THURSDAY, JANUARY 7, 1875

THE GEOLOGICAL SURVEY OF VICTORIA

Geological Survey of Victoria. Prodr omus of the Palæontology of Victoria; or, Figures and Descriptions of Victorian Organic Remains. Decade I. By Frederick M'Coy, F.G.S., Government Palæontologist, and Director of the National Museum of Melbourne. (Melbourne: John Ferres. London: Trübner and Co., 1874.)

WE have at last a first instalment in the shape of a Decade, from Prof. M'Coy, of Melbourne, Australia, upon the organic remains of that colony. It is entitled, "Prodromus of the Palæontology of Victoria, or Figures and Descriptions of Victorian Organic Remains," Decade I. The preface, by Prof. M'Coy, states that as the maps and sections of the Australian Survey would be incomplete without figures and descriptions of the fossil organic remains, it has been determined to issue a Prodromus or preliminary publication of the Victorian fossils, in decades or numbers of ten plates each, with descriptive letterpress. The first decade contains matter illustrating six different groups of fossils; viz., the Graptolites, the Marsupiata, the Mollusca (Gasteropoda), gymnospermous and lycopodiaceous plants, and Star-fishes of the family Urasteridæ. We presume that this mode of issuing the decade is an experimental one, as it will require eight or ten numbers of decades to complete one decade of a particular group, depending upon the number of plates devoted to these particular groups as they are issued. We should have preferred seeing a decade on the Graptolitidæ completed at once, or the Asteriadæ, or Volutidæ, or indeed any other, thus forming almost a monograph of some special group, as a connected whole, as it will be long before a decade of any one group can be hoped for, unless the Professor has a large stock in hand, and store already prepared. If there is one group more interesting than another, figured in the decade, it is the Graptolites: the Victorian species figured are nearly all British, European, and American; no extinct organisms of apparently the same species had so wide a distribution in space. Hall, of America, Carruthers, Hopkinson, Lapworth, Nicholson, Baily, &c., have all elaborately written (indeed still are writing) upon these mysterious Hydrozoa; and Prof. M'Coy, of Victoria, and Etheridge, of Edinburgh, are now investigating the Victorian forms. Surely something definite may be expected, or will be determined, as to their specific value. Monoprionidian forms of the genus Diplograpsus and Didymograpsus are the only genera touched upon in the decade; also one Phyllograptus, *P. folium*, var. *typus* Hall, which differs little from our British species, except in being larger. M'Coy describes ten species, four of which are British of Lower Silurian age. Our own gold-bearing Cambrian slates of North Wales thus contain a fauna, the same in time as those "goldfield slates" of our auriferous colony.

Plates 3, 4, and 5 of the decade and text are devoted to descriptions of the mandibulæ or jaws of one genus of marsupial mammalia of Australia, *Phascolomya pliocenus* (Wombat). The mandibles only are figured and described. The chief interest attached to this fossil arises from its being the first ever found in the Victorian ferruginous gold drifts or gold cement of Dunolly. Prof. M'Coy fixes the age of the deposit as Pliocene Tertiary, corresponding in time with our upper crags of Norfolk and Suffolk, and he believes the Victorian beds correspond in age with the gold drifts of the Ural chain.

Macropus titian and *M. atlas*, extinct forms of Kangaroo, occur with this fossil form of Wombat. We look forward to much original matter from Prof. M'Coy upon the phytophagous and carnivorous marsupials of the Australian continent.

Plates 6 and 7 of the Volutidæ, especially certain forms, are scarcely distinguishable from the Middle Eocene species of our own country (Barton and Bracklesham); and the higher Oligocene Tertiaries of Europe are represented in these distant Cænozoic deposits of the antipodes. The *Voluta anti-cingulata* of M'Coy seems to us to realise the alliance of our two British species—*V. ambigua* and *Voluta digitalina*. We have again a representative form in *V. antiscalaris*, M'Coy, occurring in the Tertiary and Oligocene clays of Modop and Mount Martha. The *Vololithes scalaris*, Sow. (Middle Eocene of Isle of Wight and Barton) and the *Voluta nodosa*, Sow. (Bracklesham and Barton) are so closely allied to those Australian Volutes that we fail to see any difference; they are truly representative. The remarkable shells, *V. macroptera*, M'Coy, and *V. Hannafordi*, M'Coy, are essentially new forms, and throw fresh light upon the specific value of the genus; the great expansion and globose nature of the wing or lip removes it from our British Crag *Voluta Lambertii*, but to which in many other respects it is allied.

Part VIII. with Plate 8 is devoted to the description of eight species of Zamites (Podozamites). This group of gymnospermous plants are of much interest to the palæophytologist, and, in this country and Europe, essentially typify and characterise rocks of Secondary or Mesozoic age. The discovery in Queensland of a bipinnate or distichous Zamia (Bowenia) has changed our views as to the foliage of this group of Cycadaceæ, now known to be compound instead of simple. M'Coy proposes the sub-generic name of *Bowernites* for these compound fossil Cycadaceæ resembling the recent Bowenia. The fruit found with the remains does not aid the Professor in determining their true affinity, but he states they more strongly resemble the fruit of the fossil Zamiæ of our Yorkshire oolites than the Araucarian type. The fossil or extinct British Cycadaceæ had long range in time, commencing in the Lias and living through all the Secondary rocks; Fittonia, of the Upper Cretaceous beds, being the last British form. The group is largely represented by many species in our Wealden and Purbeck rocks.

Part IX. and plate accompanying it illustrate one genus of lycopodiaceous plants (Lepidodendron). This ubiquitous genus occurs in the coal measures in every region of the globe, and frequently in the Upper Devonian rocks, but at the close of the Palæozoic period passed away. There is much conflicting evidence and information relative to the occurrence of this group of lycopods in the true coal measures of New South Wales and Victoria. Prof. M'Coy states that not one has ever yet been found in the coal strata of New South Wales or Victoria; its occurrence in both areas named is entirely unconnected with the beds yielding the coal. M'Coy believes that the coal-yielding rock of the above localities are of Mesozoic age; stating his reasons from the entire absence of Calamites and Lepidodendrons, and from the presence of Tænioptera, Phyllotheca, and other forms intimately related to those of the Mesozoic coal-beds of the oolitic formations of Yorkshire, Europe, Richmond (America), and India. That rocks of true Coal-measure age do occur in Australia there is no doubt; we cannot here discuss the fragmentary and conflicting evidence of its presence and distribution until more reliable data has been collected.

Plate 10 illustrates two species of star-fishes from the Upper Silurian rocks, Pteraster and Urasterella, both of the family Urasteridæ. M'Coy's Urasterella is the Stenaster of Billings and Palæaster of Hall; and to this latter genus have been referred those forms of old star-fishes having adambulacral, ambulacral, and marginal plates on the arms, whereas Urasterella differs in only having one row of plates on each side of the ambulacral groove. The two forms figured in the decade are named after the present mining and late geological directors of the colony. *U. selwynii* appears to be the first fossil star-fish found in Australia. These star-fishes, like many other Australian fossils, are almost identical with our British types. We know of no more remarkable fact in the history and distribution of life than the affinity that seems to exist between the forms of life over two areas so old and so vastly removed as that of Britain and Australia, antipodal to each other; universality might almost be applied through Homotaxis to the geographical distribution of the several formations which comprise the periods even stratigraphically and lithologically; as well as the existence in common of numerous genera, and with many representative and some even identical species between the two countries. What difference in time there might have been between the deposition of the sedimentary materials and its accompanying life in our European or the American area, with that of the Australian region, we shall never know; but the faunal relations were nearly the same, and the then species must have had a far wider distribution in space and time than we have hitherto imagined or generally believed.

This first Decade of Victorian Fossils will be studied with much interest by British palæontologists, firstly on account of its being from the pen of the accomplished Director of the National Museum of Melbourne, and secondly on account of the valuable researches and matter forwarded to us illustrating the palæontology or past life history of that remote region of the globe.

LIVINGSTONE'S "LAST JOURNALS"*

II.

The Last Journals of David Livingstone in Central Africa, from 1865 to his Death. Continued by a Narrative of his last moments and sufferings, obtained from his faithful servants, Chuma and Susi. By Horace Waller, F.R.G.S., Rector of Twywell, Northampton. In two vols. With portrait, maps, and illustrations. (London: John Murray, 1874.)

THE Loangwa was crossed on December 15, and on Christmas Day Livingstone lost his four goats, a loss which he felt very keenly; "for, whatever kind of food we had, a little milk made all right, and I felt strong and well, but coarse food, hard of digestion, without it, was very trying." Indeed, after this Livingstone suffered much from scarcity of food, and became greatly emaciated and weakened; and to intensely aggravate this, through the weakness of a boy and the knavery of a runaway slave, the medicine chest was stolen on January 20, 1867, a loss which was utterly irretrievable. "I felt," he sadly says, "as if I had now received the sentence of death, like poor Bishop Mackenzie." Fever came upon him shortly after, and for a time became his almost constant companion; this, with the fearful dysentery and dreadful ulcers and other ailments which subsequently attacked him, and which he had no medicine to counteract, no doubt told fatally on even his iron frame, and made it in the end succumb to what he might otherwise have passed through with safety.

The Chambezi, whose course into Bangweolo Livingstone has finally determined, was crossed on January 28. While detained for about three weeks at the village of Chitapangwa, a somewhat able and on the whole well-meaning chief, he sent off a packet of letters and despatches with some Arab slaves; these reached England in safety. He also sent forward a small supply of provisions to Ujiji. At last the southern shore of Tanganyika (or Lake Liemba, as the south part is called) was reached on March 31. By this time Livingstone was so weak, he could not walk without tottering. At the village of Chitimba, some distance west of the end of the lake, he was detained for upwards of three months, on account of a quarrel between a chief, Nsami, and the Arab Kamees, whom Livingstone found here with a slaving party, and who showed the traveller much kindness. On Aug. 30, difficulties having been adjusted, Livingstone proceeded westwards, and on Nov. 8 came upon the north end of Lake Moero, "a lake of goodly size, flanked by ranges of mountains on the east and west. Its banks are of coarse sand, and slope gradually down to the water; outside these banks stands a thick belt of tropical vegetation, in which fishermen build their huts. The country called Rua lies on the west, and is seen as a lofty range of dark mountains."

Proceeding southwards, Cazembe's, on Lake Mofwe, a lakelet a little south of Moero, was reached in a few days. The name of Cazembe is already known in connection with the journey, in the end of last century, of Dr. Lacerda, who died and was buried not far from the present village. This Cazembe (he was killed shortly after Livingstone's visit) was the tenth from the founder of the dynasty, who came from Lunda, and conquered the then reigning chief, usurping the chiefship. Cazembe treated Livingstone on the whole handsomely. The traveller remained at his village about a month, when he again went to the north of Lake Moero, and visited the Lualaba, the river which, rising in Lake Bangweolo as the Luapula, and of which the Chambezi may be considered the beginning, stretches away northwards and westwards through Lake Kamolondo, and again northwards, to what termination is not yet known. Livingstone had a firm belief that it was the upper part of the Nile, though appearances would seem to suggest that it more probably joins the Congo. There is every likelihood that Lieut.

* Continued from p. 145.

Cameron will be able ere long to solve the mystery. To this river Livingstone has given the name of his friend Webb, and to an important tributary from a reported large lake to the west, named by Livingstone Lake Lincoln, and made to join Lualuba about 3° S. lat., he has given the name of his staunch friend "Sir Paraffin Young." Livingstone again came south to Cazembe's in May 1868. Before this all but five of his men deserted to a slave party under Mohamed bin Saleh, who had been detained ten years at Cazembe's, and whom Livingstone helped to get off. He turned out an ungrateful cheat. Continuing southwards in June, Livingstone on July 18 reached Lake Bangweolo, although he was not really its first European discoverer, the Portuguese having been there long before him. With difficulty obtaining a canoe, he crossed to an island some miles off the north-west corner of the lake. The latter he calculates to be about 150 miles long by 80 broad, and is 3,688 feet above the sea. It, as well as Moero, abounds in fish of a great variety of kinds, some of which, no doubt, will ultimately be found new to science. Livingstone had no means of bringing away any specimens, and only gives the native names. As we have said, the north-east, east, and south sides of the lake are surrounded with "sponges," the water in many places being so deep as to require canoes, and is intersected by the courses of many streams. On islets in this sponge the villages are located.

In connection with this "sponge" and the rainy season, Livingstone enters in this part of his journal on a long disquisition on the climate of Central Africa, which we recommend to the notice of meteorologists. Speaking of the region around Bangweolo, he says "burns (*Scoticè* for 'brooks') are literally innumerable: rising on ridges, they are undoubtedly the primary or ultimate sources of the Zambezi, Congo, and the Nile; by their union are formed streams of from thirty to eighty or one hundred yards broad, and always deep enough to require either canoes or bridges. These I propose to call the secondary sources, and as in the case of the Nile they are drawn off by three lines of drainage, they become the head waters (the *caput Nili*) of the river of Egypt." No one had a better right to theorise on this subject than Livingstone, for few had observed so much; but it may yet be found that he allowed his eagerness to settle the Nile question to run away with his cooler judgment.

After being detained near Bangweolo for some time by the disturbed state of the country, he proceeded northwards in the company of some Arab traders. Still further delay occurred to the north of Moero, caused by the barbarity of the Arab slavers with whom he was compelled to travel, and it was not till December that a start in earnest was made north-eastwards to Tanganyika. He became so ill on the road with pneumonia and other ailments, resulting from damp and a completely enfeebled constitution, that he became insensible and had to be carried part of the way. The effects of this illness never left him. The lake was reached in February 1869, and Livingstone entered Ujiji on March 14, a "ruckle of bones." Supplies had been forwarded to him here from Zanzibar, but his misfortunes were aggravated by finding that most of them had been knavishly made away with by those to whose care they had been entrusted.

The traveller re-crossed Tanganyika in July, and on August 2 set out on a new series of discoveries to the west of the lake, in a region not before visited, scarcely even by the Arabs, that of the Manyuema. Through this region flows into the Lualaba the large river Luamo, or Luasse, or Lobumba, rising close to the west shore of Tanganyika. Livingstone's object was to reach the Lualaba and if possible cross to the west side. After vainly trying to get west, he went into winter quarters in February 1870, at Mamohela, in about 4° 20′ S. lat. and 27° 5′ E. long. Another attempt was made to reach the river with only Chuma, Susi, and Gardner. He was again baffled and returned to Bambarre, south-west of Mamohela, in July, martyred with irritable eating ulcers in the feet, which seem to be caused by some form of malaria, and with which he was for long sorely troubled; he was confined to his hut for eighty days with them. During his long detention here, which galled Livingstone dreadfully, he records many observations of the people, who certainly seem to eat human flesh, and prefer it when very "high," but who were on the whole extremely kind to himself, notwithstanding the brutal usage given them by the Arab traders, with whom the country now swarmed, and who mercilessly burned villages and slaughtered men, women, and children, simply to inspire terror. Here Livingstone became acquainted with what Mr. Waller thinks is an entirely new species of chimpanzee, a remarkable animal called by the natives the "Soko," possessing wonderful intelligence and having some very curious habits. In February 1871, some men who proved worthless scoundrels reached him from the coast, and he again started for the Lualaba, which at last he reached on March 29. He stayed at a village, Nyangwe, for four months, vainly trying to get a canoe to take him to the other side, which was here 3,000 yards off, the bed of the river being dotted with many islands. This Nyangwe at which Livingstone stayed is a place of great interest; a regular market is kept daily to which hundreds of women from the other side flock to buy and sell goats, sheep, pigs, slaves, iron, grass cloth, salt fish, earthen pots, &c. The devilish treachery of the Arab slavers seems to have reached its height here during Livingstone's sojourn. A party under one Dugumbé, without warning or provocation, assembled one day when the thronged market was at its height, and commenced shooting down the poor women right and left, so that between those who were shot and those who were drowned, hundreds were killed, and the market completely broken up. No wonder that Livingstone had "the impression that he was in hell," and that his "first impulse was to pistol the murderers." This of course completely knocked on the head any chance which he may have had of getting a canoe, and in sickening disgust he made his way back to Ujiji, which he reached on October 23. While returning through Manyuema, his party was attacked by the enraged people, who mistook Livingstone for one of the slavers, and nearly stopped his further travels by a spear which grazed his back. This was the only time during these last seven years' wanderings that the traveller was hostilely attacked. Five days after his arrival at Ujiji he was cheered and inspired with new life, and completely set up again, as he said, by the timely arrival of Mr. H. M. Stanley, the richly-laden almoner of the proprietor of the *New York Herald*. Mr. Stanley's story is known to everyone, and we need not repeat it.

