Thomas Henry Huxley

From a Photograph by Mess.rs Elliott & Fry

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NATURE

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

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NOVEMBER 1873 to APRIL 1874

"*To the solid ground*
Of Nature trusts the mind that builds for aye."—WORDSWORTH

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"*To the solid ground*
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THURSDAY, NOVEMBER 6, 1873

THE GOVERNMENT AND OUR NATIONAL MUSEUMS

WE referred last week to the intention of the Government to transfer one of the Metropolitan Museums under the control of a responsible Minister of the Crown, to the fifty irresponsible Trustees of the British Museum, this step being contemplated without referring the question either for the opinion of the Science Commission, now inquiring into these subjects, or for the authority of Parliament. We have learnt since that the measures for effecting this change are in active progress. Lord Ripon and the Trustees of the British Museum having agreed that the transfer was to be made *if practicable*, Sir Francis Sandford, Mr. MacLeod, and Major Donnelly, on behalf of the Science and Art Department; and Messrs. Winter Jones, Franks and Newton, on behalf of the Trustees of the British Museum; are now busy as Commissioners to find out if the transfer *be practicable*, and they have been exploring the South Kensington Museum for this purpose during the last week, taking notes of its contents, inspecting its refreshment rooms, its waiting rooms and the like.

What the Commissioners will propose as practicable is of course known only to themselves, if it be known even to them. Thus much, however, is known: the South Kensington Museum must remain the head-quarters of Science and Art Teaching, unless that too is to be put under the Archbishop of Canterbury and his co-Trustees, and if not, then there must be a dual Government in one and the same building, unless Mr. Lowe's project be abandoned. Now the dual Government means that one officer will represent the Archbishop of Canterbury and his co-forty-nine trustees in the Museum, and another the Lord President of the Council. The officer representing the Department will take orders from the Lord President. The officer representing the Trustees must from time to time go to Mr. Winter Jones to ascertain what the fifty Trustees have decided, and to receive his instructions how their decision is to be interpreted. Mr. Winter Jones' labours, already said to be ill-remunerated, will be increased, and his well-known powers of organisation sorely taxed. If there be two things which nature puts in ferocious antagonism one to another, it is two public officers under different responsibilities. No envy, hatred, or malice like that between two public officers. How every officer adores the Treasury! how the Audit Office loves the Treasury! what models of civil Letters the Treasury always writes to the Officer of Works, and so on.

The public has had already a specimen of this kind of dual Government at the South Kensington Museum, which has had disastrous results for Science. When the "Boilers" were first erected in 1856, the Commissioners of Patents had assigned to them a portion at the south end of the building for exhibiting those Mechanical and Scientific objects, which under a fiction were supposed to have derived their origin in "Patents." It was necessary that the visitors to all parts of the "Boilers" and to the Picture Galleries should pass through the "Patent Division." The Lord President made sensible rules for admitting the public on three days, open from 10 A.M. to 10 P.M., and three days called "Students' days," when persons not students paid sixpence each, or ten shillings a year, the object being to have three days free from crowds and kept quiet for study. After a while the Commissioners of Patents were scandalised at thus receiving public money (they are the instruments for taking seventy thousand a year from Inventors and misapplying it to General Taxation) and they said they preferred crowds every day as the most convenient public arrangement. The authorities came to open discord on the point, and the matter could only be resolved by separating the "Patent" from the other collections. So the Patent Commissioners built a separate entrance for themselves. What has been the result? About eight millions of visitors to the South Kensington Museum who would otherwise have seen the "Patent Museum" have not done so, and the Commissioners have deprived themselves and their museum of the moral support of these great numbers. And what has been the result of this? The Chancellor of the Exchequer has been allowed

to sack more than a million of pounds sterling realised from the taxes imposed on inventors' patent fees, and has not allowed one farthing to be spent for the provision of a suitable building for the "Patent Museum." Anything more discreditable to the nation than the building now crowded with models cannot be conceived. Many of the passages are not eighteen inches wide! What the present Lord Chancellor, the head Patent Commissioner, would say if he were ever to see it, cannot easily be imagined. We advise his Lordship to hold a Board in the building as soon as possible. It will probably be the first Board of Patent Trustees that ever sat there. We are satisfied that the result would be that he would instantly cause the present exhibition to be closed, and adequate space found elsewhere. Then what have inventors got in return for the tax of a million drawn from them? And what may not invention have lost by this indefensible principle of taxation?

Here then is already a very practical illustration of dual government in the South Kensington Museum already; one part of that government being composed of Trustees, who, it is reported traditionally, have never once met as a Board in their own Museum to see what was imposed upon a suffering public, upon their responsibility. We do not believe such a state of things would have been suffered under South Kensington administration. Mr. Lowe, when Vice-President, of the Council would not have suffered it.

The indifference of the British Museum Trustees to some of the best interests of Science in their own museum has been denounced again and again by commissions and committees, who report and report, but make no impression on a corporation of fifty trustees. That alone is a reason why they should not be allowed to meddle with South Kensington.

Although, as we have stated, this proposal was made without reference either to the opinion of those to whom the interests of Science and Art are more precious than they are to the members of the present Government, or to the opinion of the House of Commons, we learn that Mr. Mundella has extracted a promise from Mr. Gladstone that nothing shall be decided until Parliament meets again. Mr. Gladstone is perhaps surprised that there is any public interest in the subject. In the meantime, to assist him to form a correct judgment, we advise every learned society, which takes any branch of Science under its care, to memorialise the Prime Minister, and point out the crying necessity of a Minister, who shall be responsible to Parliament for Science, among other matters, and for all museums; that to transfer a museum already so represented to irresponsible trustees is a step worthy of the Middle Ages; and finally, that while the South Kensington system represents everything that is best in the way of progress, so much, to say the least, cannot be urged in favour of the present management of the British Museum.

We can well understand the reason for the proposed change. It lies in the individual responsibility of a Minister and the energetic executive management which have raised in a few years the South Kensington Museum into an institution of which the nation has the greatest reason to be proud; which has made it the centre of the chief intellectual activity of the country, which has utilised its resources for the teaching of hundreds of thousands of our teeming populations. The British Museum Trustees have done none of these things; they have given no trouble; they have borne snubbing admirably when they *have* moved, which has not been often. They have, in fact, proved an admirable buffer between subordinates anxious for progress and the Government; and, further, they have not been represented in the Cabinet. The moral which the Government has drawn from these facts is, that the South Kensington energy should have such a buffer, and in the existing members of the British Museum have found one ready to their hand. Hence the proposal which, if we mistake not, will, when it is generally known, not find a single supporter out of the Cabinet. It is quite possible that already it finds not many supporters in it.

BAIN'S REVIEW OF "DARWIN ON EXPRESSION"

Review of "Darwin on Expression." Being a Postscript to "The Senses and the Intellect." By Alexander Bain, LL.D., Professor of Logic in the University of Aberdeen. (Longmans, Green, and Co.)

THERE is nothing in this Postscript to "The Senses and the Intellect" so important to psychology as the declaration and announcement contained in the following sentences: "In the present volume I have not made use of the principle of Evolution to explain either the complex Feelings or the complex Intellectual powers. I believe, however, that there is much to be said in behalf of the principle for both applications. In the third edition of 'The Emotions and the Will,' now in preparation, I intend to discuss it at full length." No man can claim to have done more for the study of psychology than Prof. Bain; and in now recognising the principle of evolution and in incorporating it with his system, he is doing the science the greatest possible service. This is more than in some quarters was ever hoped from Prof. Bain, and more than was ever feared by those of his disciples who—after the manner of disciples—have clung most tenaciously to the defects of his system.

Though accepting the principle of evolution, Prof. Bain does not, it would seem, always look at phenomena from the evolutionist's point of view, as we understand it. Thus, in speaking of the large extent to which Mr. Darwin uses the principle of inheritance to account for the phenomena of expression, he says:—"Wielding an instrument of such flexibility and range as the inheritance of acquired powers, a theorist can afford to dispense with the exhaustive consideration of what may be due to the primitive mechanism of the system; he is even tempted to slight the primitive capabilities, just as the disbeliever in evolution is apt to stretch a point in favour of these original capabilities." But whence the so-called "primitive mechanism" which is here made separate and distinct from, set over against the products of inheritance? is not the "primitive mechanism" the "original capabilities" of every creature the results of evolution?

Mr. Darwin is accused of not having given sufficient attention to "spontaneity of movements," which, according to Prof. Bain, "is a great fact of the constitution." Now it may be that a "readiness to pass into movement, in the absence of all stimulation whatever," is a fact of the constitution; but we fail to see that Prof. Bain has

given any proof that such is the case. He says :—"We may never in our waking hours be wholly free from the stimulation of the senses, but in the exuberance of nervous power, our activity is out of all proportion to the actual solicitation of the feelings." What is the right proportion of activity to feeling? the proportion that Prof. Bain takes as his standard by which to discover that at times our activity is out of all proportion to feeling. Is not the simple and the whole fact this, that the amount of bodily movement that goes along with a given amount of feeling is different in each individual, and in the same individual from hour to hour. He continues :—"The gesticulations and the carols of young and active animals are mere overflow of nervous energy; and although they are very apt to concur with pleasing emotion, they have an independent source? their origin is more physical than mental." Is not the origin not of these only, but of all movements, entirely physical, though it is also a fact that some movements, and certainly these among the number, concur with pleasing emotion? Mr. Darwin has instanced the frisking of a horse when turned into an open field, as an example of joyful expression; on which it is remarked, this "is almost pure spontaneity it does not necessarily express joy or pleasure at all. How curious! One must really be a psychologist before he can see common things in such an uncommon light. Perhaps no movement necessarily expresses any state of consciousness whatever: but no ploughboy, we venture to think, ever doubted that the frisking of his horse, when he turned it loose in the field, was an expression of delight. But, then, ploughboys have no theories about spontaneous activity. All mental states correspond to certain physical conditions; that "the nerve-centres and the muscles shall be fresh and vigorous" is the physical condition of much bodily activity, and at the same time of the pleasure that goes along therewith. Granting that "the kitten is not seriously in love with a worsted ball," it thoroughly enjoys the sport nevertheless. Its amusement being mere play does not preclude its being real pleasure. And if our memories can be trusted, the worsted balls of our childhood were far more delightful than the gold and substantial realities we seriously love in our old age. S.

"*LAHORE TO YARKAND*"

Lahore to Yarkand. By Geo. Henderson, M.D., and Allen O. Hume. (L. Reeve & Co.)

TO Mr. Forsyth, the able conductor of the expedition which they describe, the authors dedicate this handsome volume, which, instead of being a continuous narrative, is divided into three separate parts, each of which will appeal to a different class of readers. The description of the route, and the incidents encountered on it, are given by Dr. Henderson, who with Mr. Forsyth and Mr. Shaw were the only Europeans that went to Yarkand on this "friendly" visit, sent by our Government to the Atalik Ghazi; it occupies two-fifths of the work. The natural history of the living forms met with, mostly by Dr. Hume, fills about one-fourth; the rest consisting of meteorological observations taken by Dr. Henderson on the journey.

The difficulties that had to be encountered *en route* were many and severe; the desert nature of the road between the districts of Ladak and Yarkand made it almost necessary to discontinue the expedition, and the great heights that had to be surmounted put a check on rapid progress, in some parts rendering it impossible.

Several opportunities occurred for the observation of the physiological effects of higher altitudes and rapid changes of barometric pressure, one pass near Gnishu which had to be traversed, named Cayley's Pass after Dr. Cayley its discoverer, being 19,600 feet above the level of the sea. From Dr. Henderson's remarks, however, it appears that mountain sickness is not dependent on the rarity of the air alone, for during the time that the expedition was in the pass mentioned, no note was recorded of any of the number suffering from it, whilst previously, on the Chang-la, which is 18,000 feet, most of the camp suffered from severe headache, nausea, prostration of mind and body, together with irritability of stomach and temper; nevertheless observations at the time showed that the pulse was not unusually rapid and the respiration was but little, if at all, increased. The feeling of suffocation occasionally experienced on waking during the night usually passed off after a few deep inspirations had been made. It is much to be regretted that, with the opportunities of verifying and extending Dr. Marcet's observations on the effects of ascending and descending mountains, Dr. Henderson was not in a position to do so, which he undoubtedly would have done if he had been acquainted with them.

Shortly after leaving Patsalung, and when on the southern boundary of Hill Yarkand, "nearly ten miles of the way was over a plain about five miles wide, which was covered to a depth of many feet (in one place where cracks existed, to not less than twenty feet) with sulphate of magnesia (Epsom salts), pure and white as newly-fallen snow." This shows the abundance of a magnesian limestone in the surrounding higher ground, and as the water-supply of the city of Yarkand was from rivers which rose in this or similar hills, the author's remark that "about every third man we saw was afflicted with goître," is scarcely more than was to be expected, and we think that if, instead of making "over to the Dád Khwah a quantity of iodine, for the treatment of goître, at which he was very much pleased," he had proposed a change in the water-supply, the Yarkandis would have been the gainers in the long run.

