THURSDAY, JULY 17, 1873

THE PAY OF SCIENTIFIC MEN

THERE are a good many points of interest attaching to the Parliamentary paper referring to the pay of the officers of the British Museum, which, thanks to Lord George Hamilton, has been issued during this week.

It shows in a striking manner what the Government thinks of Science and its votaries; nor is this all: it shows in a not less striking manner how it behoves men of Science, if they consider that there should be a career for Science at all, to at once take some action, in order that their real claims may be conceded. Mr. Lowe, in defending not long ago the high rate of pay of Treasury clerks, who "begin" at 250*l.* a year and rise quickly to 1,200*l.* (if they are unfortunate enough not to get a staff appointment with much higher pay, long before they would, in the ordinary course of promotion, reach the senior class), stated that what was principally wanted at the Treasury, over and above the ordinary qualities of a clerk, was a certain "freemasonry," which was best got at the public schools. For this "freemasonry" Mr. Lowe is willing to pay 150*l.* a year over and above the 100*l.* which is the usual commencing pay of a junior clerk in the other Crown offices.

Perhaps it is too much to say that this "Freemasonry" is required in the British Museum. But there is certainly something required in the case of the scientific appointments there, of as special a character; and that is a knowledge of Science.

What then does Mr. Lowe do to secure this specialty? He gives the man of Science who enters the Museum the magnificent sum of 90*l.* per annum on entrance, with the still more magnificent—but, unfortunately, very distant—prospect of attaining an income of 600*l.* So that:—

Public School Freemasonry : Scientific Attainments : : 250*l.* : 90*l.*

This state of things has recently been brought home to the Trustees by petitions from all grades in the Museum, and a sub-committee of the Trustees has reported that, "owing to the insufficiency of the salaries, the slowness of their progressive rise, and the lowness of their maximum, the trustees are losing, and will continue to lose, their best men."

As a result of this report, in which we consider that higher ground might have been taken, the Trustees have proposed a new scale to the Treasury, the only fault of which is that—with the exception of the case of principal Librarian, who is not a specialist, who has no special work to do which could not be done by the keepers acting in turn as Dean, and who already has just double the salary of the most highly-paid keeper—it is far too modest. As the *Daily News* has well put it, a maximum of 500*l.* is "certainly not a too lavish position for a man who must be a scholar and linguist, an archæologist, naturalist, or chemist, and must in most cases be already in middle life."

The men upon whose heads, hands, reputation, and work the success and fame of the Museum depend, are the keepers, whose pay, even as revised, is a mere pittance for such service as they render.

Altogether, the eventual *total* increased annual expenditure would amount to 5,700*l.* a year—the pay of *one* political or legal placeman, who has properly employed his "Freemasonry."

Here is the Treasury reply:—

"Treasury Chambers, March 28, 1873

"My Lords and Gentlemen,—The Lords Commissioners of Her Majesty's Treasury have had before them two letters from Mr. Winter Jones, dated the 4th instant, submitting recommendations for the grant of increase of salary to the principal Librarian and Secretary, and to various other officers of your establishment, and they desire me to say that, after giving their most careful consideration to all the statements put before them, they regret that they would not feel warranted in acceding to any alteration in the present scale of salaries.

"I have, &c.

(Signed) "WILLIAM LAW"

We trust that some determined stand will be made by the Trustees—among whom is the Right Hon. Robert Lowe—against this monstrous letter; and we trust also that some general protest will be made by men of Science and Culture generally against this latest valuation of these acquirements by the Government.

The man of Science serves his country as well as the politician, the lawyer, the soldier, or the sailor, although perhaps his claims are not stated in so blatant a manner, nor are at present so generally acknowledged, whether they will be in the future must to a large extent depend upon men of Science themselves: but whether this be conceded or not, surely in a country where the State remuneration for services performed is extraordinarily high in the upper appointments, our scientific chiefs in the public service should at all events receive the means of a decent livelihood, and such men as are employed in the British Museum, many of whom have world-wide reputations, should at least be treated as well as Government clerks.

Surely this is not to ask too much? Nay, it is already conceded by the Government in many departments where special scientific knowledge is required of no higher order than that which is so shabbily treated in the one Institution of which we have the greatest reason to be proud.

THE "POLARIS" ARCTIC EXPEDITION

WE have just received the printed Report, presented to the President of the United States by the naval authorities, of the result of their examination of those of the crew of the *Polaris*, who, in October last, were severed from that ship, and drifted on an ice-floe from about 80° north latitude during the whole of the winter until, 600 miles south from their starting-point, they were picked up on April 30, of this year, by the *Tigress* off the coast of Labrador. The Report furnishes material for one more of those thrilling narratives of Arctic adventure, which will be the delight of the boyhood of all generations, and which, commencing in the 10th century with that of Bjorne the Norseman, have been accumulating in increasing proportion, and will never fail to be added to until not a shred of mystery remains to unravel within the Arctic circle. The advocates of Arctic exploration by way of Smith's Sound, needed only the narrative furnished in this Report, to render their arguments invincible.

The *Polaris*, an ordinary wooden vessel, left New London, Connecticut, on July 3, 1871, well furnished with provisions, but otherwise ill fitted for an Arctic expedition, under the command of Captain Hall, an enthusiastic explorer, who firmly believed he was "born to discover the pole," but apparently deficient in the firmness and decision necessary to manage a crew amid the trials of an Arctic winter; the officers and crew, moreover, seem to have been collected at haphazard, and were by no means well assorted. The second in command, Captain Buddington, who has now the command of the *Polaris*, ought never to have been taken on such an expedition, and, even though the most lenient construction be put upon his conduct, is deserving of the severest reprehension. After a delay of a week at St. John's, Newfoundland, the *Polaris* sailed for the West Coast of Greenland, and after calling at several places on that coast, arrived at Disco, which she left on August 17. After calling at the settlements of Upernavik and Tessiusak, the latter in 73° 24′ north lat., the *Polaris* commenced her exploring work in earnest, leaving Tessiusak on the 24th August. Hitherto there had been no difficulty whatever in navigation, nor was the vessel destined to meet with any obstruction until passing through Smith's Sound and Kennedy Channel, she reached 82° 16′ N. lat., a point far beyond the limits of previous navigation. This she did on August 30, within a week after leaving Tessiusak. After making unsuccessful efforts to find a way through the ice, Captain Hall resolved to return and take up winter quarters, which he did on September 3, in a small sheltered cove or bend of the coast in what he called Polaris Bay, the "Open Polar Sea" of Kane, where the ship was protected by a stranded iceberg—Providence Berg. This was in 81° 38 N. lat., 61° 44′ W. long. Had the vessel been specially built for Arctic exploration, it appears to us that Captain Hall by good management could have pushed even farther north before requiring to return to winter-quarters: as it is this is one of the most wonderful and successful Arctic cruises on record, considering the distance accomplished in less than a week so far within the ice-bound region. It affords the strongest ground for hope that with a vessel specially fitted for ice-navigation, a skilful captain may ere long complete the 8° that remain to be traversed before the North Pole be brought within the sphere of the known.

From Polaris Bay on October 10 Captain Hall left the *Polaris*, accompanied by Mr. Chester, first mate, and Hans the Esquimaux with two sledges and fourteen dogs. In the progress of the journey he discovered, as appears by his despatch, a river, a lake, and a large inlet. The latter, in latitude 81° 57′ north, he named "Newman's Bay," calling its northern point "Cape Brevoort," and the southern one "Sumner Headland."

Captain Hall, it appears, had hoped, when he left the *Polaris* on this journey, to advance northward at least a hundred miles; but after having gone about fifty he was compelled, by the condition of the shore and of the ice, and by the state of the climate, to return and await the approach of spring for another attempt. He reached the ship on October 24, apparently in his usual fine health, but was attacked the same day with sickness, and, taking to his bed, the next day was found to be seriously ill. After rallying once or twice he died on November 8, and was buried on the shore. The commissioners who examined the crew reach the unanimous conclusion that the death of Captain Hall resulted naturally from disease, without fault on the part of anyone. After this sad event, the command of the expedition devolved upon Captain Buddington, who expressly declared, according to the evidence, that he had no inclination and no intention to pursue discovery further; he determined to make his way south to the United States as soon as the ice would permit. During the winter little was done, and on August 12, 1872, the *Polaris* began to move southwards. On the 16th of August the ship was made fast to a large floe of ice in the latitude of 80° 2′ north, and longitude about 68° west, and while still fast to this floe drifted south through Smith's Sound nearly to Northumberland Island. On the night of the 15th of October, 1872, in about latitude 79° 35′ north, during a violent gale of wind and snow, the ship was suddenly beset by a tremendous pressure of ice, which was driven against her from the southward and forced under her, pressing her up out of the water, and by successive and violent shocks finally throwing her over on her beam-ends. In the words of the Report,—

Captain Buddington directed the provisions, stores, and materials which had been put in readiness on deck, to be thrown over on the ice, and ordered half the crew upon the ice to carry them upon a thicker part to the hummocks, where they would be comparatively safe. He also sent all the Esquimaux, with their kyaks, out of the ship, and lowered the two remaining boats upon the floe. While so engaged, in the darkness of an Arctic night, in the midst of a fierce gale and driving snow-storm, the hawsers of the *Polaris* failed to hold her, and she broke adrift from the floe, and in a few minutes was out of sight of the party who were at that moment busily at work on the ice.

From October 15, 1872, until April 20, 1873, when they were picked up in latitude about 59° north, these nineteen men, women, and children remained through the whole of the dark and dreary winter upon the ice. In their first endeavours to reach the land, they occupied for a time different pieces of floating ice, but, forced finally to abandon all hope in this direction, they rested at last upon the floe upon which the *Polaris* had made fast.

At the time of their separation from the *Polaris* every one belonging to the expedition was in good health. She had plenty of provisions, but not much coal—probably about enough to last through the winter. She was last seen, apparently at anchor, under Northumberland Island, where it is most likely she remained for winter-quarters.

Mr. Robeson has already given preparatory orders to the United States steamer *Juniata*, now at New York, to proceed, at the earliest practicable moment, to Disco, and if possible to Upernavik, for the purpose of carrying forward the necessary coal and supplies, communicating with the authorities of Greenland, obtaining information, and, if practicable, sending forward some word of encouragement to those on board the *Polaris*. This last will most likely be impossible, but an attempt will be made.

It is also proposed to fit out at once an expedition of relief, to be sent to Northumberland Island, where the *Polaris* was last seen, in the *Tigress*, about 200 tons burden, built and fitted to contend with the ice, and the same ship by which the nineteen persons were rescued.

The following, in the words of the Report are a brief summary of some of the scientific results of the ill-managed expedition :—

While the records of the astronomical, meteorological, magnetic, tidal, and other physical departments of the exploration appear to have been extremely full, and the observations in each appear to have been conducted according to approved methods, the collections of natural history are shown to have been not less extensive, the store-rooms of the *Polaris* being filled with skins and skeletons of musk-oxen, bears, and other mammals ; different species of birds and their eggs : numerous marine invertebrata ; plants, both recent and fossil, minerals, &c. Not the least interesting of these collections are specimens of driftwood picked up on or near the shores of Newman's and Polaris Bays, among which Mr. Meyer thought he recognised distinctly the walnut, the ash, and the pine. Among the numerous facts that appear to be shown by the testimony elicited on the examination, we may mention as one of much interest that the dip of the needle amounted to 45°, and its deviation to 96°, being less than at Port Foulke and Rensselaer Harbour, as given by Dr. Kane and Dr. Hays. Auroras were frequent, but by no means brilliant, generally quite light, and consisting sometimes of one arch and sometimes of several. Streamers were quite rare. Shooting-stars were so constantly seen that, although no special shower was observed, it was scarcely possible ever to look at the star-lit sky without noticing them in one direction or another. The rise and fall of the tides were carefully observed, the average being about five and a half feet. The greatest depth of water noticed was about 100 fathoms. The existence of a constant current southward was noted by the expedition, its rapidity varying with the season and locality. The winter temperature was found to be much milder than was expected, the minimum being 58° in January, although March proved to be the coldest month.

The prevailing winds were from the north-east, although there were occasionally violent tempests from the south-west. Light winds were noticed, however, from all points of the compass. Rain was occasionally observed, only on the land, however, the precipitation presenting itself over the ice in the form of snow. During the summer the entire extent of both low lands and elevations are bare of both snow and ice, excepting patches here and there in the shape of the rocks. The soil, during this period, was covered with a more or less dense vegetation of moss, with which several arctic plants were interspersed, some of them of considerable beauty, but entirely without scent, and many small willows scarcely reaching the dignity of shrubs. The rocks noticed were of a schistose or slaty nature, and in some instances contained fossil plants, specimens of which were collected. Distinct evidence of former glaciers were seen in localities now bare of ice, these indications consisting in the occurrence of terminal and lateral moraines.

Animal life was found to abound, musk-oxen being shot at intervals throughout the winter.

Wolves, also bears, foxes, lemmings, and other mammals, were repeatedly observed. Geese, ducks, and other water-fowls, including plover and other wading-birds, abounded during the summer, although the species of land-birds were comparatively few, including, however, as might have been expected, large numbers of ptarmigan or snow-partridge. No fish were seen, although the net and line were frequently called into play in the attempt to obtain them. The waters, however, were found filled to an extraordinary degree with marine invertebrata, including jelly-fish and shrimps. Seals are very abundant. Numerous insects were observed, also, especially several species of butterflies, specimens of which were collected ; also, flies and bees and insects of like character.

The geographical results of the expedition, of which the accompanying map will give a good idea, so far as they can now be ascertained from the testimony of Messrs.

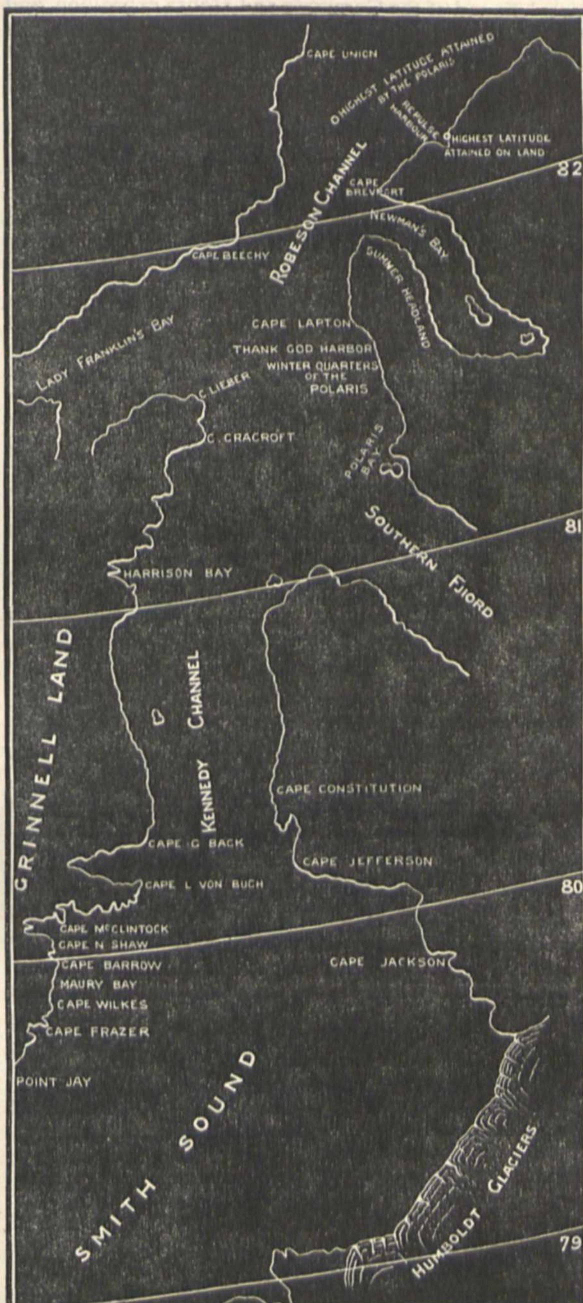


Diagram of the Explorations of the *Polaris*. (Drawn by F. Meyer, Signal Service, U.S.A.)