With Stanley, Livingstone explored the north end of Lake Tanganyika, and proved conclusively that the Lusize runs into and not out of it. It will be satisfactory if the discovery of an outlet on the west side, just announced in a despatch from Lieut. Cameron, turns out to be true. In the end of the year the two started eastward for Unyanyembe, where Stanley provided Livingstone with an ample supply of goods. Here Stanley urged his going home, but although he was now inwardly yearning to return, his judgment said, "All your friends will wish you to make a complete work of the exploration of the Nile before you retire." To this purport also was the advice of his daughter Agnes, whom he therefore calls "a chip of the old block." But had his judgment been cool enough, it might have told him that his constitution was so shattered that it was totally unequal to a task of such magnitude. The fountains he was in search of he supposed to be about 400 miles to the west of Lake Bangweolo.

The rest is soon told. Stanley left on March 15, and after Livingstone had wearily waited in Unyanyembe for five months, on August 15 a troop of fifty-seven men and boys arrived, some of the boys being Nassick pupils from Bombay, one of whom was Jacob Wainwright, who afterwards acted so important a part in the home-bringing of his body. Thus attended, then, he started on August 25 for Lake Bangweolo, proceeding along the east side of Tanganyika, over rugged mountains which sorely tried the endurance of himself and his retinue, even though he had two donkeys to ride, a present from Mr. Stanley. His weakness soon found him out; ere he reached the shore of Tanganyika his old enemy dysentery seized upon him, and seems never wholly to have left him, but to have got worse and worse, causing him fearful suffering till the bitter end. In January 1873 the party got among the endless spongy jungle on the shores of Bangweolo, where vexatious delays took place, and where the journey was one constant wade below, and under an almost endless pour of rain from above. The Chambezi was crossed on March 26, and the doctor was getting worse and worse, losing great quantities of blood daily: but he seems never to have dreamed of turning back or of resting. No idea of danger seems to have occurred to him; he had so often before got over difficulties and attacks of all kinds, and he was so full of the object his heart was bent on, that the idea of death does not seem to have entered his head. This, we believe, moreover, is a characteristic of the disease. At last, in the middle of April, he was unwillingly compelled to allow his men to make a *kitanda*, or rude litter, in which he was borne to the end. Still the dreadful illness is spoken of as a mere annoying hindrance. Thus, on the 29th of April, Chitambo's village on the Lulimala, on the south of the lake, was reached. The last entry in the journal, of the last two pages of which a fac-simile is given, is April 27: "Knocked up quite, and remain—recover—sent to buy milch goats. We are on the banks of the Molilamo." On April 30 he was careful to wind his watch, but with the utmost difficulty, and early on the morning of May 1 he was found by the boys kneeling by the side of his bed, dead.

Chitambo behaved generously, and the men, headed by Chuma and Susi, acted with great intelligence, faithfulness, and discretion. Everything was carefully locked up, and the story of the preparation of Livingstone's body for the purpose of carrying it home to his own folk, by "beekin' forenent the sun," is known to all. After a five months' march through many difficulties, the attendants reached Unyanyembe. Here Lieutenants Cameron and Murphy and Dr. Dillon were met, and early this year the body arrived at Zanzibar, and in the end of April was deposited, as was meet, in Westminster Abbey.

A monument with an appropriate inscription has been erected to Livingstone in the Abbey; and doubtless, in time to come, a more suitable memorial will take the place of that rude one placed near the spot where their hero died, by the hands of his loyal and faithful attendants.

Mr. Waller, we think, has on the whole performed his sacred task judiciously, printing the journals, as we have said, exactly as he found them, though many of his parenthetical remarks seem to us unnecessary. The maps are of great assistance to the reader, and will be found of value to the geographer, although in the meantime, so far as Livingstone's last journey is concerned, they must be regarded as to a great extent conjectural. No doubt careful criticism will soon do its work both on journal and maps, and, with the help both of previous and subsequent exploration, test the exact geographical value of the achievements which cost Livingstone his life. The illustrations are interesting and helpful.

BUCHANAN ON THE CIRCULATION OF THE BLOOD

The Forces which carry on the Circulation of the Blood. By Andrew Buchanan, M.D. Second Edition. (London: J. and A. Churchill, 1874.)

IN the same way that, among *à priori* mechanical philosophers, the possibility of discovering a perpetual motion was a favourite subject of discussion before the development of the theory of energy, so, among physiologists, the relative importance of the different forces which maintain the circulation of the blood was an equally common source of speculation before the introduction of the blood-pressure gauge and the sphygmograph. Within the last twelve or fifteen years, however, the various problems which used to occupy the attention of Magendie, Arnott, and Barry have been completely solved by entirely fresh methods of observation; and these, quite irrespective of their *opinions*, have verified or disproved their theoretical deductions according to whether or not they were based on sound premises.

Dr. Buchanan devotes much of the short work before us to the consideration of one of these bygone points, namely, the pneumatic forces which maintain the circulation of the blood, the importance of which he endeavours to demonstrate by a series of hydraulic experiments, the different elements of which are, we fear, slightly savoured with the bias of preconceived notions, as the result at which he arrives is that "after birth the circulation is mainly carried on by two forces—the propulsive force of the heart and the pressure of the atmosphere, acting nearly in the proportion of three of the former to two of the latter; but that as life advances, and the quantity of venous blood increases, the latter force becomes relatively more powerful." The most energetic of these auxiliary pneumatic forces is stated to be that of the chest, which is followed in importance by the suction force of the heart and by a "pleuro-cardiac pneumatic force," in which the heart, contracting in a rigid chamber, draws blood into it from the surrounding veins, on account of its decrease in size during the systolic act. The elaborate investigations of MM. Chauveau and Marey,* published a little more than ten years ago, put us in a position to state exactly, in inches of mercury, what are the values of the pneumatic forces which Dr. Buchanan describes; and as these results are evidently not familiar to British physiologists, to those at Glasgow at least, it may be worth while recapitulating them here. First, the sphygmograph trace in health shows that, as Dr. Arnott maintained, normal respiration has scarcely any appreciable effect on the blood-pressure, because the horizontal line joining corresponding points in the different pulse-beats is very nearly, if not quite, straight. These authors also explain how the antagonistic results of Ludwig and Vierordt—in which the one states that the blood-pressure falls during inspiration, and the other during expiration—can be accounted for; they finding that if the air-passages are partially obstructed, as by shutting the mouth and closing one nostril, the one result is produced; whilst if these same passages are freely opened, the opposite effect is observed. The influence of respiration may therefore be dismissed as comparatively insignificant.

That of the heart is much more considerable. By means of a beautifully constructed piece of apparatus M. Marey has been able to demonstrate the existence and amount of the negative or suction forces, as far as they are found to exist in the different cavities of the heart, during the different parts of each cardiac pulsation. His results are recorded by the graphic method,† and their agreement among themselves is evidence of their accuracy. The work referred to contains a full description of the apparatus employed. The following are the results:—In the right ventricle the blood-pressure does not ever go beyond zero, except at its basal portion, where it is *sometimes* found that a minute suction force develops immediately after the closure of the aortic valves, and then only. In the left ventricle an appreciable suction force is observed at the same time as in the right; it is, however, not great. It is impossible, by any means yet devised, to get at the left auricle, but the right auricle is easily arrived at from the jugular vein. In it the blood-pressure is *nearly always* negative or below zero, it being otherwise only during its systole. A study of the auricular cardiograph trace shows that immediately after the auricular systole, which is the same thing as saying at the commencement of the contraction of the ventricles, the pressure in the auricle descends rapidly below zero; that the descent is broken by a small wave, and that the suction force commences to diminish gradually after the closure of the aortic valve, becoming *nil* a very short time before that organ again contracts. The explanation of these changes is not difficult. The rapid fall in the auricular pressure during the ventricular contraction was many years ago fully explained in a peculiarly able memoir by Mr. Bryan,* and the active dilatation of the ventricles of the heart during diastole, which necessitates a corresponding internal suction force, has been shown by more than one physiologist to depend on the peculiarities of the coronary circulation.

* Marey, "Circulation du Sang;" Paris, 1863.
† *Loc. cit.* pp. 95, 96.

By employing a specially adapted manometer M. Marey was able to measure this suction force in the right auricle of *Equus caballus*, and found that it ranges, on the average, between − 7 and − 15 millimetres of mercury, the same method giving 120 millimetres as the average pressure in the left ventricle during the systole. From these figures the true relation borne by the contractile force of the heart to its suction power can be readily estimated.

The "pleuro-cardiac pneumonic force" described by Dr. Buchanan is nothing more than that above referred to as described by Mr. Bryan, the latter author having previously demonstrated that on account of the heart—a conical organ—contracting in a conical cavity, it must necessarily advance towards the apex of that cone during systole, and so leave the base to be filled by the absorption of the blood from the distended veins.

These remarks all tend to show that many of Dr. Buchanan's investigations are in the right direction, but that a further acquaintance with the literature of the subject would enable him to employ his considerable ingenuity and enthusiasm in the elucidation of points still remaining unexplained to students of the science of physiology. This want of acquaintance with the works of others is, we think, partly explained by some incidental remarks in the book before us. The author says: "I have always exercised all the branches of my profession. . . . I cannot but regard this custom as much superior to that which our medical corporations are now enforcing, of making every man from the beginning select for himself a single branch of the profession;" to which are added other remarks derogatory to specialisation in study. With these we cannot agree, and still think that "if you wish to find a man of large views of physiological nature," he is more likely to be a special student, with time at his disposal, unoccupied by miscellaneous professional calls, than one who, turning his attention to all things, has no opportunity of concentrating it on any one, to the advancement of our knowledge of its details.

* *Lancet*, Feb. 8, 1834.

OUR BOOK SHELF

Elements of Animal Physiology. Elementary Science Series. By J. Angell. (W. Collins and Co., 1874.)

THERE is more than one way by which the relative importance of scientific facts may be arrived at. An investigator, whilst prosecuting his independent researches, will not be long in forming a fairly accurate standard, and this he finds it easy to impart to others. Many engaged in educational work find it impossible to afford the time for independent observation or prolonged study, and yet it is their ambition to give their pupils a fairly correct estimate as to those of the innumerable facts surrounding them on which they should lay stress in preparing for a pass examination. The standard with them therefore becomes nothing more nor less than the questions of former years or of other similar examinations; the work which answers the greatest number of these in the most satisfactory manner being looked upon as the most valuable, especially if the irrelevant matter is reduced to a minimum. The small book before us contains a carefully compiled and accurate digest of many of the most prominent facts of human physiology, with incidental references to some of the best known peculiarities of a few of the lower animals, illustrated by several appropriate and well-selected diagrams, among which, however, there is an important one indicating the general distribution of the arterial system, which is unfortunately reversed, and another explaining the leverages of the body, representing a man as standing with his centre of gravity far in front of the tips of his toes. The language employed is clear and concise, whilst many of the best known terms in common use among physiologists are explained in a glossary at the end of the book. Some of the practical illustrations suggested to the pupil for his own instruction are particularly to the point. There are some explanations with which, however, we cannot agree, such as that the activity of the circulation of the blood which accompanies physical exercise is the result of the alternate compression and relaxation of the veins; and that a much vaunted theory as to the cause of cholera, which involves the purchase of a much advertised apparatus for its relief, has sufficient foundation for even the slightest mention in any book for the use of students. The non-technical character of the work will commend it to many as a useful introduction to physiology.

The Gardener's Year Book and Almanack, 1875. By Robert Hogg, LL.D., F.L.S. (*Journal of Horticulture* Office.)

THIS is a very handy and valuable little book. The information it contains is of a kind that may be thoroughly depended upon. Besides a great deal of practical information of a miscellaneous sort, there are tolerably copious gardening directions for each month, besides selected lists of fruits and vegetables, and of the new plants of last year. It will be very useful to amateur gardeners, and would be still more so if it gave some short and plain descriptions of various horticultural operations—such, for example, as pruning different kinds of fruit-trees.

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.*]

Absence of Microscopic Calcareous Organic Remains in Marine Strata charged with Siliceous Ones

IN a letter headed "Deep-Sea Researches," and subscribed "W. C. Williamson, Owens College," in your issue of the 24th Dec. (vol. xi. p. 148), the author, after having stated that Dr. Wyville Thomson has come to the conclusion that the calcareous Globigerinæ and other such elements had been removed by the "solvent action of carbonic acid accumulated in the deep-sea waters," adds that, "In my memoir [1847, *op. cit.*] I arrived at the same conclusion."

Then follow extracts from the "Memoir" itself, alluding to the removal of all the calcareous forms, leaving only the siliceous structures," by "carbonic acid gas in solution in water."

Finally, the author states:—"After venturing upon these conclusions in 1847, not as mere speculative guesses, but as the deliberate result of a long series of investigations carefully worked out, I need scarcely say how intense was the interest with which I read Dr. Wyville Thomson's observations, which so thoroughly sustain and confirm the accuracy of mine. My conclusions were wholly derived from the microscopic observations of earths and rock specimens which I compared with the few examples of foraminiferous ooze with which I was then familiar."

"Felix qui potuit rerum cognoscere causas."

In enumerating the different kinds of destruction which take place in sponge-spicules generally, I have noted that the calcareous spicule is subject to one in particular, "in which there is a general breakdown of the whole fabric, which gradually becomes resolved into a group of aqueous-looking globules, of different sizes, among which there is not a trace of the original structure to be seen. Were this change confined to those calcareous spicules which I have mounted in Canada balsam, I should have inferred that it was caused by the balsam; but I find that the same change accompanies these spicules where they may have been taken in by the kerataceous sponges to form an axis for their horny fibre; and it is worthy of remark that the spicules of the Echinodermata, which may lie side by side with them, do not appear to be similarly affected. Of what nature the origin of this disorganisation may be I am ignorant; it is a chemical question; but the destruction takes place so rapidly in many instances that I have for some time past ceased to mount any more calcareous spicules, and now preserve a record of them by immediate sketches." (Ann. and Mag. of Nat. History, vol. xii. 1873, p. 457.)

Thus it follows that a removal or an annihilation of the forms of these microscopic calcareous organisms takes place after they have been repeatedly washed in fresh water, dried under a great heat, and covered at the same time with balsam, that is, treated artificially; as well as naturally, when they are mixed up with other microscopic organisms to form the core of the horny fibre of marine sponges; while the same thing takes place with the Foraminifera, as testified by slides, in some of which fragments of *Operculina arabica* mounted upwards of twenty years ago have nearly all passed into dissolution, and others in which the spicules of calcareous sponges which were mounted not more than six years since have disappeared altogether, leaving nothing but a few aqueous-looking globules in their places respectively.