As the Atalik Ghazi was away at the time Mr. Forsyth arrived at his destination, and as the latter had strict orders to return before winter, the mission was partially unsuccessful. The return journey being later in the year, the cold and discomfort were greater than on the march north; an idea may be formed of the acuteness of the cold from the author's note on the Sukat pass. "My ink was constantly hard frozen, and on several occasions when I thawed it before the fire and attempted to write in my pencil notes, it froze at once on the point of the pen. Several times I tried to photograph, and once or twice succeeded, but usually the tepid water used for washing the plate froze as I poured it from the jug, and instantly destroyed the picture."

The illustrations of scenery, which in many books of travel are but indifferently drawn, and disappointingly inaccurate, are in this work replaced by "heliotype prints"

from photographic negatives taken by Dr. Henderson himself, and nothing can, in most cases, be more satisfactory. What is wanted on such occasions is not only a picture, but a representation sufficiently full of detail to enable the reader by simple inspection to form a truthful idea of the country described. Such are found in the photographs of the Valley above Paskyum, and the fort and bridge over the Indus river at Kalsi, and others before us, which, from the contrasts of light and shade, and the evident glare, bring vividly before the mind the intensity of the heat, as well as the desolateness of the locality, a combination scarcely possible in any character of engraving.

The Natural History notes are mostly ornithological and botanical. In his *résumé* of the ornithological results of the expedition, Mr. Hume informs us that "altogether, 158 species were observed, but of these only 59 pertain to the ornithologically unknown hills and plains of Yarkand. . . . Of these fifty-nine species, 7, *Falco hendersoni* (? *F. milvipes*, of Hodgson), *Saxicola hendersoni*, *Suya albo superciliaris*, *Podoces hendersoni*, *P. humilis*, *Galerida magna*, and *Caccabis pallidus*, are probably new to Science." An excellent illustration, by Mr. Keulemans, is given of each of these new species, except the last, which is very closely allied to *C. chukar*, and the coloration of the drawing of *Sturnus nitens* (Hume) exemplifies very successfully the propriety of the specific name. Mr. Gould's description of *S. purpurascens* is compared with that of the new species, the former being absolutely speckless and much smaller. *Podoces hendersoni* and *P. humilis* are both new species of this genus, which the author, following Bonaparte, places with the Choughs and not with the Jays and Magpies, remarking, however, "remembering their ground-feeding, dust-loving habits, . . . I cannot avoid the suspicion that these birds may constitute a very aberrant form of the great Timaline group."

On the Chang-la pass above referred to, Mr. Shaw obtained a butterfly, which Mr. H. W. Bates places in the mountain genus *Mesapia*, naming it *M. shawii*; it closely resembles *M. peloria*. Several specimens of the moth, *Neorina shadula* were also obtained.

Dr. Hooker and Mr. Bentham have written the descriptions of the new species of flowering plants, which are figured; they include, from the Tamaricaceæ, *Hololachne shawiana*; from the Compositæ, *Iphiona radicta* and *Saussurea ovata*; and from the Apocynaceæ, *Apocynum hendersonii*. Dr. Dickie of Aberdeen describes the Algæ and Diatomaceæ, and has also named some new forms.

OUR BOOK SHELF

The Internal Parasites of our Domesticated Animals. By T. S. Cobbold, F.R.S. (The *Field* Office.)

IN this short and concise work Dr. Cobbold has embodied a series of articles which have appeared from time to time in the *Field*. They, having been originally written for the perusal of the non-scientific public, are put in a simple and elementary manner, and much stress is laid on the practical bearing of the science of helminthology, the true value of which the author clearly shows to be but little appreciated by the growers of stock. Several excellent illustrations accompany the descriptions, which will greatly assist the amateur reader. The entozoa infesting the ox are first described,—flukes, tapeworms, and measle, together with round worms. The importance of more perfect sewage arrangements whereby the ejecta of one animal are not allowed to contaminate the ingesta of another, is laid great stress on. The great carelessness on this point in India evidently leads to the preponderance of parasitic diseases in that country, where the heat and attending thirst cause the frequently small supplies of water to be employed for drink when in a very unfit state, on account of the abundance of ova of parasites that it may contain. A description is also given of the manner in which the Burates or Cossacks of the region of Lake Baikal are nearly all infested with tapeworm, from the custom prevalent amongst them of eating their meat—the flesh of calves, sheep, camels, and horses—in an almost raw condition, and in enormous quantities. We think that there is one point in which this work is particularly suggestive. The great gaps there are in our knowledge of helminthology, such as the imperfect information that can be given as to the source of the liver fluke, must cause most readers who have opportunities at their disposal to wish to develop further a subject which has so many obvious practical bearings on the prosperity of this country; for England in the opinion of many competent authorities is developing more and more into a meat-producing and not seed-growing land. The parasites of the sheep, dog, hog, and cat are those which form the rest of this instructive little volume.

Chapters on Trees: a Popular Account of their Nature and Uses. By Mary and Elizabeth Kirby (London: Cassell, Petter, and Galpin.)

The Amateur's Greenhouse and Conservatory. By Shirley Hibberd. (London: Groombridge and Sons, 1873.)

WE have here a brace of books on arboriculture and floriculture, each of which will be welcomed by a certain class of readers, and will fill a useful place in popular scientific literature. Both are written in an agreeable and attractive manner, and are bound and generally got up in a style to suit the drawing-room table. The authoress of the first (or authoresses, for though two names appear on the title-page, the pronoun used is sometimes the first person singular) must not be taken too implicitly as a guide in her scientific and structural details. Many of her statements are, to say the least, very doubtful, and bear the marks of a want of acquaintance with the recent results of botanical science. Passing by this defect, we have a great deal of interesting information and gossip about a great number of our forest-trees. There are also very good descriptions, forming the best part of the book, of many other trees of great economic value with which we are not so familiar, as the ebony, the camphor, the nutmeg-tree, &c. The illustrations—one full-sized one for every tree, besides smaller ones—are, with a few exceptions, excellent.

The second volume, like all Mr. Shirley Hibberd's, contains a great amount of practically useful information on the culture of plants. Indeed anyone who is interested in the matter will find here advice on almost every point connected with the construction and management of plant-houses, and with the selection, cultivation, and improvement of ornamental greenhouse and conservatory plants. There are a large number of woodcuts and some well-executed coloured plates. The book comes, however, more within the range of the gardener than of the scientific student.

Tenth Annual Report of the Belfast Naturalists' Field Club. (Belfast: 1873.)

WE are glad to see from the Committee's report that the condition of this club is in every respect satisfactory, both as to numbers, finances, and, most important of all, amount and value of work done by the members. The

first part of the Report is concerned with the six summer excursions of the club in 1872, interesting accounts of the history, antiquities, and natural history of the various places visited being given. Of the papers contained in the volume, we mention the following :—"The Lignite of Antrim and their Relation to the True Coal," by Mr. William Gray, in which the author considers the subject both geologically and economically. The Rev. Dr. MacIlwaine, in a paper on "Life," gives an account of the various theories as to the nature of life held by philosophers from the earliest times to the present day. A different aspect of the same subject is discussed in Mr. Robert Smith's paper on "Darwinism," in which the author briefly sketches the nature of the Darwinian theory of development, and gives practical exemplifications of its working in every-day life. Mr. William Gray gives an entertaining account of some of the doings of the notorious "Flint Jack" in Ireland ; and the longest paper in the volume, by the Rev. Edmund M'Clure, is one of considerable ethnological value, on "Family Names as indicative of the Distribution of Races in Ireland." The Society offers a considerable number of prizes, competition for which will no doubt tend to encourage the practical study of the various subjects with which the Society is concerned. Altogether it seems to be in a thoroughly healthy condition.

LETTERS TO THE EDITOR

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

Prof. Young and the Presence of Ruthenium in the Chromosphere.

I HAVE been asked by Prof. Young, of Dartmouth College (U.S.) to say, with reference to the statement made on p. 244 of the third edition of my "Spectrum Analysis" concerning the presence of Ruthenium (Ru) in the solar atmosphere, that possibly by a *lapsus calami* he may have written the symbol (Rb) when giving the information of his discovery to Dr. Huggins, from whom I received a note on the subject.

Although, in accordance with Prof. Young's desire, I make these remarks, I cannot help feeling that they are quite unnecessary, as no one who knows the careful exactitude of Prof. Young's work could for a moment suppose that he was capable of making a confusion between Rubidium and Ruthenium.

H. E. ROSCOE

Owens College, Manchester, Nov. 4

The Miller Casella Thermometer

I WAS surprised on reading Messrs. Negretti and Zambra's letter published in your journal of October 23.

I was under the impression that it had been conclusively established that the principle upon which the Casella-Miller or Miller-Casella Deep-Sea Thermometer is constructed is identical with the one originally made in 1857 by Messrs. Negretti and Zambra at the suggestion of Mr. Glaisher, F.R.S., by the late Admiral Fitz-Roy's directions for the Board of Trade.

I was present when Mr. Scott, F.R.S., Director of the Meteorological Department of the Board of Trade, read a paper upon the subject at the Meteorological Society, January 17, 1872 ; he said :—"I submitted one of these instruments, made for the late Admiral Fitz-Roy, to hydraulic pressure; it proved good and trustworthy. The history of these instruments was perfectly familiar to many gentlemen interested in deep-sea soundings in 1869."

I may add that I saw the original instrument at the Hydrographic Office ten years ago ; in justice I am bound to say that Messrs. Negretti and Zambra were the first manufacturers of a deep-sea thermometer unaffected by pressure.

208, Piccadilly, Oct. 29 P. PASTORELLI

Captain Hutton's "Rallus Modestus"

IN the notice of the current *Ibis*, which appeared in Vol. viii. p. 519, reference is made to a paper by Captain Hutton, contending for the validity of his *Rallus modestus*, as distinct from *R. dieffenbachii*.

The next number of the *Ibis* will contain my reply to Captain Hutton's communication. In the meantime I will merely state that the whole of his argument rests on the assumption that *Rallus dieffenbachii* and *R. philippensis* are the same, in which he is entirely mistaken.

It is a fallacy, therefore, to suppose that because he has shown his bird to be distinct from *Rallus philippensis*, with which he compares it, he has proved it to be distinct from *Rallus dieffenbachii*, which, by his own admission, he has never seen.

Oct. 18 WALTER L. BULLER

Flight of Birds

IN NATURE, vol. viii. p. 86, Mr. J. Guthrie calls attention to, and asks explanation of, a curious phenomenon in the flight of birds observed by him :—"In the face of a strong wind," he says, "the hawk remained *fixed in space* without fluttering a wing for at least two minutes. After a time it quietly changed its position a few feet with a slight motion of its wings, and then came to rest again as before, remaining as motionless as the rocks around it."

I have often observed the same phenomenon, but, until recently, not carefully enough to warrant any attempt at explanation, though always convinced that it was *not* due to any invisible vibratory motion of the wings, as suggested by Mr. Guthrie. During the past summer, however, while on a tour through the mountains of Oregon. I had a fine opportunity of watching very closely a large red-tailed hawk (*Buteo montanus*) while performing this wonderful feat, and of noting the conditions under which alone, I believe, it is possible. These conditions are precisely those described by Mr. Guthrie, viz., a *steady wind*, blowing across an *upward slope*, terminated by a ridge. For a half-hour I watched the hawk, with wings and tail widely expanded, but motionless, balancing himself in a fixed position for several minutes in the face of a strong wind ; then changing his position and again balancing, but always choosing his position just above the ridge.

I explain the phenomenon as follows :—The slope of the hill determines a slight *upward* direction to the wind. The bird inclines the plane of his expanded wings and tail very slightly *downwards*, but the inclination *is less than that of the wind*. Under these conditions it is evident that the tendency of gravity would be to carry the bird *forward and downward*, while the wind would carry him *backward and upward*. The bird skilfully adjusts the plane of his wings and tail, so that these two opposing forces shall exactly balance. He changes his place and position from time to time, not entirely voluntarily, but because the varying force or direction of the wind compels him to seek a new position of equilibrium. JOSEPH LE CONTE

Oakland, Cal., U.S., Sept. 19

Collective Instinct

IN response to the appeal which closes Mr. Buck's interesting letter (NATURE, vol. viii. p. 332), the following instance of "collective instinct" exhibited by an animal closely allied to the wolf, viz., the Indian jackal, deserves to be recorded. It was communicated to me by a gentleman (since deceased) on whose veracity I can depend. This gentleman was waiting in a tree to shoot tigers as they came to drink at a large lake (I forget the district) skirted by a dense jungle, when about midnight, a large Axis deer emerged from the latter, and went to the water's edge. Then it stopped and sniffed the air in the direction of the jungle, as if suspecting the presence of an enemy ; apparently satisfied, however, it began to drink, and continued to do so for a most inordinate length of time. When literally swollen with water it turned to go into the jungle, but was met upon its extreme margin by a jackal, which, with a sharp yelp, turned it again into the open. The deer seemed much startled, and ran along the shore for some distance, when it again attempted to enter the jungle, but was again met and driven back in the same manner. The night being calm, my friend could hear this process being repeated time after time—the yelps becoming successively fainter and fainter in the distance, until they became wholly inaudible. The stratagem thus employed was sufficiently evident. The lake having a long narrow shore intervening between it and the jungle, the jackals formed themselves in line along it, while concealed within the extreme edge of the cover;

and waited until the deer was water-logged. Their prey being thus rendered heavy and short-winded, would fall an easy victim if induced to run sufficiently far,—*i.e.* if prevented from entering the jungle. It was, of course, impossible to estimate the number of jackals engaged in this hunt, for it is not unlikely that, as soon as one had done duty at one place, it outran the deer to await it in the another.