Tyson, Meyer, and their comrades, may be summed up briefly as follows :—

The open polar sea laid down by Kane and Hayes is found to be in reality a sound of considerable extent formed by the somewhat abrupt expansion of Kennedy's Channel to the northward, and broken by Lady Franklin's Bay on the west, and on the east by a large inlet or fiord, twenty-two miles wide at the opening, and certainly extending far inland to the south-east. Its length was not ascertained, and Mr. Meyer thinks that it may be, in fact, a strait extending till it communicates with the Francis Joseph Sound of the Germania and Hansa expedition, and with it defining the northern limits of Greenland. This inlet was called the Southern Fiord. North of it, on the same side, is the indentation of the shore called Polaris Bay by Captain Hall.

From Cape Lupton the land trends to the north-east, and forms the eastern shore of a new channel from twenty-five to thirty miles wide, opening out of the sound above mentioned, to which Captain Hall gave the name of Robeson Straits. North-east of Cape Lupton, in lat. 81° 57′, is a deep inlet, which Captain Hall called Newman's Bay, naming its northern point Cape Brevoort, and its southern bluff Sumner Headland. From Cape Brevoort the north-east trend of the land continues to Repulse Harbour, in lat. 82° 9′ north—the highest northern position reached by land during this expedition.

From an elevation of 1,700 ft. at Repulse Harbour, on the east coast of Robeson Straits, the land continues north-east to the end of those straits, and thence east and south-east till lost in the distance, its vanishing point bearing south of east from the place of observation.

No other land was visible to the north-east, but land was seen on the west coast, extending northward as far as the eye could reach, and apparently terminating in a headland and near latitude 84° north.

Mr. Meyer also states that directly to the north he observed, on a bright day, from the elevation mentioned, a line of light apparently circular in form, which was thought by other observers to be land, but which he supposed to indicate open water.

Of course the full scientific results of the *Polaris* expedition cannot be known until that vessel shall have been found and brought back with the treasures she has gathered, and the records and details of her Arctic explorations. But enough is told by the witnesses whom we have examined to excite expectation and encourage the hope of large and valuable additions to the domain of human knowledge.

Enough has been said to show that the way to the North Pole is clear and practicable: it remains for Britain to consummate the glory she has already acquired by sending out an expedition so equipped that it cannot fail to return with the solution of the Arctic mystery, whose bourne is being pushed further and further back every year. We would recommend the Report to the Joint Committee of the Royal and Geographical Societies now considering the subject of an Arctic Expedition.

SCIENCE AND ANGLING

Flies and Fly Fishing, with Hints on Minnow and Grasshopper Fishing. By Capt. St. John Dick. (Hardwicke.)

IT is doubtful whether much real progress has been made in the art of angling since the time of Walton, whose "Complete Angler" was published in 1653. A great improvement has taken place in fishing-tackle and implements, and we have much better rods, reels, lines, and lures now, than could have been got in old Isaac's time. Of late years the number of rod-fishers has enormously increased, and there is quite a plethora of popular treatises on the art of fishing. But in all the books we have seen, including the one whose title is at the head of this notice, there is a striking absence of any guiding principles to go by; and notwithstanding the marked improvement in the mechanical appliances referred to, and the increased number and activity of anglers, we repeat that it may be fairly doubted whether the latter are more successful fishers than their representatives 200 years ago. The cause of this is probably owing to the fact that hitherto attention has been almost exclusively directed to the mere practice of the art, and that angling as a science has been all but completely ignored. We have *ad nauseam*, empiric and dogmatic rules for the guidance of the tyro, but few of these are based on sufficient data, and most of them are quite untrustworthy. There is no statement for example, more frequently made in books on angling than that if the wind be from the east trout will not rise to the fly; and yet there are lakes (notably Loch Leven, Kinross-shire, probably the best trouting lake in Great Britain), in which the fish take best when the wind blows from that quarter. Another generally accepted canon is that fish will not rise freely during a thunderstorm, or when "there is thunder in the air;" but in our own not very large experience, we have again and again proved the falsity of this rule. It would be easy to multiply examples of the worthlessness of such empiric directions. What is wanted is a scientific treatise on angling. A principle in Science, some one has said, is a rule in art; and it is such rules that are desiderated. The object of this paper is rather to indicate this want than to supply it; and we have little hopes of much progress being made in the "gentle art" until it is carefully studied and treated scientifically. Until this is done there are many difficult problems connected with angling which must, we fear, remain unsolved. One day, for example, fish will take greedily any fly that is offered them, for an hour or two; and before or after this, their feeding time, the most skilful angler will practise all his wiles in vain. Another day, only flies of a particular colour or shape have any chance of taking. Again, it does happen occasionally that a veteran Waltonian will return from his favourite stream or lake, under the most auspicious influences of sky, wind, and water, with a very light basket, or it may be, an empty one. It is also a fact that the most successful day's fishing is sometimes achieved by going dead against all recognised rules and imitations of Nature. These are only a few of the things that require to be explained, and in the explanation of which a careful study of the nature and habits of fishes—how they are affected by atmospheric influences, &c.—would probably greatly assist. Of course, there are scientific anglers who have picked up their science under difficulties, and as they best could; and their number might be indefinitely increased if greater facilities were afforded for acquiring scientific knowledge. Such anglers will be sure to have the indispensable qualities of patience and perseverance; but they must also be careful observers of Nature, of the conditions of the water, of the appearance of the sky, and of meteorological phenomena in general; and in addition to all these they will be found to possess an intimate acquaintance with some special branch of Natural History.

There is a point connected with angling which is raised by Captain Dick, but not for the first time, and which demands investigation. It seems to be beyond question that, over the whole of Great Britain, trout are every year becoming scarcer. It is very seldom that the angler now-a-days makes a basket equal to what would have been called a very common take a score of years ago. So alarming has been this decrease that district associations are being formed for the purpose of watching and protecting the spawning grounds in their neighbourhood. The falling off is probably due to a variety of causes, such as over-fishing, pollution of streams, want of protection of spawning fish and spawning beds, the prevalence of pike, &c. It is certain that many streams and lakes, easy of access to populous districts, suffer from being over-fished; but the example of Loch Leven, already referred to, shows what may be done if proper precautions be taken. This lake is only 3½ miles by 2½, and 9 miles in circuit, and is open to anglers from all quarters (by paying a certain sum per hour) during the four months May, June, July, and August. The rest of the year the lake is closed, and the spawning grounds are carefully watched. There are both pike and perch in the lake, but nets are freely used to keep down these marauders. The results of these measures are worthy of notice. For the last fifteen years the takes have been gradually increasing, and last year upwards of 17,000 trout were taken by the rod. During the months of May and June this year nearly 9,000 have been taken, and it may be added that the average weight of Loch Leven trout is a little under 1 lb. What has been done by private enterprise for this lake might and should be done by Government for all the lakes and rivers in the country. There is no reason, that we know of, why there should not be a close time for trout as well as for salmon. The pollution of rivers by public works is a more difficult question to deal with; but surely something could be done to prevent such wholesale destruction as that, for example, which took place in the first week of July this year in the rivers Teviot and Ribble. In the former of these rivers tens of thousands of fish, including trout, smelt, grayling, and even salmon, were poisoned in one day. Unless some action be taken by Government strictly prohibiting manufacturers from sending their poisonous refuse into our rivers, not only will the fish in these soon become extinct, but the rivers themselves thus impregnated will act as open sewers generating and propagating disease in every direction. With a little judicious legislation, the quantity of fish obtained in fresh water might be so largely increased as to become important as an item of food for the people. We have indicated how this might be done with regard to trout, &c. With regard to salmon, all that is necessary to do is to blast the rocks at the Falls of the Tummel, the Gary, and the Spean, in Scotland, and of the Axe, and other rivers in England, and the area of the spawning grounds of this monarch of our rivers would at once be doubled. This could be done at little expense, due allowance being of course made for vested rights and any interests involved

A single glance at any page of Captain Dick's book is sufficient to show that he is more accustomed to wield the rod than the pen; indeed we fail to see the *raison d'être* of the gallant captain's work. He has, it is true, mentioned one or two things worth setting down in an article or essay, but not worth writing a book about. His list of artificial flies is very full and may be of service. The only contribution to Natural History we can find is his statement—which we are inclined to accept as fact—that "although fish generally lie with their heads pointing up stream, they never, by any chance, take a fly in that position, but always make a decided turn in the act of rising, and take the fly with their heads pointing down stream." He adduces this as a reason for fishing down stream, of which practice, in opposition to the best anglers, he is a strenuous advocate. As to fishing with minnows, he prefers the ordinary metal kill-devils to natural minnows and to all other imitations. In this, also, experienced anglers will generally disagree with him. There is no lure more deadly for large trout, in certain seasons, than the natural minnow, and next after that, we should say, is the phantom minnow. In his remarks on pike-fishing, the author does not refer to the spoon-bait, which nevertheless, in lakes, especially in dull weather, may safely be backed against any other lure. Why does the author almost always use the word "fisherman," and only once the much more precise term "angler"? Strictly speaking, "fisherman" is a generic term, and applies equally to net and rod-fishers, but by common usage is generally employed to denote the former; whereas "angler" is a distinctive term which can be applied only to the rod-fisher.

MIVART'S "ELEMENTARY ANATOMY"

Lessons in Elementary Anatomy. By St. George Mivart, F.R.S. Pp. 535. (Macmillan, 1873.)

THIS modest volume is one of the series to which Huxley's "Physiology," Oliver's "Botany," and Roscoe's "Chemistry" belong. Like them it has the indispensable merit of being an elementary manual written by a master of the subject; for while special investigations may be often well performed by advanced students, primers and text-books can only be properly written by experienced teachers.

The plan of the book is to describe in a popular manner the various bones and other parts of human anatomy, excepting the reproductive organs, and then to point out the chief variations among other vertebrata. It would perhaps have been better to have called it "Elementary Lessons in the Comparative Anatomy of Vertebrate Animals:" for as all the organs are used to illustrate those of man, consideration of non-vertebrate classes is very reasonably omitted. Moreover, for reasons given in the preface, with which every teacher of the subject will probably agree, the largest space is given to the account of the endoskeleton. The whole forms a collection of facts, accurate in detail, carefully arranged, and clearly described. One would think there must be slips among so many isolated statements, but we have failed to detect one in a careful perusal of about 300 pages. The sixth chapter contains a review of the general morphology of the vertebrate skeleton, and here Mr. Mivart's well-known views, communicated to the Linnæan and Zoological Societies, are expounded fully but simply. Without admitting all his positions, as for example the homology of the *trabeculæ cranii*, most of what is stated in this chapter is well enough established to form part of a manual for students of comparative anatomy.

But who are these students? No one could follow the closely printed pages of description here given, without a good general acquaintance with human anatomy and a thorough knowledge of the human skeleton. For this reason we think it would have been better to have curtailed or even omitted the preliminary accounts of each organ in man, because they are not sufficient alone, and there are many excellent treatises on this subject already. If it is answered that the book is really intended for boys and girls at school, then the details given, especially in osteology, are far too numerous: in fact they would be unintelligible without a good museum, and learning zygosphenes and hypapophyses without seeing them is far worse mental training than *Barbara Celarent*, or the verbs in -*μι*. For the second class of readers mentioned in the preface, teachers, medical students, and others acquainted with human anatomy, this little treatise will be found just what they want in order to learn "its more significant relations to the structure of other animals." The only defect they will find is the omission of the organs of reproduction and the structure of the ovum.

The woodcuts are generally sufficient, and some of the diagrams are remarkably ingenious and useful. Some are, however, much too small, *e.g.* the diagram of the skull, Fig. 197, and all the figures of entire skeletons, as 200; while others, as 137, representing the shoulder-girdle of *Hemidactylus*, after Parker, greatly need the shading and tinting of the original drawing. The plan of repeating an illustration whenever it is referred to is not often adopted in English books, but on the whole it is, we think, the most convenient.

Experience will show what class of students will really make most use of Mr. Mivart's Lessons. We heartily recommend them to all medical students and zoologists who have access to a good museum. P. S.

OUR BOOK SHELF

Die Robbe und die Otter (Phoca vitulina *et* Lutra vulgaris) *in Ihrem Knochen-und Muskel-skelet.* Eine anatomisch-zoologicgische Studie von Dr. J. C. G. Lucae. 102 pp. 15 plates. (Frankfort-on-the-Main, 1873.)

UNDER this title the distinguished anatomist, Prof. Lucae, has contributed to the "Transactions of the Senckenbergian Society of Naturalists," an elaborate treatise upon the anatomy of the Common Seal (*Phoca vitulina*). The osteology of *Phoca* is minutely described, and every part of its skeleton compared with the corresponding portions of that of the Otter—one of its nearest allies among the terrestrial Carnivora. Comparisons with other mammals are also given.

Fifteen well-executed plates illustrate this excellent memoir, which, when completed (the first part being only now before us) will leave little to be added to our information as to the osteology of the true Seals (*Phocidæ.*) To our knowledge of the structure of the two other families of the marine Carnivora (the Trichecidæ and Otariidæ) we have lately received a valuable contribution in the shape of Dr. Murie's Memoirs on the Walrus and Sea-lion, published in the Zoological Society's "Transactions," so that great progress has lately been made towards a perfect understanding of the osseous structure of the marine Carnivora.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Agassiz and Forbes

MR. GEORGE FORBES has, in NATURE of May 22, given his version of the controversy between Agassiz and Forbes. I had no intention, in a former note, of reviving, for the benefit of the readers of NATURE, this unpleasant subject; but simply wished to protest against the *ex cathedra* statements of the reviewer of Tyndall. The materials for an impartial discussion of the history of glacier work are accessible to all investigators, and when it comes to be written, Agassiz and Forbes will obtain due credit for their share of the work. One of the points at issue between Forbes and Agassiz is not a matter "of facts to be proved or disproved by facts." The conversation between Agassiz and Forbes (Heath as witness for Forbes) held on the first day of their sojourn on the Aar Glacier, refers simply to *a difference of opinion on the explanation of certain bands* (observed previously by several persons, and well known to Agassiz). The nature of these bands has to this day remained problematical and why Agassiz, when writing to Humboldt that *he had observed these bands at a depth of* 120 *ft. in the body of the glacier*, should give any credit to Forbes passes all understanding. This observation was made after Forbes's departure, and Agassiz certainly needed no "reconciliation with his conscience" to describe this as "le fait le plus nouveau que *j'ai* observé." The testimony of Mr. Heath is of no value, for it certainly would be the height of presumption, in a man without any previous acqnaintance with glaciers, to undertake to decide in a few lines, a point to this day a subject of controversy among investigators of glaciers; his endorsement of the claims of Forbes is as ridiculous as the attempt made by a prominent Swiss geologist (who gives his testimony in favour of Forbes), to ignore the claims of Agassiz, by passing his name over in silence when writing the history of geological science in Switzerland.

