. The inhabitants of the Kuram Valley are agriculturists and their irrigation works gave evidence of immense labour. A paper by Captain R. Beavan was read describing the country between Kandahar and Girishk.

Lieutenant St. George C. Gore described the *Pishin Valley*, which is now to be annexed by the British Government. Its extreme length is about 48 miles, and its average width including the hill ranges on either side, from 25 to 30 miles. It is a perfectly open, nearly flat, alluvial plain, with a very barren aspect owing to the absence of trees, except fruit trees in a few gardens.

SECTION F—ECONOMIC SCIENCE AND STATISTICS

Prof. Leone Levi delivered an address upon *The Scientific Societies in Relation to the Advancement of Science in the United Kingdom.*—The importance of the subject, and the renewed effort to rear a building in the Metropolis for several scientific societies, now insufficiently accommodated, had induced him to submit the paper. In the seventeenth century there were only two scientific societies in this country; but at the present time, in an age often described as wholly given to the ignoble occupation of money-making, the calendar exhibited an amount of activity quite unknown at former periods. The membership of the three Royal Societies was then mentioned, and Prof. Levi gave many interesting particulars of societies instituted for the promotion of the physical and mathematical sciences, natural history and biology, archæology and geography, the applied sciences, and instanced a large number of miscellaneous societies. Altogether, including local scientific societies, the number of members of scientific societies in the United Kingdom is about 60,000, or deducting ten per cent. representing those belonging to several societies, about 54,000 individual members. But even that could be scarcely considered as representing men of science, and probably about 25,000 persons was the number of people who had any recognised status in the world of science, or who were actually engaged in the pursuit of science within the British isles. Some facts were then given as to the income of scientific societies.

Eliminating from the total vote the amount expended for elementary education, the proportion devoted to science and art has been considerably diminished. In 1835, the Government of the day voted 65,000*l.* for elementary education, and 70,000*l.* for science and art, or a proportion of 52 per cent. for science and art. In 1878, the vote for elementary education amounted to 3,624,000*l.*, and that for science and art to 529,000*l.*, or a proportion of 12 per cent. for science and art. Further, Government aid was principally given to physical and natural science, leaving a wide range of scientific exploration altogether unassisted. Great had been the achievements of science in modern times, and England owed to its cultivators a profound debt of gratitude. Our manufactures and industry, our productive power and means of locomotion, all depended for their development on the advance of science, and these scientific societies had a high economic value. Much more, however, remained to be accomplished, and England's hope to maintain her high position in productive industry must depend on the success which men of science might attain in fathoming the inexhaustible secrets of nature, on the increase in the number of patient yet ardent votaries of science, and still more on the diffusion of education and scientific knowledge among the great body of the people.

SCIENTIFIC SERIALS

Bulletin of the United States Geological and Geographical Survey of the Territories (vol. v. No. 1. Washington, February 28).—Notes on the Aphididæ of the United States, with descriptions of species occurring west of the Mississippi, by Chas. V. Riley and J. Monell.—The relations of the horizons of extinct vertebrata of Europe and North America, by E. D. Cope.—Observations on the faunæ of the miocene tertiaries of Oregon, by E. D. Cope.—Notes on the birds of Fort Sisseton, Dakota territory, by Chas. E. McChesney.—Palæontological papers, No. 9.—Fossils of the Jura-trias of South-eastern Idaho, by C. A. White, M.D.—Jura-trias Section of South-eastern Idaho and Western Wyoming, by A. C. Peale, M.D.—Fossil forests of the volcanic tertiary formations of the Yellowstone National Park, by W. H. Holmes.—Palæontological Papers, No. 10.—Conditions of preservation of invertebrate fossils, by C. A. White, M.D.—Supplement to the bibliography of North American invertebrate palæontology, by C. A. White, M.D., and H. Alleyne Nicholson. This supplement embraces publications which have been made during the year 1878, and also all the omissions pertaining to the first list issued as No. 10 of the Miscellaneous Publications of the U.S. Geological Survey. The year 1878 was not productive of many memoirs on North American invertebrate palæontology. Dr. White records the publications made in the United States, Prof. Nicholson those made in British North America, West Indies, and Europe.

THE *Verhandlungen der k. k. geologischen Reichsanstalt, Wien* (No. 10, 1879) contain the following papers:—On a new occurrence of celestine in the Banat Mountains, by Fr. von Hauer.—On the distribution of Silurian deposits in the Eastern Alps, by G. Stache.—On a peculiar variety of the greenstone of Dobschau, by S. Roth. The peculiarity of this rock consists in its copious tenor of calcspar, beside felspar and hornblende. Apart from these principal constituents, augite, diallage, and secondary quartz are represented in the mixture. Here and there the hornblende incloses small crystals of pyrites and of nickeline.—On *Cyclocladia major*, Lindl. and Hutt., by Karl Feistmantel.—On a collection of petrifactions from the Silurian deposits made by Herr M. Dusl at Beraun, by Prof. G. Laube.—On the recent eruption of Mount Etna, by Ad. Pereira. The author gives a somewhat scanty description of an ascent he made during the last eruption, during which he actually reached the active crater.—The last paper in the number is a valuable account of an excursion into the district between the Bosna and Drina Rivers (Bosnia), by Dr. E. Tietze.