A native servant, who accompanied my friend, told him that this was a stratagem habitually employed by the jackals in that place, and that they hunted in sufficient numbers "to leave nothing but the bones." As it is a stratagem which could only be effectual under the peculiar local conditions described, it must appear that this example of collective instinct is due to "separate expression," and not to "inherited habit."

Cases of collective instinct are not of infrequent occurrence among dogs. For the accuracy of the two following I can vouch. A small skye and a large mongrel were in the habit of hunting hares and rabbits upon their own account, the small dog having a good nose and the large one great fleetness. These qualities they combined in the most advantageous manner, the terrier driving the game from the cover towards his fleet-footed companion, which was waiting for it outside.

The second case is remarkable for a display of sly sagacity. A friend of mine in this neighbourhood had a small terrier and a large Newfoundland. One day a shepherd called upon him to say that his dogs had been seen worrying sheep the night before. The gentleman said there must be some mistake, as the Newfoundland had not been unchained. A few days afterwards the shepherd again called with the same complaint, vehemently asserting that he was positive as to the identity of the dogs. Consequently, the owner set one watch upon the kennel, and another outside the sheep-enclosure, directing them (in consequence of what the shepherd had told him) not to interfere with the action of the dogs. After this had been done for several nights in succession, the small dog was observed to come at daydawn to the place where the large one was chained: the latter immediately slipped his collar, and the two animals made straight for the sheep. Upon arriving at the enclosure the Newfoundland concealed himself behind a hedge, while the terrier drove the sheep towards his ambush, and the fate of one of them was quickly sealed. When their breakfast was finished the dogs returned home, and the large one, thrusting his head into his collar, lay down again as though nothing had happened. Why this animal should have chosen to hunt by stratagem prey which it could easily have run down, I cannot suggest; but there can be little doubt that so wise a dog must have had some good reason.

Dunskaith, Ross-shire, Aug. 18 GEORGE J. ROMANES

IN your number of August 14 (Vol. viii. p. 302) Mr. E. C. Buck alluded to the curious and interesting instances of instinct and gregarious action in lower animals, and mentioned that this action has been more particularly observed in the case of wolves in India. These remarks remind me of a curious instance of combined action between two foxes for the capture of their prey, which I witnessed myself more than once; and as similar proceedings, on the part of these animals have been so frequently observed in the hilly country of the department in which I reside, I cannot but conclude that the same habit will prevail among them, wherever they are found. The case is as follows:—One of the two foxes, in the pursuit of a rabbit or hare, continued yelping at short and regular intervals and thus drove the unsuspecting victim in the direction of the appointed bush, where the other fox was concealed and ready to seize its prey as soon as it came within its reach. The capture being effected, they generally divide the prey between them; but if the ambushed fox, in jumping at its prey, has not gained the end in view, the two baffled compeers alternately repeat many times the unsuccessful leap, in order probably to find out the cause of the miscarriage.

The above allusion to foxes leads me to mention another instance of the ingenuity of these animals, which is very remarkable, and one, I believe, which is but little known. On one occasion, in early life, when I happened to pass my College vacation at the Chapelle d'Angillon (Department of the Cher), my attention was attracted twice or three times, when rambling by the side of a small stream called the Petite-Saudre, by a floating mass of moss, which, when drawn to the bank, was found to be swarming with fleas. An old peasant of the neighbourhood, who observed my surprise, gave me the following explanation of the fact, the correctness of which, said he, he could warrant:—Foxes are much tormented with fleas, and when the infliction becomes severe, they gather, from the bark of trees, moss which they carry in their mouths to the side of a stream where the water deepens by degrees. Here, they enter the water, still carrying the moss in their mouths; and, going backwards beginning from the end of their tail, they advance by slow degrees, till the whole body of the animal, with the exception of the mouth, is entirely immersed. The fleas, during this proceeding, have rushed successively in rapid haste to the dry parts and finally to the moss, and the fox, when he has, according to his calculation, allowed sufficient time for all the fleas to take their departure, quietly opens his mouth. The floating moss, with its interesting freight, is carried away by the stream, and the animal finds its way back to the bank, with an evident feeling of much self-satisfaction at having thus freed himself from his tormentors.

Many persons, and very trustworthy ones, confirmed to me the old peasant's account.

Montpellier, Oct. 17 A. PALADILHE

Venomous Caterpillars

ONCE before I wrote to you on this subject, and had hoped that the entomological mountain had long since been safely delivered of its mouse. But from recent communications such appears not to be the case.

Any large caterpillar with tolerably stiff hairs that will not, in different degrees, affect tender skin when brought incautiously in contact, may probably be looked upon as a phenomenon. That any larva with stiff spines will occasion inconvenience by more violent contact is, I should think, evident to any thinking naturalist. That inflammatory symptoms will most probably follow in either case is also evident. The puncture made by a single steel filament would occasion little or no inconvenience; but if multitudes of these filaments were simultaneously directed on a limited surface of skin, the result would be very different. The best analogue of the irritation caused by larval hairs is, as I before hinted, to be found in that following the handling of certain boraginaceous plants—*Echium vulgare*, *Symphytum officinale*, &c.

Mr. Riley, the State Entomologist for Missouri, has, in his fifth annual report, devoted a chapter to this subject, and states that he is acquainted with fifteen indigenous larvæ having so-called urticating powers, and in every instance the action is mechanical. Those observers who place so much stress upon the fact of contact with a hairy larva causing pain should not let surprise get the better of their judgment; nor, in the case of those residing abroad, should they allow themselves to be influenced by native superstitions. The position is simply this: any hairy larva is likely to cause irritation mechanically, from particles of the numerous hairs piercing the skin; no case has yet been proved in which such irritation is the result of *venom*, such as that of *Urtica* among plants.

Lewisham, Oct. 10 R. MCLACHLAN

Harmonic Echoes

THE phenomenon mentioned by W. G. M. of notes higher in pitch than the sound producing them being reflected from railings, is not at all uncommon, and is very easy of explanation. Suppose a person standing close to a line of upright bars, the distance between the bars being . a . If he now makes any sharp sound, so as to propagate a single wave, this wave will be successively reflected by each of the bars; so that, in answer to the single wave he propagates, he will have an echo of the pitch corresponding to $\frac{V}{2a}$ vibrations per second (V being the velocity of sound). If, however, he stands at any distance, say κ, from the row of bars, he ought to get a slightly descending echo, as then each wave succeeds the last at a distance increased by twice the difference between $\sqrt{\kappa^2 + n^2 a^2}$ and $\sqrt{\kappa^2 + (n-1)^2 a^2}$, where n is the number of the bar measured from opposite the observer. ARNULPH MALLOCK

Brampford Speke, Oct. 13

Evolution as applied to the Chemical Elements

WHEN so little is really known about evolution, even in the sphere of organic matter, where this grand principle was first

prominently brought before our notice, it may perhaps seem premature to pursue its action further back in the history of the universe. However, it seems but natural that we should apply this hypothesis to explain the close connection that holds between certain of the so-called elements. Pre-supposing that this theory has not been discussed before, I will just mention the chief grounds for holding it, and leave the examination into its truth or falsity in the hands of more experienced chemists. Herbert Spencer defines evolution as the integration of matter at the expense of force; this integration being accompanied by a loss of polarity, and by specialisation in a certain direction. Thus much being granted let us see how far this change from simple to complex is traceable in the qualities of certain of the elements, as seen especially in those that fall under natural groups.

In the first place, we may call some of the metals more generalised than others. Thus all hydrogen salts are soluble in water; so, to a less extent, are those of lithium, sodium, and potassium; but as the atomic weight (or mass) increases, so the salts of those metals become less and less soluble. This is only true speaking generally, for we see that, in particular cases, the hydrate of barium is more soluble in water than that of calcium, &c. But, as a rule, the salts of barium are less soluble than those of strontium; these, again, than calcium salts. But, on the whole, we may say that with increase of atomic mass of the metals, their salts lose their general properties and become more and more specialised, the salts taking their character from the metal in combination.

Secondly, according to this hypothesis, increase of atomic mass should be accompanied by absorption of motion. Just as the very complex molecules, of which living organisms are built up, are deficient in polarising or crystallising force, so are also the more massive chemical atoms: for it is evident that the heavy atoms of lead and bismuth have far less of this force, called chemical affinity, than have the light sodium, or the still lighter hydrogen atoms. In colloid bodies, the atomic attractions are mostly used up in keeping together the comparatively great masses of the molecule: hence but little polarity, or attraction among the molecules themselves, is manifested, and the compounds from the union of these molecules are unstable. So, too, the more massive atoms of elements enter with more difficulty into combination, and the products formed are unstable. Thus, the chlorides of platinum, or the oxides of lead, &c., are less stable, and more difficult of formation, than the corresponding salts of potassium or magnesium. Whereas colloids and crystalloids readily unite together: this is paralleled by the strong affinity that hydrogen, or any metal, has for chlorine or oxygen. Here the metal is the light crystalloid, the non-metal, the colloid, so to speak. It is only with the more specialised of the metals, those which we have seen have massive atoms, that hydrogen will unite, viz., antimony and arsenic; and the compound it forms with the former is very unstable, whilst the hydride of bismuth is unknown. These compounds are not alloys like that of hydrogen with palladium, but they show the comparatively non-metallic nature of arsenic and antimony. This consideration leads us to suppose that the non-metals are still more highly evolved than the metals, and that in the special direction towards electro-negative polarity. Besides we know that the intermediate links differ in degree, not in kind.

The lessening of the atomic heat with increase of mass shows a further absorption of motion, besides the potential energy possessed by the more massive atoms. It might be objected that motion has never been extracted from these massive atoms; on the contrary, as a rule, the heat of combustion is greater as atoms of the element entering into combustion are lighter. But the molecules of organic matter must be decomposed by suitable means before they can do any work; just so with the elements, which receive their name for the very reason that, as far as we know, they are incapable of decomposition. Perhaps, indeed, the increase in the number of rays in the spectra of highly heated sulphur and nitrogen will be regarded as an instance of such motion.

Thirdly, if we look at the atomic weight of groups of the elements, it is seen that the increase of mass occurs by a simple proportion. Gladstone, Dumas, Odling and others have shown the close relation of the numbers for particular groups; whilst lately Mendelejeff has given out a law of periodical recurrence, connecting the properties and the atomic weight, either received or theoretical, of all known elementary bodies. Thus we have—

$$\left.\begin{matrix}\text{Ca} = 40\\ \text{Ba} = 137\end{matrix}\right\} \quad \text{Sr} = \frac{40 + 137}{2} = \begin{matrix}88{\cdot}5\\ (\text{Sr} = 87{\cdot}5)\end{matrix}$$

$$\left.\begin{matrix}\text{Cl} = 35{\cdot}5\\ \text{I} = 127\end{matrix}\right\} \quad \text{Br} = \frac{35{\cdot}5 + 127}{2} = \begin{matrix}81{\cdot}25\\ (\text{Br} = 81)\end{matrix}$$

$$\left.\begin{matrix}\text{Li} = 7\\ \text{K} = 39{\cdot}1\end{matrix}\right\} \quad \text{Na} = \frac{7 + 39{\cdot}1}{2} = \begin{matrix}23{\cdot}05\\ (\text{Na} = 23)\end{matrix}$$

These instances suffice to show how near the calculated atomic weights come to those found by experiment.

In the fourth place it is a significant fact, that the elements themselves become changed in properties under different circumstances; the allotropic forms that result may be said to correspond with "varieties" among organised bodies. In the case of the elements greater atomic mass was said to denote evolution; in the best known allotropic varieties we find change from the normal form to be accompanied by increased density. Thus ozone (allotropic oxygen) and red phosphorus have both a greater density than the usual forms of these bodies.

With greater evolution, the so-called elements become more electro-negative; so in these instances, ozone has a greater affinity for hydrogen and the metals than has oxygen, and amorphous phosphorus less affinity for oxygen than ordinary phosphorus.

The varieties of sulphur would seem to be exceptions, for they are of less density than the usual form; the specific gravity of crystallised sulphur is 2·05, that of plastic sulphur, 1·95. However Berthellot terms the crystallised octagonal variety, electro-negative, plastic sulphur, on the contrary, electro-positive. Hence the octagonal form is at once denser and more electro-negative, and should be regarded accordingly as more highly evolved.

In the fifth place, let us note some of the actions and reactions of matter and forces.