I would also remind Mr. George Forbes and the editors of the "Life and Letters of Forbes," that Agassiz's affirmation carries as great weight as that of Forbes or Mr. Heath. Forbes is entitled to whatever credit there is in his explanation of these bands and no more, an explanation which has not been adopted by Agassiz for the very good reason that he did not deem it a satisfactory one, and did not attach to it the same importance which Forbes did. Agassiz expressed to Forbes considerable surprise at the appearance of the bands which presented that morning peculiar conditions, not usually seen except after a hard rain, and on the strength of this surprise Forbes lays claim to the discovery of the bands, and boldly accuses Agassiz of knowing nothing about them at the time of his visit. In investigations carried on for several years, as those of the glacier of the Aar under Agassiz, it was most natural that special points should not always be uppermost in the mind of the investigator, however interesting they might appear to a visitor; this will fully account for any want of interest shown by Agassiz on first meeting Forbes and discussing the veined structure of the ice.

Agassiz certainly owed nothing to Forbes, who was an invited guest on the glacier of the Aar, a novice in glacial work. No attack was made upon Forbes, as is stated by Mr. George Forbes; it originated with him. In a letter addressed to Forbes by Agassiz when he first discovered that Forbes had published, independently as his own, observations made upon the glacier of the Aar, during his stay with the Swiss party, he says: "the idea that in thought you conceived the project of an independent publication did not come to me for an instant. I should have thought I did you injustice by such a supposition." Agassiz felt *he* "had been deeply wronged" by the course taken by Forbes; he made no answer to Forbes, and paid no further attention to the subject, not because there was "no room for discussion," but because the tone adopted by Forbes was so insulting and overbearing as to render all further discussion impossible without its degenerating into the personalities afterwards indulged in by Forbes, in his letters to his friends, which the editors of his Life and Letters have taken special pleasure in reproducing.

Forbes did not hesitate to bring Mr. Heath uninvited to the glacier of the Aar, probably to act as his witness and swel the party, yet both he and his son regard the presence o friends of Agassiz, to assist him in his work, a most monstrous circumstance. Pioneers usually find it difficult to explore the way, but when the track is once blazed it is easy enough to follow and find the path.

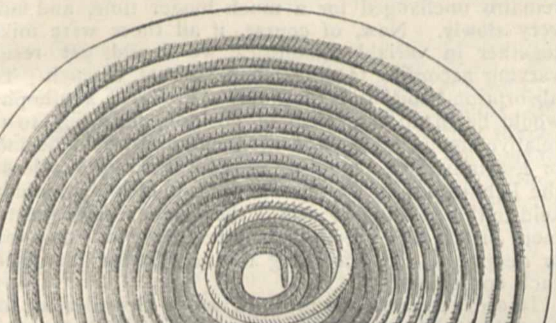
As I do not wish to fill the pages of this journal with personal explanations, my contributions in NATURE to this subject must cease with this note. It is not my purpose at present to refute the imputations cast upon Agassiz by the editors of Forbes's Life and Letters; he can well afford to pass them over as he has done thus far, in silent contempt, the more so since, fortunately for Agassiz, the editors have given us from Forbes's own letters all that was necessary to show a course of duplicity, on Forbes's part, towards the man with whom "he served his apprenticeship in glacier observation," which is happily rare among scientific men. ALEXANDER AGASSIZ

Probosces capable of sucking the Nectar of Anagræcum sesquipedale

MR. W. A. FORBES, in the number for June 12 started the question, whether moths are known to inhabit Madagascar with probosces capable of such an expansion, as to obtain the last drops of the nectar secreted in the lower part of the whiplike nectaries of *Anagræcum sesquipedale*.

As long as a direct answer to this question has not been given, it may be of some interest to state in general the existence of moths provided with probosces sufficiently long for the honeyspurs in question.

Some days ago I received a letter from my brother, Fritz Müller (Itajahy, Prov. St. Catharina, Brazil), in which he says: "I recently caught a Sphinx (not determinable by Burmeister's "Brazilian Sphingidæ"), the proboscis of which has a length of about 0·25 metres—a length not approached by any honey-tube of this country known to me. I enclose the proboscis." Being unable to get the name of this species of Sphinx, I append the illustration of its proboscis, magnified in the proportion 7 : 1.



This proboscis, in its contorted condition forming a roll of 10-11 millimetres in diameter, and showing at least 20 elegant windings, in its expanded condition attains a length of between 10 and 11 inches, and would consequently be adapted to the nectaries of *Anagræcum sesquipedale*, which have been found by Darwin 11½ inches long, with only the lower inch and a half filled with nectar. Darwin indeed says, with regard to the fertilisation of *Anagræcum sesquipedale* (p. 198 of his work on Orchids): "there must be moths with probosces capable of extension to a length of between 10 and 11 inches."

Lippstadt, July 1 HERMANN MÜLLER

An Order of Merit

YOUR leading article in the last number of NATURE on the subject of a proposed "Order of Merit for Scientific Men," recalls the views (in exact correspondence with your own) entertained by my brother-in-law, the late J. Beete Jukes. These were expressed by him in no uncertain terms on the occasion of publishing an address on the Geological Survey, delivered in Dublin in 1865.

I take the liberty of sending you a print for your perusal, and to refer to note B, at p. 21. I was glad to see the subject so well dealt with in your article. ALF. H. BROWNE

5, West Hill, Highgate

"Men of science have of late years pandered too much to the utilitarian quackery of the age, and it is time that some one should stand up to protest against it. Government and the House of Commons should be told that Science must be supported and encouraged for her own purely abstract purposes, independently of all utilitarian applications. The necessary preliminary, indeed, to these utilitarian applications is the discovery and establishment of abstract scientific truth by men who look to that alone, and whose whole faculties and lives are devoted to it. The men who afterwards make the practical applications of it often attain, indeed, far wider reputations than the real men of science, and become to the popular gaze the representatives of Science itself. The higher class are rarely much known to the public during their lives, and are not usually men who would experience any satisfaction if they were nick-named Knights or labelled with C.B., or would feel inclined to accept any other crumbs that might fall from the table of the politically great and powerful. Nor would they commonly care much for pecuniary rewards, unless as a means to enable them to do their work without drudging for the support of themselves or their families. They are the men, however, who in the end rule the world, and doubtless they are often sustained in their labours by a consciousness of this fact.

"It would manifestly conduce to the public good and the national honour if such men, when they do arise amongst us, should be sought out, recognised as public benefactors, and allowed means to do that work which their faculties, and theirs only, enable them to perform" ("Her Majesty's Geological Survey of the United Kingdom," &c., by J. Beete Jukes, F.R.S. 1867.)

Geological Subsidence and Upheaval

SIR J. HERSCHEL thought that the earth's crust floats upon an ocean of molten matter, and that the washing of detritus from the land into the sea, by altering the relative weight of different portions of the shell, occasions a subsidence of the ocean's bed and an upheaval of the land, which may be either gradual and insensible, like the process of denudation, or spasmodic and by fits and starts producing earthquakes and sometimes volcanic eruptions.

This theory was at one time adopted, at least partially, by Sir C. Lyell, but is not mentioned in the latest edition of his "Principles," and is generally rejected by geologists as at variance with the opinion held by Sir W. Thomson and others in regard to the internal solidity of the earth. But this objection may be avoided by modifying Sir J. Herschel's theory. We may repudiate his hypothesis that a great fiery ocean exists below the outer crust. We may arrive at many of the important conclusions which he drew from this hypothesis, and which he described as all that a geologist could require, by admitting either that *solid rocks are plastic*, or that *some of the lower and warmer strata of the earth are more pliable than the upper.*

As to the plasticity of solid bodies, it may be sufficient to refer to the experiments of M. Tresca (Comp. Rend. de l'Acad., 1864–65, and Annales du Conservatoire, No. 21). Dr. Tyndall (Glaciers of the Alps, p. 9) suggests the possibility that the contortions of the strata in the valley of Lauterbrunnen may have been produced by pressure acting throughout long ages on the rocks in their present hard and solid condition.

Again, the lower strata of our globe may be rendered more pliable than the superincumbent rocks by the great internal heat, although it may be insufficient to fuse them or even to maintain them in a viscous condition. Many of the geological effects of a molten ocean may thus be produced.

The theory that volcanic eruptions are caused by water percolating through superficial cracks may, perhaps, give a clue to the reason why volcanoes often occur in a great circle round the globe and in diametrically antipodal positions. When other causes concur to modify the form of the earth, the tidal strain occasioned by the sun and moon may often be required to overcome the *vis inertiæ;* this strain being greatest in the great circles of the globe perpendicular to the direction in which the sun and moon happen to be, cracks would probably occur most readily in these circles.

It seems at least a curious coincidence that some areas of recent subsidence, *e.g.* coral reefs and islands, are parts of the earth's surface which have lately increased rapidly in weight; and it may be worthy of consideration whether coral and volcanic islands have contributed to deepen the bed of the ocean.

J. F. ANDERSON

Cauterets, Hautes Pyrenees, July 12

Curious Rainbow

AN unusual atmospherical effect was witnessed here to-day, which I had a good opportunity of observing. The sun was about 8° from the horizon, shining brightly upon a heavy shower which had a background of dark clouds. The result was, of course, a double rainbow of remarkable brilliancy. In addition, however, to the ordinary circular and concentric bows, there was a third of an elliptical form, the two ends of which respectively sprang from the two ends of the inner arc, while the elliptical curve cut the outer arc at each extremity of a chord, which was parallel to, and which intersected the normal radius at a point about two-thirds of its length above, the diameter that formed the common base. The top of the elliptical bow was thus the outermost of the three, but the space between its inner margin and the outer margin of the second bow, although quite distinct, was not large.

The appearance of the third bow was due to light reflected from the sea. The sun being low, the resulting line of reflection was long, and it was the linear character of the source of light which gave the elliptical form to the bow it occasioned.

Dunskaith, Ross-shire, July 10 GEORGE J. ROMANES

CHLOROPHYLL COLOURING-MATTERS *

II.

I THINK there can be no doubt that the spectra of the various yellow substances given in Pl. II., Figs. 3, 4, and 6 of Dr. Kraus's work, are due to a variable mixture of xanthophyll, yellow xanthophyll, and lichnoxanthine. These can be separated, and do occur in different kinds of plants, either alone or mixed in such variable proportions that the spectra of the solutions show the absorption-bands, not only in variable positions, but also much less distinctly in some cases than in others. This difference is ascribed by the author, not to a variation in the relative proportion of two or more substances, each having definite and unvarying characters, but to the modification of one single substance, due to some unknown cause, assigning as a reason for this supposition that the chemical reactions are the same, and that the positions of the absorption-bands vary so gradually from one extreme to the other that no distinct demarcation can be detected. Now this is so very fundamental a question in such studies, and, according as it is decided, would modify the conclusions so much, that it is requisite to discuss it somewhat fully. No doubt the position of the absorption-bands seen in the spectra of solutions in different liquids does differ very considerably, but I feel persuaded that the spectrum of the same chemical compound, dissolved in the same liquid, is the same in all cases; and that, if there is any difference between the spectra of two similar solutions, it is due to a difference in the substances themselves. I would restrict the term *modification* to those changes sometimes produced by the action of weak alkalis or acids, or by deoxidizing reagents, which are only of a temporary nature, so that when the solution is restored to its original state, the spectrum is seen to be just as at first. We really do require such a term, and I have myself constantly used it in this sense. There is, however, no such relation between the different colouring-matters belonging to what I have called the xanthophyll group; and, though the presence or absence of oily substances may, and sometimes does, materially influence the position of the absorption-bands seen in the spectra of plants themselves, yet, when dissolved in a relatively large quantity of a solvent, this effect is altogether overcome. As I have shown in my late paper the position of the absorption-bands in the different members of the xanthophyll group is very different, and yet it would be easy so to mix them as to have a perfect series of connecting links, and in my opinion the variations from what appear to be independent compounds may be explained in an extremely simple and satisfactory manner, without supposing that the optical characters are subject to any such variations as are ascribed to them by the author. Whenever I have met with these variations I have looked upon them as presumptive evidence of there being a mixture, and have always been able to prove the truth of this principle by subsequent conclusive experiments. The following example will serve very well to explain my views. Many yellow flowers are coloured by a variable mixture of what I have called xanthophyll, yellow xanthophyll, and lichnoxanthine. The former occurs separately in the Alga, *Porphyra vulgaris*, the second in such pale yellow flowers as the yellow *Chrysanthemum*, and the last in the yellow fungus, *Clavaria fusiformis*. The absorption-bands of these two kinds of xanthophyll are in a very different position, and the lichnoxanthine gives no bands, only an uniform absorption, extending over about one half of the spectrum from the blue end. The chemical reactions are also equally distinct. On dissolving each in absolute alcohol, and adding a little hydrochloric acid, the first fades slowly, without being first changed into another yellow substance, and without turning blue or green; the second is first altered into another yellow substance, giving a spectrum with two absorption-bands in a different position, and then turns to a deep blue, whilst the last remains unchanged for a much longer time, and fades very slowly. Now, of course, if all these were mixed together in variable quantities, we should get results varying according to the relative amount of each. The absorption-bands due to the two kinds of xanthophyll would lie in an intermediate position, according to the relative amount of each constituent, and would be more or less indistinct, according as there was more or less of the lichnoxanthine; and on adding a little hydrochloric acid to the solution in alcohol the colour would turn to a more or less blue green, and subsequently fade to a pale or deeper yellow, according to the relative quantity of each constituent.

In order to make my meaning more clear, let us suppose that we were to take a mixture of equal quantities of xanthophyll and yellow xanthophyll. Using the notation I have so often explained in former papers, the centres of the absorption-bands of the spectra of a solution in bisulphide of carbon would then be—

Xanthophyll	$6\frac{1}{2}$	8
The above mixture	$6\frac{3}{4}$	$8\frac{1}{4}$
Yellow xanthophyll	7	$8\frac{1}{2}$

Now on exposing solutions of xanthophyll or yellow xanthophyll to the sun both fade, and if examined when very little colour was left undecomposed, the bands would be seen to be in the same position as at first, the solution being in fact just as if a large part of the colour had been removed, or as if it had been much diluted. In the case of the mixture this would not be the case. Xanthophyll is more rapidly decomposed than yellow xanthophyll, so that when very little colour was left the bands would be no longer in the original position, but in the same place as those of yellow xanthophyll, showing that a small quantity of this is left, when all the other has been destroyed. If some lichnoxanthine had been mixed with the solution, after longer exposure to the sun no absorption-bands would be seen, only the general absorption due to that substance. Moreover if we took equally deep coloured solutions in absolute alcohol of the same three different specimens, and added a little hydrochloric acid to each, the xanthophyll would fade till it was colourless, the yellow xanthophyll would turn to a fine blue,

* Continued from p. 204.

and the mixture would also turn blue, but of only about half the depth of colour. If lichnoxanthine had been present it would have caused the colour to be green; and, after the blue product had faded, it would remain as a residual yellow. By experimenting with such known mixtures we therefore see that, independently of being able to partially separate the constituents, the evidence of the solution being a mixture consists in the difference in the position of the absorption-bands, in the change in their position, or disappearance, when partially decomposed by light, and in the relative quantity of blue substance formed by the action of hydrochloric acid, and of the residual yellow. Such, then, being the case, we know what kind of methods to employ in studying natural coloured solutions, suspected to be mixtures; and on applying them to the investigation of the solutions obtained from leaves and flowers, I find that they behave exactly like such artificial mixtures, and not only so, but there is generally no difficulty in more or less perfectly separating the constituents, so as to correspond more or less closely with the different substances in their more pure state. The evidence of their being mixtures is therefore as good as could be expected. Kraus seems never to have made such experiments, and yet he strongly criticises what I had said about the existence of several distinct kinds of xanthophyll; but I contend that by adopting the principles I have described, we can completely explain the various facts on perfectly simple principles, without supposing that the optical characters of any single substance are subject to variations from some unknown, and, as I believe, altogether imaginary cause.