So that this dissolution may arise without the presence of "carbonic acid gas in solution in water;" and as it is common to the calcareous organisms mounted in balsam for the cabinet, as well as in the core of horny fibre in the marine sponges of the "deep-sea," we may fairly assume that the removal of the calcareous forms from the siliceous ones in marine deposits may be due to more causes than that assigned by the author of the letter to which I have alluded.

Moreover, even the siliceous spicules which form the core of the glassy fibre in the vitreous sponges may, with the circumjacent layers of the fibre itself, undergo absorption to such an extent, in the skeleton of these sponges, *after death*, as to leave nothing but a siliceous shell with hollow, continuous tube throughout.

Such are the results of my microscopic observations among these minute organisms, and therefore, in the concluding words of the letter under reference, "I think I am justified in wishing the fact to be placed on record."

Indeed, so common and rapid is the process of destruction or inherent disintegration among the microscopic calcareous organisms which I have mentioned, that I am compelled to the conclusion that it is to this chiefly, and not to "carbonic acid gas in solution in water," that we must look for a satisfactory explanation of the fact that minute calcareous organic forms are comparatively absent among the siliceous ones of marine deposits, both recent and fossilised.

The agency of decay is as difficult to comprehend as the agency of development (why we should die any more than why we should live); hence it becomes unphilosophical to limit the operations of either to any *one* process. All that appears certain in the matter is, that the *three* great attributes of the system, viz., creation, preservation, and destruction, form a cycle in which, to speak figuratively, the words "perpetual change" may be enwreathed.

HENRY J. CARTER

Budleigh-Salterton, Dec. 26, 1874

The Constant Currents in the Air and the Sea

THE *Philosophical Magazine* for July, August, and September contains a memoir, continued through the several numbers, by Baron N. Schilling, Captain in the Imperial Russian Navy, on "the Constant Currents of the Air and the Sea." It appears that this memoir was first published in the Russian, afterwards in the German, and finally translated and published in the English language; so that it seems to be regarded as a memoir of considerable importance.

When any new and extraordinary results are obtained in any department of important scientific inquiry, the interests of science require that the basis of these results should be critically examined before they are received; and this is especially so where, as in this case, the results are entirely at variance with those of profound and elaborate researches in the same direction which have preceded. We propose, therefore, to examine briefly only a very few points in the reasoning from which these results have been deduced.

The author states in the commencement that equilibrium is disturbed by the three following causes :—

(*a.*) Alteration of the specific gravity of the water or air.

(*b.*) The rotation of the earth on its axis.

(*c.*) The attraction of the sun and moon.

He accordingly treats the subject under these three general heads. Under the first two he endeavours to show that none of the usual causes to which the currents of the ocean and the atmosphere have been usually referred can have much, if any, effect in producing them, and that they must, therefore, be due to some other cause. This seems to be designed to make way for the introduction into this subject of the new disturbing forces contained above under the last head (*c*). Much might be said with regard to what is stated under the first two heads in disparagement of the forces upon which these currents have been heretofore supposed to depend, but we shall confine ourselves here to a very few steps merely in the reasoning under the last head.

The author sets out under this head by assuming that the equilibrium theory of the tides is applicable to the real case of nature, and with this assumption he endeavours to show that the flood-tide rises higher above the plane of static equilibrium than the ebb-tide sinks below it. Now, it is well known by all who are familiar with tidal theories, that this theory is entirely worthless as a representative of the real tides of the ocean. Here, then, there seems to be a weak place in the very foundation of the whole reasoning, and any results based upon it should be received with much distrust, if even all the following steps in the argument were regarded as valid. In the second place, he attempts to show, by a method which is very unscientific and inconclusive, that the forces of the sun and moon tend to produce a current from the east towards the west in the flood-tide, but the reverse of this in the ebb-tide. This is then followed by another assumption in the following language :—"Since, as we have shown, the flood rises more above the normal level of the sea than the ebb sinks below it, we think we can assume, as an hypothesis, that the force of the flood-current will be greater than that of the ebb-current." From this he infers that the difference in these forces must produce a constant current in the ocean in the torrid zone from east to west, but, for reasons which do not seem clear, the reverse of this toward the poles ; and in this way, taking into account the deflections of the continents, he accounts for all the ocean currents without the aid of any of the usual causes assigned. In the case of the atmosphere he thinks that the same reasoning must hold, but admits that in this case the alteration of the specific gravity by heat toward the equator may produce some additional and modifying effects. Saying nothing with regard to the steps in the argument, these results are based upon a confessedly doubtful hypothesis, and therefore should not be received without further proof.

This is not a question to be settled by authority, but after the profound investigations of Laplace and Airy upon the tidal forces and the solution of the tidal problem, from which no constant currents around the earth were obtained, we would scarcely expect that such results would be legitimately obtained in a few pages of verbal reasoning without the aid of mathematics. It is true that more recently a very small effect of that kind has been obtained, tending to produce a westward current in all latitudes, from which, by means of friction, the earth's rotation on its axis is supposed to be slightly changed, but this effect is of an order almost infinitely small in comparison with those under consideration, and not at all contemplated in the author's reasoning, referred to above. WM. FERREL

Washington, D.C., Nov. 7, 1874

Mud Banks on Malabar Coast

THE phenomenon of the "mud banks and of tracts of mud suspended in the sea" on certain parts of the Malabar coast, is not, as you suppose (vol. xi. p. 135), unexplained. The late Capt. Mitchell, curator of the Madras Museum, some years ago submitted a quantity of the mud to microscopic examination, and published the results in the *Madras Journal of Literature and Science* (I have not the work at hand, or I would give you volume and page). He found it to consist almost entirely of Diatomaceæ, of which he detected and distinguished sixty-two species. In the paper in the Madras Journal Capt. Mitchell gives a list of the genera and a numerical list of the specific forms.

The causes that have determined this local development of Diatomaceæ remain for investigation. They appear sometimes to shift their place. Thus, a Dutch navigator (Stavorinus, I believe) described two such banks as existing to the south of Cochin in 1777, but these no longer exist.

Richmond, Surrey HENRY F. BLANFORD

Ring Blackbird

EVERY morning a brown bird (apparently a female blackbird) feeds at my library window. She has a white spot on the breast, and a large white ring, in the exact position of that on a Barbary dove, not meeting under the chin. Is this an unusual variety? I see no mention of such a peculiarity in any of the books at hand, as Lewin, Bewick, Mudie, &c. C. M. INGLEBY

Valentines, Ilford, Jan. 4

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*ON THE MORPHOLOGY OF CRYSTALS**

PROFESSOR MASKELYNE, in introducing his subject, said that in the assembly-room of the Chemical Society he should have to treat of Crystallography as the Science of Chemical Morphology. To the chemist the crystallisation of a substance is a familiar marvel ; so familiar, indeed, that he hardly sufficiently considers its importance in relation to his own science. For the physicist, on the other hand, the instinct with which the molecules of a substance obey the laws of a sublime geometry—sublime because simple and universal—is a theme the contemplation of which has guided him to some of the most subtle and almost metaphysical conceptions that he has formed regarding the constitution of matter, and has afforded him invaluable insight into the working of the laws that control the pulsations of heat and light and other manifestations of force. But, although the morphological relations of the crystal are the external expression of the more subtle physical properties which underlie them, he stated that the purpose of the lectures he was about to deliver would be confined to the consideration only of the former.

Placing a large and very perfect crystal of apophyllite from the Ghâts of India on the table, the lecturer pointed out that certain faces carrying peculiar striations were repeated four times ; that again others of a triangular form, planted on the angles of the latter, were repeated eight times, and that these had a lustre of their own ; while again a plane of octagonal form was repeated only once on the top and at the bottom of the crystal, and carried a peculiar roughened surface, which was seen to be made up of innumerable small square pyramids in parallel positions. He further showed that by turning the crystal round about an axis perpendicular to the last planes, the relative situations of the planes, as viewed from any point, came always to be the same at any revolution through a quarter of a circle. A group of faces repeated with similar properties was defined as a *form*, the crystal in question thus exhibiting three forms ; the repeated faces of each form retaining the same general aspect so long as they were not moved round through an angle greater or less than 90°. Then taking crystals of quartz which presented the same *forms*, he pointed out that faces that corresponded to one another on the different crystals, and even on the same crystal, have very different relative magnitudes ; and that, in fact, these magnitudes were controlled by no rigid geometrical law. On the other hand, the angles which measured the inclination of corresponding faces on each other were in every case identical ; hence angular inclination, that is to say, the direction in space, not relative position, that is to say, precise mutual distance, in the faces, has to be recognised as a principle

* Some notes of the Lectures delivered at the Chemical Society's rooms in Burlington House, on the Morphology of Crystals, by Prof. N. S. Maskelyne, F.R.S.

fundamental to crystallography. This may be expressed by saying that the angles of a crystal are symmetrically repeated.

The study of crystallography in its aspect as the science of chemical morphology thus resolves itself into the discovery of the laws which regulate the repetition of planes, the directions of which in space, and not their relative magnitudes, result from that geometrical instinct which guides the molecules of every individual substance as they become colligated into the symmetrical structure of a crystal.

The lecturer then went on to point out that the features of a crystal the symmetrical recurrence of which had to be studied were the *faces*, the *edges*, and the *quoins* (or solid angles); and he entered on a general geometrical review of the conditions under which faces in meeting produce an edge, or a quoin, or a series of edges or of quoins; and after showing the mode by which the angular inclination of two faces was measured, he dilated on one in particular among the various modes in which faces might meet, namely, that in which three or more faces intersect with each other in the same line or edge, or in edges parallel to the same line. For the crystallographer such groups of planes possess the highest significance; a group thus presenting parallel edges he denominates a *zone*, and it is clear that the direction of the line to which all the edges that can possibly be formed by the intersections of any and every pair of the planes belonging to the zone is indicated when we know the direction of any one of these edges. A considerable part of the earlier among the ensuing lectures will have to be devoted to the consideration of this subject of zones: and the development of the relations between the planes of a zone, under the restrictions imposed by a simple and beautiful law, will be found to involve fundamental principles regarding the symmetry which controls at once the morphological and the physical properties of the crystal in such a manner that all the systems, the symmetrical forms, and the general character of the optical, thermal, magnetic, electric and mechanical properties of the crystallised substance hang, as it were, suspended from that simple law by a chain, each link of which is a simple deduction from the link in the argument immediately above it.

Then taking a crystal of the mineral barytes, Prof. Maskelyne pointed out that certain planes upon it were repeated, some in parallel pairs, and others four times, but also in pairs that were parallel, while all of these planes presented the property already stated to be characteristic of a zone: their edges were parallel. Then, supposing a lapidary's wheel to have been passed through the middle of the crystal perpendicularly to all these edges, and therefore perpendicularly to the faces themselves, he proceeded to deal with the profile of the planes of the zone as they would be seen in such a section. He first defined such a section as the *plane of the zone*, or the *zone-plane;* and characterised it as a plane perpendicular to the edges of the zone. Then drawing a figure to represent this profile or *zone-plane*, he pointed out that two of the planes of the zone being perpendicular to each other, he might draw two lines through a point within the crystal and in the zone-plane parallel to the traces of those two planes, and therefore perpendicular to each other, and that now he could use these lines as axes, or as an artificial scaffolding, to which he could refer the traces of the other faces of the zone, and by the aid of which he might determine the relative directions of those faces.

The circumstance already established by the scrutiny of many crystals, namely, that the faces of the crystal might be drawn nearer or further from a point within the crystal indifferently, justified the lecturer in drawing the traces of two of the faces in the zone so as to intersect in the same point on one of the two axes thus chosen. They would thus intercept on the other axis two different portions of that axis. Calling the former of these axes Z and the latter X, we may say that the ratio of the *intercept* by either of the two planes on the Z axis to the *intercept* on the X axis by the same plane is the tangent of the angle formed by the trace of the plane in question with that of the plane parallel to the axis of X, or the co-tangent of the angle it forms with the trace of the plane parallel to the axis Z. This tangent for the plane in question, which gave an angle of 51° 8′ by measurement for the angle on the axis X, had a value 1·2407. The other face of the zone, being represented by the line which met the axis of X at an angle of 68° 4′, would thus yield a corresponding tangent of 2·4834. It will be seen, therefore, that the ratios of the intercepts for the two planes would be, for the first plane,

$$\text{the } X \text{ intercept} : \text{the } Z \text{ intercept} :: 1 : 1{\cdot}2407$$

for the second plane,

$$\text{the } X \text{ intercept} : \text{the } Z \text{ intercept} :: 1 : 2{\cdot}4834$$

If the first of these ratios be called that of $a : c$, the second will be that of $a : 2c$, i.e. of $\frac{a}{2} : \frac{c}{1}$. The co-tangents of the angles would of course yield similar ratios for the distances on the axes X and Z at which the two planes intersect with them: but the common intercept on the Z axis would in this case be unity. The ratios would be

$$\frac{X \text{ intercept}}{Z \text{ intercept}} \text{ for the first plane } = \frac{0{\cdot}80594}{1} = \frac{a}{c}$$

$$\text{Ditto} \quad \text{for the second plane} = \frac{0{\cdot}40267}{1} = \frac{a}{2c}$$

A third plane in the zone treated in the same way would give an angle the tangent of which would lead to a ratio for the intercepts corresponding to $\frac{a}{5} : \frac{c}{2}$, and if the same process were extended to all the planes in the zone, it would be found that all of them would yield, by the simple process of measuring their inclinations and taking the tangents of their angles on the plane represented by the axis X, values that may be represented by the proportion $\frac{a}{h} : \frac{c}{l}$, where a and c are in the ratio above determined, and where h and l always are capable of representation by rational and generally, nay, almost always, by very small whole numbers. This law thus simply enunciated for the faces of a single zone, as referred to two axes parallel to two faces of the zone here taken as perpendicular to each other, will be found, when the faces of the crystal are referred to three axes instead of two, not in the same plane, and also when they are inclined to one another at other angles than right angles, still to control the inclinations of the faces of the crystal, provided only that the axes $X\ Y\ Z$ thus taken be lines of crystallographic significance, such as lines parallel to edges formed by faces of the crystal; while the ratios $a : b : c$ represent the intercepts on those axes taken in the order $X\ Y\ Z$ of a fourth face of the crystal and are the numerators, while letters such as $h\ k\ l$ stand for the numerical denominators in the fractions that represent the ratios of the intercepts of any other fifth plane of the crystal. Any three numbers in the ratios $a : b : c$ represent the intercepts on the axes of the fourth or standard plane, and are called the *parameters* of the crystal; one parameter in particular being generally taken as unity. The numbers by which the parameters have to be divided in order to assign the ratios of the intercepts to any fifth plane of the system, namely, the simplest numbers expressive of the ratios $h : k : l$, are called the *indices* of that plane; and when these indices are united into what is termed the *symbol* of the plane, by being written in brackets as $(h\ k\ l)$, (3 2 1), &c., one understands by this that

$\frac{a}{h} : \frac{b}{k} : \frac{c}{l}$ represent the ratios of the intercepts of the plane ($h\,k\,l$), and $\frac{a}{3} : \frac{b}{2} : \frac{c}{1}$ those of the plane (3 2 1). Where either of these values h, k, or l becomes zero, this would represent an intercept indefinitely great upon the axis to which it refers, since the algebraic value of a quantity of the form $\frac{m}{0}$ is infinity. Referring again to the original zone on the crystal of barytes, we see that the face, the trace of which on the zone plane was taken for the axis of Z, will nowhere intersect with that axis, so that its index for the axis of Z becomes 0, and similarly for the plane parallel to the axis X. In like manner if an axis Y perpendicular to the zone plane representing the profile of the zone of barytes had been taken for a second axis, all the planes of that barytes zone would have been parallel to that axis Y, which is in fact its *zone axis*, being parallel to the edges of the zone, and the index with respect to that axis would for each plane of the zone have been 0. Thus, taking our indices in the order corresponding to that of the axes $X\,Y\,Z$, we can now say that the plane, the trace of which gave us our axis of Z, would have for its symbol (n 0 0), where n was any whole number, or rather, since we may divide the whole symbol by n without altering the ratio, (100). So, the plane the trace of which gave us the direction for the axis of X would be (001); the standard plane that gave the parameters a and c, having for its intercepts the values $\frac{a}{1} : \frac{c}{1}$, would be represented by the symbol (101), while the other two planes would receive the symbols (201) and (502).