(*a*) Heat: In any organic group, generally speaking, the greater the vapour density, accompanying greater complexity, the higher is the boiling point. So it is with the elements, taken according to natural groups, the greater the atomic weight, the higher the fusing or boiling point. This is seen in the case of chlorine, bromine, and iodine; arsenic, antimony, and bismuth, &c. Exceptions to this rule are the three closely allied metals, zinc, cadmium, and mercury, the most volatile of which is the heaviest, the least volatile, the lightest. Again, the more complex the chemical constitution of bodies is, the worse, generally, do they conduct heat and electricity: so too the more highly evolved and massive the atoms, the worse conductors are they as a rule. This applies strictly only to groups, as calcium conducts better than barium or strontium, but silver, though heavier and of greater atomic weight, nearly five times better than calcium. The difference of conducting power between metals and non-metals is very apparent. Where the atomic mass is greater, as the body verges more towards the electro-negative, this loss of conductibility and the high fusing point is easily accounted for by the mechanics of motion. The heavier atom takes longer to communicate its motion in the one case; or is more difficult to move in the other.

Some natural groups of the elements offer good examples of what has just been stated, *e.g.*

	Atomic Weight	Specific gravity.	Solubility of Salts.	Electric conductivity.
Ca	40·0	1·5	Maximum.	22·14
Sr	87·5	2·5	—	6·71
Ba	137·0	4·5	Minimum.	Minimum.

	Atomic weight.	Physical state.	Chemical activity.	Vapour density.
Cl	35·5	Gas.	Maximum.	2·4
Br	81·0	Liquid.	—	5·4
I	127·0	Solid.	Minimum.	8·7

Hydrogen has the greatest conducting power of all gases. To the principle that lighter atoms have greater polarity or chemical affinity, Bunsen has found an exception, that cesium is heavier and yet more electro-positive than potassium or sodium.

The order of solubility or of chemical activity shows that chlorine and calcium are the more generalised of their respective groups, as we should expect.

(*b*) In the case of Light, not much can be said as yet: but with regard to radiation and absorption of radiant heat, Tyndall has shown that the complex molecules of organic vapours are the best radiators, and that uncombined atoms can hardly be said to radiate or absorb at all. So we see that the simple, "metallic" vapours radiate but ill, whilst the more complex atoms do not reflect, but rather absorb light and heat rays. Indeed, we may suppose, that as in the case of complex vapours, the more highly evolved atoms, requiring a greater supply of force, turn these rays that fall on them to account; whilst the metals dispense with them by reflecting them.

(*c*) The chief relations of electricity have already been alluded to. The chemical affinity between elements increases as they differ in electric polarity; and the more highly evolved, the more chlorous or electro-negative are they.

Lastly, late researches have shown that the elements nitrogen and sulphur at a high temperature, give more complex spectra. This fact, if it be a fact, has thrown some doubt on their claim to be regarded as absolute elements.

In explaining the phenomenon, we should probably consider the sulphur particle to be composed of several groupings of the ultimate element, which, driven apart by the action of heat, are made to vibrate separately with various velocities. Thus the allotropic form of oxygen, ozone, has been represented by a simple formula $\begin{matrix}O\\O\end{matrix}\Big\}O$, being made up, as it is supposed, of two groupings of the element oxygen, that being the ultimate atom.

The above statements seem to me to agree in showing, that if the hypothesis of evolution is tenable at all, it can be extended to explain all or nearly all the relations between the elements at present existing on this globe. C. T. BLANSHARD

Queen's College, Oxford

Ancient Balances

Apropos of Mr. Chisholm's interesting account of ancient weighing instruments, in your last number, I venture to call his attention to the representation of an equal-armed balance in an Egyptian papyrus of the nineteenth dynasty, about 1350 B.C. It is to be found in the celebrated "Ritual of the Dead," a hieroglyphical papyrus of Hunnefer, of the reign of Seti I. In the "Judgment Scene" the heart of the deceased is represented as being weighed in a balance in the Hall of Perfect Justice, and in the presence of Osiris. The balance is of the ordinary equal-beam construction, the final adjustment being attained by a sliding weight on one side of the beam, exactly like the "rider" on our exact balances. The papyrus may be seen in the British Museum. G. F. RODWELL

Brilliant Meteors

ON Saturday evening (Oct. 18), about half-past 8 o'clock, I observed, from Boltsburn, Durham, a meteor of considerable brilliancy in the north-western part of the sky; it shot downward from an elevation of about 40°, and left a streak of very red light on its path. The streak continued visible for nine or ten seconds. JOHN CURRY

Boltsburn, Oct. 20

LAST evening, October 26, when returning home I observed a brilliant meteor stream across the sky. It may be worth while to record it.

Not having my watch, I can only guess the time as about 8.20 P.M. The first appearance was like a flash of lightning intensely white, arresting attention at once. When observed it streamed from ξ Persei above Capella (in altitude) and disappeared in Lynx. For two-thirds of its course its light was very bright, and it left a brilliant train of sparks, but for the remaining third it merely showed its own single expiring light.

Later in the evening when observing with the telescope in Cepheus, two shooting stars crossed the field at different times, apparently from the same radiant. T. T. S.

Thruxton Rectory, Hereford

SIR HENRY HOLLAND

ALTHOUGH the late Sir Henry Holland, whose name has been familiar to the world during the greater part of the present century, cannot be regarded as a ma eminent in scientific research, still, as a Fellow of the Royal Society of nearly sixty years' standing, as President of the Royal Institution, as one who was ever ready to contribute towards the advancement of scientific research, and as the friend of all the most eminent men of science of his time, which was a long one, we deem him worthy of more than a passing notice.

As much as for anything else, Sir Henry was known as an indefatigable traveller; his fondness for travelling, indeed, having led to the illness which was the immediate cause of his death on October 27 last, his 86th birthday. He had very early in his career deliberately determined to set aside two months each year for the purpose of indulging his favourite recreation. This year, immediately after his return from a visit to Russia, he set off for Naples in September last, staying a short time at Rome and Paris on his way home. He arrived in London on October 25, suffering from a slight cold, which was sufficient, notwithstanding the wonderful robustness of his constitution, to cut him off in two days. He began his travelling career by a visit to Iceland in 1810, since which he has explored almost every corner of Europe, and been eight times in America. In his "Recollections of Past Life," published in 1872, he speaks thus of his travels:—

"The Danube I have followed with scarcely an interruption, from its assumed sources at Donau-Eschingen to the Black Sea—the Rhine, now become so familiar to common travel, from the infant stream in the Alps to the 'bifidos tractus et juncta paludibus ora' which Claudius with singular local accuracy describes as the end of Stilicho's river journey. The St. Lawrence I have pursued uninterruptedly for nearly 2,000 miles of its lake and river course. The waters of the Upper Mississippi I have recently navigated for some hundred miles below the Falls of St. Anthony. The Ohio, Susquehanna, Potomac, and Connecticut rivers I have followed far towards their sources; and the Ottawa, grand in its scenery of waterfalls, lakes, forests, and mountain gorges, for 300 miles above Montreal. There has been pleasure to me also in touching upon some single point of a river, and watching the flow of waters which come from unknown springs or find their issue in some remote ocean or sea. I have felt this on the Nile at its time of highest inundation, in crossing the Volga when scarcely wider than the Thames at Oxford, and still more when near the sources of the streams that feed the Euphrates, south of Trebizond."

It was mainly on account of the reputation which even then he had achieved as a traveller, that he was elected a Fellow of the Royal Society in 1815.

Sir Henry was elected President of the Royal Institution in 1865, and took the very warmest interest in its success, and in the promotion of scientific research, being seldom or never absent from his post, doing much to popularise science among the upper classes, among whom, as our readers know, he was always a welcome guest. For fifteen years Sir Henry contributed 40*l.* annually to a fund specially set apart for the promotion of research, and was always ready to take by the hand promising young students who were diffident of their own abilities. Sir Henry himself never knew what it was to struggle, no man ever slid more easily into the highest professional and social position, and no man was ever probably less spoiled by his success. He counted from the very first among his patients, many of whom became his intimate friends, the highest in social and political rank both at home and abroad, and the most eminent in literature, science, and art, knew nearly everyone whose name during the last sixty years has been before the public, and was respected and loved by all with whom he came in contact. Sir Henry had naturally good abilities, great tact and knowledge of the world, a mind stored with knowledge gained from books, from travel, and from his intercourse with men, which, combined with his genial

bearing, rendered his society wonderfully delightful. As a physician, he was possessed of high skill.

Of Sir Henry's contributions to literature, his "Medical Notes and Reflections" (1839) and his "Chapters on Mental Physiology" (1852) are well known to the medical profession. He contributed a considerable number of articles to the *Edinburgh*, and other reviews, which, in 1862, were published as "Scientific Essays." In 1815, he published his celebrated "Travels in the Ionian Isles and Greece," of which a second edition appeared in 1819; a work abounding in classical, antiquarian, and statistical information, interspersed with interesting details respecting manners and customs, scenery and natural history. In 1816 he contributed to the "Philosophical Transactions" a memoir on the manufacture of sulphate of magnesia at Monte della Guardia, near Genoa, and afterwards papers to various other scientific journals. Last year he published his well-known "Recollections of Past Life," a volume which must long keep Sir Henry Holland's name alive. His memory will be cherished by all who knew him as something ever pleasant to recall.

The Royal Institution has thus, within a year, lost its Secretary and its President, not to mention the resignation of its Professor of Chemistry, who has not yet been replaced. Whoever is elected to fill the Presidential office will, we doubt not, keep up the traditions of the place, and do what in him lies to carry out the original design of the founders and donors of the Institution, never losing sight of the fact that above everything it is meant to be one of the few temples of original scientific research in the country. Its laboratories have recently been rebuilt, and we hope they will ever continue to be taken ample advantage of for purposes of study and research, not only by the earnest successors of the great men who have rendered them famous, but also by competent members, for whom they were originally equally intended by the enlightened and science-loving men to whom the conception of the Institution was originally due.

We conclude this notice by giving a few of the dates, in addition to those already given, which mark Sir Henry Holland's career. He was born at Knutsford, Cheshire, Oct. 27, 1787, and was educated at Newcastle-on-Tyne, and at the school of Dr. Estlin, near Bristol, where he became head boy. In 1804 and 1805 he attended Glasgow University, and in 1806 he entered the Medical School at Edinburgh, where he became acquainted with many of the notable men that then frequented "the grey metropolis of the north"—Sir Walter Scott, Brougham, Sydney Smith, Horner, Jeffery, Dugald Stewart, Sir William Hamilton. In 1816, after spending some time in travel, he established himself in London, and at once achieved high professional success. He became Physician in Ordinary to the late Prince Consort in 1840, and to the Queen in 1852; and next year was created baronet. Sir Henry was twice married, his second wife, who died in 1866, having been the daughter of his old friend Sydney Smith.

THE AMERICAN MUSEUM OF NATURAL HISTORY IN CENTRAL PARK NEW YORK *

FOR many years a large number of the generous and public-spirited citizens of New York had long felt the need of a museum and library of natural history that should be on a scale commensurate with the wealth and importance of their metropolitan city, and would encourage and develop the study of natural history, advance the general knowledge of kindred subjects, and to this end furnish popular amusement and instruction. In 1868 a remarkable opportunity presented itself of securing a rare collection that would form an admirable nucleus for such a comprehensive museum. The most extensive dealer in specimens in the world, Edouard Verreaux, of Paris, suddenly died, leaving in the hands of his widow a collection, which, at the rates he was accustomed to sell specimens, would have brought over 500,000 francs, 100,000 dols. in gold . . . . Dying suddenly, he left the rich gatherings of an industrious lifetime seriously embarrassed with debt. This opportunity it was decided to try to improve, and a subscription of nearly 50,000 dols. was at once made up as a beginning, and since that time about 100,000 dols. have been contributed in money, though the present property of the institution, including the large donations of specimens which have been steadily coming in, could not be replaced, nor could other as interesting and valuable specimens for less than 250,000. A rare and nearly complete collection of American birds, and many fine birds of paradise and pheasants were first purchased by Mr. D. G. Elliott. While negotiations were about to be opened for the Verreaux collection, a second museum unexpectedly became available. Prince Maximilian of Neuwied on the Rhine above Bonn (not the Emperor Maximilian of Austria and Mexico) died, and the young son inheriting the estate had no scientific taste, and offered the results of his father's life-work for sale. The elder Prince, who formed the collection, passed 1815, 1816, and 1817 exploring Brazil from Rio up to Bahia, and of course a large proportion of the great collections he secured had never at that early date been seen by scientific men in Europe before, and were therefore types of new species.

This collection the American Museum purchased entire. An agreement was soon after made with Mme. Verreaux by which all the choice specimens in her cabinet not contained in the Elliott and Maximilian purchases were selected for the museum, and all these specimens have been safely received from Europe, and are now on public exhibition in Central Park. Large donations of shells, corals, and minerals have been received, and one collection of 20,000 insects. The liberal subscriptions first made induced the principal subscribers to consent to act as trustees for the fund and property acquired by it, and by a special Act of the Legislature they were created a body corporate—they and their successors to have entire and unrestricted control for ever over all the museum property. They have limited their number to twenty-five, and the survivors fill every vacancy, thus securing a fixed policy and stable character to the institution. An arrangement has been made between the trustees and the Department of Public Parks in New York by which the city may furnish lands and buildings, while the collections are to be bought and cared for by moneys contributed by the trustees themselves and the generous public. In pursuance of this plan, by which the authorities of the city and private citizens might co-operate toward the common end of establishing a large museum, 500,000 dols. were appropriated by the city to commence a suitable thoroughly fire-proof edifice, and the Department of Parks was authorised to set apart so much of the public lands under their control as they might deem proper and necessary for the proposed structure and its future extensions.