The flowers of different varieties of *Eschscholtzia californica* are also a good illustration of my views. The very yellow petals are coloured by yellow xanthophyll, with a very little xanthophyll and lichnoxanthine, and thus correspond with many other similar flowers, but the more orange-coloured petals, and the orange-coloured portions of the yellower petals, contain in addition, another colouring-matter, giving the absorption-band in the green shown in Plate II. Fig. 7, at 1 *a*, of Kraus's work which, however, he did not look upon as evidence of a mixture—merely of what he calls a modification. Now, on exposing such a solution in bisulphide of carbon to the sun, this orange-coloured substance is more rapidly decomposed than the others, and in a while a yellower solution is left, which gives exactly the same spectrum as that due to the colouring-matter from the yellow petals. According to this view of the subject we therefore see that the yellow flowers are of the usual type, and that the more orange-coloured portions of the petals, and the whole of the orange-coloured varieties differ only in there being developed an unusual and independent substance, which in this case is of orange-colour, whereas in the flowers of some other plants, such additional colouring-matters are red or blue, as the case may be, and instead of being allied to xanthophyll, differ in almost every particular.

In conclusion I would say that the yellow colouring-matters, soluble in bisulphide of carbon, which exist in green leaves, are the above-named xanthophyll, yellow xanthophyll, and lichnoxanthine. This is probably the reason why this is also the normal type of yellow flowers, and why only in particular cases one or both of these substances are absent. To this I attribute the statement of the author that the chemical reactions are the same, for he has apparently never examined those plants which yield them in an approximately pure state.

In Pl. III. Fig. 2, Kraus gives a representation of the spectrum of a coloured solution obtained from certain species of *Oscillatoriæ*. This he has named *phycoxanthine*; but I am persuaded that the solution must have contained three perfectly distinct colouring-matters, which can be separated by chemical and photo-chemical methods, and do occur almost, or quite, separately in other plants. For one of these substances I have adopted the author's name phycoxanthine. It may be obtained in the most pure state from the lichen *Peltigera canina*, when growing in such a damp and shady situation, that very little orange lichnoxanthine is developed. When dissolved in absolute alcohol and hydrochloric acid is added, it fades without turning blue. Another constituent of the mixture is what I have called *fucoxanthine*, which occurs quite free from phycoxanthine in *Fucus* and other olive *Algæ*, and even in the same species of *Oscillatoriæ*, growing where there is very little light, as those which contain phycoxanthine, if growing well exposed to the sun. When dissolved in absolute alcohol and hydrochloric acid is added, it turns to a splendid blue. The third constituent of the mixed solution is what I have named *orange lichnoxanthine*, which can be obtained by itself from lichens, and is left when such a mixed solution as described by the author, in bisulphide of carbon, is exposed to the sun under green glass, until the phycoxanthine and fucoxanthine have been destroyed. When dissolved in absolute alcohol and treated with hydrochloric acid it fades very slowly. The relative amount of this is greatest in those specimens of *Oscillatoriæ* which grow very much exposed to the sun and air, and I have found by careful comparative quantitative analyses that the relative quantity of these various substances, which together constituted the author's phycoxanthine, varies in such a manner that, as far as the fundamental colouring-matters are concerned, the same or closely allied species of *Oscillatoriæ*, growing exposed to a varying amount of light, furnish a most interesting series of connecting links between olive *Algæ* and lichens. When their vitality and constructive energy are very much reduced by want of light, their type of colouring closely approaches to that of olive *Algæ*, whereas when they are exposed to much air and light, the type approaches to that of such lichens as *Peltigera canina*. I have met with other analogous cases, and if more extended research should still further confirm the existence of this analogy between the results due to abnormally reduced or increased vitality in the same kind of plants, and the normal characters of lower and higher classes of plants, it would certainly be remarkable, as showing that the vegetative energy of the lower classes is in some way or other of a lower type than that of the higher classes, and would present a striking analogy to the relation between the structure of animals whose development has been arrested, and that of those of lower organisation.

The fact of being able to prove that a coloured solution obtained from a plant is really a mixture of a number of different substances, may at first sight appear to be of very little consequence, but I trust that some of the conclusions deduced from this method of study will justify me in looking upon it as very well worthy of attention. When we come to study the various classes of plants growing under various conditions, with the view of constructing such a general science as that I have named comparative vegetable chromatology, these details become not only of the very greatest importance, but absolutely essential. By making qualitative and comparative quantitative analyses of the colouring-matters, carefully distinguishing the fundamental from the accidental, there seems every reason to believe that the petals and the foliage of plants can be brought into morphological agreement, and many of the leading classes of plants distinguished, and at the same time connected together, so as to form a continuous series, advancing from the lowest classes of animals to the highest classes of plants; whereas, if we were to look upon mixtures as independent colouring-matters, and were not to distinguish well-marked species, the whole vegetable kingdom would appear broken up and disjointed, without any chromatological continuity.

H. C. SORBY

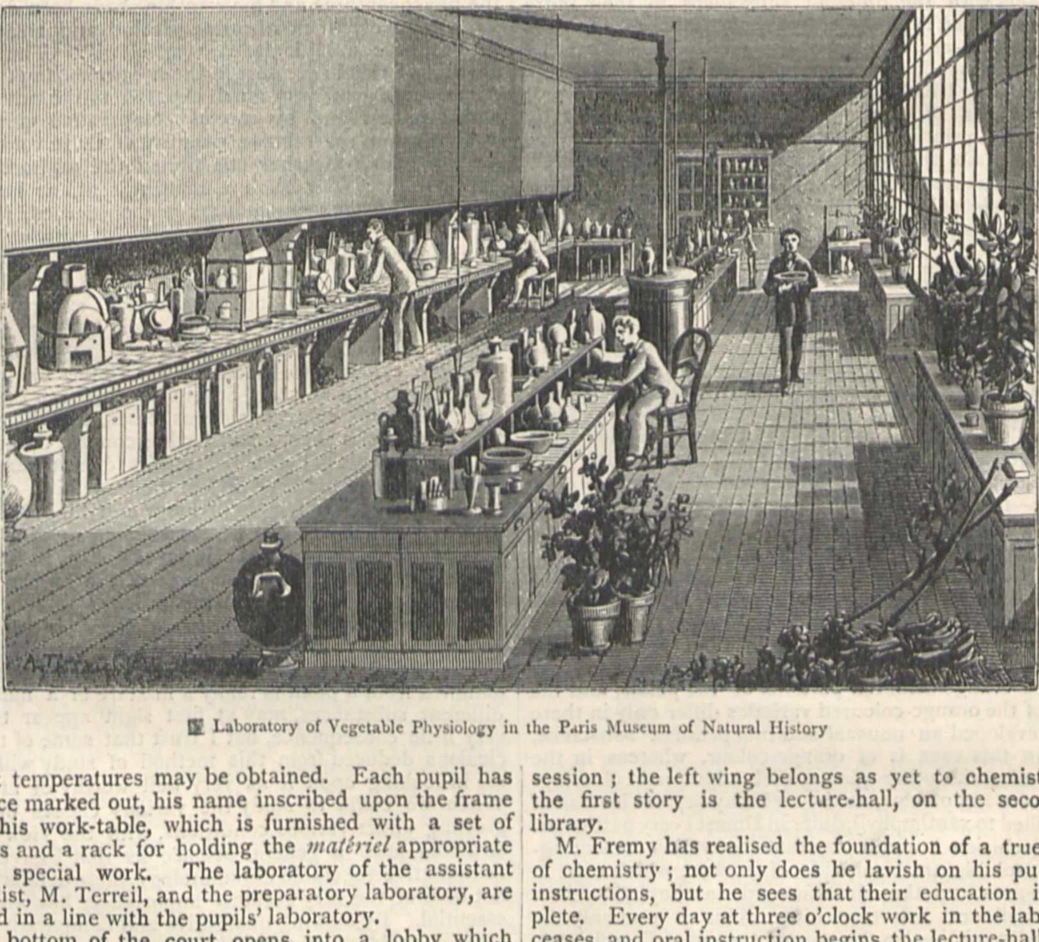
THE NEW LABORATORIES OF THE NATURAL HISTORY MUSEUM, PARIS *

IN order to provide every facility for the higher scientific education, and induce young men to devote themselves to scientific research, the French Government have established a school of advanced study, in the form of a suite of laboratories in which young men receive a practical education *par excellence*; they are trained there in manipulations and dissections, and initiated in all those delicacies of touch, those turns of the wrist, which are traditional in the green-rooms (*coulisses*) of science, but which cannot be taught in the theatre.

Without noticing at present the zoological laboratories under the zealous management of M. A. Milne-Edwards, and through which have already passed several students desirous of taking the degree of licentiate in natural science; or the physiological laboratory, at the head of which is the eminent M. Claude Bernard, or the laboratories of comparative anatomy and geology, we shall take the reader through the Rue de Buffon, into the new buildings which contain the chemical laboratory of M. Fremy, the botanical laboratory of M. Brongniart, and the laboratory of vegetable physiology and anatomy of M. Decaisne.

M. Fremy had already, for many years, assembled his pupils in the old Museum buildings, badly lighted, small, confined, where they were very uncomfortable; now, on the contrary, they are installed in a new building where they are furnished with every convenience for their work.

As soon as we enter the court, we find on the right and left, platforms (*paillasses*) in the open air with a glass roof, where all experiments can be made, of a nature to taint the atmosphere of the laboratories. On each side are ranged buildings, one specially intended for beginners, the other for more advanced students. The latter is provided with furnaces, by means of which the



Laboratory of Vegetable Physiology in the Paris Museum of Natural History

highest temperatures may be obtained. Each pupil has his place marked out, his name inscribed upon the frame above his work-table, which is furnished with a set of drawers and a rack for holding the *matériel* appropriate for his special work. The laboratory of the assistant naturalist, M. Terreil, and the preparatory laboratory, are situated in a line with the pupils' laboratory.

The bottom of the court opens into a lobby which communicates with the two wings of the building; here are conveniences for depositing the clothes which the students exchange for their working garb on entering the laboratory. A door in this corridor gives access to an antechamber into which open the laboratories of M. Fremy, and that of his special assistant, placed side by side.

The first and second stories of the buildings on the right and in the centre are intended for the botanists of M. Brongniart, who have not yet obtained complete possession; the left wing belongs as yet to chemistry; on the first story is the lecture-hall, on the second the library.

M. Fremy has realised the foundation of a true school of chemistry; not only does he lavish on his pupils his instructions, but he sees that their education is complete. Every day at three o'clock work in the laboratory ceases, and oral instruction begins, the lecture-hall, moreover, being open to the public. M. Fremy gives instruction in general chemistry, with a well-known power of exposition; M. Terreil has charge of analysis; M. Ed. Becquerel, of the Institute, initiates the students in the management of physical apparatus; Jannetaz, assistant in mineralogy, gives instruction in that branch; and lastly, M. Stanislas Meunier, already known by his researches upon meteorites, treats of all the parts of geology which are connected with chemistry. Examinations are held by the lecturers for the purpose of testing the work of the pupils, who are rewarded at

* From an article in *La Nature*, No. 1.

the close of their studies with certificates testifying to their diligence and their acquirements.

All this instruction is absolutely gratuitous. M. Fremy wishes to remain faithful to the old motto of the museum, "Tout est gratuit dans l'établissement," though this excessive liberality is perhaps open to criticism.

Behind the magnificent chemical rooms we found the modest laboratory of M. Decaisne. Descending a few steps we reach a garden set apart to experiments in culture, having on the left a glazed gallery: this is the laboratory of vegetable anatomy and physiology. M. Decaisne superintends and advises the anatomists during his daily visits; M. Dehérain, who is well known for his researches in agricultural chemistry and vegetable physiology, directs the work of the laboratory represented in our illustration. It is a long apartment, perfectly lighted, into which stream the rays of the sun, that plays so important a part in all the phenomena of vegetable life; on the right, ventilators carry off all the strong-smelling gases which the chemist is obliged to employ; long tables, furnished with earthenware vessels, extend along the middle of the apartments as well as underneath the windows. Everything is scrupulously tidy.

This laboratory of agricultural chemistry will no doubt yield to agricultural chemistry important results. The man of science will have here the means of preparing at pleasure true artificial soils; he will see plants of various kinds grow under his eyes; he will nourish them with organic and mineral substances whose composition is known to him. He will follow step by step the various phases of vegetable life; he will study the yet mysterious laws of vegetable life. Indeed it is difficult to state all the powerful resources that are in the hands of the experimenter.

AËRIAL SPECTRES

IN an article on the above subject in *La Nature*, No. 4, M. G. Tissandier gives the following account of what he saw from a balloon on February 16, last.

At mid-day we quitted the earth wrapped in a thick mantle of fog; after traversing the mass of the clouds, we were suddenly dazzled by torrents of light which shot

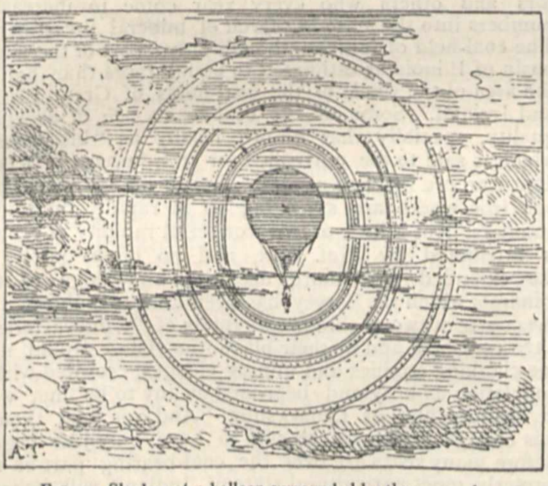
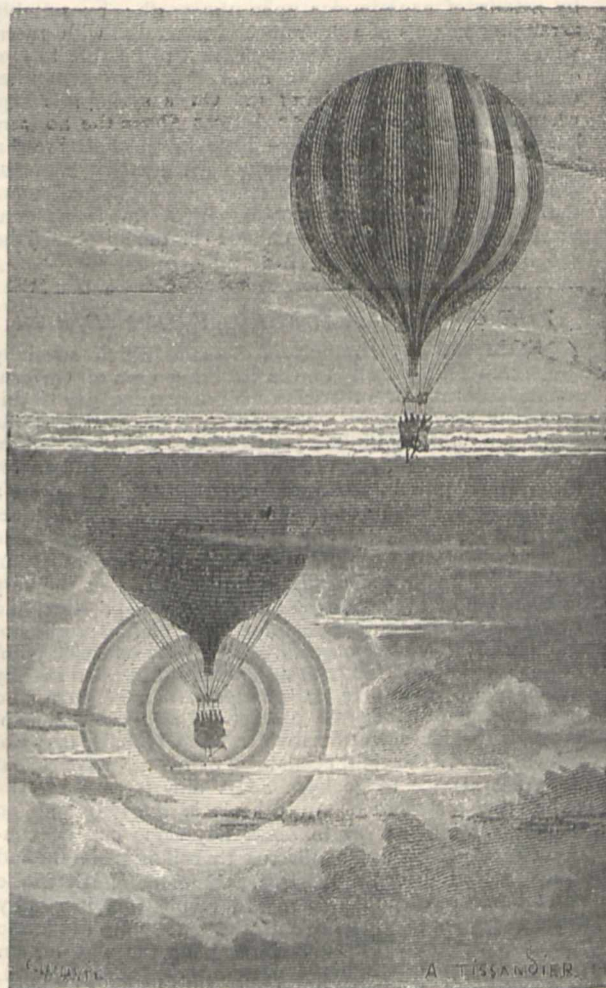


FIG. 1.—Shadow of a balloon surrounded by three aureoles.

rom a tropical sun, a stream of fire, in the midst of an azure sky. Neither the *mer de glace* nor the snowy fields of the Alps, give an idea of the plateau of mist which stretched under the car like a glassy circle, in which valleys of silver appeared in the midst of flakes of gold. Neither the sea at sunset nor the ocean waves when lighted up by the orb of day at noon, approach in splendour this array of circular cumulus, but which have, in addition, "the light that never was on sea or land."