Since all planes on a crystal must intersect if continued far enough with all three or with only two, or finally with only one of the axes, they may be considered as falling into one or other of three groups: such, namely, as have three whole numbers in their symbol; such as have one zero in their symbol (the zero corresponding to the axis with which they do not intersect); and such, thirdly, as have two zeros with unity for their indices.

Passing from a system with rectangular axes, the lecturer next considered the general case of an axial system in which the axes might be oblique to each other. In pointing out that the three planes which contain these axes, namely, the planes $X\,Y$, $Y\,Z$, $Z\,X$, divided the space around the point in which they and the axes intersected into eight divisions or octants, he proceeded to designate the position of a point situate anywhere in space by the Cartesian method of co-ordinates. The point O of intersection of the axes being called the origin, and positions to the right, above, or in front of it, being considered as positive; those to the left, to the rear, and below it, as negative, it becomes possible, by means of lines parallel to the axes projected from the point, to determine its position in either octant. Then taking two planes in a zone which intersected with all three of the axes, such as two planes (111) and (321), the lecturer showed, by a representation in a model, how the edge in which these two planes intersected could have its direction determined by making it parallel to the diagonal of a parallelepiped the sides of which would represent the co-ordinates of any point in that line, in the ratios of $u\,a : v\,b : w\,c$, where u, v, and w represented values which the lecturer proceeded to educe from the symbols of the faces. For this purpose he represented the planes by two equations or expressions involving the ratios of the co-ordinates of any point in the plane, in terms of the parameters of the crystals and the indices of the planes.

Then, by a familiar algebraic method, he obtained an expression for the relations between the co-ordinates for any point in the line in which the planes intersected. The expression thus obtained gave a symbol for the edge in the form of the *determinant* of the indices of the two planes: thus a symbol [U V W], included in square braces, representing the edge formed by the planes ($e\,f\,g$) and ($h\,k\,l$), had for the values of its indices—

$$U = f\,l - g\,k$$
$$V = g\,h - e\,l$$
$$W = e\,k - f\,h$$

and the lecturer proceeded to show that any third plane with the indices $p\,q\,r$ belonging to the zone [U V W] must fulfil the condition—

$$p\,U + q\,V + v\,W = 0$$

and furthermore, that if two zones had a plane in common, the symbol of that plane is found by taking the determinant of the symbols of the zones.

The next subject treated of had reference to the various means which geometry offers for a more convenient treatment and representation of the different zones of a crystal, than that of making an elaborate drawing of its edges. Of these, the method of referring the planes of a system to a sphere by means of their normals was shown to possess great simplicity. A sphere being conceived as described around the point, or *origin*, in which the axes cross one another as a centre, lines drawn from that point perpendicular to each plane of the crystal—the *normals* to these planes—are continued till they penetrate the surface of the sphere in points that will be called the *poles* of the planes, the symbol for a pole being identical with that for the plane to which it belongs. The poles of a zone of planes will thus be distributed along the arc of a great circle of the sphere, its *zone circle*. Hence the discussion of the inclinations of the planes of a crystal, and so, many of the chief problems of crystallography, becomes reduced to their treatment by spherical trigonometry; and what has further rendered this mode of considering the relations of the planes of a crystal especially advantageous has been the means which the principles of the projection of the sphere afford us of graphically representing within the circumference of a circle the poles corresponding to all the faces, however numerous, that any single crystal or that all the different crystals of a substance may present, while the symmetry which they obey in their distribution is seen at a glance. The stereographic projection employed in Prof. Miller's system for this purpose affords by its simplicity, its ready application, and the important geometrical principles which it possesses, by far the most practical, and with a little experience in the student, much the most intelligible representation of even the most complex forms of crystallography.

The characteristics of the stereographic projection were exhibited in a small working model, in which it was shown that the eye, supposed to be placed at a point on the sphere of projection, would see the arcs of circles on the opposite hemisphere as though projected on a plane screen passing through the centre of the sphere and intersecting with its surface in a great circle, *the circle of projection*, at the pole of which the eye was situate; such arcs of circles on the sphere were shown to be projected as arcs that themselves were circular, and the method of finding the centres for these projected arcs, and again the mode of determining the value of an arc on the projected circle by drawing lines from a projected pole of that circle to the circle of projection, so as to intercept the required arc upon the latter circle, were illustrated in the case of arcs upon the model.

The next subject taken up by the lecturer was in the form of a digression in which he treated of the relations of the parts into which a line was divided by four points, two of which might be supposed to be stationary, while the two others assume different positions on the line. First the harmonic and then the anharmonic division of such a line was discussed; and from this, the lecturer passed to the consideration of the harmonic and the anharmonic division of an angle, contained by two and divided by two other lines; and he showed, firstly, that when two lines out of four passing through the same point are perpendicular, and one of these bisects the angle formed by the remaining two lines, the sines of the angles taken in the proper order are in the harmonic ratio. Another point illustrated was that a sheaf of four lines presents the same anharmonic ratios of their sines as does a sheaf of four lines severally perpendicular to them. Reverting to the subject of the traces of the faces of a zone on their own zone plane, it was now seen that we can discuss the subject of relations of any four planes in the zone by considering those of their normals the angles between which are measured on a great circle of the sphere. But it remains to obtain an expression that shall connect these angles with the symbols of the poles or faces of the zone. Such an expression obtained by Prof. Miller in the first case involves a relation of the simplest kind. In short, the anharmonic ratio of four planes is the ratio which we obtain directly from the determinants of the symbols for the four planes. Since, however, the symbols for a zone as obtained from the symbols of different pairs of faces of the zone may, and generally do, differ by a common factor, it is advisable to put the expression for the anharmonic ratios of four tantozonal planes under the form of a convenient symbol given them by V. von Lang, viz., for the four planes $PQRS$:—

$$\left[\frac{PQ}{QR}\right] : \left[\frac{PS}{SR}\right] = \frac{\sin PQ}{\sin(PR-PQ)} : \frac{\sin PS}{\sin(PR-PS)} = \frac{m}{n}$$

where the letters on the left side of the expression stand for the symbols of the planes of which the determinants are to be taken. This very important expression offers the means of determining one unknown symbol or one unknown angle among those belonging to the four planes; another result that flows from it is the necessity for the anharmonic ratios of four planes in the zone, *i.e.* the magnitudes m and n, being always rational if the planes belong to a crystal. And this is another and more general way of stating the fundamental crystallographic law, that of the rationality of indices.

Prof. Maskelyne next proceeded to discuss some of the further results deducible from this great law. Firstly, since the harmonic ratio of four planes brings those planes under the requisite condition of rationality, we can say of any zone in which two of the planes are perpendicular to each other, that for any third plane of the zone inclined on one of them at an angle ϕ, a fourth plane may also exist as a possible plane of the zone, also inclined on the first plane at the angle ϕ; and further, the professor went on to state that if we ask the question what are the conditions for three consecutive planes in a crystal zone to include the same angle ϕ, we find for answer that only in those cases is this possible where cos. ϕ is rational, and that this is only so where ϕ possesses one of the values 90°, 60°, 45°, and 30°.

After a review of the results thus far obtained, the professor entered upon the subject of symmetry, and defining the different varieties of geometrical symmetry; such as, firstly, the symmetry of a plane figure to a centre of symmetry, to one or to several lines of symmetry, or to a pivot of symmetry; and secondly, that of a solid figure to a centre of symmetry, to one or to several planes of symmetry, and to one or to several axes of symmetry: he defined certain terms which would be found useful in the discussion of the symmetry of crystals. Thus, a plane figure was *enthy-symmetrically* divided by a single line of symmetry or *ortho-symmetrically* divided by two lines of symmetry perpendicular to each other; while an axis of, for instance, hexagonal symmetry became one of di-hexagonal symmetry, where each repeated element of form is itself doubled, as by reflection, on a plane of symmetry.

In applying the principles of geometrical symmetry to crystals, it was shown that the best and simplest method was that of dealing with the distribution of their poles on the sphere of projection.

The condition requisite for a single plane of symmetry to exist upon a crystal was then shown to be that this plane should be at once a zone plane and a possible face of the crystal. On the other hand, for a crystal to be symmetrical to a centre, no particular condition was requisite, since the direction and not the requisite position of a crystal plane has been seen to be the important point regarding it, while again every plane passing through the origin may be represented by the symbol of either of its poles indifferently. Now, an axial system as previously defined involves five variable quantities; namely, the three angles between the axes:

ξ, the angle YZ
η, the angle ZX
ζ, the angle XY

and the two ratios involved in the parameters, namely, $\frac{a}{b}$ and $\frac{c}{b}$.

Hence, for a crystal to be centro-symmetrical, all these five quantities may vary from one substance to another. If, however, the crystal system be divided symmetrically by a plane, two of these axial elements are absorbed in satisfying the two requisite conditions of that plane being at once a crystal face and a zone-plane.

A crystal system that is simply centro-symmetrical presents the kind of symmetry characteristic of what is called the Anorthic system of crystallography; a crystal that obeys the principle of symmetry to a single plane belongs to the Oblique or Clinorhombic system.

(*To be continued.*)

TWO REMARKABLE STONE IMPLEMENTS FROM THE UNITED STATES

THE similarity of stone implements, both modern and prehistoric, that obtains throughout the world, has been commented upon so frequently as scarcely to need further illustration. Within a few days, however, I have found two forms of arrow and javelin points that are so unusual in their shapes, and otherwise of interest,

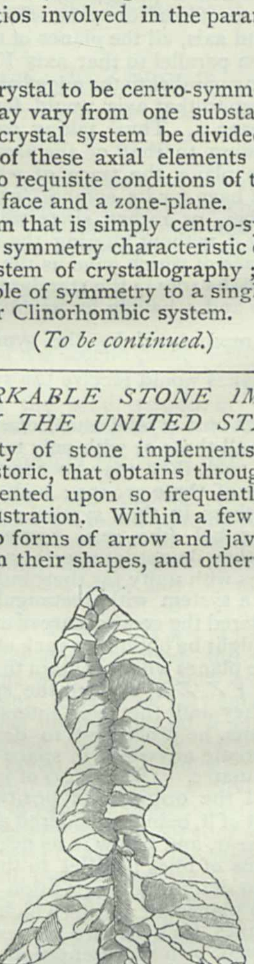

Fig. 1.—(Natural size.)

that I believe drawings of the two, and a brief note concerning them, will be welcomed by archæologists.

Fig. 1 represents a "flame-shaped" arrow-point, as this shape has been well called by Mr. E. B. Tylor (*vide* "Anahuac," by E. B. Tylor, p. 96, Fig. 1). Although I have collected fully ten thousand specimens of "Indian relics" from the immediate neighbourhood of Trenton, New Jersey, U.S.A., of which a very large proportion were spear and arrow heads, I have not been able before to duplicate this form, or to find any unmistakable trace of it in the bushels of fragments that here cover the ground in some places. This arrow-head, accompanied by the javelin (Fig. 2) and several of the leaf-shaped pattern, was found in a fresh-water shell-heap on the bank of Watson's Creek, Mercer Co., N. J. The peculiar interest attaching to this "flame-shaped" specimen is, I consider, two-fold. First, the form is one hitherto known only as Mexican—at least, in the works on Stone Implements of which I have knowledge there is no illustration of a similar specimen; and secondly, while possibly this specimen may have been brought from Mexico, through the system of barter so extensively carried on by the aborigines—(I have found fragments of obsidian arrow-points in New Jersey, the material of which, if not the finished weapons, must have come from Mexico)—it seems more probable that it was fashioned in this neighbourhood, and being found, it may be, of an unde-

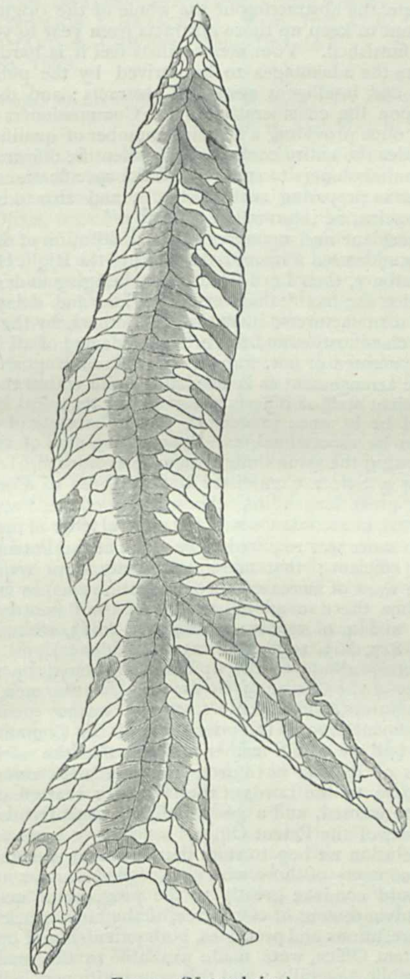

FIG. 2.—(Natural size.)

sirable shape (Mr. Tylor does not state if this pattern was common or rare in Mexico), was not adopted as one of the many forms given to this class of weapons. If my supposition is correct, then the specimen is a good example of the production of a similar style of weapons in distant quarters of the globe.

The mineral, both of this specimen and that which is represented by Fig. 2, is a dull bluish-white hornstone, very similar in general appearance to the European flint. The smaller specimen measures two and a quarter inches in length. It is noticeably thin, and remarkable for the small size and irregular outlines of the flakes. This irregular flaking off of the mineral under the blows of the hammer-stones is due to the "impure" character of the mineral, there being thread-like veins of brittle silex (?) enclosing minute pebbles extending through the mass in every direction, and these appear to have checked the flakes and caused their jagged irregular outlines.

Fig. 2 represents a remarkable javelin head made of the same material as the preceding, and having, but in a less degree, the "flame-shape" of the smaller specimen. The character of the workmanship indicates, I think, that the same aborigine chipped them both. Like the other, this spear-head is very thin and "irregularly" flaked. In the shell-heap in which these were found, as far as we have examined it, there was nothing else that differed from the ordinary "finds" and contents of aboriginal graves, being simply leaf-shaped arrow-heads, grooved stone axes, a corn-crusher and basin ("Querns," *vide* Evans' "Stone Implements of G. B.," p. 233), and a polished celt.

CHAS. C. ABBOTT

Trenton, New Jersey, U.S.