The great object of the museum is twofold. First, to interest and instruct the masses which already throng its halls, and occasionally number over 10,000 in a single day; and, secondly, and especially to render all the assistance possible to specialists. These wants are shown to be amply met by the large, palatial saloons for the public, and over the whole building a high Mansard story, containing spacious and well-lighted rooms with every modern convenience, where naturalists from every part of the country may pursue their favourite studies for any length of time, and be secure from all possible interruptions. The building will undoubtedly be ready for occupation in the spring of 1875.

* A Paper read by Albert L. Bickmore, Ph. D., Superintendent, at the Meeting of the American Association.

THE COMMON FROG*

III.

TO prosecute successfully our inquiry "What is a Frog?" it will be well now to make acquaintance with the more remarkable forms contained in its *Order*, after which, by considering the other Batrachian orders, we may arrive at a certain appreciation of its *Class*.

The Frog's own genus (Rana), which contains about 40 species, has its head-quarters in the East Indies and in Africa, but extends over all the great regions of the

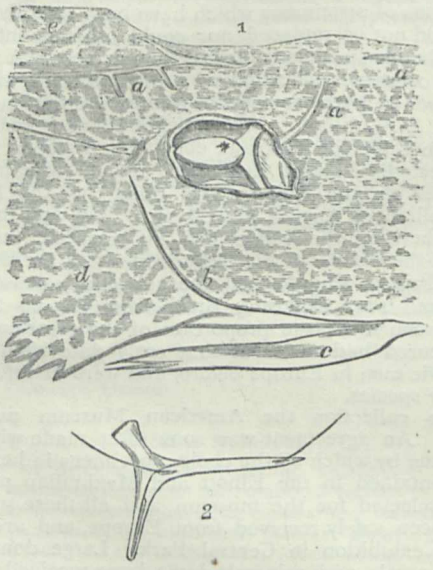

FIG. 7.—Poison Organ of *Thalassophryne reticulata* (after Günther). 1, Hinder half of the head with the venom-sac of the opercular apparatus *in situ*. * Place where the small opening in the sac has been observed. *a*, Lateral line and its branches; *b*, gill-opening; *c*, central fin; *d*, base of pectoral fin; *e*, base of dorsal fin. 2. Operculum, with the perforated spine.

world, except Australia, and parts more southerly still, and except countries situate above 66° north latitude. In South America, however, but a single species is as yet known to exist.

Amongst the largest species are *Rana tigrina*, of India and the Indian Archipelago, and the bull-frog (*R. Mugiens*)

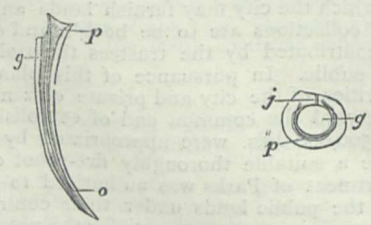

FIG. 8. FIG. 9.

FIG. 8.—Vertical, Longitudinal Section of the Poison-fang of a Serpent (after Owen). *g*, deep grove; *o*, its lower termination, which affords exit to the poison; *p*, pulp-cavity. FIG. 9.—Magnified Transverse Section of a Serpent's Poison-fang (after Owen). *g*, groove round which the substance of the tooth (containing *p*, the pulp-cavity) is bent; *j*, the point where the sides of the tooth meet and convert the "groove" into what is practically a central cavity.

of North America. The latter animal may often be seen in the Gardens of the Zoological Society, where it is fed on small birds—a sparrow being easily engulphed within its capacious jaws.

The Edible Frog, *par excellence* (*R. esculenta*), is found in England as well as on the Continent of Europe. It is as widely distributed over the old world as is *R. temporaria*, but it is unknown in America. It is easily to be discriminated from the common species (see Fig. 4 on p. 510) by the absence of that dark, sub-triangular patch which extends backwards from the eye in *R. temporaria*.

The male of *R. esculenta* is further to be distinguished from the male of the common Frog by the fact of its having the floor of the mouth on each side, distensible as a pouch—the pouches, when distended, standing out on each side of the head. These pouches are called "vocal sacs," and no doubt aid in intensifying these animals' croak, which is so powerful that (on account of it and

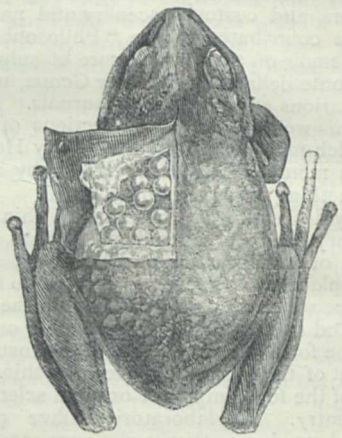

FIG. 10.—The female of *Nototrema marsupiatum*, with the pouch partly cut open (after Gunther).

because of the country where they are common) they have been nicknamed "Cambridgeshire Nightingales." Specimens from Cambridgeshire are preserved in the British Museum.

A large South American Frog (*Ceratophrys cornuta*), which devours other smaller Frogs as well as small birds and beasts, is noteworthy on account of the singular bony

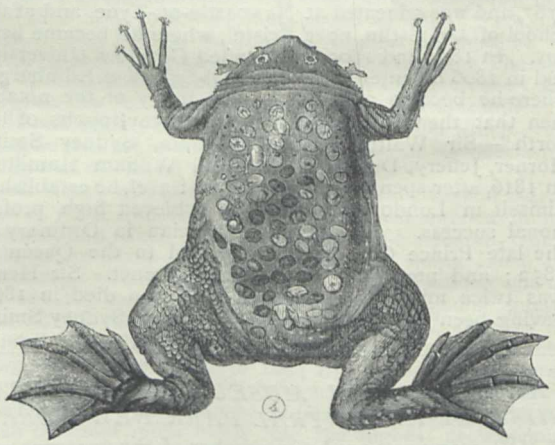

FIG. 11.—The Surinam Toad (*Pipa americana*).

plates which are enclosed in the skin of its back: a character which it shares with a small South American Toad (*Brachycephalus ephippium*), and which we shall hereafter see to be a point of special interest.

A Frog newly discovered* (of a new genus but one allied to *Rana*), called *Clinotarsus*,† has been

* Continued from vol. viii p. 512.

* The type of this genus is a species which was in my own collection (with no clue to the locality whence it originally came), but is now deposited in the British Museum. It was first described in the Proceedings of the Zoological Society for 1868, under the name *Pachybatrachus*.

† Proc. Zool. Soc., 1869.

(see Fig. 5, vol. viii. p. 511) represented, in the hope that by the wider circulation of a figure of it, it may be recognised, and its habitat so ascertained.

The common Toad (*Bufo vulgaris*) is as widely distributed over the earth's surface as is *Rana esculenta*. It is less aquatic than the frog, and more sluggish in its motions. In shape it resembles the frog, but is more swollen, with much shorter legs and a warty skin (see Fig. 6, vol. viii. p. 511). The toes are less webbed, and the margin of the upper jaw, as well as the lower, is entirely destitute of teeth. The jaws are similarly toothless in *all* toads.

The toad is provided with an oblong, elongated gland called *Parotoid*) behind each eye. These glands emit a milky secretion which is acrid and very unpleasant to the

FIG. 12.—*Dactylethra capensis*.

mouth of some carnivorous animals. Those who have observed a dog attacking a toad can hardly have failed to notice the disgust which the former animal seems to exhibit by the copious flow of its saliva, its many head-shakings, &c. The toad's secretion, however, cannot be said to be poisonous, and certainly it is not so in the mode in which the venom of serpents is poisonous, since a chicken may be inoculated with it, and yet appear to suffer no injury whatever beyond the infliction of the slight wound necessary for the performance of the opera-

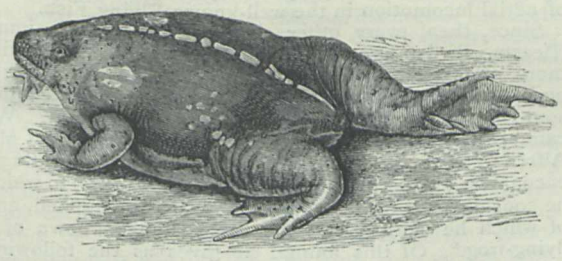

FIG. 13.—*Rhinophrynus dorsalis*.

tion. Nevertheless the secretion exercises a very decided effect upon certain animals, since the tadpoles both of frogs and of salamanders are very powerfully affected by being kept in the same water with a toad, if the latter be specially irritated in order to make it discharge its pungent and irritating secretion.

True poison and organs fitted both to inflict wounds and to convey the venom into them are not indeed found in any animals which are even near allies of the frogs and toads. Nevertheless a very perfect organ for both wounding and poisoning has been discovered by Dr. Günther to exist in a certain fish (*Thalassophryne reticulata*), belonging to a group which, on account of their superficial resemblances to frogs, are termed "Batrachoid."

He found in the fish no less than four spines each per-

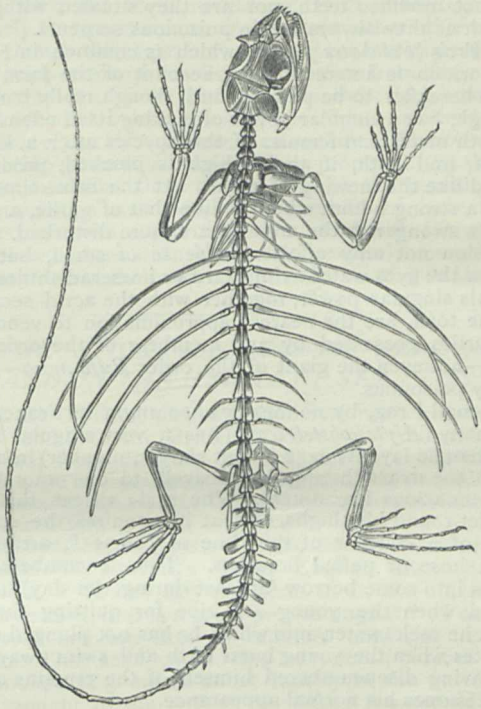

FIG. 14.—Skeleton of the Flying-dragon.
(Shewing the elongated ribs which support the flitting organ.)

forated like the tooth of a viper, and each having a sac at its base. One such poison-spine was situated on each

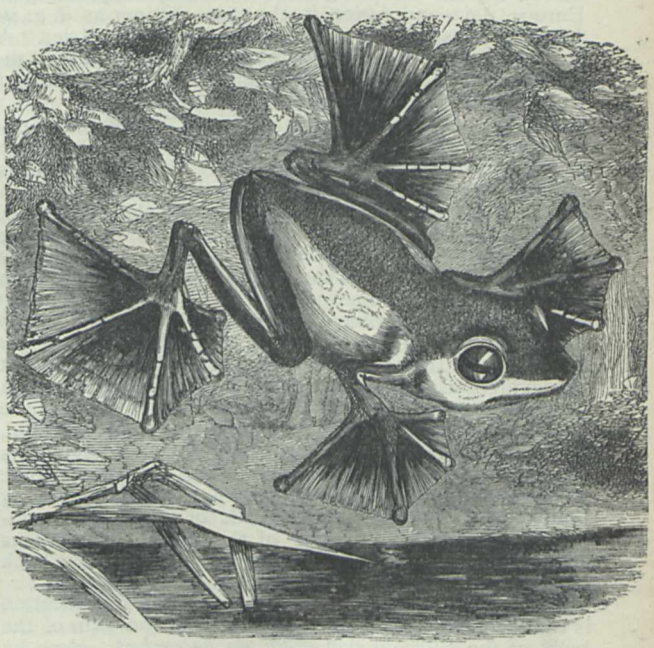

FIG. 15.—The Flying-frog (from Wallace's "Malay Archipelago")

side of the hinder part of the head in front of the gill opening. Two others were dorsal spines placed one behind the other on the mid-line of the back. These

poison-organs are probably only used for defence. They are formed, however, on the very same type as are the poison fangs of vipers. Unlike the latter, however, they are not modified teeth, nor are they situated within the mouth as they always are in poisonous serpents.

A Frog (*Pelobates fuscus*) which is common in France (and which is interesting on account of the form of its skull hereafter to be pointed out), though really harmless enough, has a singular power of making itself offensive.

Both males and females of this species utter a kind of croak, and both, if their thigh is pinched, produce a sound like the mewing of a cat. At the same time they emit a strong odour, which is like that of garlic, and becomes stronger as the animals are more disturbed. This emission not only affects the sense of smell, but even makes the eyes water as mustard or horseradish does.

This singular power, together with the acrid secretion of the toad, are the nearest approximation to venomous properties possessed by any members of the order, no toad—not even the giant of the order *Bufo agua*—being really poisonous.