When our balloon had passed about 50 metres beyond the plain of clouds, its shadow was projected with remarkable precision, and a magnificent circular rainbow appeared round the shadow of the car. Fig. 2 gives a very exact idea of the phenomenon. The shadow of the car formed the centre of rainbow-coloured concentric circles, in which were distinctly seen the seven colours of the spectrum, violet, indigo, blue, green, yellow, orange, and red. The violet was inside, and the red on the outside, these two colours being at the same time those which were seen with the greatest distinctness. We were,



G. 2.—Optical phenomenon observed from a ba loon.

at the time the observation was made, at a height of 1,350 metres above the level of the sea.

The balloon, the gas in which expanded under the heat of the sun, continued to rise rapidly in the air, its shadow visibly diminishing; soon, at a height of 1,700 metres, the rainbow-circle enveloped it entirely, and disappeared from around the car. A little later, at about $1^h\ 35^m$, we approached the bed of clouds, and the shadow was girt this time by three silver-coloured aurioles, elliptical and concentric, as shown in Fig. 1.

Nothing can give an idea of the purity of these shadows, which are cut out in an opaline mist, or of the delicacy of tone of the rainbow which surrounds them. The complete silence which reigns in the aërial regions, where this play of light is seen, the absolute calm which exists there, above clouds transformed by the sun into flakes of light, adds to the beauty of the spectacle, and fills the soul with inexpressible admiration.

We do not yet know exactly to what cause to attribute the production of a luminous contour around the shadow projected upon vapours or mists. Some observers have thought that these phenomena are due to the diffraction of light, but it is possible that they have a common origin with the rainbow. What tends to confirm this opinion is the necessity for the presence of the vapour of water as a necessary condition of the phenomenon: if it is the result of diffraction, it ought to appear as well upon a white wall, or any kind of screen, as upon a cloud. It is possible, moreover, to study these curious phenomena by means of experiments upon the earth; by suitably arranging screens of silk or muslin saturated with water, which resemble a cloud, we may expect to be able to produce the phenomenon. M. Leterne points out another excellent method of studying it. On a spring morning, when the sun, about 15 or 20 degrees above the horizon, has warmed the atmosphere a little, and has produced a light condensation of vapour upon the grassy borders of the roads, one may see his silhouette projected upon the humid verdure, surrounded by a luminous contour, in which is seen the colours of the spectrum, the red, however, being strongest.*

* *Comptes Rendus*, t. lxxvi. p. 786.

THE GEOLOGICAL SURVEY OF INDIANA

GEOLOGY is a branch of Science which specially commends itself to the fostering care of Governments, paternal or otherwise. More particularly is this true of a new country, where, in the imagination of the settlers, untold wealth has yet to be dug out of the earth, if only they could discover in what quarter best to look for it. Accordingly, in not a few of our colonies and in a number of the States of the Union, geological and mineralogical surveys have long been at work, originated and continued at the public expense. In most cases, of course, the first aim of such surveys, and in fact the very justification of their existence in the eyes of practical and by no means scientific legislators, is the finding of mineral wealth. If they were begun from the lofty scientific point of view they would fail, and deservedly. But when a really able scientific man gets the charge of one of them, and has at the same time that mother-wit and knowledge of the world which scientific men so often lack, he may not only attend to the rigid economics of his paymasters, but do great service to geology. His aim is to show the public that a strictly scientific basis is the only one on which a mineral survey to be of any value can be conducted. And this is so obvious that if it is simply and clearly stated, it for the most part commends itself to the common-sense of public men. In laying this necessary basis and then in carrying out the survey for economic minerals the geologist may both pave the way for an enormous increase to his country's industry and wealth, and add much of permanent interest and importance to the common stock of geological knowledge.

Perhaps the most notable illustration of the successful accomplishment of this double mission is furnished by the career of Sir William Logan, whose practical kindly ways enabled him to triumph over the shortsightedness of colonial obstructionists, and whose patient and sagacious labours among the rocks of Canada have made his name honoured and familiar all over the world, and have conferred distinction also upon his country. In the United States, too, fostered by the liberality of the Legislatures, a number of admirable State surveys have been made, or are still in progress. Under the auspices of such men as James Hall, Owen, the Hitchcocks, the brothers Rogers, Hayden, Whitney, Blake, Cook, and others, not only have maps been constructed, but elaborate reports have been published, embracing, in addition to the paramount economics, much valuable information in geology, mineralogy, and palæontology.

One of the latest of these State surveys is that of Indiana, which was started some four years ago under the direction of Prof E. T. Cox. Like those already referred to, it was organised by the authorities "for the purpose of collecting information designed to promote the interests of agriculture, arts, manufactures, and mining." But it was furnished at the same time with an analytical laboratory "for analysing such ores and substances as may be deemed useful to the State," and with space "to build up a geological and natural history cabinet," while in order to render its labours as speedily serviceable as possible, an annual report of progress was required to be issued.

Prof. Cox has evidently a hard task before him. He has been invited to become a kind of depository of all the mining information in the State. He is to see that trustworthy mineral surveys are made, and at the same time he is expected to look after the laboratory and infant museum at Indianopolis and—perhaps most laborious but not least useful of all—to receive everybody who wants to know about coal, iron, or other mineral produce, and to collect and furnish to such inquirers all the information procurable. He generously says in one of his reports that this latter part of his duties "has always given him pleasure," though he confesses that it has consumed a considerable portion of his time. Fortunately he can count on the help of a small but apparently able staff of assistants, and notwithstanding all the obstacles in his way he has succeeded in getting through a large amount of work which, though not yet of high scientific value, must bear most importantly upon the future development of Indiana.

Three volumes of reports with maps have been published, bringing the account of the progress of the Survey up to the end of last year. Each of these neatly printed and not too bulky octavos describes several counties of the State with reference chiefly to the distribution of economic minerals; and the maps which accompany it, though roughly and cheaply executed, are clear and must be of infinite service to the many speculators and others who every year come in increasing numbers into the state in search of mineral investments. The coal-field of Indiana, though only a part of the larger basin of Illinois, is estimated to equal more than half of the area of the whole of the coal-fields of Great Britain and Ireland. Some of the coal-seams are of excellent quality, specially that known locally as "block-coal," which is said to be unrivalled for iron-furnaces. Abundant iron ore likewise occurs. Hence not only coal-pits but iron-works are springing up in rapidly increasing numbers. Not a little of this wonderful rapidity of growth is attributed by Prof. Cox, and no doubt justly, to the extended and more accurate knowledge of the minerals which the Survey has been able to publish. In the course of two or three years tracts of "primeval forest" have vanished, and in their place the visitor would now see clanking engines and mining villages, crowded with a population as busy and begrimed as any to be met with in Staffordshire or Lanarkshire. And yet vast though this change is, it may be said to have only just begun. Before many years are over the coal-bearing part of the formerly quiet agricultural state of Indiana will become one of the most active centres of industry in the Union, with railways diverging in all directions to carry away its mineral produce.

Prof. Cox and his assistants have not only been successful in pointing out the mineral resources of the various counties. In looking through his reports one can see that he continues from year to year to slip in more of general scientific interest. This is notably the case with the volume lately published. In addition to a series of elaborate analyses of coals, we find that in the coal-pit sections the names of characteristic fossils have found their way into the text, that notices are given, not merely of the economically useful minerals, but of the geological formations which have no special industrial value,—Silurian, Drift, River-terraces, &c. The volume contains also meteorological tables and notices of recent geological changes. But by far the most interesting contribution to science in its pages is a "Report on the Wyandotte Cave and its Fauna," contributed by Prof. E. D. Cope, with an account of the geology of the cave, by Prof. Cox himself. This remarkable cavern runs through the "sub-carboniferous" limestone in numerous branches which are said to have a total length of twenty-two miles, and greatly to excel the more famous Mammoth cave of Kentucky in the number and beauty of their stalactites. It contains a peculiar fauna, numbering at least sixteen species, which show a general resemblance to those of the latter cave, and include one species of blind fish (*Amblyopsis spelæus*) which lives in the subterranean waters of Kentucky.

In these Reports each county is described separately, so that the same geological facts require to be frequently repeated. This is, doubtless, the most useful arrangement for those for whom the volumes are primarily intended. But it would be a service to other readers if a good table of contents were given, and if the index were made much fuller, especially in matters of general geological interest. The volumes are eminently praiseworthy, and we hope to see them followed, before long, by a good map and a general geological Report of the whole State of Indiana. A. G.

INTELLECT OF PORPOISES

A SINGLE visit to the Brighton Aquarium would suffice to convince a recent correspondent, Mr. Mattieu Williams, that the intellect of the porpoise, as foreshadowed by its convoluted brain, exceeds, beyond comparison, that of the cod-fish or any other representatives of the piscine race. Of the two specimens now inhabiting the largest tank in the building, over one hundred feet long, the first-comer so readily accommodated itself to its altered conditions, that on the second day it took its food, smelts and sprats, from its keeper's hand, and has continued to do so ever since. The later arrival was, at first, less sociably inclined; but both have latterly become equally tame, and frequently, while receiving fish from my hand with the gentleness of pet dogs, have permitted me to pat and stroke their slippery india-rubber-like backs.

During feeding-time it is amusing to watch the avidity with which these porpoises take their food; one, the more active of the two, usually securing the lion's share, and displaying marked sagacity by frequently snatching a second or third morsel before disposing of the first.

The keeper in charge of these interesting animals is now in the habit of summoning them to their meals by the call of a whistle; his approaching footsteps, even, cause great excitement in their movements, and recent experiments have proved them to be acutely sensitive to the vibrations of sound. By the physiologist a more pleasing spectacle can scarcely be witnessed than the graceful actions of these cetacea, as they swiftly pursue their course up and down their spacious tank, ascending to the surface of the water at intervals of fifteen or twenty seconds, to breathe, each inspiration being accompanied by a spasmodic sob-like sound, produced by the rush of air as a breath is rapidly liberated and inspired through the single central blow-hole.

Onward progress is effected in these animals, as in all other cetacea, exclusively by the action of the horizontal caudal fin; the development of muscle at the "wrist" of the tail on which this action depends being enormous and plainly visible externally; the pectorals are devoted principally to the purpose of steering the creature to the right or left, aiding it also in rising to the surface of the water.

The fact alone of the porpoise suckling and evincing much maternal solicitude for the welfare of its young indicates the superiority of its position in the zoological scale above that of the other representatives of the finny tribe; and to this, in addition to the remarks just made upon their sagacity when feeding, many other facts may be cited, pointing in the same direction. The curiosity attributed to these creatures, as illustrated by the experiences of Mr. Mattieu Williams, receives ample confirmation from their habits in confinement. A new arrival is at once subjected to the most importunate attention, and, advancing from familiarity to contempt, if disapproved of, soon becomes the object of attack and persecution. A few dog-fish, *Acanthias* and *Mustelus*, three or four feet long, placed in the same tank, soon fell victims to their tyranny, the porpoises seizing them by their tails, and swimming off with and shaking them in a manner scarcely conducive to their comfort or dignified appearance, reminding the spectator of a large dog worrying a rat. The fine sturgeon, six feet long, now sharing an adjoining tank with the cod, was first placed with these animals, but in a short time was so persecuted that for safety it had to be removed; while to this day the lacerated condition of its tail bears witness to the pertinacious attention of its former comrades. Some large skate (*Raja clavata* and *maculata*), while they maintained their usual habit of lying sluggishly on the floor of the tank, escaped molestation; but no sooner did these fish display any unwonted activity than the porpoises were upon them, and, making a convenient handle of their characteristic attenuated tails, worried them incessantly. On one occasion I witnessed the two *Cetacea* acting evidently in concert against one of these unwieldy fish, the latter swimming close to the top of the water, and seeking momentary respite from its relentless enemies, by lifting its unfortunate caudal appendage high above its surface. It need scarcely be remarked that the skate were removed before further mischief could be done, leaving the porpoises, with the exception of a few conger, which during the day-time mostly lie hidden in the crevices of the rock-work, turtles, and a huge monk-fish (*Rhina squatina*) sole occupants of this colossal tank.

While far behind the porpoises in display of intellect, it may be hereafter shown that the representatives of the *Gadidæ*, or cod-family, are by no means the least intelligent of fish. W. SAVILLE KENT

AN INTERNATIONAL COINAGE

A PROPOSITION has been made for holding a private conference for an International Coinage at Vienna in the course of next September, and to consider more particularly the following points:—

1. The question of Valuation.
2. The principal Coins.
3. The Unit of Value, and its Sub-divisions.
4. The charge for Coining, the rate of alloy, and other technical questions.
5. The preservation of the full value of the principal Coins in circulation, and the coining of others.
6. The different modes of introducing a new money-system.

The prime mover and most active agent in the promotion of this conference is Mr. A. Eggers, Consul in Bremen. The declared object is to bring together a limited number of semi-official or private representatives of the various countries, with a view of a full discussion of the subject; and a committee has been constituted consisting of several French and German gentlemen who are interested in the question of the International Coinage.

Mr. Eggers has recently paid a visit to this country with a view of inducing some of the English advocates of an International Coinage to take part in the proposed conference. It was suggested by Mr. J. B. Smith, M.P., that a private meeting should be held to enable Mr. Eggers to explain his views, and this meeting was accordingly held on the 25th ult. at the Standards Office, 7, Old Palace Yard. But few persons, however, attended; amongst them were Dr. Leone Levi and Mr. Hendricks; Mr. J. B. Smith was himself absent from illness.

The principal propositions of Mr. Eggers, which seem to be fully explained in his printed pamphlet, entitled "Die Geldreform," published at Berlin, were—

1. That the International Coins should be of a round metric weight.
2. As common units of value, a dollar of fine gold $1\frac{1}{2}$ gramme, and a coin of 25 grammes of silver $\frac{9}{10}$ fine.
3. As nearly corresponding with the pound sterling, a coin of 5 dollars, or a new sovereign of $7\frac{1}{2}$ grammes of fine gold.

And he suggested that such a gold dollar and sovereign might be first introduced in Canada, as very nearly agreeing in value with the American gold coinage.

The objections raised against these propositions were, first, that if the fine gold in the dollar weighed $1\frac{1}{2}$ grammes, the addition of $\frac{1}{9}$ alloy would make the actual weight of the dollar $1\frac{2}{3}$ grammes, which is not a round metric weight. There would be the same result with the new sovereign of $7\frac{1}{2}$ grammes fine gold, as $\frac{1}{9}$ alloy would make the actual weight $8\frac{1}{3}$ grammes.