THE *Rendiconto delle Sessioni dell' Accademia delle Scienze dell' Istituto di Bologna* (1878-79).—From this part we note the following papers:—Observations on some habits of *Vespertilio murinus*, L., and on some studies in comparative anatomy connected with this animal, by Sig. Ercolani.—Notes on an ancient Phœnician skull found in Sardinia, compared to similar skulls of the present time, by Sig. Calori.—On the decomposition of salts of a volatile base and its importance in toxicological operations, by Sig. Selmi.—Note on certain fermentations at low temperatures, by the same.—Researches on the principal phases of the annular eclipse of the sun of July 19 last, partially visible at Bologna, by Prof. Saporeti.—On the ossification of the humor vitreus of the human eye, and on some other strange modifications of the same, by Sig. Ciaccio.—On the equilibrium of plane polygons of variable form, by Sig. Ruffini.—On a new hydrotacchimeter, by Sig. Cesare Razzaboni.—On some researches in analytical geometry, by Sig. Beltrami.—On the thermical and galvanometrical laws governing the formation of the electric spark in gases, by Sig. Villari.—Contributions to the fossil conchology of Italy, by Sig. Foresti.—On the excreting apparatus of *Janus cristatus* by Sig. Trinchese.—On the ossiferous breccia of the S. Teresa cave, by Sig. Capellini.—On the flora of the province of Bologna (third paper), by Sig. Cocconi.—On the history of geodesy in Italy, by Sig. Riccardi.—On a Holtz's machine of special construction, by Sig. Righi.—Chemical researches on the metamorphoses of the marbles of Carrara and of Monte Pisano, by Prof. Santagata.—On the deposits and genesis of phosphates generally and their use in agriculture, by Sig. Predieri.—On the motion of water in vessels communicating by long tubes, by Sig. Cesare Razzaboni.—On the quantitative analysis of mixtures containing alcaline sulphides, carbonates, sulphates, and hyposulphates, by Sig. Cavazzi.—On the origin of the optical nerve in the brain of fishes, by Sig. Bellonci.—On the structure of so-called cellular and parenchymatose cartilage, by Sig. Ciaccio.—On some products of arsenical putrefaction, by Sig. Selmi.—On the thermical and galvanometric laws of the induction spark, by Sig. Villari.

THE *Journal of the Russian Physico-Chemical Society* of St. Petersburg (tome xi. No. 6) contains the following papers of

interest:—On some cinchonin compounds, by M. A. Wischnegradsky.—On the origin of milk, by M. L. Schichkoff.—On isotributylene by M. A. Butlerow.—Researches on the nucleine of milk, by M. N. Lubavin.—Analysis of the water of the Oka river, as well as of the sources which supply the aqueduct of Nishnii Novgorod, by M. N. Socoloff.—On β chloropropionic aldehyde, by M. G. Krestownikoff.—On β chlorobutyric aldehyde, by M. J. Karetnikoff.—On homoitaconic acid, by MM. G. Krestownikoff and W. Markownikoff.—On the products of dry destillation of phtalate of calcium, by M. O. Miller.—On the tenor of nitrogen in the detonating nitroethers, by M. J. Tcheltzoff.—On some applications of the mechanical theory of heat to the variations in the state of an elastic body, by N. Schiller.—On the influence of hydrogen on the volumes and on the elasticity co-efficients of palladium and its alloys, by N. Hesehus.

THE *Rivista Scientifico Industriale* (Nos. 14 and 15).—From these parts we note the following papers:—On the subdivisibility of the electric light, by Prof. Rinaldo Ferrini.—Observations of Swift's comet, made at the Royal Observatory of Brera, at Milan, by Prof. G. V. Schiaparelli.—On the non-existence of nascent hydrogen and the reduction of perchlorate of potash, by Dr. D. Tommasi.—On the smallest species of the Araceæ family, by Prof. O. Beccari. The name given to the new species by the professor is *Microcasia pygmaca*.—On the presence of lithium salts in the sea-water between Pozzuoli and Castellammare, by Prof. S. de Luca.—On the synthesis of sulphuretted and seleniuretted hydrogen, by Prof. A. Januario.—On red amber, by Prof. Capellini.—On the phenomena of acoustic attraction and repulsion, by Prof. Tito Martini.—On a new seismological instrument called "Ascoltatore endogeno" (endogenous listener), constructed by Prof. Giovanni Mugna.