A small Frog, by no means uncommon in France and Germany (*Alytes obstetricans*) has a very singular habit. The female lays its eggs (about sixty in number) in a long chain, the ova adhering successively to one another by their tenacious investment. The male twines this long chaplet round his thighs, so that he acquires the appearance of a courtier of the time of James I. arrayed in trunk hose or puffed breeches. Thus encumbered, he retires into some burrow (at least during the day) till the period when the young are ripe for quitting the egg Then he seeks water, into which he has not plunged many minutes when the young burst forth and swim away, and he, having disencumbered himself of the remains of the ova, resumes his normal appearance.

Certain Frogs (forming a very large group) are termed Tree-frogs, from their adaptation to arboreal life by means of the dilatation of the ends of the digits into sucking discs, by which they can adhere to leaves. One of them, the common green Tree-frog (*Hyla arborea*) is spread over Europe, Asia, and Africa, in the same manner as *R. esculenta*, except that it is not found in the British Isles. A few toads also have the tips of their digits similarly dilated. Such, *e.g.*, is the case in the genera *Kaloula* of India, and *Brachymerus* of South Africa.

The female of a peculiar American Tree-frog (*Nototrema marsupiatum*) has a pouch extending over the whole of the back and opening posteriorly. Into this the eggs are introduced for shelter and protection. A dorsal pouch also exists in the allied American genus, *Opisthodelphys*. An American species of *Hylodes* has the habit of laying its eggs in trees singly in the axils of leaves, and the only water they can obtain is the drop or two which may from time to time be there retained.

A still more remarkable mode of protecting the egg is developed by the Great Toad of tropical America (*Pipa americana*). In this case the skin of the females' back at the laying season thickens greatly and becomes of quite a soft and loose texture. The male, as soon as the eggs are laid, takes them and imbeds them in this thick, soft skin, which closes over them. Each egg then undergoes its process of development so enclosed, and the tadpole stage is, in this animal, passed within the egg, so that the young toads emerge from the dorsal cells of the mother completely developed miniatures of the adult. As many as 120 of these dorsal cells have been counted on the back of a single individual.

The only instance of a similar cutaneous modification is that pointed out by Dr. Günther* in the skin of the belly of the Siluroid fish, *Aspredo batrachus*. Here he found that "the whole lower surface of the belly, thorax, throat, and even a portion of the pectoral fins, showed numerous shallow, round impressions, to which a part of the ova still adhered." He concludes that "it is more than probable that towards the spawning time the skin of the lower parts becomes spongy, and that, after having deposited the eggs, the female attaches them to it by merely lying over them." "When the eggs are hatched the excrescences disappear, and the skin of the belly becomes smooth as before. Even in the highest class of animals (*Mammalia*) we are familiar, in the Kangaroo and Opossum order (*Marsupialia*), with a special external receptacle (the marsupial pouch) for the protection and secure development of the young; but nothing of the kind exists amongst birds or reptiles. In fishes, however, the male of the little Sea-horse (*Hippocampus*) is provided with a ventral pouch in which the eggs are sheltered, and the same class presents us with a mode of carrying the eggs still more bizarre than that of *Alytes obstetricans* just related. In the fish *Arius fissus* the male actually carries about the ova in the mouth, protected by the jaws, till relieved of the inconvenience by the hatching of the young fry.

A South African Toad (*Dactylethra capensis*) is interesting, as we shall hereafter see, on account of certain anatomical points in which it agrees with *Pipa*, and differs from all other Anoura. No interesting facts, however, are known as to its habits.

Another noteworthy form is the Mexican *Rhinophrynus dorsalis*, the exceptional characters of which are the tongue, which is free in front instead of behind, and the enormous spur-like tarsal tubercle.

Almost all Frogs and Toads pass the first stages of their existence in water, going through a free, tadpole stage, and all are more or less aquatic when adult. The only exceptions are *Pipa*, *Nototrema*, *Opisthodelphys*, and the *Hylodes* before referred to. Very many kinds, however, are, when adult, inhabitants of trees. The question may suggest itself to some, "Are there any which can be said in any sense to be aërial animals?" Birds are almost all capable of true flight, as also are those aërial existing beasts the Bats, and as were those extinct reptiles the Pterodactyles. Certain squirrels and opossums can take flitting jumps by means of an extension of the skin of the flank, and a similar, though much greater extension, supported by elongated freely ending ribs, is found in the little lizards (*Draco*) called Flying Dragons.

The class of Fishes supplies us, also, with an example of aërial locomotion in the well-known Flying Fish.

Since, then, every other class of vertebrate animals (Beasts, Birds, Reptiles and Fishes) presents us with more or fewer examples of the aërial species, we might perhaps expect that the Frog-class would also exhibit some forms fitted for progression through the air. We cannot say with certainty that such is the case; but Mr. Alfred Wallace, in his travels in the Malay Archipelago, encountered in Borneo a Tree-frog (*Rhacophorus*) to which he considers the term "flying" may fairly be applied, and of which he says, it "is the first instance known of a flying-frog." Of this animal he gives us the following account:—

"One of the most curious and interesting creatures which I met with in Borneo was a large tree-frog which was brought me by one of the Chinese workmen. He assured me that he had seen it come down, in a slanting direction, from a high tree as if it flew. On examining it I found the toes very long and fully webbed to their extremity, so that, when expanded, they offered a surface much larger than the body. The fore-legs were also bordered by a membrane, and the body was capable of considerable inflation. The back and limbs were of a very deep shining green colour, the under surface and the inner toes yellow, while the webs were black rayed with yellow. The body was about four inches long, while the webs of each hind foot, when fully expanded, covered

* See Catalogue of the fishes in the British Museum, vol. v. p. 268.

a surface of four square inches, and the webs of all the feet together about twelve square inches. As the extremities of the toes have dilated discs for adhesion, showing the creature to be a true tree-frog, it is difficult to imagine that this immense membrane of the toes can be for the purpose of swimming only, and the account of the Chinaman that it flew down from the tree becomes more credible."

The great group of Frogs and Toads, rich as it is in genera and species, and widely as it is diffused over the earth's surface, is one of singular uniformity of structure. The forms most aberrant from our type, the common frog, have now been noticed, except that perhaps the maximum respectively of obesity and slenderness may be referred to. In the former respect the Indian Toad *Glyphoglossus* may serve as an example, and for the latter may be selected *Hylorana jerboa*.

ST. GEORGE MIVART

(*To be continued.*)

A FOSSIL SIRENIAN FROM THE RED CRAG OF SUFFOLK

AT the opening meeting of the Geological Society, Prof. Flower communicated a description of a fine fragment of a skull of an animal of the order *Sirenia*, which is of great interest as affording the first recorded evidence of the former existence of animals of this remarkable group in Britain. The specimen forms part of the very rich collection of Crag fossils formed by the Rev. H. Canham, of Waldringfield, near Woodbridge. It was found in the so-called "coprolite" or bone-bed at the base of the Red crag, and presents the usual aspect of the mammalian remains from that bed, being heavily mineralised, of a rich dark brown colour, almost black in some parts, with the surface much worn and polished, and marked here and there with the characteristic round or oval shallow pits, the supposed *Pholas* boring.

The fragment consists of the anterior or facial portion of the cranium which has separated, probably before fossilisation, from the posterior part at the fronto-parietal suture, and in a line descending vertically therefrom. This portion has then been subjected to severe attrition, by which the greater part of the pre-maxillary rostrum, the orbital processes of the maxillaries, and other projecting parts have been removed. In consequence of this, what may be called the external features of the skull, which are especially necessary to determine its closer affinities, are greatly marred, though enough remains of its essential structure to pronounce with confidence as to its general relationship to known forms. Fortunately, the whole of the portion of the maxillæ in which the molar series of teeth are implanted is preserved; and though the teeth have fallen from the alveoli in the front part of the series, and in the posterior part are ground down to mere stumps, so that the form of the crowns cannot be ascertained in any, many important dental characters may still be deduced from the number, form, size and position of the sockets and roots that remain.

As the intensely hard, ivory-like rostra of the ziphioid Cetaceans, the tympanic bones of the Balænidæ, and the teeth of terrestrial mammals almost alone remain in these deposits to attest the former existence of their owners; it is, doubtless, to the extreme massiveness and density of the cranial bones, as characteristic of the order Sirenia, that we owe the preservation of so large a portion of the skull under the very unfavourable conditions to which it, in common with the other fossils of the formation, must have been exposed.

After a comparison of the characters of the cranium with those of the several existing and extinct members of the order, Prof. Flower referred it to the genus *Halitherium*, and showed its relationship to *H. Schinzi* of Kaup from the miocene of the Rhine basin, a formation, it will be remembered, in which several of the animals of the Red Crag bone-bed occur. It is, however, of larger size than that species, the teeth are larger, both absolutely and relatively to the cranium, and certain other differences occur, though the imperfect nature of the materials makes exact comparison of fossils only known from fragments not altogether easy or satisfactory. Believing, however, that it does not belong to either the above-mentioned, or any other of the hitherto described species of *Halitherium*, the specific name of *H. canhami* was proposed. It should be mentioned that there are six teeth in the maxillary or molar series on each side, all present at the same time, the first two with single roots, the third with two roots, and the last three with three roots, precisely resembling in form those of the molar teeth in the existing Manati.

ON THE STICK-FISH (Osteocella septentrionalis) AND ON THE HABITS OF SEA-PENS

MR. COOTE M. CHAMBERS has most kindly presented to the British Museum a specimen of the Stick-fish, from English Bay, Burrard's Inlet, British America. The specimen was placed alive, immediately it was caught, into a tin tube, filled with a solution of arsenic and salt.

Mr. Chambers observes that the Stick-fish are only to be found in Burrard's Inlet, English Bay, British Columbia. "It has only one bone in it, and appears to live on suction, and is a great prey to dogfish." Further: "I would mention that in summer only can they be caught. They are found to the least depth of from 30 to 40 fathoms, they move about rapidly in the water, and when brought to the surface, move for a few seconds like a snake, then make a dart as swift as lightning, and disappear."—July 23, 1873.

Unfortunately the specimen did not arrive in a good state for exhibition. The greater part of the animal portion had been washed off, probably by the motion of the solution during the transit; only about a foot of the flesh, which was loose on the axis, and the thick, swollen, naked, club-shaped base without polypes remained; but it was in a sufficiently good state to afford the means of determining its zoological situation and of examining its microscopical and other zoological characters.

Mr. Chambers' specimen is the animal of the axis, or stick, that I described as *Osteocella septentrionalis* (Ann. and Mag. Nat. Hist. 1872, lx. p. 406), and it proves that the axis belongs to a kind of *Pennatula*, or Sea-pen, nearly allied to the long Sea-rushes named *Pavonarius quadrangularis*, found on the West Coast of Scotland, and is evidently the same animal as *Pavonaria blakei*, described by R. E. C. Stearns. The idea of its being a fish, which seems so generally entertained by the people of British Columbia, is clearly a mistake, though one of the observers sent a figure of the Sea-pen, with mouth and eyes like an eel (!), which is copied in NATURE, vol. vi. p. 436.

Osteocella.—The complete polype-mass very closely resembles *Pavonaria quadrangularis*, as figured by Johnston ("British Zoophytes," t. xxxi.), from Prof. Edward Forbes' drawings; but the animal is entirely destitute of calcareous spicules, and the axis is cylindrical, hard, and polished.

Two days after I received this specimen, I received by post Mr. Stearn's description of the Stick-fish (*Pavonaria Blakei*), from the San Francisco *Mining and Scientific Press*, August 9, 1873.

The description of Mr. Stearn, made from a fresh animal, need not be repeated; but as he does not mention the microscopic structure, I sent a fragment of Mr. Chambers' specimen to Mr. Carter to be examined, who kindly writes:—"The fragment arrived safely, although

the Post-office tried to crush the box to the thickness of silver-paper. The bit contains no spicules, nothing but a mass of contorted tubes filled with small nuclei like ova. "The nuclei are about 1-600th of an inch in diameter, and I suppose they are in tubes. The part you sent was boiled in *Liquor potassæ*; that is how the structure alone came out, but there were no spicules in it, examined in this way or in water alone, but many fat globules, and a few sheaf-shaped calcareous concretions, common in all preparations of animal matter."—September 5, 1873.

The habits of *Pennatulidæ* are very imperfectly known and not at all understood. Dr. Johnston observes in the "British Zoophytes," vol. i. p. 160, that the fishermen believe that the common Sea Pens, which they call Coxcombs, "are fixed to the bottom with their ends immersed in the mud." The *Virgularia mirabilis* are believed by the fishermen to have one end erect in the mud, and *Pavonaria quadrangularis*, according to Profesor Forbes, "lives erect, its lower extremity, as it were, rooted in the slimy mud at a depth of from twelve to fifteen fathoms." Mr. Darwin, who observed a species on the coast of Patagonia, which he called *Virgularia patagonica*, says: "At low water hundreds of these zoophytes may be seen projecting like stubble, with the truncate end upwards a few inches above the surface of the muddy sand. When touched or pulled they suddenly drew themselves in with force so as nearly or quite to disappear. By this action the highly elastic axis must be bent at the lower extremity, where it is naturally slightly curved, and I imagine it is by this elasticity alone that the zoophyte is enabled to rise again through the mud."