A far more serious objection was that the difference between the $7\frac{1}{2}$ gramme fine gold in the proposed new sovereign, and 7·32238 grammes in the existing sovereign, equal to 0·17762 grammes, would increase the value of the sovereign more than $5\frac{1}{2}d.$, which was quite inadmissible.

The question of a silver International Coin was not discussed, the general opinion being that the difficulties of agreeing upon a single gold unit were already sufficiently great, and that until they could be overcome, it was almost hopeless to expect that any International Coinage could be established. The adoption in the German Empire of the 20-mark piece as the gold coin unit, and containing 5·04*d.* less in value of fine gold than the sovereign, together with the very large amount of the new German gold coinage, appears to offer at the present time an insuperable obstacle to the common adoption of an International Coinage, however desirable it may be.

NOTES

AT the meeting of the Paris Academy of Sciences on the 7th instant, three elections to the Section of Anatomy and Zoology took place. The places to be filled were those of Mr. Agassiz, elected a Foreign Associate, and MM. Pictet and Pouchet, deceased. In the first case M. Steenstrup obtained 38 votes and Mr. Darwin 6; in the second Mr. Dana obtained 35 and Mr. Darwin 12; in the third Dr. Carpenter obtained 35, Mr. Darwin 12, and Mr. Huxley 1 vote. Messrs. Steenstrup, Dana, and Carpenter were therefore declared duly elected.

THE Professorship of Anatomy at King's College, London, rendered vacant by the death of Mr. Partridge, was refilled on Friday last by the appointment of Dr. Curnow, a former student of the College, whose medical career at the University of London has been one of the most brilliant on record. After having obtained the scholarships and gold medals in Anatomy and Materia Medica at the first M.B., he was equally successful at the second M.B., gaining the same honours in Medicine and Obstetric Medicine. At the M.D. examination Prof. Curnow also obtained the gold medal. We cannot but think that the Council of King's College have made a judicious selection, and have gracefully recognised talent in one of their most promising pupils.

THE Royal College of Science for Ireland, in connection with the Science and Art Department, South Kensington, has conferred the diploma of associate on the following gentlemen:—Faculty of Engineering: G. P. Culverwell, E. P. Culverwell, R. W. Frazer, and E. Barrington. Faculty of Manufactures: Thomas Abbott. The two Royal Scholarships were awarded to John O. Hicks and James Patterson. The silver medal to F. A. Caldwell.

"IT never rains but it pours." Prof. Agassiz, as representing the Anderson Natural History School, of Penikese Island, has been presented by Mr. C. W. Galloupe, of Swampscott, with a handsome yacht of 80 tons, estimated to cost 20,000 dollars. The vessel will be used for dredging, temperature soundings, &c., along the coast in the neighbourhood of the island; its presentation makes perfectly complete the apparatus for practically training the students of the finest natural history school in the world.

AMONG the "Innocents" slaughtered yesterday in the House of Commons we are sorry to notice the Weights and Measures (Metric System) Bill, which was withdrawn by Sir Thomas Bazley, in the absence of Mr. J. B. Smith. No notice had been given of this step, which naturally drew forth some protests.

THE Report of the College of Physical Science of Newcastle-upon-Tyne, at the end of the second year of its existence, is altogether satisfactory. The classes have been augmented from four to eleven, and the number of students shows a considerable increase over the previous session; the attendance at the evening classes is also satisfactory. The number of students attending instruction in practical chemistry has been so great as to render it necessary to make arrangements for materially increasing the laboratory accommodation. The Council are very sanguine of the success of the college, though they feel the necessity of founding more professorships and obtaining more accommodation, and think that the wealthy manufacturers and merchants of Newcastle and the North of England ought to render much more assistance than they do. We hope the wealthy manufacturers of the North will see it to be their duty, as it certainly is their interest to contribute to the success of such an institution in their midst. It would certainly be a disgrace to Newcastle if its Science College should, in the midst of enormous wealth, not attain the greatest possible measure of success. There is no reason why this institution should not be made as successful as Owens College, Manchester, and we hope that ere long similar institutions will be established in all the large towns of England. It would be a pity that those who are concerned in the management of the Newcastle institution should mar its success by any antiquated restrictions as to a knowledge of ancient languages by those who have shown themselves deserving of a degree in science.

WE regret to announce the death of the eminent engineer, Mr. J. R. McClean, M.P., F.R.S.

OUR readers have no doubt heard of the recent miserable thefts of living Italian coral from the Crystal Palace Aquarium. It is really difficult to find words to characterise the despicable meanness of the act. Mr. Lloyd says that these things are never taken when working people are present. Meantime the public must suffer for the act of an individual, for it has been thought necessary so to secure the corals under lock and key, that they cannot be so well seen as before, when in open tanks. We can only hope that the petty thief will be discovered: happily such acts are rare in our places of public resort.

A NEW part of the quarto "Transactions of the Zoological Society," just issued, contains three papers by Prof. Owen. The last of these is of special interest, as containing the first account of a new extinct Struthions form from Australia, proposed to be called *Dromornis australis*, for the full description of which we must refer our readers to the paper in question.

THE post tertiary fauna of Australia is extremely rich in *Macropodidæ*, or Kangaroo, many of which greatly exceed any of the existing species in size. Professor Owen has lately described a large series of these in a memoir presented to the Royal Society, and has divided them into numerous genera, founded upon somewhat minute distinctions in the characters of the teeth. We have just received from Mr. Gerard Krefft, Curator of the Sydney Museum, a photograph of the teeth of a giant of the race, the four molars together measuring from before backwards as much as three inches. It is unaccompanied by any description, and pending the publication of Prof. Owen's memoir, we are unable to say whether it belongs to either of the species described therein.

THE tank containing the Spring Lobster or Sea Crayfish, *Palinurus vulgaris*, at the Brighton Aquarium, No. 26, is invested with special interest at the present moment, on account of the appearance, during the last few days, of innumerable young. Until within late years, the early condition of this, the largest of our British crustacea, was regarded as a distinct species, allied to *Squilla*, representing the Stomapodous instead of the Podopthalmous order of their class; it was thus described by Leach under the name of *Phyllosoma commune*. The celebrated Belgian naturalist, Prof. Van Beneden, was one of the first to establish the identity of these two forms, and the result of his praiseworthy investigations was simply and amply confirmed by the recent arrivals at the Brighton tanks. In this "*Phyllosoma*" phase, the ovate body is so remarkably transparent and flattened out, that even when several inches in length they can scarcely be distinguished at the surface of the sea, where they often float in countless numbers. Some very fine examples of these crustacea, illustrating this interesting stage of their development, are exhibited in the typical invertebrate series in the Royal College of Surgeons. The specimens at the Brighton Aquarium just excluded from the egg are very minute, scarcely exceeding half-an-inch in total length, and although swarming in their tank are, on account of their extreme pellucidness, only visible on the most close inspection. The "berried hen" producing this large brood of young, was added to the collection about a month ago. An adjoining tank, No. 28, is teeming in a similar manner with the young of the Common Lobster, *Homarus vulgaris*.

THE number of the "Proceedings of the Asiatic Society of Bengal," containing a report of the annual meeting, has just been received. The chief feature of this meeting was the admirable address of the president, Dr. T. Oldham, from which we are glad to see that under the auspices of this Society, a very large amount of valuable work continues to be done to the literature, archæology, ethnology, and natural history of India. For years the Indian Government ignored the acknowledged claims which this Society had upon it, in return for the Society's handing over to Government its invaluable collection. It is gratifying to be told by the president that the Government of India have acceded in full to the claims of the Society. This gives us some hope that the Government, who have, the president tells us, sanctioned the necessary expenditure for photographic observations of the forthcoming Transit of Venus, will, as the Society desires, maintain and render permanent the small establishment about to be fixed for this object on some elevated spot, for the special purpose of solar observation in connection with meteorology. The British Association at its last meeting requested the Society to urge the Indian Government to establish and maintain an observatory for this purpose in India. The direct value, both to science and to commerce, of the work of such an observatory would be incalculable; and we hope the Society will continue importunate until the Government accede to its wishes. We are moreover glad to see that a committee of the Society has been organised to supplement the work of the *Challenger* by exploring the Indian seas, an almost virgin soil; the necessary funds for the purchase of instruments have been granted, and we hope the ship, which is all that is wanting, will be forthcoming when the instruments are ready. Altogether the Society must be congratulated on the work it does amid many discouragements.

TELEGRAPHIC intelligence has been received in Berlin announcing that the English steamer conveying the German African exploring expedition to Congo has been wrecked off Sierra Leone. There was no loss of life, but all the effects and scientific instruments of those on board were lost.

SHOCKS of earthquake occurred on the morning of July 12 at Rome, Frosinone, Alatri, and several other places. No damage was done. The shocks and subterranean roaring continue in the neighbourhood of Alpago. A rather strong shock of earthquake occurred on the same day in the Valley of Lira, at Isola. The workmen left the manufactories, and several houses were damaged.

MR. J. L. HADDEN, C.E., who was blinded by watching the electric light at Constantinople, is reported as having recovered.

ON June 15, according to the official journal of the Viceroyalty of Konieh, in Asia Minor, snow fell heavily on the mountain called Bulgardagh, in the Kaza of Erkeli. In some places the snow was five feet deep.

WE have already referred to the U.S. exploring expedition to Montana, in connection with the survey for the Northern Pacific Railroad. The correspondent of the *New York Tribune*, writing from Fort Rice in the Upper Missouri, near a newly-founded town called Bismarck, gives details concerning the organisation of the expedition, which was expected to set out from Fort Rice at the end of June. There is a large military escort as a protection against the Indians, and the scientific party is well equipped. It is expected that the waggons which carry out supplies will return loaded with specimens of the natural products of the region, especially of the Yellowstone Basin, to be arranged systematically, and deposited in the National Musuem of the United States. The results of this expedition, so liberally fitted out by the American Government, are likely to be of great service to science.

THE *Times of India* contains an account of the death of a huge boa-constrictor which infested some marshy ground at the foot of the hills near Poodoocottah. The animal was regarded as sacred by the natives, who would not molest it, although only on the morning when Dr. Johnstone and Mr. Pennington, with great danger to themselves, bravely hunted it up and shot it, it had swallowed a young child. The animal is about 21 feet long, and its stuffed skin is to be deposited in the Madras Museum.

AS might be expected, Mr. G. J. Symons' "British Rainfall for 1872," considering the unusual wetness of the year, is of great interest to meteorologists. The author deserves great credit for the immense trouble he has taken in putting together in a handy and useful form such a multitude of statistics, and the great care he appears to have taken to secure accuracy. The greatest rainfall in the three kingdoms during 1872 occurred at The Stye in Cumberland, 1,077 ft. above the sea-level, where it reached the extraordinary amount of 243·98 in.; the smallest amount was at Silsoe in Bedfordshire, where it was only 26·18 in., unusually small as compared with most other places. The volume, besides rainfall statistics, contains much that is of interest to meteorologists, including some statements on the supposed connection between rainfall and sunspot frequency, that are worthy of attention.

"THE U.S. Sanitary Commission in the Valley of the Mississippi during the War of the Rebellion, 1861—1866," is the title of a very interesting volume, giving a detailed account of the organisation and working of this benevolent commission during the American civil war. It seems to have been on the whole well organised and successful in carrying out its object, thus doing much to alleviate the miseries of that unfortunate war.

MR. FREDERICK AYRTON, barrister-at-law, long resident at Cairo, who died in London recently, has bequeathed to the British Museum a splendid library of caligraphic writings in Arabic, Persian, and Turkish, collected during many years' residence in Egypt, and the market value of which probably exceeds 3,000*l*. Mr. F. Ayrton was a perfect connoisseur in the Oriental science of caligraphy, of which so little is known, artistically, in Europe; and he devoted time and money, without stint, to this his favourite study. His collection is, perhaps, unrivalled in Europe. The gift is made on condition that the trustees set apart a room in the Museum for the exhibition of these specimens of Oriental caligraphy, and that Mr. Ayrton's Arabic scribe, Asaád Effendy, be engaged for three or four years, at a salary of 100*l*. per annum, to draw up a catalogue *raisonné* of the contents of each series.

"LES Richesses Naturelles du Globe à l'Exposition Universelle de Vienne," by M. Bernardin, is the title of a short pamphlet called forth by the Vienna Exhibition, the author's object being to show that most of the industrial materials obtained from the animal, vegetable, and mineral kingdoms within the last forty years have been lighted upon by chance, and that if competent men were to make a thorough investigation of the subject, Nature might be made to contribute to industry a vastly greater amount of material than she at present does.

WE learn from Trübner's *Literary Record* that M. Alphonse Pinart has just published a catalogue containing a description of the different collections made during his stay in what was formerly Russian America (Alaska), brought to Europe, and is now exhibiting in one of the galleries of the Museum of Natural History, Paris. The collection comprises objects of Natural History in general, Palæontology, Conchology, and especially a rich collection of objects of high ethnographical interest, as costumes, tools, arms, &c., used by the aborigines of Alaska.

WE are indebted to *Iron* for the following:—During the recent building of a bridge in Holland one of the traverses, 465 feet long, was misplaced on the supports. It was an inch out of line, and the problem was how to move it. Experiment proved that the ironwork expanded a small fraction of an inch for every degree of heat it received. It was noticed that the day and night temperature differed by about 25°, and it was thought this might be made to move the bridge. In the morning the end out of place was bolted down securely, and the other end left free. In the heat of the sun the iron expanded, and towards night the free end was bolted down, and the opposite end was loosened. The contraction then dragged the whole thing the other way. For two days this experiment was repeated, till the desired place was reached. We find no record that the heat of the sun has ever been employed in this way before.

THE following is from *Ocean Highways*:—During the last three years a naval party, commanded by Lieutenant Simpson, has been employed by the Chilian Government to explore the western side of Patagonia. In November and December 1871, Lieutenant Simpson, whose narrative has only just been published, ascended the river Aysen, which falls into the sea in latitude 45° 20' S., opposite the Chinos Archipelago, to the south of Chiloe. He soon came to rapids and waterfalls which stopped his boats, but he pressed on through the forest in pouring rain on foot, and crossed the Cordillera at a point where it has never before been visited. The country had no inhabitants, but it is well wooded, and signs of coal were found.

NO. 5 of the "Lecture Extras" of the *New York Tribune*, contains seven lectures with numerous woodcut illustrations. The principal lectures are, "Sound and Hearing," "Voice and Speech," and The Explanation of Musical Harmony," by Prof. Elsberg, of the University Medical College, New York, "Deep Placer Mining in California," by Prof. Benjamin Silliman, of Yale College, and "The Seven Senses," by Dr. R. W. Raymond, U.S. Mining Commissioner.

ADDITIONS to the Brighton Aquarium during the past week:—3 Green Turtle (*Chelonia viridis*), 4 Green Lizards (*Lacerta viridis*), 45 Mackerel (*Scomber scomber*), 3 Sea-trout (*Salmo trutta*), 4 Bass (*Labrax lupus*), 8 Black Bream (*Cantharus lineatus*), 3 Shad (*Clupea Alosa*) 1 Scad (*Trachurus trachurus*) 2 Octopus (*O. vulgaris*), 2 bunches of spawn of Squid (*Loligo vulgaris*), a brood of young Lobsters (*Homarus vulgaris*), hatched in tank No. 28.