PROTECTION FOR INVENTIONS

WE stated in our leading article of the 24th ult. on this subject, that in the course of the discussion at the Society of Arts, Col. Strange had mentioned that the Patent Commissioners requested the Royal Society some time ago to nominate one of three eminent men of science who should perform the herculean task of infusing scientific order into the Patent Office, but without salary.

The Society of Arts, in their journal of the 25th ult., have very properly published correspondence which fully establishes the correctness of a statement which otherwise might well be thought incredible. The subject of niggardliness to scientific men is so important, not merely to the men themselves, but more still to the progress of knowledge, and therefore to the interests of the whole community, that we feel bound to republish this correspondence. We must, of course, regret to animadvert on the acts of the late Lord Romilly, who is no longer amongst us to justify them; but the public duty must still be performed, and as his lordship wrote as the spokesman of his colleagues, they can at any rate defend, if they can, what at present seems indefensible.

In Lord Romilly's letter the proposed duties of these unpaid men of science are enumerated: they are to "superintend the general management of the Patent Office, to see that the indexes and abstracts of the specifications are made accurate and complete, and to redress the other defects complained of."

We here see precisely what sort of work four highly salaried lawyers considered men as eminent in science as they in law might with perfect justice be expected to execute for nothing, namely, a combination of hard routine drudgery with the most delicate discrimination in questions extending over the whole range of scientific knowledge. It is true that their labours were to be lightened by the invaluable privilege of "acting in conjunction with the Lord Chancellor and the Master of the Rolls, and of referring to them" whenever the occasion of too tough a problem might require it. In plain English, the men of science were to do all the work of the Patent Office gratuitously, but in the name of these highly-paid lawyers, who notoriously do none of it, but who would thus pocket both the credit and the substantial reward.

If this had been an isolated example of the assessment of scientific work in England, we should hardly have cared to draw attention to it for the mere sake of denouncing exceptional narrowness of view and selfish injustice. It is because the example is typical that we assist Col. Strange and the Society of Arts in exposing it. The best proof of the prevalence of the same spirit is afforded us by some evidence volunteered by the Marquis of Salisbury before the Duke of Devonshire's Science Commission. His lordship observed that "Government departments have got an idea into their heads—I do not know why—that scientific opinions differ in this from medical and legal opinions, that they have a right to have them gratuitously. I have never been able to understand on what grounds that theory rests; and my belief is, that if you would assimilate scientific knowledge to medical and legal knowledge in that respect, you could always get, for a proper remuneration, the very best scientific opinion that the country is able to furnish. You cannot expect that you should be able to make upon a man, every moment of whose time is occupied, a demand involving his time for hours or days of research, if you are not prepared to behave to him as you would to a lawyer in a similar case."

There is no reason to suppose that, though these observations reflect with severity upon the Patent Commissioners' proposal, Lord Salisbury had that case in view when he made them. He was no doubt giving the result of his wide experience as a statesman and departmental chief, and it is a comfort to know that in the present Cabinet there is at least one man competent to assign its true value to scientific work, and bold enough to insist that that value shall be given. It will be perceived that Lord Salisbury hints that the departments are not, and cannot be expected to be, supplied with "the best scientific opinion," because it is not properly paid for. He therefore urges liberality to men of science, as we have always done, strictly on the ground of public policy. An instance in point recently came to our knowledge where a department asked one of our most eminent physicists for an opinion on a meteorological question, but the correspondence was abruptly closed on his venturing to inquire what would be his remuneration for preparing a laborious and difficult report.

Foreign nations are now teaching us that it is time short-sighted parsimony like this came to an end, and that the sooner men in authority are "prepared," as the Patent Commissioners phrase it, to pay handsomely for the most fruitful work of which man is capable, the better for the country.

It must not be overlooked that at the time this preposterous proposal was made by the Patent Commissioners two of their own number were the recipients of 5,000*l.* or 6,000*l.* a year, paid out of the Patent fees, for which they rendered, and could render, for want of the requisite knowledge, absolutely no service to the Patent system, and that the surplus income of the office was about 90,000*l.* per annum.

The following is a copy of the correspondence referred to by Col. Strange in his remarks during the discussion, as having taken place on the subject of appointing unpaid Commissioners of Patents :—

(*Copy of the Memorial.*)

To the Right Hon. the Lord Romilly, Master of the Rolls.

My Lord,—The great use of patents is to make known the inventions, processes, and secrets of others. It is therefore highly important that the mass of information accumulated at the Patent Office should be made available, so as to make known as far as possible all inventions and modes of manufacture for the benefit of the country. The advantage of so doing would be immense, and would help to keep the manufactures of this country in advance of others. Action in this direction on the part of the authorities has been prayed for in every memorial that has been presented.

One of the first memorials was presented by the Institution of Mechanical Engineers, with Mr. Robert Stephenson as president at its head. This was presented in 1853 to the Right Honourable Frederick Lord Chelmsford, Lord High Chancellor of Great Britain, the Right Honourable Sir John Romilly, Master of the Rolls, Sir Fitzroy Kelly, her Majesty's Attorney-General, and Sir Hugh McCalmont Cairns, her Majesty's Solicitor-General; and prayed for greater facilities being given to persons making inquiries in any branch of knowledge at the Patent Office.

The second memorial in 1862 was presented to the Right Honourable Sir John Romilly. It prayed amongst other things for "a building as an office for patents, including in it a complete library, a commodious reading-room, and suitable offices for a proper staff of clerks and others to prepare well-digested and numerous abstracts and abridgments of inventions and processes, made public either by the specifications of patents or otherwise, and whether English or foreign."

A third memorial was presented to Sir John Romilly in 1864. It prayed not only that the efficiency of the office should be increased, but called the attention of the Commissioners to recent reductions in the staff and its disorganised state; which staff was "utterly inadequate to satisfy the requirements of persons seeking information among the very numerous works contained there." The memorialists went on to state that "they had entertained the hope that, so far from a reduction being made, there would have been an increase ordered to such an extent as would have enabled the abridgments of the specifications in the various branches of art (which abridgments were commenced about seven years ago) to be pushed vigorously forward, so as to complete the abstracting of the whole of the original specifications, and to keep up those abstracts from year to year as new matter is furnished. Your memorialists feel it is hardly possible to overrate the advantages to be derived by the public from a complete and intelligent system of abstracts; and they venture to urge upon the consideration of the Commissioners the necessity of at once providing a sufficient number of qualified persons (to be under the entire control of the scientific officer appointed by the Commissioners to superintend the specifications) to assist that officer in preparing such abstracts, and also to collect and epitomise scientific information generally."

The president and members of the Institution of Mechanical Engineers addressed a memorial in 1864 to the Right Honourable Lord Westbury, then Lord Chancellor, bringing under his lordship's notice the fact "that very great loss and delay are occasioned to manufacturers, inventors, and others, by the want of a complete classification and the prompt indexing of all inventions, whether patented or not, foreign as well as English. Such a systematic arrangement as is needed is quite within the compass of an efficient staff of officers possessed of technical knowledge, and could be at once proceeded with; the state of inventions could then be ascertained, and the common case of several persons patenting the same thing would be avoided."

In 1864 a Select Committee of the House of Commons inquired at great length into the working of the Patent Office; and reported, in accordance with the general tenor of the evidence, that much more was required to be done at the Patent Office to render it efficient; that more attendants were required, and "that the want of increased accommodation was so much felt as to prejudice the due administration of the Patent-law" (paragraphs 3 and 4 of report; answers 10 to 13, 18 to 21, 658 to 662, 667, 817, 863, 1038, and 1039 of evidence).

We merely allude to the opinions expressed by the Select Committee of the House of Commons, scientific men, manufacturers, engineers, and inventors, as the various memorials and other documents are in the possession of the Commissioners of Patents; but we would further mention that the various Commissioners of Patents have from the year 1858 reported from time to time to the Lords of the Treasury that great improvements were wanted, and a good building urgently required for the purposes of the Patent Office.

In conclusion we beg to state that it is our decided opinion, and that of many of those who have signed various memorials, that it would conduce greatly to the progress of manufactures and the advancement of commerce, if the large stock of knowledge of inventions and processes, both patented and open, stored at the Patent Office, were made available to the manufacturers and the public generally; and this your petitioners believe would best be compassed if her Majesty were graciously pleased to appoint that "other person as Commissioner of Patents," as contemplated by the Patent-law Amendment Act of 1852, and if the staff at the Patent Office were augmented by the addition of a sufficient number of persons, possessed of good technical knowledge, and well able to abstract all specifications as they came in daily, so that they might at once be entered into an efficient Subject-matter Index, which would give a true indication of what was in the specifications. In addition to this of course the large number of specifications already at the office would require to be abstracted and entered in a similar manner in a new edition of subject-matter indexes, that would really indicate what was contained in each specification, which the present indexes do not. Further, we beg to urge that similar subject-matter indexes be formed of all inventions and processes comprised in the very numerous indexes and tables of contents of the scientific books contained in the excellent scientific and technical library of the Patent Office, so that any person using due diligence might easily learn with tolerable certainty whether an invention were new or old, which is not now the case.

We beg to append a sample page of such two subject-matter indexes as we would submit are urgently required. It is almost superfluous to mention that there are now several hundred thousands of pounds accumulated surplus, and an annual surplus of about sixty thousand pounds, contributed by the very class of persons who would benefit by such improved indexes.

L. L. DILLWYN, M.P.
RICHARD BAGGALLAY, M.P.
CHARLES FOX, Mem. Inst. C.E.
CHARLES HUTTON GREGORY, President Inst. C.E.
EDWARD WOODS, Mem. Inst. C.E.
C. WILLIAM SIEMENS, Mem. Inst. C.E., F.R.S.
ROBERT MALLET, Mem. Inst. C.E., F.R.S.
FREDERICK J. BRAMWELL, Mem. Inst. C.E. Council.
EDWARD A. COWPER, Mem. Inst. C.E.

20th March, 1868.

(*Copy of Reply of the Master of the Rolls to Mr. Dillwyn.*)

Rolls, 31st March, 1868.

Sir,—I transmitted to the Lord Chancellor the memorial presented to me on the 20th March instant by yourself and the gentlemen who accompanied you, relative to the present state of the Patent Office, together with my views on the subject; and we have since considered the matter in consultation together.

The result of this is that we are prepared to recommend to her Majesty's Government that three gentlemen should be appointed to act as Commissioners of Patents together with the Lord Chancellor and the Master of the Rolls for the time being —one to represent mechanical science, another to represent chemical science, and a third to represent the subjects more usually and more especially comprised in the term "Natural Philosophy." We should propose that the gentlemen to be recommended to her Majesty for this purpose should be, as regards the first, from gentlemen to be nominated by the Society of Mechanical Engineers; as regards the second, from gentlemen to be nominated by the Chemical Society; and as regards the third, from gentlemen to be nominated by the Council of the Royal Society. But we are not prepared to recommend that any salary should be attached to the services of these gentlemen. We trust and believe that gentlemen fully competent for the purpose may be found who have sufficient leisure, and who, from their love of science and their desire to disseminate more widely the discoveries made in these branches of science, would be willing to give their services without remuneration, and to superintend the general management of the Patent Office, to see that the indexes and abstracts of the specifications are made accurate and complete, and to redress the other defects complained of in your memorial, acting in all these respects in conjunction with the Lord Chancellor and the Master of the Rolls, to whom they would refer whenever the occasion might re quire it.

I think it, however, desirable to repeat that, on fully considering the subject, both the Lord Chancellor and myself have arrived at the same conclusion, that it would be inexpedient to create either one or more salaried officers for this purpose; and to say that we should both, if applied to, recommend her Majesty's Government not to accede to that part of the views of the gentlemen who composed the deputation, which had relation to the creation of paid officers. ROMILLY.

L. L. Dillwyn, Esq., M.P.

FRANCIS KIERNAN, F.R.S.

WE have to record the death, on Dec. 31st last, of Mr. Francis Kiernan, whose discoveries in connection with the structure of and circulation through the liver, published in the Philosophical Transactions of the Royal Society, and separately in a work entitled "Anatomical Researches on the Structure of the Liver," are so well known to all physiologists and histologists.

Mr. Kiernan was born in Ireland on October 2nd, 1800. His father was a member of the medical profession, who came to this country during his son's younger days. The son was educated at the Roman Catholic College at Ware, in Hertfordshire, and received his medical training at St. Bartholomew's Hospital, where, as a student, he gave signs of marked ability, devoting all his energies to the study of anatomy. In 1825 he obtained the membership of the College of Surgeons, and the Fellowship in 1843. In 1834 he was elected a Fellow of the Royal Society, subsequently receiving the Copley Medal·

Mr. Kiernan was amongst those most actively engaged in the establishment of the University of London, of the Senate of which institution, on its incorporation in 1837, he became a member, and subsequently a frequent examiner in his special subjects. He was never married. In 1865 he was seized with a paralytic stroke, from the effects of which he never fully recovered.

The investigations of Mr. Kiernan on the liver, together with those of Mr. Bowman on the kidney, will be always looked back to by biologists as the first-fruits of the introduction to natural science of the microscope in its modern form. Unlike many such productions, however, they have both fully stood the test of time.

THE RECENT THAW

THE thaw of January 1, 1875, happened almost simultaneously in Paris and London, and the phenomenon having been observed in both cities, it is possible to come to a definite conclusion concerning many similar occurrences.

The exact hour of the change in Paris may be stated to have been nine o'clock in the evening. If we suppose it was four o'clock in London, we see that five hours were a sufficient space of time for the gale to run the distance between both cities—about 300 miles.

Telegraphic warnings had been sent from London to the Paris Observatory, but were of little practical use, for want of proper means to disseminate the intelligence: otherwise, many inconveniences which were experienced by the Parisians, surprised by the falling of sleety snow, would have been avoided.

This remarkable occurrence may be referred to as affording strong evidence in favour of extending and popularising in both countries the use of weather telegrams. But I think it may be useful to try to draw from these circumstances some other conclusions.

In January 1871 I inquired of M. Buys Ballot, now the president of the Utrecht Meteorological Office, if he could tell me how to foresee if winds were likely to take a favourable course for ballooning from Lille to besieged Paris. I was told by the learned meteorologist to look at the upper clouds, as any real change must of necessity take place in the upper strata of the atmosphere, and descend gradually to the earth.

Unfortunately these upper clouds were for days and days running from the south, and the opportunity of trying an ascent was lost. Before the sudden thaw of the 24th of December, as well as before the 1st of January, I saw other clouds taking distinctly the same northern course. It seemed to me that the motion of the upper strata was communicated gradually to the air in closer proximity to the earth, and that the meteorological revolution of the 1st of January was preceded by a great change produced in higher regions through some unknown cause.

My conclusion seems to me to be supported by the fact that the air was obscured by vapours before the thaw actually took place. The sun lost apparently almost all his warming power, as the difference between *minima* and *maxima* read at the Observatory of Paris at the end of the cold periods amounted to a very few centesimal degrees—three or four only; clear air and hot sun being, if the theory is supported by facts, an evidence that cold weather is to last for a long period. It seems that the upper current is produced by cold and dry air coming from the north and pushed southwards.

It would be interesting to submit the theory to the test of systematic ascents, in order to inquire into the condition of the upper winds, and to measure their deflection or velocity, or their dimensions either in vertical or in horizontal directions.

Some of the readers of NATURE may possibly feel inclined to help me in working out these suggestions practically, or at least to ascertain if they are justified by facts as far as can be ascertained without travelling in the air. W. DE FONVIELLE

EARTHQUAKES IN THE PHILIPPINE ISLANDS

A CORRESPONDENCE from Manila, dated Oct. 17-18, gives the following notice of earthquakes occurring there and in the neighbourhood on Oct. 16, which may be of interest to some readers of NATURE :—

Manila.