Bohadsch, as quoted by Johnston, says that the *Pennatulæ* swim by means of their *pinnæ*, which they use in the same manner that fishes do their fins. Ellis says: "It is an animal that swims freely about in the sea, many of them having a muscular motion as they swim along." And in another place he tells us, that "these motions are effected by means of the pinnules or feather-like fins, these are evidently designed by nature to move the animal backwards and forwards in the sea, consequently to do the office of fins." Mr. Clifton describes the Australian species as swimming rapidly in shallow water; and the American naturalists all seem to agree that the Stick Fish, *Osteocella septentrionalis* of Burrard Inlet, which has only a slight crest of polyps, and not *pinnæ*, or fins, as Ellis calls them, swims about like a fish, and is eaten by the dog-fish.

There seems to be no doubt that the Sea-Pens and Sea-Rushes do live in groups together, erect, and sunk in the mud, and that they are sometimes found swimming free in the sea, but the question is, are the free specimens those that have been disturbed by the waves and currents, and do they afterwards affix themselves in the mud, or are they vagrant specimens that live for a time and then die or are eaten by fish, their struggling being mistaken for swimming? Dr. Johnston observes, that when the Sea-Pens are placed in a basin or plate of water, he never observed a change of position, but they remain in the same place and lie with the same side up or down just as they have been put in. That is my own experience even when they are placed in a deeper vessel, but this may arise from the animal having lost part of its vitality before it was taken.

It may be useful to give the synonyma of these animals.

Osteocella, Gray, Cat. Pennatulidæ, 1870, p. 40. Ann. and Mag. Nat Hist. 1872, ix. p. 405.

Pavonaria, sp. Stearns, *Mining and Scientific Press*. San Francisco, Aug. 9, 1873.

Verillia, Stearns, Californian Acad. Sci., Aug. 18, 1873.

1. *Osteocella cliftoni*, Gray, Cat. Pennatulidæ, 1870, p. 40; Ann. and Mag. Nat. Hist. 1872, ix. p. 406.

Hab., Western Australia (G. Clifton, Esq.), B.M.

2. *Osteocella septentrionalis*, Gray, Ann. and Mag. Nat. Hist. 1873, ix. p. 406 (style only).

"New Marine Animal," Sclater, Brit. Assoc., Aug. 20 1872; NATURE, vol. vi. p. 436 (with figure of fish, of which it is said to be the notochord).

"Axis of Pennatulid," H. N. Moseley, NATURE, Sept. 26, 1872, vol. vi. p. 432.

"Pennatulid," Dawson, NATURE, Oct. 24, 1872, vol. vi. p. 516; Whiteaves, Nat. Hist. Soc. Montreal, 1872.

"New Alcyonoid," Stearns, Proc. Cal. Acad. Sci., Feb. 1873, v. part 1, p. 7.

Pavonaria blakei, Stearns, *Mining and Scientific Press*, San Francisco, Aug. 9, 1873.

Verrillia blakei, Stearns, Proc. Acad. Cal. Acad. Sci., Aug. 18, 1873.

Hab., Gulf of Georgia, Barraud's Creek, near New Westminster, Washington Territory: Herd, Claudet, Doane, Stearns, Chambers. Fraser's River: Dick and Nelson. B.M.

Mr. Stearns's paper in the Proceedings of the Californian Academy of Sciences is a reprint of the paper in the San Francisco *Mining and Scientific Press*, with a few additions, and the addition of a new sub-genus, *Verrillia*, although he quotes *Osteocella*.

Since I have seen the proof of this paper, the Hon. Justice Crease has informed me that he has forwarded to me a series of the animals of *Osteocella*, and also an account of the animal from an examination of fresh examples by Dr. Moss; the latter has arrived, and I communicated it on September 25 to the Zoological Society; it is illustrated by figures. J. E. GRAY

THE RELATION OF MAN TO THE ICE-SHEET IN THE NORTH OF ENGLAND

IN the interesting review of Sir Charles Lyell's "Antiquity of Man," communicated to NATURE of Oct. 2, Mr. A. R. Wallace mentions the fact that "there is as yet no clear evidence that man lived in Europe before the Glacial Epoch, and even if he did so, the action of the ice-sheet would probably have obliterated all records of his existence." The fact was true when it appeared, but both the fact and the remark which follows it, may now have to undergo considerable modification. The Committee for the Exploration of the Victoria Cave, near Settle, Yorkshire, assisted by a grant from the British Association, have just made a discovery which may prove to be of the greatest importance not only to the geologists of Europe, but to all those who take an interest in the origin and early history of man.

In May 1872 the Committee were exploring a bone bed in the cave, which occurred at a considerable depth beneath other deposits. It was full of hyæna-dung, broken bones, and teeth. A quantity of these were sent to Mr. Busk for determination, and he kindly returned the following list:—

Elephas primigenius	*Rhinoceros tichorinus*
Ursus spelæus	*Bison*
Ursus priscus	*Cervus elaphus*
Hyæna spelæa	

These are well known to represent the fauna of the river gravels in the south of England. Among them was a bone which puzzled even Mr. Busk, and he has only now given his mature and definite opinion on the subject. He writes: "The bone is, I have now no doubt, human; a portion of an unusually clumsy fibula, and in that respect not unlike the same bone in the Mentone skeleton." When Mr. Busk has taken some time to consider the question there are few scientific men who will dispute his verdict. The occurrence of the bones of man with this group of animals is a new fact for this part of the kingdom, but one that might be expected from a similar co-existence in the south of England, in Kent's Cavern, Wookey Hole, and elsewhere.

But at Settle this discovery possesses a far greater

interest from the evidence there of the relation of these animals and man to the great ice-sheet. This hyæna-bed dips into the cave, and has been worked only a short distance from its mouth; but at the mouth itself, vertically under the farthest projection of the overhanging cliff, lies a bed of stiff glacial clay containing ice-scratched boulders. This bed dips outwards at an angle of about 40°, and evidently lies on the edges of the beds containing man and the older mammals. It has been suggested that it may have fallen from the cliff above, and therefore may not necessarily have come into its position in glacial times, but, on a careful consideration, this is quite impossible. Upon it lies a great thickness of talus or scree, which is made up of fragments of limestone split off from the cliff above by the frosts of successive winters. If all this were now removed it would be barely possible for the glacial drift to fall from the cliff above to its present position, but if all the talus were restored to the cliff, of which it forms the waste, such a fall would be impossible. It is quite clear, from the waste of the cliffs which has taken place since the glacial drift came where it now lies, that the cliff then projected many feet farther out and would prevent such a fall.

A strong argument lies also in the fact that the loose talus all lies above the drift and is quite free from mud, whereas all the deposits below it are heavily charged with it, and the mud is just such a fine impalpable stiff mud as would result from the grinding of glaciers and the flow of glacier water. It seems probable that the drift is really the remnant of a moraine lateral or *profonde*, left here by a glacier or an ice-sheet, and that the remains of the older mammals and of man disinterred from beneath it are of an age at any rate previous to the great ice-sheet of the Irish Sea basin. But there is another line of argument which tends to the same conclusion. Three years ago it was believed by most geologists that the fauna here disinterred had never existed in this particular area—and why? because their remains had never been found in any of the river deposits of the district. It was supposed that the great extension of the ice prevented their migration hither. It is clear, now that we have found these remains in caves, that they must have peopled the northern district at one time as thickly as they did the south of England, where their bones are so common in river gravel. But their remains in the northern district occur now only in caverns, and have been removed from the open country. When we compare this removal of the mammoth-fauna over certain districts with the presence of evidence of land glaciation on a great scale, we begin to see that they bear a definite relation to one another, and that the ice-sheet was the great "besom of destruction" which swept away all remains of the older inhabitants from those portions of the country adjacent to the great ice centres.*

Again, there is another matter relating to this question which has hardly received the attention which it deserves. This is the complete absence of palæolithic implements and the fauna which is usually associated with them in the river gravels of the south, over co-extensive areas of the north of England, indicating the removal of palæolithic man from those areas by the ice-sheet. If I am not much mistaken, this discovery at Settle may have an important bearing in several ways. It will carry back the proofs of the antiquity of man to a time previous to the ice-sheet, that is to interglacial if not to preglacial times. It will corroborate the opinions expressed by Mr. Godwin Austen, Mr. James Geikie, and others, that the older valley gravels of the south of England are not of an age subsequent to the Till of the North. And it will give some support to the views of Messrs. Searles Wood and Harmer, that the Till of the north-west of England, though older than the great submergence, is probably of younger date than the greater part of the drifts of the east coast.

* *Geological Magazine*, vol. x. p. 140.

The Cave Committee will continue their work with redoubled vigour. It is much to be hoped that the scientific public will come to their assistance, and not let the expense of the undertaking fall, as now, almost entirely on the district of Craven.†

R. H. TIDDEMAN

ATLANTIC FAUNA

LAST May the s.s. *Hibernia* belonging to the Telegraph Construction and Maintenance Company, was despatched to repair the French Atlantic Cable, in which a fault was indicated some 200 miles from Brest. A brief account of some of the animal forms obtained by me in that expedition may not be without interest to some of the readers of NATURE.

To Mr. R. London, superintending the expedition, I am greatly indebted for the many facilities that he afforded me, of obtaining specimens of the deep-sea fauna. The first cast was made about 100 miles nearly due west of Brest, at a depth of 83 fathoms. Here we found numerous valves of *Pecten*, a fine *Ophiocoma*, with rays nine inches in length, which when handled broke itself into numerous fragments, *Echinus lividus*, *Spatangus purpureus*, &c.

At the surface we obtained by means of a towing-net a great abundance of a minute Entomostracous crustacean of a greenish-blue colour, with deep sapphire eyes, a *Cydippe*, two species of *Idotea* and *Polybius Henslowii*.

On the Atlantic cable, which was raised to the surface at a point 112 miles west of Brest, were found numerous shells of a small boring mollusc, one of the *Pholadidæ*, apparently *Xylophaga*. The outer covering of the cable, consisting of tarred manilla hemp, was perforated in many places by the round holes which they had formed and in which their shells were found. In places they had penetrated the outer covering, and had passed between the iron wires to the gutta percha core, in which they had made numerous shallow indentations, but in no case had they penetrated this to any depth. This cable, it will be remembered, was laid in 1869.

We now steamed about 87 miles westward to the edge of the Little Sole Banks, where the water deepens from 90 to 480 fathoms within a distance of a few miles. Here the cable was again hooked and brought to the surface from a depth of about 300 fathoms. Adhering to its surface was a species of *Pycnogonum* in great abundance. The specimens lived for some time after being brought to the surface, and moved about sluggishly.

A few bright red anomourous crustaceans were also obtained. These were very active, and lived for some days in a bucket of water.

They had, while in confinement, a peculiar habit of drawing their claws over their head, antennæ, and eyes, which suggested the idea that they were confused and dazzled by the extraordinary amount of light to which they were exposed.

A species of *Tubularia* of great beauty grew abundantly in clusters on the cable, and throve well in confinement. The cable was thickly overgrown with *Sertularias* of various species, moored to which by their hinder legs a species of *Caprella*, diabolic in appearance, but sluggish and inactive in nature, abounded.

A few miles farther westward the cable was raised from a depth of 480 fathoms. *Sertularias*, *Tubularias*, *Caprella*, &c., were still abundant; but the *Pycnogonum* was conspicuous from its absence.

In the recent expedition in which the *Great Eastern* and *Hibernia* have been employed in endeavouring to repair the Atlantic Cable of 1865, the natural history results have been much more meagre. Perhaps the most interesting objects obtained are some fragments of rock,

† Messrs. Birkbeck and Co., Craven Bank, Settle, have kindly consented to receive subscriptions,

consisting of Hornblende with interspersed crystals of quartz, found in lat. 51° 56′ N., long. 35° 45′ W., at a depth of about 1,760 fathoms.

FRED. P. JOHNSON

NOTES

PROF. SYLVESTER has recently made a discovery which is likely to create some interest, not only amongst mathematicians, but also amongst mechanicians and instrument-makers. By means of a sort of lazy tongs he has succeeded in converting spherical motion into plane motion, a result, we believe, hitherto looked upon as unattainable. This discovery will form the subject of a communication which Mr. Sylvester is announced to lay before the London Mathematical Society at its Annual General Meeting on Thursday next (November 13).