THE additions to the Zoological Society's Gardens during the past week include a Mississippi Alligator (*Alligator mississippiensis*) from New Orleans, presented by Mr. John Hanley; four blossom-headed Parrakeets (*Palæornis cyanocephala*) and an Alexandrine Parrakeet (*P. alexandri*) from India, presented by Mr. Hugh Nevill; six Zenaida Doves (*Zenaida amabilis*) from the West Indies, presented by the Right Rev. Dr. Stirling; a Tabuan Parrakeet (*Pyrrhulopsis tabuensis*) from the Feejee Islands, and a Wagler's Conure (*Conurus wagleri*) from Venezuela, both new to the collection; an Eland (*Oreas canna*) from South Africa, purchased; two Crested Porcupines (*Hystix cristata*) born in the Gardens.

ON THE GERM THEORY OF PUTREFACTION AND OTHER FERMENTATIVE CHANGES.*

II.

THE author next proceeded to describe and illustrate, by diagrams enlarged from camera lucida sketches, some of the variations he had observed in organisms found in the milk glasses when introduced into other media. Another unnamed species of Oidium closely allied to that before referred to, and like it operating as a putrefactive ferment upon urine, was seen to present strange varieties according to the fluid in which it grew and the length of time it remained in it; yet, when placed in boiled milk, it returned to exactly the same character which it had when in the flask of unboiled milk in which it was first observed. But still more remarkable modifications were seen among the Bacteria. One species of very large size, but of ordinary form and movements, as seen first in the milk, presented the following, among other varieties. In Pasteur's solution it grew as motionless algoid threads with nucleated segments. In urine and turnip infusion it did not grow at all, nor did it in the albuminous fluid till boiled and cooled solution of sugar of milk had been added, when it returned to its original Bacteric form at first, but afterwards assumed the characters of a toruloid organism. In boiled milk it resumed the original Bacteric character, but, after seven weeks, the Bacteria had changed from very large to excessively minute ones.

Another species, seen in the first instance in milk, as about the most minute form of Bacterium the author had ever observed, grew in Pasteur's solution as an ordinary full-sized Bacterium; but in urine it assumed the unjointed and cork-screw shape, and the spiral movements of a Spirillum. In turnip infusion it grew with extreme rapidity as an ordinary double-rod-like moving Bacterium, but after remaining some weeks in that medium it assumed a remarkable fungoid character with greatly increased

* Continued from p. 214.

diameter, which on introduction into urine reproduced the moving Spirillum, now of very large size, and sometimes remarkably branched, but as time passed gradually growing a smaller and smaller progeny as the liquid became vitiated, till at length it lost in the urine its spiral shape, and returned to the appearance of the minute ordinary Bacterium first seen in the milk. These may serve as samples of this class of observations, which proved on the one hand how utterly fallacious are any descriptions hitherto given of Bacteria according to form, size or movement, yet, on the other hand, showing that the different Bacteria, like the different Oidia, retained amid all their variations their distinct specific characters.

The fermentative changes induced in the media by the introduction of the various organisms were next alluded to. The test-tubes of the experiment with unboiled milk were shown, and it was pointed out that each different organism was accompanied by a different appearance of the milk, implying that each was associated with a special chemical change in the fluid in which it grew. An enlarged sketch was also exhibited of the boiled milk glasses as they were seen some weeks after they had been inoculated with the various Bacteria, showing that no two of those glasses were alike. In that containing the Bacteria derived from a drop of tap-water introduced into urine the milk had changed to a beautiful green colour; that with the kind which formed the Spirillum in urine was a pure white curdy mass, sharply acid to test-paper, while a third, inoculated with a curious irregular form of Bacterium from another of the milk-flasks, was of umber brown colour. This glass was brought to the meeting because it was of especial interest, not only on account of its peculiar tint, but because it was an instance of a primary alkaline fermentation of milk. Another milk glass had been inoculated with the same organism, and had undergone the same change, assuming in a few days the same umber brown colour, accompanied by powerful alkaline reaction. This particular Bacterium was in some forms undistinguishable from pairs of granules of a form of "Granuligera," which occurred in one of the milk glasses associated with the large Bacteria above mentioned; but the Granuligera having been obtained unmixed by introducing it successively into liquids which permitted its growth, but not that of the Bacterium, it proved to be a feeble acid ferment of milk, not producing any effect upon its colour. One of the glasses sketched was of peculiar interest, because it contained a large motionless Bacterium, which had been the sole product of exposure of a glass of the boiled milk for an hour in a sitting room, the fungus spores that in all probability entered with it having been prevented from developing by the growth of the Bacterium. It happened that the Bacterium thus derived from the air refused to grow in Pasteur's solution, urine, or turnip infusion, so that if the experiment had been performed with either of those fluids, it would have afforded negative results as regards the Bacterium, though fungi would probably have appeared; and this might have been quoted as a good illustration of absence of Bacteric development after atmospheric exposure.

The Oidium, which, as before mentioned, was a powerful putrefactive ferment of urine, produced scarcely any effect on milk, which had remained unchanged in flavour for seven weeks, although converted into a thick mass, not by coagulation of the casein, but simply by the dense jungle of the fungus filaments, while test paper indicated merely a very faint increase of alkaline reaction. The fluid remaining thus unimpaired in quality, explained the luxuriant growth and healthy appearance of the fungus in it, contrasting strikingly with its characters in urine, in which it rapidly occasioned putrefaction, and then formed merely a scum of toruloid rounded cells.

In describing these facts, the author did not affect the circumlocution that would be necessary in order to avoid using the language of the germ theory. As stated at the outset, his original object in the investigation had not been to prove that theory, but to throw light upon the nature and habits of the fermenting organisms. Nevertheless, for the sake of any who might still entertain doubt upon the question, it might be well to point out that the facts which had been adduced were irreconcilable with any other view. It was plain that they utterly disproved the oxygen theory, while they indicated with sufficient distinctness that all instances of so-called spontaneous generation had been due simply to imperfect experimentation. It remained to consider shortly the only other rival theory, the somewhat specious one of chemical ferments. After pointing out some of the inconsistencies of that theory with the facts observed, and how its difficulties became increased with the discovery of every new organism with its corresponding chemical change, requiring the assumption of a new and purely hypothetical chemical ferment, the author reminded the Society that in truth there was not a fact in chemistry to favour the belief that any substance destitute of vitality possessed the one faculty which distinguished all true fermentation, viz. the property of self-propagation of the ferment. Perhaps the most remarkable instance of a chemical ferment was the resolution of the amygdalin of the bitter almond into the essential oil of bitter almonds, hydrocyanic acid, formic acid and glucose under the influence of emulsin. The amygdalin neither gained nor lost a single atom, but was simply broken up into new compounds under the influence of the peculiar albuminous principle emulsin. But did the emulsin undergo multiplication as in the true fermentations? On the contrary, it had been shown by Liebig and Wöhler in their original paper * that a certain weight of emulsin would only break up a limited quantity of amygdalin, and that the emulsin when afterwards separated no longer affected amygdalin. So far from having the property of self-propagation, it lost its catalytic power in the act of catalysis. Thus the chemical ferment theory was in truth utterly destitute of scientific basis as explaining true fermentation.

Such being the case it was contended that the germ theory must now be regarded as demonstrated; viz. that putrefaction and other true fermentations characterised by indefinite multiplication of the ferment are caused by the growth of living organisms, which, while capable of great variations according to the circumstances in which they are placed, retain their specific characters like larger plants, and like them spring only from pre-existing similar organisms.

Nevertheless the so-called chemical ferments had a high degree of interest in this question, as very likely playing an important part in bringing about the chemical changes. For just as it was proved that a peculiar albuminous principle, emulsin, existing in the sweet as well as in the bitter almond, but absent from the pea, or bean, or other leguminous plants examined by Liebig and Wöhle, could break up as much as ten times its weight of a stable crystallisable substance like amygdalin, so it seemed probable that other peculiar albuminous principles might exist in other plants, such as the fungi, and in like manner break up larger or smaller quantities of other stable organic compounds. In this sense, then, as intervening between the growth of the organisms and the resulting decompositions, the theory of chemical ferments might be welcomed as a valuable hypothesis.

Lastly, the author showed some blood obtained from a horse between three and four weeks previously, in the hope that by exposing the carotid artery antiseptically, and receiving the blood from it into a "heated" vessel, and protecting it from dust, he might, after the clot had contracted, decant off the clear serum, and inoculating or exposing the uncontaminated fluid, observe organisms and fermentations corresponding to those which occur in the practice of surgery.

But to his great surprise day after day passed without the clot showing any sign of shrinking, and it remained still uncontracted. In the flask shown, the buffy coat was seen to be present on the upper part of the still tremulous jelly-like coagulum, but instead of being powerfully pinched together into a comparatively small bulk bathed with serum, that part like the rest of the clot was everywhere in contact with the sides of the glass, and not a drop of serum was to be seen. At the same time there was no smell whatever about the cotton that covered the neck of the flask, showing that putrefaction had been avoided. Somehow or other the exclusion of living organisms, while it had not interfered with coagulation, had prevented the fibrine from acquiring a tendency to shrink. This fact, while entirely new, and opening up a wide field of inquiry, was seen to tally with phenomena met with in surgical practice, such as the absence of shrinking of the plug of clot near a ligature placed upon an artery. It was an illustration of how little we are often able to predict what may arise when even the most familiar objects are placed in new circumstances.

SCIENTIFIC SERIALS

THE *Journal of Mental Science*, July.—We have heard or read of a rather impressionable gentleman who, as he perused Dr. Buchan's "Domestic Medicine," fancied himself afflicted with

* *See* "Annales de Chimie et de Physique," 1837, p. 185.

every disorder therein described, not even excepting the pains of pregnancy. Bearing this in mind, we would recommend that none save those well assured of their own sanity should read the *Journal of Mental Science.* There is so much about morbid psychology, madness, and idiocy, that weak readers are in some real danger of being taken possession of by an uncomfortable suspicion that they may be a little touched themselves. The place of honour is given to an address on idiocy by Dr. J. C. Bucknill. This is a piece of special pleading (justified, perhaps, by its occasion) for the education of idiots. Now, as these miserable abortions must be kept in life because of the *indirect* evil effects of any system of extinguishing them, we certainly desire that they should be kept in asylums and made comfortable. But we cannot even grant that they are "more worthy of our efforts than those races of animals which men strive to bring to perfection." Except in so far as Science may be advanced by such work, it seems very much of a waste of time for such a man as Séguin to labour for four months to fix the eye of an idiot as the first step in the education of sight. We cannot go into ecstacy on hearing that idiots are actually taught to use knives and forks, when so many rational beings around us have neither knives nor forks to use, nor any use for them. By all means let the charitable support asylums for idiots; but at the same time it should not be forgotten that these poor creatures can never be educated into anything useful or lovely, and that a point is soon reached beyond which further education is misspent labour.—A valuable paper on "The Use of Digitalis in Maniacal Excitement" is contributed by Dr. W. J. Mickle. Next follows, under the title of "Consciousness and Unconscious Cerebration," a rather muddled attempt, on the part of W. G. Davies, B.D., to upset Dr. Carpenter's doctrine of "unconscious cerebration." From this article one might suppose that the views combated were peculiar to Dr. Carpenter and his so-called disciples Dr. Bastian and Miss Cobbe, whereas in truth the writer has against him not these only, but also the most distinguished of living psychologists. His writing is a good deal in the bad old style, the language serving at times, as it seems to us, to obscure rather than express thought. Dr. Carpenter is accused of imagining a nervous anatomy to suit his theory. But Mr. Davies does not himself seem to be up with the latest scientific surmises. For example, in laying the groundwork of one of his own arguments, he says: "The very same cells in the visual sense-centre cannot, at one and the same moment, see brown and yellow." He does not seem to be aware that it is highly probable that the cells that see one colour never do see another. There are over a dozen other papers, all of more or less, some of them of considerable interest.

THE *Monthly Microscopical Journal* for this month commences with an article by Mr. J. W. Stephenson on the optical appearances presented by the inner and outer layers of Coscinodiscus when examined in bisulphide of carbon and in air, in which the importance of considering the refractive index of the medium in which calcareous and silicious structures are examined, is fully discussed. This is followed by a paper on some new diatoms from the harbours of Peru and Bolivia, by Mr. F. Kitton, in which *Aulacodiscus formosus* and *Omphalopelta versicolor* are the most important.—Mr. F. Wenham, in a very temperate manner, rebuffs the unjustifiable statements of the American microscopists, who, not realising the high scientific position he holds in this country, accuse him of acting unfairly to Mr. Tolles, and insinuate that he has acted from mercenary motives. He ends by saying, "I trust that Colonel Woodward, having affirmed that 'the position taken by me is certainly true for objectives, as ordinarily constructed,' will allow that this additional lens embodies a deviation from the ordinary question, which was to the effect that there would be no loss of angle aperture of ordinary objectives by the immersion of the front surface in fluids."—Dr. Braithwaite continues his observations on the bog-mosses.—Dr. Royston-Piggott considers the high-power definition of minute organic particles, in which he divides his subject into five parts, including the nature of the least circle of confusion, the nature of mixed shadows, and the nature of perfect definition.—The preparation of the brain and spinal cord for microscopic examination, forms the subject of a paper by Mr. H. S. Atkinson, in which he explains in detail the methods employed by Professor Rutherford, and the means of staining sections adopted by himself.

Petermann's Geographische Mittheilungen, No. VI.—An account of Dr. Nachtigal's travels in Northern Africa, which appears in this number, we have already noticed in the advanced sheets One of the longest and most valuable papers is by Dr. C. E. Meinicke on Dr. Bernstein's explorations in the Northern Moluccas, accompanied by a map. An important article is the second part of an account by Freiherr F. von Richthofen, of some of the results of his journey from Pekin southwestwards through China, embracing valuable details on the geology, topography, and natural history of the little known interior of that country. Another important article is on the Aurora Borealis, by M. E. Pechuel-Loesche, who for the purpose of ascertaining the real nature of the phenomenon, brings together the results of the observations of those who have carefully observed it in the Polar regions. This is to be followed by another paper in the same direction.—Dr. H. Wagner contributes an article on the Development of the German Railway System, accompanied by a well-constructed map.

A VERY interesting number of the *Bulletin Mensuel de la Société d'Acclimatation de Paris* has been published for May. One of the principal papers is a long article by the Abbé Desgodins, missionary at Yer-ka-lo, on the zoology of Thibet. The varied temperatures of its different levels are such that the country contains a great variety of animals, the fauna of both tropical and cold climates being found there. A description is given by M. Robert of his patent artificial incubators for hatching eggs, which seem to be more perfect in all their details than any of those appliances we have seen. As a proof of the usefulness of such a Society, the secretary calls attention to the increased price of certain animal and vegetable products of foreign countries, which, if the principle of acclimatisation were more fully developed, could be produced much cheaper in France. Experiments on sericulture have shown that silk of varied colour can be produced by feeding the silkworm on different leaves. Worms fed on vine leaves produce a silk of a magnificent red colour. Lettuce has been found to produce an emerald-green coloured silk. During April, 51 animals and 886 birds were received at the Gardens of the Society, while 51 animals, and 1,333 birds were distributed. Among interesting items of intelligence we may mention that the ostriches have begun to lay, and it is hoped that kangaroos may be so freely bred in France as to justify their being turned loose in suitable parts of the country. Three Trumpeter Swans were received from America.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 19.—"On a tendency observed in Sun-spots to change alternately from the one Solar Hemisphere to the other." By Warren De La Rue, D.C.L., F.R.S., Balfour Stewart, LL.D., F.R.S., and Benjamin Loewy, F.R.A.S.