10.12 A.M.—Hard shock; duration about 1 min.; general direction from E.—W., but moving from S.E.—N.W. to N.E.—S.W.

10.15 A.M.—E. 25° N.—W. 25° S.; duration 5 sec.; rotation from E.—N.

10.20 A.M. till 10.15 P.M.—Thirty-seven other light shocks, *i.e.* in the whole thirty-nine shocks in twelve hours.

The interval of these shocks became at last greater and greater in the following order :—

10.20 A.M.	11.20 A.M.	12.2 P.M.	12.55 P.M.
10.25 „	11.23 „	12.19 „	1.9 „
10.30 „	11.26 „	12.20 „	1.52 „
10.40 „	11.31 „	12.22 „	2.40 „
10.43 „	11.34 „	12.24 „	4.2 „
10.46 „	11.41 „	12.31 „	6.25 „
10.50 „	11.44 „	12.42 „	8.15 „
10.51 „	11.46 „	12.45 „	9.15 „
11.12 „	11.58 „	12.50 „	10.15 „
11.15 „			

Bulacan.

10.8 A.M.—Hard shock.
10.11 A.M. till 1 P.M.—Lighter shocks.

Pampanga.

10.13 A.M.—N.W.—S.E. Hard shock; duration 50 sec.
10.21 A.M.—Duration 20 sec.
12.30 P.M.—Light shock.

Pangasinan.

10.25 A.M.—S.E.—N.W. Duration 26 sec; light shock.

Cavite.

10.11 A.M.—Light shock.
10.45 A.M.—Light shock.
12.13 P.M.—Light shock.

Batangas.

10.2 A.M.—E.—W. Two shocks, of 10 sec. and 7 sec. duration.

Laguna.

Light shock; 2 sec. duration.

Royal Natural Hist. Museum, Dresden, Dec. 25 A. B. MEYER

THE TRANSIT OF VENUS

THE following telegrams have been received during the past week :—

From Prof. Peters, *viâ* Wellington, New Zealand :—

"Transit observation great success first contact; photographs, 237."

"*New York, Dec.* 31.—Intelligence has been received here from Honolulu, dated the 12th inst., respecting the observations of the Transit of Venus at that station. The atmospheric conditions were favourable for the observations; 150 measures of cusps and limbs and 60 photographs were obtained. A totally unexpected appearance was presented at the internal contact. The disc of the planet became visible as an entire circle some minutes before contact, and from then to the complete establishment no definite or sudden phase was observed. There was no black drop after the internal contact. Twenty out of sixty photographs came out blurred. Valuable results, however, were obtained. The first external contact occurred at 3h. 7m., and the first internal contact at two minutes later than the *British Nautical Almanack* stated. The revelation of the complete circle of the planet occurred before the actual internal contact, owing to the effulgence of the corona, the sun illuminating the whole surface of Venus before the complete immersion."

In connection with the news from Honolulu, an article in the *Times* of Tuesday says :—"The most remarkable part about it is that the observers evidently regarded as an 'unexpected appearance' a phenomenon similar to one observed and recorded in the former transits of 1761 and 1769. In the observations of Chappe d'Auteroche in the latter year, recorded by Cassini, a drawing is actually given of the horns of Venus visible beyond the edge of the sun, and it seems probable from the text that the planet was actually seen on the sun's chromosphere at the moment of egress."

Indeed, this phenomenon need not have caused any surprise if the conditions had been previously clearly understood. In reference to this point, some statements from the *Daily News* Thebes correspondent (Dec. 9) are worth quoting. In speaking of the commencement of the phenomenon the correspondent says Venus "appeared anything but a promising subject for the purpose at first. She seemed literally to dance about the face of the sun, and her limb was jagged like a saw. They both appeared elliptical in an almost extraordinary degree, owing of course to refraction, and they did not lose it entirely till they were at least 7° from the horizon. Gradually the limbs of both got more and more defined, till Venus looked like a small black pea resting on a luminous disc. The sun, however, still remained somewhat troublesome, particularly to the photographers, and it was not till just before internal contact that he was really steady. The atmosphere of Venus was distinctly seen at certain periods. It showed as a pale white circle round part of her edge, and was totally different to the brilliant sunlight. The general remark was that it reminded us of moonlight. This caused a certain difficulty in estimating the true time of contacts, and perhaps any small discrepancy in observation may be accounted for by this phenomenon. . . . There is one curious coincidence to note, and that is, that no one seemed to have observed the black drop which has been so much talked about; a faint haze was seen, and a few jets of black springing out from each side of the point of contact, but nothing more. Neither in the photographs did it show, which perhaps might have been expected. Certainly, the weather could not have been more favourable just at the critical time, though, curiously enough, immediately after, a haze came on, which would seriously have affected the results. Need I say that we are all thankful the observation has passed off so well, and if only the other stations to which expeditions have been sent are equally fortunate, the sun's distance ought to be definitely settled. I fully expect that the appearance of the faint line will give rise to a long discussion in the astronomical world. It will be very curious to note what other stations saw. At all events one thing is certain, and that is that our atmosphere must have been very clear, and also that of Venus; clouds in the planet must have intercepted the sunlight, and have prevented the formation of the luminous ring, or rather partial ring. At one time the whole planet, when it had half passed over the limb of the sun, was visible, reminding one of the dark part of the new moon on a clear night. I may say that the whole appearance of internal contact was quite unexpected, and the absence of the black drop puzzled every observer. External contact was observed, I hear, almost simultaneously by all observers, a point of the utmost importance when the degree of ellipticity of the planet has been determined from measurements of her diameter."

NOTES

THE Germans, we are glad to see, have finally decided to send out a second expedition to the east coast of Greenland. It is to consist of two steam-vessels, of 300 tons burden, each manned by thirty men; one to explore Greenland, while the other advances to the north pole. The estimated cost is about 50,000*l.* sterling, and the expedition is to leave in June 1875 or June 1876, according as the money can be got together. There is no hint that the German Government is to lend assistance, though we hope it will do something, after such a good example has been set by our own Government. It would be a splendid and healthy outlet for national rivalry to have these two expeditions start this year, each doing its best to win the Arctic campaign, and striving to be the first to unfurl its particular national flag over the long-fought-for goal. At all events, during the next two or three years we ought to hear of some fine conquests having been made in the far north. The preparations for our own expedition are steadily progressing. Commander Markham, R.N., arrived on Tuesday at Portsmouth.

ONE of the principal articles in this month's *Geographical Magazine* is on Lieut. Cameron's recent discoveries in the Tanganyika region. The writer justly rates Lieut. Cameron's work as of the highest importance, and we earnestly hope that the appeal of the Royal Geographical Society for subscriptions to enable Cameron to complete his work will be liberally responded to. Already 1,494*l.* have been subscribed, including 500*l.* from the Geographical Society; but of this, 544*l.* will be swallowed up by expenses already incurred, so that there is really only 950*l.* available. This, "it is confidently hoped, will be largely increased as soon as the people of England are fully aware of the necessities of their young countryman in the heart of Africa, and of the glorious work that he is bravely attempting to do, alone and single-handed."

DR. ALLCHIN will give the course of lectures on Comparative Anatomy and Zoology this session at University College, London, pending the appointment of a successor to the late Prof. Grant. The introductory lecture will be delivered to-day, at 4 P.M.

MR. BOWDLER SHARP, of the British Museum, delivered a lecture on "The Birds of our Globe," on Tuesday, January 5, in the private music-room at Mr. N. Holmes's residence, Primrose Hill. The lecturer, commencing with the "Accipitres," or birds of prey, gave a concise description of the various families and genera of birds, terminating, according to modern classification, with the "Struthiones," illustrating at the same time the different groups by an elaborate series of paintings specially prepared for the occasion by Herr Keulemans, the well-known ornithological artist.

WE have received a foretaste of the forthcoming new edition of the "Encyclopædia Britannica," in the shape of a separate reprint of Mr. A. R. Wallace's carefully written article on "Acclimatisation." After an examination of a considerable number of instances, Mr. Wallace concludes: "On the whole, we seem justified in concluding that, under favourable conditions, and with a proper adaptation of means to the end in view, men may become acclimatised with at least as much certainty and rapidity (counting by generations rather than by years) as any of the lower animals."

THE great hurricane which swept over Hong Kong on the 22nd and 23rd of September last, and to which we referred at length last week, appears, from official reports, to have caused considerable damage in the Government Gardens. Mr. Ford, the superintendent, reports that the largest trees suffered the most severely, several of the oldest and largest being entirely destroyed. Many other trees, although not destroyed, were severely damaged, having nearly the whole of their branches broken off, while many which were thus damaged, but which had not their roots broken or strained, will, in course of time, produce fresh branches and foliage. A considerable number of smaller trees and shrubs were entirely destroyed, having been broken off close to the ground, while others were blown over and a great portion of their roots so much exposed to air and light as to threaten their ultimate destruction. Operations were at once commenced for the preservation of as many of the trees and shrubs as there was any prospect of saving, and the greater part of them were replanted and protected by supports. The flower-pots containing plants in various parts of the gardens were broken in great numbers, and the plants for the most part much disfigured. In the nurseries, likewise, the plants in pots were thrown out, but no serious damage was effected. With regard to trees in different parts of the town, which come under the Forest Department of Hong Kong, Mr. Ford says: "I have observed that in nearly all cases where trees were blown down in the typhoon of September 1871, and those trees were again set upright and have continued to grow up to the late typhoon, they have again fallen, and in several cases are this time entirely destroyed; thus proving, as a general rule, that when once a tree suffers so severely as to cause its prostration, little reliance can be placed on that tree ever afterwards continuing or becoming a sound and healthy one." In the Surveyor-General's Report to the Colonial Secretary of Hong Kong on the damage caused by this hurricane, it is regretted that no record remains of the pressure of the wind, owing to the meteorological station connected with the Government Hospital being swept away by its force. It is further said, however: "That the island was not many miles distant from the focus of the cyclone is proved not only by the intensity of the wind, but by a feature known to exist only within such a focus, namely, the abrupt intervals of calm during the height of the gale. These lulls were instantaneous, often lasting as long as four or five minutes; and, alternating with the most violent gusts, equally sudden, the conjoint action of the two became, as it were, that of a battering ram."

MANY experiments have been tried in France to test the effects of cold on railway axles. Many engineers suppose that accidents to wheels do not result from any diminution of tenacity of the metal, but merely from its losing all its elasticity owing to the frost hardening the surface of the earth. A fact which can be adduced as a strong argument in favour of that theory was observed by the inhabitants of Montmartre during the last period of frost. The passing of the trains which run so frequently through the Batignolles tunnel at a distance of half a mile was heard by them day and night, which is never the case in ordinary circumstances. As soon as the thaw set in the trains ceased to be heard; the earth having resumed its former elasticity, the sounds were dissipated as before. It has been observed by French railway engineers that thaws are apt to lead to the breaking of axles and chains. The elasticity being only partially recovered, many shocks affect the trains when running at a fast rate, and are apt to lead to catastrophes.

MR. W. PHILLIPS, of Shrewsbury, proposes to publish, under the title of "Elvellacei Britannici," dried specimens of the larger ascomycetous fungi. To persons forming collections of our indigenous fungi, Mr. Phillips's fasciculi will be useful, since similar collections have hitherto principally comprised only the *Hymenomycetes*. Mr. Phillips will be assisted by various well-known mycologists, and he proposes to issue a very limited number of copies at twelve shillings each fasciculus of fifty species.

M. Amédée Guillemin has published through Hachette a very interesting work on Comets, profusely illustrated. All the modern theories are discussed, from Descartes to Schiaparelli, a number of traditions and stories connected with comets being also introduced.

We omitted to mention in last week's notice of the anniversary meeting of the French Academy the speech delivered by M. Dumas on De la Rive. It is a part of the duty of the perpetual secretaries to deliver such *éloges* at each anniversary meeting. That duty has been performed by each perpetual secretary from Fontenelle to our days, and the collection of these *éloges* is an important part of the Academical publications. M. Bertrand is at present engaged in preparing the *éloge* of M. Elie de Beaumont, which will be delivered in 1876.

A commission, nominated by the Geographical Society of Paris, and composed of Admiral Fluriot de Langle, MM. Delesse, Charles Grad, H. Farry, and Jules Girard, has just published some instructions to navigators to aid in their study of the physical geography of the sea. These instructions, which the Society sends gratuitously to everyone who is willing to turn to account, in the interest of science, his stay on board ship, point out, in a style sufficiently precise and elementary to come within the comprehension of all, the principal points on which observations should be made, and the best methods to be adopted for collecting useful particulars.

At St. Peter's College, Cambridge, on April 6, there will be an examination for a Natural Science Scholarship. The subjects of examination will be botany, chemistry and chemical physics, geology, and comparative anatomy and physiology. No candidate will be examined in more than two of the above-mentioned subjects. Applications to become candidates must be made on or before March 29 to the Rev. J. Porter, tutor of the College, who will give all necessary information.

By the death of Prof. William Macdonald, of St. Andrew's University, the chair known as that of "Civil and Natural History" becomes vacant. Dr. Macdonald held it for twenty-four years. The post has from the first been practically a sinecure, and almost seems to have been instituted for the sake of the professor. We wonder if the Senate of St. Andrew's will allow their University to be befooled by the appointment of a successor to Dr. Macdonald in this unique chair of "Civil and Natural History."

We are glad to see that it is intended to form a society at Watford, having for its object the investigation of the meteorology, geology, botany, and zoology (including entomology, ornithology, &c.) of the neighbourhood, and the dissemination amongst its members of information on natural history and microscopical science. The evening meetings of the society will be held (by permission) in the rooms of the Watford Public Library, and during the summer months field meetings will also be held. It is proposed that the annual subscription be ten shillings, without entrance fee. The names of ladies and gentlemen willing to join the society will be received by Dr. Brett, Watford House, by Mr. Arthur Cottam, St. John's Road, Watford, and by Mr. John Hopkinson, jun., Holly Bank, Watford. It is hoped that a sufficient number of names will be received within the next few days to warrant a meeting being called to found the society in the course of the present month.

The Institution of Civil Engineers seems to be one of the most prosperous of our scientific societies. On its books on Nov. 30, 1874, were 2,130 members; its income for the past year was upwards of 10,000*l.*, and its investments amount to nearly 33,000*l.*

A rare phenomenon, says the *Malta Times*, occurred in the forenoon of Monday, the 21st ult. During a strong wind from the south-west, which had prevailed for two days previously, the sea suddenly rose several feet and flooded the moles and roads surrounding the harbours, causing four or five steamers, moored between the Custom House and Calcara Rise, to snap their stern hawsers like packthreads, and carrying away boats that were hauled ashore in the French and other creeks. The sea then receded as suddenly as it rose, leaving portions of the bottom of the harbour exposed, upon which men and boys might be seen collecting fish and other marine animals that had been left aground by the retiring water. Shortly afterwards the sea resumed its ordinary level. Similar phenomena have been noticed occasionally during the course of many years.

M. W. de Fonvielle has published a small volume, "Le Mètre International définitif," giving an account of the determination of the metre and the negotiations relating to it from 1789 to 1874.

The *Daily News* of Monday has a letter from its correspondent on board the *Challenger*, giving a few details in addition to those contained in the recent *Times*' letter. From Hong Kong the ship was to return to Manila and other places, as far as New Guinea, then make for Yokohama, Japan.

There was a slight shock of earthquake at Malta on Friday last, at 1 P.M.