SOCIETIES AND ACADEMIES

PHILADELPHIA

Academy of Natural Sciences, January 7.—Description of a new species of goniobranchus, by Andrew Garrett.

January 14.—List of land shells inhabiting Rurutu, one of the Austral Islands, by A. Garrett.

January 21.—Notes on some Pacific Coast fishes, by W. N. Lockington.

January 28.—Further notes on the mechanical genesis of tooth-forms, by J. A. Ryder.—Note on hyraceum, by Drs. Greene and Parker.—Morphological notes on the limbs of the amphiumidæ, by J. A. Ryder.—The land shells of the Mexican Island of Guadeloupe, by W. G. Binney.

February 4.—Prof. Leidy on fossil remains of a caribou deer.

February 11.—On the parasol ant, by Rev. H. C. McCook.

February 18.—Structure of chimpanzee, by Dr. Chapman.

February 25.—Descriptions of three new species of calceolidæ from Upper Silurian, by V. W. Lyon.

March 11.—Nudibranchiate gasteropods of North Pacific, by Dr. R. Bergh.—On the variability of *Sphæria quercuum*, by J. B. Ellis.—Notes on *Opuntia prolifera*, by T. Meehan.

March 25.—Notes on *Amphiuma*, by Dr. Chapman.—On a new genus and species of *Scombridæ*, by W. N. Lockington.

PARIS

Academy of Sciences, September 1.—M. Daubrée in the chair.—M. Faye presented, in the name of the Bureau des Longitudes, the *Connaissance des Temps* for 1881, and mentioned the improvements introduced.—The following papers were read:—Mathematical theory of the oscillations of a double pendulum by Mr. Peirce; note by M. Faye.—Note on solar temperatures, by M. Janssen. The expression, *temperature of the sun*, is wanting in precision, and the methods of measurement adopted are faulty, in view of the want of homogeneity in the solar surface, and the vast envelopes which prevent the radiation reaching us in all its force. To conclude the temperature of the photosphere from its radiating power, one should know the emissive power (which is, however, unknown to us). The common methods may give truly the calorific force of solar radiation which reaches the earth's surface, but they give no exact notions of even an average temperature (which expression, indeed, is inapplicable to the sun). M. Janssen's efforts are now directed to a study of the sun in each of its distinct parts, employing analytical methods, and especially photography of the spectra of portions studied.—On the chemical constitution of alkaline amalgams, by M. Berthelot. The addition of solid mercury to amalgams containing already several equivalents of this metal liberates little or no heat, just as in the addition of solid water to saline hydrates, which already contain several equivalents of water; nearly all the heat or work having been developed in the previous combination. This gives a new relation between saline hydrates and metallic alloys.—On the projects of an American maritime canal, and of communication between Algiers and Senegal, by M. de Lesseps. He presented a volume of proceedings of the International Congress and reports relating to the former scheme. As to the latter, he thinks it would be well to commence by establishing telegraph stations at various points where water is obtainable.—On a means of diminishing the loss of *vis viva* in a divergent ajutage of large dimensions, the angle of which is too open, and which may be divided into several by conical surfaces having the same axis, by M. de Caligny.—On a process of obtaining in any ball governor the degree of isochronism desired, &c.; practical rules, by M. Leanté.—Anatomical and morphological researches on the nervous system of insects, by M. Brandt. *Inter alia*, it is untrue that all insects have a sub-œsophagean ganglion separate from the others (*Rhizotrogus*, *Stylops*, and *Hydromedra* have not). The circumvolutions of the brain are found in *all* insects, in various development, and the development differs in individuals of the same species. In general, the development of the hemispheres, but not of the whole brain, is related to instincts and habits. In some insects having two thoracic ganglions, the first is simple, the second compound; in others both are compound. The transformation of the nervous system takes place in some insects by reduction of the number of ganglions; in others by an opposite process.—On two new elements in erbine, by M. Cléve. The spectrum of the old erbine is attributed to three distinct oxides. The two new elements he designates *Thulium* (from Thule, the old name of Scandinavia) and *Holmium* (a derivative from the Latinised name of Stockholm).—Prof. Lawrence Smith remarked on the doubts of some *savants* as to the results of recent study of earths of the yttrium and cerium group.—Partial synthesis of milk-sugar and contribution to synthesis of cane-sugar, by M. Demole.—Reaction of tungstates in presence of mannite, by M. Klein.—On the determination of urea; reply to M. Esbach, by M. Méhu.—On the physiological effects of formiate of soda, by M. Arloing. It lowers the animal temperature, accelerates the respiratory movements, &c., is poisonous when the dose exceeds 1 gr. per kilog. of weight of the animal. It might be advantageously used for salicylate of soda in some cases.—On some facts relating to contraction, by MM. Brissand and Richet.—Morphological and zoological researches on the nervous system of dipterous insects, by M. Künckel.—On the plurality of nuclei in certain plant cells, by M. Treub.

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