1. Hitherto in our reductions we have summed up the spotted areas of the various groups occurring on the sun's surface on any day, and have regarded their sum as a representation of the spot-activity for that day. It has occurred to us to see what result we should obtain by taking instead for each day the excess of the spotted area in the one solar hemisphere above that in the other.

2. On adopting this method, it soon became evident that during periods of great disturbance there is a tendency in spots to change alternately from the north or positive to the south or negative hemisphere, and *vice versâ*, the period of such change being about 25 days. When, on the other hand, the solar disturbance is inconsiderable, the spots do not present any such systematic oscillation.

3. We have graphically represented on a diagram the results derived from this method during three of the most considerable periods of solar disturbance.

In this diagram the observed values of hemispherical excess are marked with an asterisk, and a curve is drawn so as to equalise their smaller irregularities. The northern hemisphere is reckoned positive, and the southern negative. The unit of area is, as before, the one millionth of the sun's visible hemisphere.

4. The first of these three periods extends from the beginning of August to the end of December, 1859. We derive from our diagram the following Table, exhibiting the maximum amounts of hemispherical excess, with their respective dates:—

Date.	Hemispherical excess. North.	South.
1859, July 31	+4180	
Aug. 18		(+ 40)
Aug. 27	+2580	
Sept. 11		−2920
Sept. 17	+ 920	
Oct. 3		−1420
Oct. 16	+1000	
Nov. 3		−2480
Nov. 15	+ 120	
Nov. 20		−1320
Dec. 7	+1050	
Dec. 22		−1400

From these we derive the following values of a period of oscillation by taking the differences in dates between the positive extremes:—

27 days, 21 days, 29 days, 30 days, 22 days—mean, 25·8 days;

while doing the same with the negative extremes, we obtain:—

24 days, 22 days, 31 days, 17 days, 32 days—mean, 25·2 days.

5. The second of the three periods extends from the end of June to the beginning of November 1860. Treating this in the same manner, we obtain:—

Date.	Hemispherical excess. North.	South.
1860, July 1	+4900	
July 22		− 600
July 30	+2040	
Aug. 9		−2400
Aug. 21	+ 400	
Sept. 5		−1400
Sept. 16	+ 400	
Oct. 1		−1180
Oct. 9	+ 800	
Oct. 19		−2560
Oct. 31	(− 380)	

From these we derive, by taking the differences in dates of the positive extremes,

29 days, 22 days, 26 days, 23 days, 22 days—mean, 24·4 days;

while doing the same with negative extremes, we obtain:—

18 days, 27 days, 26 days, 18 days—mean, 22·25 days.

6. The third of these three periods extends from the beginning of May to the end of August 1862. Treating this in the same manner, we obtain:—

Date.	Hemispherical excess North.	South.
1862, May 9	+ 600	
May 22		−1160
June 3	+2960	
June 15		−2600
June 29	+1880	
July 16		−800
July 26	+2400	
Aug. 14		−200
Aug. 23	+ 460	

Taking, as before, the distances between the positive extremes, we obtain:—

25 days, 26 days, 27 days, 28 days—mean, 26·5 days;

while from the negative extremes we obtain:—

24 days, 31 days, 29 days—mean, 28·0 days.

From the whole three periods we obtain, as the most probable mean value, 25·2 days.

7. We do not profess to have discovered the cause of these oscillations, but we would nevertheless suggest that the observational facts here brought to light may perhaps be connected with two other observational facts, the one of which was first brought to light by Carrington, and the other by ourselves.

The first of these is the fact that, generally speaking, spots in the north hemisphere have much about the same latitude as those occurring at the same or nearly the same period in the south, both sets widening or contracting together. We may perhaps, therefore, suppose, by applying this law, that the latitude of the spots which cause the positive extremes in the above series is not greatly different from that of those which cause the corresponding negative extremes.

The second observational law is that which tells us that spots about the same period have a tendency to attain their maximum at or near the same ecliptical longitude. Now, if we suppose that in the foregoing three series the greatest positive extremes were caused by the positive spots attaining their greatest size, and the greatest negative extremes by the negative spots, attaining their greatest size, it would follow that the two sets, positive and negative, must have taken their rise at places on the sun's surface 180° of longitude different from each other inasmuch as the one set about twelve or thirteen days before or after passed (let us say) the same ecliptical longitude as the other.

But if the positive set have the same latitude as the negative, and if the one is 180° of solar longitude different from the other, it would mean that *the two outbreaks are at opposite ends of the same solar diameter.*

This conclusion is an interesting one, but, of course, it requires to be verified by further observation before it be finally received. Meanwhile, we are engaged in mapping out systematically the positions of the various outbreaks of the sun's surface, and we shall soon, therefore, be able to find whether or not there be any truth in this conjecture.

Geologists' Association, July 4.—Mr. Henry Woodward, F.R.S., president, in the chair.—1. "A sketch of the Geology of Northamptonshire," by Samuel Sharp, F.S.A. A general section of the county of Northampton shows the lias as a basal formation with the inferior oolite beds of the "Northampton sands" above. Fossils are abundant, and some species are not found in other localities. The upper division consists of a nearly white siliceous sand with bands of clay and a plant bed, the whole of these deposits being evidently of estuarine and littoral origin. Above these, but unconformably, lies the bed classed as Great Oolite, and which consists of, firstly, a series of clay beds with a ferruginous base and containing a plant bed; then, secondly, a limestone series abounding with fossils and affording an ornamental stone called "Alwalton marble." The bed of clay reposing on these great oolite strata may be considered the equivalent of the "Bradford clay," and still higher in a general section will be found the Forest marble, the Cornbrash, and, highest of the secondaries, the Oxford clay. The high lands of the county are frequently capped by boulder clay and glacial gravels containing fragments from nearly the whole series of the primary and secondary rocks. A peaty fluviatile bed above the gravels contains at its base numerous remains of mammalia. The lias extends throughout the county though appearing only in the valleys, the iron sands occupy the middle and the Lincolnshire limestone the northern portion of the county, while the other formations are patchy in extension. A high table-land about Naseby gives rise to the Avon, the Welland, and the Nene, which occupy the principal valleys of the county. In past times efforts were made at considerable cost to find coal, and recently the question of whether coal can be obtained in the county has been discussed, but judging from what we know of the rocks of the nearest coal-field of Warwickshire, and of the intervening district, as much as 4,500 ft. of strata may lie above coal-seams of sufficient thickness to be worked. Moreover, Prof. Hull, F.R.S., concludes that "Carboniferous" coal will not be found at any depth in Northamptonshire.—2. "On some new Crag Fossil," by Alfred Bell. The author's observations since his former paper on the crags was read, confirm the views he then expressed as to the divisibility of the English crags into four divisions founded on palæontological evidence. He had determined 145 species (some new, some new to the crag, and some new to particular divisions) in addition to those given in his published lists.—3. "An account of the Eruption of Mount Vesuvius of April 1872," by J. M. Black. In this paper the brief but violent and destructive eruption of last year was described by the author, who has carefully noted the various phenomena that occurred during its continuance. An ascent of the volcano was made by Mr. Black, a few days after the eruption, and the form and condition of the crater observed. The author had succeeded in photographing various parts of the mountain after the eruption, and the views so taken were exhibited.

PHILADELPHIA

Academy of Natural Sciences, April 1.—Dr. Ruschenberger, president, in the chair. The following paper was presented for publication:—"On the Affinities of the Sirenians," by Theo. Gill. Prof. Leidy remarked that the rat presented this evening by Mr. L. Fussel was a specimen of the Black Rat, or *Mus rat-*

tus, which had been caught on board a ship in the vicinity of the city. This rat is exceedingly rare, but is said to have once been common enough, and is also said to have been nearly exterminated by the common brown or Norway Rat.

April 8.—Dr. LeConte announced the death, at Davidsburg, York Co., Pa., on March 10, of Friedrich Ernest Melsheimer, M.D., a correspondent of the Academy, aged nearly ninety-one years. He inherited great taste for entomology from his father, E. F. Melsheimer, a clergyman, who cultivated natural science with much success, and not only was a highly esteemed correspondent of Knoch and other European entomologists of the end of the past and beginning of the present century, but an active collaborator with Say, the founder of descriptive entomology in the United States. Entomology also owes to Dr. Melsheimer the catalogue of the described Coleoptera of the United States, which was published by the Smithsonian Institution in 1853. It was the first work of bibliographical importance in the modern history of that branch of science, and gave a powerful impetus to its development in the United States, and has greatly diminished the labour of those who have continued the study of that department.

April 15.—"Observations on a Change of Structure of a Larva of *Dryocampa imperialis*," by Thos. G. Gentry.—"Remarks on Extinct Mammals from California. Prof. Leidy directed attention to some fossils, which he had borrowed, through Prof. E. O. Hovey, from the cabinet of Wabash College, Crawfordsville, Indiana. The most interesting specimens consist of an upper molar and a complete lower molar series of a lama as large as the existing camel. Remains of a still larger species from California have been previously indicated under the name of *Auchenia californica*. The present specimens were referred to a species with the name *Auchenia hesterna*. Prof. Owen has described some remains of an equally large lama from Mexico, which he refers to an allied genus with the name *Palauchenia magna*, and which perhaps may be the same as the *Auchenia hesterna*. An inspection of Prof. Owen's figures of a series of molar teeth leads to the suspicion that he has inadvertently mistaken the upper series for the lower ones, and has thus been led to refer them to a genus different from *Auchenia*.

April 22.—"Influence of Nutrition upon Sex among the Lepidoptera," by Thos. G. Gentry.—"Fungus Parasite on a Mouse." Prof. Leidy exhibited a mouse with several whitish masses adherent to the ears, side of the face, and nose. The mouse had been caught in the children's department of Blockley Hospital. The white matter examined beneath the microscope proved to be composed of sporular bodies, single, double, or in short chains of a dozen or more. They measure about the $\frac{1}{4000}$ of a line in a diameter. The fungus is a Torula or Oidium, and resembles that found in Aptha. Perhaps the disease in the mouse is the result of feeding upon articles imbued with adherent portions of apthous matter from the mouths of children.

BERLIN

German Chemical Society, June 24.—C. Rammelsberg, vice-president, in the chair.—F. Römer has investigated the following derivatives of normal propylic alcohol:—The mercaptan and its mercury-compound, propyl-xanthogenic acid and its sodium salt, and the monamine. By heating cyanate of potash with propyl-sulphate of potash no cyanurate of propyl was formed, but a well-crystallised biuret in which three atoms of hydrogen are replaced by three molecules of propyl.—R. Otto sent a well-crystallised specimen of phosphate of ammonium and magnesium from the cesspool of an old house in Brunswick, analogous to the crystals of "Struvite" found in Hamburg in 1842.—C. Scheibler showed a specimen of glass ground by a new method, which has come to us from America, and is now practised in the glassworks of M. Hasenclever at Hollberg, near Aix-la-Chapelle. By means of Giffard's injector a current of fine hard sand is thrown with great force on the glass, which is thus ground; but any pattern cut in paper and pasted on the glass remains unaltered. Even hard minerals, such as corundum, can be ground by this process.—C. Böttinger has studied the action of baryta on pyruvic acid. According to Finck two acids are thus produced, one crystalline, which he called uritinic, and one syrupy body, to which he gave the name of uritonic acid. Mr. Böttinger's researches throw doubts on the existence of the latter body, which seems to be a mixture of uritinic, acetic, and oxalic acids.—C. Rammelsberg communicated new researches on the composition of vesuvians of different origin.—W. H. Pike, of London, has treated sulfo-urea with chloride of benzoyle, obtaining well crystallised benzoyle-sulfo-urea $(C_7H_6ONH)CS(NH)_2$ of the melting-point 170°.

PARIS

Academy of Sciences, July 7.—M. de Quatrefages, president, in the chair. The following papers were read:—New clinical researches on the localisation, in the anterior lobes of the brain, of the action by which the brain contributes to the psycho-physiological faculty of speech, by M. Bouillaud. At the conclusion of this somewhat long paper, M. E. Chevreul made some remarks on Dr. Bouillaud's conclusions.—On the exponential function, by H. Hermite.—On the heat of combination referred to the solid state, a new expression for thermo-chemical reactions, by M. Berthelot.—The election of Dr. Carpenter, Mr. Steenstrup, and Mr. Dana, as recorded in our notes, then took place.—On a system of optical telegraphy, invented during the siege of Paris, by a commission appointed by the Governor, by M. Laussedat.—On the nutritive and milk-producing properties of *Galega officinalis*, by M. Gillet-Damitte.—On the constitution of the sun and the theory of the spots, by M. E. Vicaire. The author vigorously supported the scoriæ theory of spots, which he regards as formed by the fall of heated products of combustion into a boiling liquid; he considers that the prominences are formed at the same time and by the same agency.—Solar cyclones compared to those of our own atmosphere, by M. H. Tarry.—On a new isomer of valeric acid, by MM. Friedel and Silva.—On the transformation of succinic into malic acid, by M. E. Bourgoin. The author has succeeded in effecting this by heating fine and dry argenetic malate, mixed with fine sand, to 180°.—On the mode of decomposition of explosive bodies as compared with the phenomena of supersaturation, by MM. Champion and Pellet.—On the action of benzyl chloride on napthalamine, by MM. Ch. Froté and D. Tommasi.—Experimental researches on the action of nitrous oxide, by MM. F. Jolyet and T. Blanche. The authors believe that this gas is not a true anæsthetic, but acts by producing asphyxia.—Researches on the floral organogenesis of the hazels, by M. H. Baillon.—Discovery of the makis and the horse in the fossil state in the phosphorites of Lot, by M. E. Delfortrie.—On the crystalline forms of Scotch Lanarkite, by M. A. Schrauf.—Details of the earthquake of the 29th of June, by M. W. De Fonvielle.

BOOKS RECEIVED

ENGLISH.—Geological Evidences of the Antiquity of Man. 4th ed.: Sir Charles Lyell (J. Murray).—Human Longevity, its Facts and Fictions: Wm. J. Thoms (J. Murray).—The Human Mind; a System of Mental Philosophy: Jas. G. Murphy (W. Mullan, Belfast).—Mrs Taylor's A B C of Chemistry. Edited by W. M. Williams (Simpkin, Marshall & Co.).—Six Lectures on Light, delivered in America: John Tyndall, F.R.S. (Longman & Co.).—Journal of Anatomy and Physiology, 2nd Series, No. 12 (Macmillan & Co.).—Relations of the Air to the Clothes we wear, &c.: Dr. Max von Pettenkofer: translated by Dr. Hess (Trübner & Co.).—The Royal Readers, No. 6 (T. Nelson & Sons).—Essay on the Mathematical Principles of Physics: Rev. Jas. Challis, M.A. (Deighton, Bell & Co., Cambridge).

PAMPHLETS RECEIVED

FOREIGN.—Sitzungsberichte der Königl Böhmischen Gesel. in Prag, Jan. to June and July to Dec., 1871, Jan. to June 1872.—Eleven copies of Proceedings of Ditto: K. W. Zenger, A. von Waltenhofen, O. Feistmantel, J. Schöbl, J. Dienger, J. M. Solin, E. Weyr, W. Matzka. K. Domalip, and C. Küpper. Die Bewegungen der Thiere und ihr psychischer Horizont: von Dr. Karl Möbius.

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