The additions to the Zoological Society's Gardens during the past week include two Razor-billed Curassows (*Mitua tuberosa*) and a Yarrell's Curassow (*Crax carunculata*) from South America, presented by Mrs. A. E. Nash; seven Golden Agoutis (*Dasyprocta aguti*), from Guiana; five Guira Cuckoos (*Guira piririgua*) from Parà; an Ani (*Crotophaga ani*), two Orinoco Geese (*Chenalopex jubata*), two Red-tailed Guans (*Ortalida ruficauda*), a Spotted Cavy (*Cœlogenys paça*), and a Collared Peccary (*Docotyles tajacu*), all from South America, purchased.

*THE PRESENT CONDITION OF THE ROYAL SOCIETY**

(*Extracted from the President's Address at the Anniversary Meeting.*)

Committee of Papers.—The strength of the Society being represented by its publications, the Committee of Papers is the one whose functions are unquestionably the highest and most onerous, as they are the most closely scrutinised by the Fellows and the public.

Every member of the Council is included in this committee, which meets after almost every Council meeting, and no part of its duties is at present performed by a sub-committee. It appears to me to be very doubtful whether this arrangement, even if the best, can last, owing to the greatly increased number of papers now communicated and their augmenting bulk, and to the value of their contents being less easily estimated as the subjects of scientific research become more specialised. As it is, in the majority of cases but few of the members present can judge of the merits of many of the papers; and it is not easy after a protracted Council meeting, and one occupied with promiscuous business, to fix the attention of a large committee upon subjects with which but few members present may be familiar. It is true that the committee is aided in all cases by the written opinions of careful and impartial referees, and by the special attainments of our secretaries, and that it is most desirable that the sometimes divergent opinions of these should be weighed by

* Continued from p. 178.

others as well as by experts in the subjects of the papers. But for all this a committee of the whole Council is not necessary; and though I should not be disposed to advocate a return to a system once pursued of resolving the committee into sub-committees charged with special subjects, I think it possible that some other plan may meet the difficulties of the case and relieve our overburdened Council of much labour. A possible plan for relieving both the Council and the committee, while securing as careful a scrutiny of the papers as we now have, would be a division of the labours of the committee, and an addition of extra members to its number, chosen from among the Fellows, who should continue in office throughout the session. This, or some plan of the kind, would have the advantage of engaging more of the Fellows than at present in the affairs of the Society; and I feel sure that so responsible a position as that of Extra member of the Committee of Papers would be accepted with pride by those Fellows who are most competent to discharge the duties.

It seems convenient to refer here to suggestions that have been made to me as to the expediency of breaking up our transactions or proceedings, or both, into sections devoted to physics and biology respectively, or even subdividing them still more. This separation has been advocated on the ground that science has become so specialised that no scientific man can grasp all its subdivisions, that the mixed publications are cumbersome and difficult to consult, and that private libraries are now overburdened with the publications of Societies, of each of which a small part would suffice for all their possessors' wants. There is no question that this, if now an evil, will soon become intolerable, for our publications increase rapidly in number of contributions and in their bulk. There are, however, so many considerations to be discussed before any system of relief can be adopted, that I confine myself to stating the subject as it has been urged upon me.

The Society's library now comprehends 36,270 volumes and 10,000 tracts, the most considerable collection of scientific works in the possession of any private body; and in respect of Transactions and Proceedings of scientific academies, societies, and institutions, I believe it is unrivalled among public bodies.

A complete Catalogue of the Scientific Books, MSS., and Letters, which I regret to say is unaccompanied by any historical or other information regarding the library, was printed in 1839. Another catalogue of the miscellaneous literature and letters was printed in 1841; and there is also a MSS. catalogue of maps, charts, engravings, and drawings, which number upwards of 5,000.

For some years past the Library Committee, indefatigable in steady endeavour, have greatly increased the value and efficiency of our library; and in 1873, previous to leaving old Burlington House for our present apartments, it ordered a rearrangement of the whole, and the preparation of a new catalogue, which is being proceeded with as fast as the current duties of the officers will permit.

In the mean time the Catalogue of Transactions and Journals is printed for working purposes, and will be added to until such time as the general catalogue is ready for press.

The collection of Oriental MSS. presented by Sir William Jones in 1792, and added to by his widow in 1797, was largely consulted by several of the distinguished foreigners who assembled at the Oriental Congress in London last September. From conversation with some of these gentlemen, I learnt that the collection contains many documents of the greatest value and rarity, together with some that are unique; and it may be worth the consideration of the Council, whether they would not be more useful if transferred to, or deposited in, the India Office or some other Oriental library, where they would be consulted to greater advantage than here. At present they occupy part of the room devoted to our archives.

The two most noteworthy additions to the library during the past year have been the MSS. on logic and mathematics of our late fellow Prof. Boole, presented by his widow; and Dr. Fayrer's collection of forty-seven original drawings of the poisonous snakes of India, which are of interest in connection with his and Dr. Brunton's experiments on snake-poisons, printed in our "Proceedings."

The apartments devoted to the library afford space for twenty years' addition at the present rate of increase; they are remarkably commodious; and those who assembled at our Soirée last spring and saw them for the first time lighted up and decorated will consider with me that they are not only a noble suite of apartments, but that they are in keeping with the purposes and the high position of the Society.

You are aware that the Council resolved that the Catalogue of Scientific Papers should be continued through the decade 1864-1873. This work is now progressing under direction of the Library Committee, who have had charge of the undertaking from the commencement. The necessary funds are granted by a vote of the Council, and we may hope, in the course of the coming year, that the seventh volume of this important work will be ready for publication; and we confidently trust that the Government will extend its liberality by printing this as it did the former volumes of the series. The total outlay upon the six volumes already published (which comprise papers published between 1800 and 1863) has been 8,936*l.* 12*s.*, of which 3,720*l.* 15*s.* 6*d.* (the cost of preparation) was defrayed by the Society, and the rest (the cost of printing, paper, and binding) by the Treasury; against which must be set the proceeds of sale, repaid to the Treasury in occasional amounts, the last within the present year, making a total amount of 1,000*l.*

The number of copies of the Society's Transactions distributed gratuitously to institutions and individuals not Fellows of the Society is now 209, and of the Proceedings 325.

House Committee.—The great labours of this committee in connection with the removal into the apartments we now occupy had not terminated at the beginning of the past session; and various matters have still to be attended to. That the arrangements the committee has made have given satisfaction to the Fellows at large has been amply acknowledged. We are, indeed, greatly indebted to them for the knowledge, experience, and time, all so freely given in our service, as also to the knowledge of our requirements and the practical views of our Assistant Secretary, upon whom fell the duty of suggesting the best disposition of the apartments throughout this large and commodious building. Lastly, I would beg your permission to record the services of the eminent architect, Mr. Barry, who has throughout shown the greatest regard to our position and requirements, and but for whose professional ability enlisted in our service we might have found ourselves as ill as we are now well accommodated.

Funds and Bequests.—The Donation Fund.—In 1828 our former President, Dr. Wollaston, invested 2,000*l.* in the Three per Cents for the creation of a fund, the dividends from which were to be expended liberally "from time to time in promoting experimental researches, or in rewarding those by whom such researches have been made, or in such other manner as shall appear to the President and Council for the time being most conducive to the interests of the Society in particular, or of science in general." There is no restriction as regards nationality: but members of Council are excluded from participation during their term of office.

To this fund many liberal additions were made. Mr. Davies Gilbert gave 1,000*l.*; Warburton, Hatchett, Guillemard, and Chantrey each contributed 100 guineas. From these gifts, and by accumulations, the fund in 1849 had increased to 5,293*l.* With subsequent contributions, and a bequest of 500*l.* by our eminent Fellow the late Sir Francis Ronalds, the total, as shown by the balance-sheet now in your hands, amounts to 5,816*l.* 1*s.* 1*d.* In addition to the balance-sheet already referred to, a detailed statement of grants from the Donation Fund is, in accordance with a resolution of Council, published with the Report of the Anniversary Meeting.

Sir Francis Ronalds died in 1873; his bequest (reduced by payment of legacy duty to 450*l.*) was made, as declared in his will, in recognition of the advantages he had derived when Honorary Director of the Observatory at Kew, from the sums granted to him out of the fund to aid him in the construction of his photographic apparatus for the registration of terrestrial magnetism, atmospheric electricity, and other meteorological phenomena.

Of the grants made during the past session, I would especially mention 100*l.* to Dr. Dohrn in support of the Stazione Zoologica at Naples, in which two British naturalists, Mr. Lankester and Mr. Balfour, have recently made a valuable series of observations on marine animals.

Among the others were a grant of 25*l.* to Dr. Carpenter for the purpose of constructing an apparatus to illustrate the theory of oceanic circulation in relation to temperature, and 50*l.* in aid of the Sub-Wealden Exploration. In reference to this last, I should remark that, in recognition of the important scientific results which have been obtained from the Sub-Wealden boring (which is now carried to a depth of 1,000 feet), and in view of obtaining further assistance from her Majesty's Government towards the work, the Council authorised me to lay before the Chancellor of the Exchequer such a statement as I should judge appropriate, with the object of obtaining a grant from the public purse in aid of the boring.

In pursuance of this resolution, I joined the Presidents of the Geological Society and of the Institution of Civil Engineers in presenting a memorial, which was most favourably received, and was answered by a promise on the part of the Treasury of 100*l*. for every 100 feet of boring that should be accomplished, down to a depth of 2,000 feet.

The Government Grant (of 1,000*l*. per annum) continues to be expended with satisfactory results. I must refer you to the report which will be published in our Proceedings for the statement of the grants, making, however, special allusion to Dr. Klein's work on the Anatomy of the Lymphatic System, towards which 100*l*. from this fund was granted, and by means of which copies have been distributed to the best advantage in this country and abroad.

The Scientific-Relief Fund slowly augments, and has been of the greatest service. It is almost unique among charities in costing nothing in the working, and in being inaccessible to direct or indirect canvassing. The amount hitherto expended in relief since its establishment has been 2,240*l*., extended to fifty-two individuals or families.

The Gilchrist Trust.—One of the most munificent bequests ever made in the interest of science is that of the late Dr. Borthwick Gilchrist, a retired Indian medical officer, well known as the author of the "Grammar of Hindostani."

Dr. Gilchrist was an intimate friend of Dr. Birkbeck, Joseph Hume, Sir John Bowring, and others of the advanced Liberals of fifty years ago, and took part in the establishment of the "London University," now University College. He died in 1841, leaving his large fortune to be devoted, after his wife's death, to "the benefit, advancement, and propagation of education and learning in every part of the world, as circumstances permit," the trustees having an "absolute and uncontrolled discretion" as to the mode of applying it. The income of the Trust, which is being gradually augmented by the sale of building-lots at Sydney, where Dr. Gilchrist had invested a considerable sum in the purchase of an estate with a view to its ultimate rather than its immediate productiveness, now amounts to about 4,000*l*. per annum. The trustees have created various scholarships for bringing young men of ability from India and the colonies to carry on their education in this country; and they have also given assistance to various educational institutions which they considered to have a claim for occasional help from the fund, such as the Working Men's College in London and the Edinburgh School of Arts; and they have instituted short courses of scientific lectures to working men in London, Manchester, Leeds, and Liverpool.

The trustees now desire to do something effectual for the *advancement* of learning; and a scheme—subsequently submitted to the Council of the Royal Society—was suggested by Dr. Carpenter, the secretary of the Trust, as one which seemed to him to be the most effectual for carrying out this object; and it was adopted by the trustees on his recommendation.

In a letter addressed to myself in June last, Dr. Carpenter informed your Council that the trustees of the fund had resolved to employ a portion of it in the promotion of scientific research, and empowered him to submit the following liberal proposal to the consideration of your Council: namely, the trustees propose annually to entertain the question of placing 1,000*l*. at the disposal of the Council of the Royal Society to be expended in grants to men of proved ability in scientific research, but who, from their limited pecuniary means, are precluded from prosecuting inquiries of great interest by the necessity of devoting to remunerative work the time they would wish to devote to such inquiries; the Council of the Society to undertake on their part to recommend to the trustees suitable subjects of inquiry, competent men circumstanced as indicated, and the sum to be assigned in each case. The trustees desire, further, that the grants should not be regarded as eleemosynary, but rather as studentships carrying with them scientific distinction, and not as rewards for past work, but as means for work to be done.

Upon this communication (in which you cannot fail to perceive not only an enlightened regard for the interests of science on the part of the trustees, but, on the part of their secretary, an accurate perception of the best means of supplying one of the greatest scientific needs), your Council appointed a committee to report on the proposal. Their labours are already concluded; the proposition has been accepted, but under stipulation for fulfilment of the following conditions by applicants for the grants:—

That the grants should be made for one year only in each case, though subject to renewal.

That the recipients be designated *Gilchrist Students* for the year in which the grants are made.

That no application for grants be received except it has been approved by the President and Council of any one of the six Societies—namely, the Royal, Astronomical, Chemical, Linnean, Geological, and Zoological; and that all applications be submitted to a committee, consisting of the Presidents of the six Societies together with the officers of the Royal Society, which committee shall recommend the applicants to the Gilchrist Trustees.

That a form of application be prepared setting forth the general objects of the Gilchrist Studentships, and the conditions upon which they are conferred.

That each student furnish, at the end of the year for which the grant is made, a report of his progress and results, signed by himself and countersigned by the President of the Society through which the application was transmitted.

Simple and acceptable as such a scheme appears, it may prove by no means always smooth in the working. It will be easy to find subjects, and candidates too; but the trustees must not expect in every case a full annual harvest for what they annually sow, or that some of the seed will not be productive of a crop of good intentions rather than good fruits. Putting aside all the temptations to procrastination that pre-payment fosters, there is the fact that every subject of scientific research presents a labyrinth in which the investigator may wander further and further from the main gallery, always following some tempting lateral track leading to discovery, but never either reaching the end of it or getting back to that which he set out to follow.

We must, however, hope for the best results from so munificent an endowment of scientific research, and watch with the deepest interest the progress of an experiment, the means for instituting which, after being urgently called for from the Government and our Universities, are now forthcoming from private resources.

The Wintringham Bequest.—Hitherto this curious bequest has, so far as the Society is concerned, proved alike profitless and troublesome, as will appear from a few particulars of its history.

Sir Clifton Wintringham, Bart., a Fellow and son of a Fellow of this Society, died at Hammersmith, January 10th, 1794, and bequeathed 1,200*l*. Three per Cent. Consols (payable twelve months after the decease of his wife) to the Royal Society, subject to the condition that within one month of the payment of the annual dividends in each year the President should fix on the subjects for three essays in Natural Philosophy or Chemistry, and submit them to the Society to be adopted by secret ballot. The subjects were then to be advertised in the papers of London, Paris, and the Hague: the essays were to be sent to the Royal Society within ten months of date of advertisement, each author to deliver ten copies; and the President and nine members of Council were to choose the best, and then to have made a silver cup of 30*l*. value, to be presented to the successful essayist on the last Thursday in December. In case of failure the dividends were to be paid to the treasurer of the Foundling Hospital.

Lady Wintringham died in 1805; but the Royal Society heard nothing of the bequest until 1839, when steps were taken to obtain possession of the fund. The Foundling Hospital put forward their claim; legal proceedings were taken, costs being paid out of accumulated dividends; and in 1842 the Royal Society were put in possession of the 1,200*l*. stock. Owing to the essential difficulties of carrying out the conditions of the testator's will, the dividends have ever since been paid to the Foundling Hospital.

The Council, desirous that those difficulties should be overcome, have at different times appointed a committee to examine the question and suggest, if possible, a solution; but no satisfactory conclusion has yet been arrived at.

The Handley Bequest.—Mr. Edwin Handley, of Old Bracknell, Berks, was a country gentleman, and the possessor of a considerable landed and personal estate in Berkshire and Middlesex. He died in 1843, having bequeathed the bulk of his property, after the decease of his two sisters, to the Royal Society.

The last of these ladies died in 1872, since when certain legal formalities have been complied with, and the claims of the Royal Society to the landed estates under the Mortmain Act have been brought before the Court. In February last the Master of the Rolls decided that "the gifts to the Royal Society, so far as they relate to pure personalty, are good charitable gifts, but otherwise void." The personalty as set forth in the "Bill of Complaint," comprises 6,033*l.* 7*s.* 5*d.* Three per Cent. Consols, 1,904*s.* 17*s.* 2*d.* Reduced, and 41*l.* 18*s.* 5*d.* Bank of England Stock.

By the terms of the will, the Society is to preserve the property intact in value, as a Fund Principal, the income of which is to be applied to the rewarding inventions in art, discoveries in science, physical or metaphysical ("which last and highest branch of science," to quote the testator's words, "has been of late most injuriously neglected in this country"), or for the assistance of fit persons in the prosecution of inventions and discoveries. The rewards or assistance are to be granted annually, or after longer periods, to British subjects or foreigners, according to the impartial decision of the President and Council.

A delay in distributing the bequest has arisen from the absence of a party on whom it was essential to serve a decree; this has, however, been now served, and there is every reason to believe that the suit will go forward; in which case we may hope to receive the proceeds early next year.

The Dircks Bequest.—Mr. Henry Dircks, of Liverpool, and latterly of London, who died in 1872, has bequeathed the residue of his property (about 4,000*l.*) after payment of debts and charges, to the Royal Society, Royal Society of Literature, Chemical Society, and Royal Society of Edinburgh, in equal shares and proportions, in furtherance of their several objects. As, however, it is possible that certain claims to the residue under the Bankruptcy Act, dating from 1847, may be set up, we are advised that the estate cannot be administrated without the aid of the Court of Chancery, which has been appealed to accordingly.

The Ponti Will.—Lastly, it is my duty under this head to inform you that our secretary has received a communication from the Secretary of State for Foreign Affairs, to the effect that the late M. Girolamo Ponti, of Milan, has bequeathed a portion of his immense property to the "Academy of Science of London." As, however, it does not appear what Society is indicated under this title, and as the relatives of the testator intend to dispute the will, the Council, as at present advised, will take no steps in the matter. I have further to observe that under the terms of the will, the Academy of Science will, if it accepts the trust, be burdened with annual duties and responsibilities respecting the distribution of the proceeds which would be altogether inconsistent with the position and purposes of the Royal Society.

The Fairchild Lecture.—This lecture no longer appears in the annual financial statement of your treasurer. Though an obvious anachronism and regarded almost from the first with little sympathy either within or without our walls, it should not pass away without a notice from the Chair. In February 1728 Thomas Fairchild, of Hoxton, gardener, bequeathed 25*l.* to be placed at interest for the payment of 20*s.* annually for ever for preaching a sermon in the parish church of St. Leonard's on Tuesday in Whitsun week on "the wonderful works of God in the creation, or on the certainty of the resurrection of the dead proved by certain changes of the animal and vegetable parts of the creation." From 1733 to 1758 most of the lectures were read by Archdeacon Denne, one of the original trustees, who in 1746 contributed all his lecture-fees to the fund, which, with a subscription raised by the trustees, enabled them in 1746 to purchase 100*l.* South Sea Stock. Subsequently this stock was offered to and accepted by the Society: the transfer was made in 1757; and from that date the lecturers were appointed by the President and Council. The lectures have been regularly delivered, but of late years to empty pews, under which circumstances the Council, after full deliberation, unanimously resolved that it was desirable to relieve the Society from the Fairchild Trust, and that to this end application should be made to the Charity Commissioners. The regular forms having been gone through, the Trust was transferred to the Commissioners in November last, and thus disappears from our balance-sheet.

The Croonian and Bakerian lectures are given annually as usual; and those of this year appear in our Proceedings. These do not diminish in interest and importance.

The Davy Medal.—The Council has accepted the duty of annually awarding a medal, to be called the Davy Medal, for the most important discovery in chemistry made in Europe or Anglo-America. The history of this medal is as follows:—

Our former illustrious president, Sir Humphry Davy, was presented by the coalowners of this country with a service of plate, for which they subscribed 2,500*l.*, in recognition of his merits as inventor of the Safety Lamp. In a codicil to his will Sir Humphry left this service of plate to Lady Davy for her use during her life, with instructions that after her death it should pass to other members of the family, with the proviso that, should they not be in a situation to use or enjoy it, it should be melted and given to the Royal Society, to found a medal to be awarded annually for the most important discovery in chemistry, anywhere made in Europe or Anglo-America.

On Sir Humphry's death the service of plate became the property of his brother, Dr. John Davy, F.R.S., who, in fulfilment of Sir Humphry's intentions, bequeathed it after the death of his widow, or before if she thought proper, to the Royal Society, to be applied as aforesaid. On the death of Mrs. Davy the plate was transferred to the custody of your treasurer, and, having been melted and sold, realised 736*l.* 8*s.* 5*d.*, which is invested in Madras guaranteed railway stock, as set forth in the treasurer's balance-sheet. The legacy duty was repaid to the Society by the liberality of the Rev. A. Davy and Mrs. Rolleston.

The style and value of the medal, and the steps to be taken in reference to its future award, are now under the consideration of the Council, and will, I hope, be laid before you on the next anniversary. The acceptance of the trust has not been decided upon without long and careful deliberation, nor without raising the question of the expediency of recognising scientific services and discoveries by such trivial awards as medals, and of the extent to which the awards entrusted to our Society are depreciated by their multiplication. My own opinion has long been that some more satisfactory way of recognising distinguished merit than by the presentation of a medal might be devised, and that the award might take a form which would convey to the public a more prominent and a more permanent record of the services of the recipients, such as a bust or a portrait to be hung on our walls, or a profile or a record of the discovery to be engraved on the medal, which might be multiplied for distribution or sale to Fellows and to foreign Academies. In short, I consider awards of medals without distinctive features to be anachronisms; it is their purpose, not their value, which should be well marked; and the question is, whether that purpose is well answered by their being continued under the present form.

Instruments.—The small but remarkable, and, indeed, classical collection of instruments and apparatus belonging to the Society, and for which there was no accommodation in old Burlington House, was, on our migration from Somerset House in 1857, by order of the Council, deposited in the Observatory in the Kew Deer-Park, near Richmond, then under the control of the British Association.

The instruments have been now for the most part brought back and placed in our instrument-room, and will, I hope, at no distant period be accessible to the Fellows.

SCIENTIFIC SERIALS

Cosmos, Guido Cora's Italian Geographical Journal, Nos. 4 and 5 (in one), contains a long and carefully compiled article on Italian travellers in Egypt from 1300 to 1840; Payer and Weyprecht's official account of the Austro-Hungarian Arctic Expedition; and the continuation of F. M. Prscevalski's exploration of Eastern Mongolia and Thibet. There are, besides, Notes on Gordon's Nile Expedition,—an Austrian naturalist, Ernst Marno, has been appointed to accompany Col. Gordon; there is a short account of the travels of a Persian youth, Abdul Kerim, in Tunisia. The part contains an excellent map of the border region between Persia and Beluchistan, compiled from the maps of Major St. John and the English Admiralty.

SOCIETIES AND ACADEMIES

LONDON

Anthropological Institute, Dec. 22.—Prof. Busk, F.R.S., president, in the chair.—Mr. J. Park Harrison exhibited tracings of late Phœnician characters from the south-west of

Sumatra. They are said to be still in use, and differ entirely from early letters in other parts of the island. The natives have a tradition that some descendants of Alexander settled there; and if Nearchus' second expedition, the account of which is lost, reached the Bay of Bengal, the date, Mr. Harrison considered, would agree sufficiently well with the letters. His sailors were principally Tyrians.—Col. Lane Fox read a paper on early modes of navigation, in which he described the various contrivances employed by savage races for transit on the water. Commencing with the simple trunk canoe, the author traced the development of the art of boat and ship-building through the stages of stitched plank canoes, bark canoes, rafts, outrigger canoes, single and double, the double canoe, the variation of hull, the weather platform, the rudder, and the rude sail, and gave the distribution of their many forms and modifications. It was argued that the rude bark float of the Australian, the Tasmanian, and the Ethiopian, the catamaran of the Papuan, the dug-out canoe of the New Zealander, and the built-up canoe of the Samoan, were survivals representing successive stages in the development of the art of shipbuilding, not lapses to ruder methods of construction as the result of degradation; that each stage supplies us with examples of what at one time was the perfection of the art countless ages ago. Some of the more primitive kinds spread over nearly the whole world, whilst others had a more limited area of distribution. Taken together, they enabled us to trace back the history of shipbuilding from the time of the earliest sculptures to the commencement of the art.

Victoria (Philosophical) Institute, Jan. 4.—A paper by Mr. J. E. Howard, F.R.S., entitled "Early Dawn of Civilisation considered in the Light of Scripture," was read by the author.

BERLIN

German Chemical Society, Dec. 14.—A. W. Hofmann, vice-president, in the chair.—Two physiological researches of interest were communicated by Prof. Jaffé, of Konigsberg. Nitrobenzol being poisonous, it appeared reasonable to expect, what experiments fully bore out, that ortho-nitrotoluol, which resists oxidation most completely, should be more poisonous than the two isomeric bodies. *Para-nitrotoluol* is almost without effect upon the health of dogs. Five grains daily were given for several weeks without producing more than a slight inflammation of the mucous membrane of the stomach, and at last jaundice. The urine contained *nitrobenzoic acid* (*para*), but a comparatively small quantity of it only. The rest of the substance had become transformed into *nitrohippuric acid*. This acid was found combined with urea, and therefore insoluble in ether. As in similar experiments, when substituted toluols or benzoic acids had been given to animals, substituted hippuric acids had not been found in the etherial solution, it is not improbable that such acids, though not found, were yet present in the shape of urea compounds. *Para-nitrohippuric acid* constitutes orange prisms, fusing at 129°, and forming well-defined salts with barium and with silver, different from a nitrohippuric acid formerly described by Bertagnini. In the urine of one individual dog a new substance has been discovered by the same *savant* in the following manner:—The alcoholic extract precipitated with H_2SO_4 yielded sulphate of urea, soluble in water, and the sulphate of *a new base*, $C_6H_6N_2O_2$, which combines with one molecule of HCl, but has a sour reaction, and dissolves baryta. It forms prisms, melting and decomposing at 213°. The dog has unfortunately been lost.—Messrs. Forst and Zincke, in re-preparing a product formerly prepared from silver by Limpricht and Schwanert, and described as two substances isomeric with hydrobenzoin and isohydrobenzoin, $C_{14}H_{12}(OH)_2$, have found this opinion to be erroneous; their experiments yielding but a mixture of the two latter bodies. There are, therefore, only two, and not four hydrobenzoins in existence.—M. Wroblewsky described meta-acetyltoluol, prepared from meta-bromotoluol, a liquid boiling at 158°, and yielding isophthalic acid and two isomeric sulpho-acids.—A. Ladenburg has undertaken the useful task of submitting to rigid experiments the opinion generally adopted, that the position of *one* lateral chain in benzol is indifferent with regard to the substance thus constituted; in other words, that no isomeric aromatic bodies can exist with only one lateral chain. He showed this time the identity of ordinary benzoic acid with benzoic acid prepared from phenol, and the complete identity of the three phenols prepared from the three different oxybenzoic acids. The proof will have to be completed by further researches, in which Mr. Ladenburg is still engaged.—Messrs. Michaëlis and Ananoff have undertaken researches respecting the constitution of phosphorous acid, for which they have established the formula $HP = O(OH)_2$. Without entering into details, we can only say that the method consisted in the action of $C_6H_5PCl_4$ on phosphorous acid, when no phosphorous chloride, PCl_3, but only oxychloride, PCl_3O, was formed. They have also prepared a monobasic phenylphosphorus acid, $C_6H_5P = O(OH)H$.—Prof. Nilson, from Upsala, described as the best method for extracting *selenium* the treatment of the flue-dust with cyanide of potassium.—T. Piccard has found in the sperma of the salmon, besides a new base, *protannin*, lately described by Mieschke, also *sarkin* and *guanin*.—C. Schisbler described a volumetric method for determining CO_2 in carbonates without introducing temperature and barometric pressure into the calculus. The method consists in making a "normal" analysis with a pure carbonate and comparing the volume of CO_2 obtained with that of the unknown quantity of CO_2 yielded by the substance analysed the same day.—H. Uppenkamp described hexylic sulphocyanide and isosulphocyanide.—C. Biedermann and L. Ledoux reported on the formation and properties of mesitylenic phenol, $C_9H_{12}O$.—A. W. Hofmann communicated his researches on fractions of beech-tar distilling above 260°. By oxidation they yield a phenolic substance, $C_{11}H_{16}O_3$, in which H_2 may be replaced by Br_2, and a quinone, $C_8H_8O_4$, which takes up H_2 when treated with reducing agents. Prof. Hofmann further reported on the following experiments of Mr. M'Creath:—The action of water on guanidine, CH_5N_3, consisting in the loss of ammonia and the formation of urea; the action of anhydrides has been studied, when it was found that benzoic anhydride acts on guanidine in a similar way, producing ammonia and dibenzoyl-urea.—A. Oppenheim has submitted crystallised pure glycerine to distillation. The boiling point corrected proved to be very constant at 290°. Nearly every manual and dictionary of chemistry contains erroneous data in this respect, although the same number has already been published in 1860 by Mendelejeff.

PARIS

Academy of Sciences, Dec. 28, 1874.—This was the anniversary meeting of the Academy, an account of which appeared in last week's NATURE, p. 178.

BOOKS AND PAMPHLETS RECEIVED

COLONIAL.—On the General Theory of Duplex Telegraphy: Louis Schwendler (Asiatic Society of Bengal).—On Earth Currents: Louis Schwendler (Asiatic Society of Bengal).—Second Annual Report of the Secretary of Agriculture of Victoria (Melbourne, Australia).

FOREIGN.—Anthropologische Beiträge: Georg. Gerland (Max Niemeyer, Halle).—Classification de 160 Huiles et Graisses Vegitales. 2nd Edition: M. Bernardin (Annoot-Brackman, Gand).—A. Dobsinai Jegbarlang: Dr. Krenner Jozef Sandor,—Die Eishöhle von Dobschan, Dr. Jos. Alex. Krenner (K. Ungar, Budapest).—Jahrbuch der Kaiserlich-Koniglichen Geologischen Reichsanstalt, Band xxiv. (Wien)—Az Arapály Fuinei Obölben: E. Stahlberger (K. Ungar, Budapest)—Essai sur la Vie et les Ouvrages de L. A. J. Quetelet (F. Havez, Brussels).—Verdhandlung des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens: Dr. C. J. Andrà (Max Cohen und Sohn, Bonn).—Sitzungsberichte der neiderrheinischen Gesellschaft für natur, und Heilkunde zu Bonn (Max Cohen und Sohn, Bonn)—Memoires de la Société de Physique et d'Histoire Naturelle de Genève, vol. xxii. Part ii. (Ramboz et Schuchardt, Genève).

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