THE two gentlemen recently elected to Science-Fellowships at Oxford, are remarkable instances of success attending most irregular and unusual undergraduate careers. Mr. Yule was at one time a boy at Magdalen College School, he obtained the Brackenbury Scholarship for Physical Science at Balliol College, but was obliged to throw it up after a short time, on account of his failure to pass the classical examinations of the University. He bethought him of the more merciful ordinances of the sister University, and having obtained a Scholarship at St. John's College, Cambridge, proceeded on his undergraduate course unchecked by the lessened barrier of the previous examination. After being placed senior in the Natural Sciences Tripos, he returns to Oxford, we may hope bringing treasures from the East—and at any rate ready to use his vote for the improvement of the Oxford Examination Statutes. Mr. Macdonald is an individual who has come as near as is possible to achieving the feat of being in two places at one time. In fact, theoretically, he has been in two places at one time. He had the great courage and energy whilst holding a position in the Education Office, to enter as an Undergraduate at Merton College, and by consent of the College authorities he kept his term by sleeping in Oxford, which place he left every morning during term, so as to be at his official post, returning in the evening in time for hall dinner. His office-holidays he employed in practical work in the Oxford laboratories, whilst analytical chemistry had to be studied in his own sitting-room, converted for the time into a workshop. Such a history makes it very certain that the examination system has not failed at Merton College to secure at any rate a most worthy recipient of the fellowship.

THE election to the two vacant Fellowships at Merton College, took place on Oct. 30, when the choice of the electors fell upon Mr. John Wesley Russell, Lecturer of Balliol College, as Mathematical Fellow; and Mr. Archibald Simon Lang Macdonald, Commoner of Merton College, as Natural Science Fellow. Mr. Russell was placed in the first class in Mathematics under Moderators, in Trinity Term, 1871; and Mr. Macdonald in the first class in Natural Science at the final examination, in Michaelmas Term, 1871.

WE are glad to be able to add St. John's College, Cambridge, to the list of those which have opened their Fellowships to Students of Natural Science. Since 1868, the College has given Exhibitions yearly, and Foundation Scholarships since 1870, for the encouragement of a knowledge of Physics, Chemistry, and Biology. On Monday last the Master and Seniors, in proof of their desire to place the Natural Sciences on the same footing as Classics and Mathematics, elected one of their scholars, Mr. A. H. Garrod, B.A., who was a Senior in the Natural Science Tripos of 1871, to a Fellowship.

ABOUT the end of January 1874, there will be an election to a scholarship in Natural Science at Exeter College, Oxford, candidates for which will be examined in biology, chemistry, and physics. Candidates are not expected to exhibit *special* knowledge of more than one of the above subjects, and preference will be given to a candidate who excels in biology, or one of its branches. The candidate selected will have to satisfy the college that he has sufficient classical and mathematical knowledge to pass responsions. There is no limit of age disqualifying candidates for this scholarship. The scholarship is of the annual value of 80*l.*, tenable for five years from matriculation. The scholar elected will have the use, during term, of a place in the histological laboratory of the college. For further information application should be made to Mr. E. Ray Lankester, Natural Science Lecturer, Exeter College.

MR. CHARLES J. F. YULE, of St. John's College, Cambridge, wishes us to state that he is not "the Cambridge B.A." whose letter appeared in last week's number.

AT the Commitia, held on Thursday, October 30, at the Royal College of Physicians, Dr. Robert Druitt was elected a Fellow of the College. The president announced that the Harveian Oration in the ensuing year would be delivered by Dr. Charles West. The Gulstonian Lectures will be delivered by Dr. J. F. Payne; the Croonian Lectures by Dr. Murchison; the Lumleian by Dr. Sibson.

WE regret to record the death, on Oct. 24, of Dr. Crace Calvert, F.R.S., F.C.S. The illness which caused it was contracted at Vienna, whither he had gone to act as juror in the International Exhibition. The *Journal of the Society of Arts* furnishes some particulars concerning the work of Dr. Calvert. As an analytical chemist his renown was European. He left England as a youth to pursue his education in France, and in the schools of that country secured many honours by the awards which he obtained. He subsequently pursued the study of chemistry, and was appointed assistant chemist at the Gobelin works, under his learned master, Chevreul. Soon after his return to England, he commenced reading a series of papers before the Society of Arts on chemistry applied to industry. At a later date, when the Society of Arts proposed to establish Cantor lectures, he gave the proposition his hearty support, and delivered two courses of lectures on "Chemistry applied to the Arts." He also delivered courses on "Synthesis and the Production of Organic Substances," on "Aniline and Coal Tar Colours," and on "Dyes and Dye-stuffs other than Aniline." In 1846 he settled in Manchester, and was soon after appointed Professor of Chemistry at the Royal Institution there. He was also for some time a lecturer at the Manchester School of Medicine. His connection with the Manchester Sanitary Association led him to hygienic investigations—one of the principal results of which was a patent for the application and preparation of carbolic acid. In scientific circles great interest attached to Dr. Calvert's protoplasmic investigations, some of the results of which were communicated in a paper read at the meeting of the British Association in Edinburgh some years ago, and afterwards published in the Transactions of the Royal Society. Dr. Calvert was a Fellow of the Royal Society of England, a Fellow of the Chemical Society, and an honorary Fellow of the Chemical Society of Paris. He was also a member of the Royal Academy of Turin, and of the Imperial Academy of St. Petersburg.

THE death is announced of Prof. J. A. F. Breithaupt, of Freiberg, the well-known Mineralogist, on October 22, at the age of 82 years.

Ocean Highways announces the death from scurvy on the Novaya Zemlya Coast, of the distinguished Norwegian Arctic Explorer, Captain Sivert Tobieson.

AT the meeting of the Royal Geographical Society last Monday, Sir Bartle Frere, the President, said that, though there

was no further news of Dr. Livingstone, the latest accounts of both the expeditions sent out in the hope of meeting him, tell of satisfactory progress. Of the West Coast Expedition under Lieutenant Grandy, R.N., the latest direct accounts state that the expedition had just left San Salvador, about June 16, in good health, so that we may one day hope to hear of their further progress in their search for tidings of Livingstone, and every step of their progress will add to our knowledge of that most interesting, but little known, region. Comparing Consul Newton's dates with those of Dr. Beke's Portuguese informant, published on Saturday last, Sir Bartle Frere thinks we must await some confirmation of the latter report before concluding that Lieutenant Grandy had turned back. The other expedition started under Lieutenant Cameron on the east coast, and notwithstanding all delays, Lieutenant Cameron made a fair start for the lake region; and, by the latest accounts, was pushing on with every prospect of reaching a district where he was most likely to obtain tidings of Livingstone.—Mr. C. Markham, the Secretary, read a paper giving some interesting information connected with the voyage of the *Polaris* to the Arctic regions, and a discussion followed in which the desirability of another Arctic expedition was strongly urged, some of the members proposing that, if Government refused, the society itself should send one, but this view was controverted by Captain Sherard Osborne, who maintained that such an expedition, to be successful, should be under the auspices of the Government.

WE have great pleasure in calling attention to a series of science lectures for clerks and working-men, which are to take place in South Place Institution, Finsbury. The first three lectures, on November 4, 11, and 18, are by Prof. Duncan, F.R.S., on the Geological History of the Earth, and these are to be followed by others on Light, &c. The gentlemen who get up these lectures deserve great credit, as they expect to be considerably out of pocket in their endeavour to place science lectures by the most eminent scientific men within the reach of the classes mentioned, who, we hope, will take ample advantage of the opportunity. The charge for admission is almost nominal.

AMONG the Local Societies, concerning which we have received information since we published our list, is the "Junior Philosophical Society," a London Society which meets on the second and fourth Friday of each month from October to June, at 8 P.M. The Society seems earnestly bent on work in the way of reading papers, and occasional excursions, no member being admitted who does not prove his willingness to take his share in the work of the Society. Many of the papers to be read this winter are on important scientific questions; and we would recommend the Society to the attention of those young men who are within convenient distance of the meeting-place, 6A, Victoria Street, Westminster.

HIS Excellency Senor Don Gregorio Beintes, Minister Plenipotentiary of the Republic of Paraguay, has appointed Mr. Charles Twite, M.E., late reporter to the Royal Commission on Mines, who explored the mineral resources of Siam; M. Balanza, botanist, late Commissioner of the French Government to New Caledonia and Egypt; and Mr. Keith Johnston, F.R.G.S., members of a scientific commission to inquire into and report on the natural resources of Paraguay. Dr. Leone Levi, F.S.S., Professor of Commercial Law in King's College, Consul-General of Paraguay in London, will edit the reports and exhibit them in relation to the economic condition of the country. Such reports will be published towards the end of next year.

THE Exhibition which will be held in Manchester, by the Society for the Promotion of Scientific Industry, of appliances for the Economical Consumption of Fuel, will be opened on December 18 next. In connection with this subject, a gentleman has placed a gold medal at the disposal of the Council of the Society for the best specimen of peat fuel that shall come nearest to coal in its use and character, special regard being had to its cheap and rapid production.

THE Council of the Institution of Civil Engineers have forwarded us a list of thirty-six subjects, on which they invite communications.

MR. ALBERT MÜLLER has sent us No. 2 of his "Contributions to Entomological Bibliography up to 1862;" further numbers will appear as materials accumulate. The list contains a great deal of information, and it will no doubt be valued by entomologists. It may be obtained from Mr. E. W. Janson, Museum-street.

THE Director of the Imperial Russian Telegraph has given his consent to the transmission, free of cost, within the boundaries of the Russian empire, of messages announcing new astronomical discoveries.

MR. JAMES DALLAS, of Benakandy, Cachar, writing us on the subject of inherited peculiarities, says that a friend of his has a black-and-tan English terrier dog, two inches of the end of whose tail is folded back so acutely as to come in contact with the upper portion. A pup, of which the dog is the undoubted father, has inherited the paternal peculiarity, with the difference that, instead of the end of the tail being turned up, it is turned down.

A SERIES of methodical observations on the various movements of a ship affected by waves was carried out on board the ship *Norfolk* during her last voyage from Melbourne to London. The observations during the voyage (from July 24 until October 16) were effected by self-registering instruments, under the care of Mr. W. T. Deverell, on behalf of Mr. Spencer Deverell, of Portland, Victoria, who has devoted many years' study to the mathematical investigations of the movements of ocean waves and to their action upon a floating body. A complete report will constitute no doubt a valuable contribution to naval literature.

IT is stated that the steamer *Tuscarora*, under the command of Capt. George E. Belknap, has lately been fitted up at San Francisco to undertake the labour of making soundings between the Pacific coast and Japan, in connection with the new cable route. On the detail of the *Juniata*, for service in the *Polaris* search, the sounding apparatus, which had been put on board for a similar service between New York and the West Indies, was transferred to the *Tuscarora*. This included a supply of new steel wire, with Sir William Thomson's patent reel. The vessel was to proceed early in July to Puget Sound, and thence, by way of the Aleutian Islands, to Hakodadi.

IT is stated by the *Australian and New Zealand Gazette*, that the Government has signified its willingness to grant a site for the proposed Adelaide university; to give 10,000*l.* towards the cost of its erection, provided an equal amount is raised by private subscription; and to provide an annual grant equal to 5 per cent. on other subscriptions.

THE great Exhibition of Vienna (we learn from the *Journal of the Society of Arts*) is to be commemorated by the establishment of an "Athenæum," as it is called, modelled after the Conservatoire des Arts et Metiers of Paris, and the Museum of Industry at Brussels, for the special instruction of workmen and small manufacturers. It is to be installed in the midst of the industrial quarters of the capital. A large quantity of drawings, designs, models, instruments, machines, tools, raw and partially manufactured materials, have been promised by exhibitors, and Baron Schwarz-Senborn, director of the exhibition, has presented a collection of between three and four thousand volumes of book

connected with industrial exhibitions. The establishment starts with a capital of more than 11,500*l.*

ON Sept. 1, an earthquake took place at 4.10 P.M. with slight shocks at Drama, in European Turkey. There was an earthquake at about 9 P.M. on Sept. 6, in Armenia, at Erzeroum, and elsewhere. Several shocks of earthquake were felt on Aug. 21, in the City of Guatemela, but very few houses were damaged.

La Nature records the recent death of M. Godard, senior, the oldest of French aëronauts.

THE additions to the Zoological Society's collection during the past week include a Bosman's Potto (*Perodicticus potto*) from Africa, and a Blue Magpie (*Cyanopolius cyanus*) from China, presented by Rev. A. W. Peter; two Ursine Dasyures (*Dasyurus ursinus*) from Australia, presented by the Acclimatisation Society of Victoria; an Alpine Marmot (*Arctomys marmotta*), an Inconvenient Curassow (*Crax incommoda*) from S. America, a Red-bellied Thrush (*Turdus rufiventris*), a Red Oven-bird (*Furnarius rufus*), and two Yellow Trupials (*Xanthosomus flavus*) from Buenos Ayres; a Hoffmann's Sloth (*Cholopus hoffmanni*) from Panama, purchased; a Sun Bittern (*Eurypyga helias*) from S. America, deposited.

*THE SELECTION AND NOMENCLATURE OF DYNAMICAL AND ELECTRICAL UNITS**

WE consider that the most urgent portion of the task entrusted to us is that which concerns the selection and nomenclature of units of force and energy; and under this head we are prepared to offer a definite recommendation.

A more extensive and difficult part of our duty is the selection and nomenclature of electrical and magnetic units. Under this head we are prepared with a definite recommendation as regards selection, but with only an interim recommendation as regards nomenclature.

Up to the present time it has been necessary for every person who wishes to specify a magnitude in what is called "absolute" measure, to mention the three fundamental units of mass, length, and time, which he has chosen as the basis of his system. This necessity will be obviated, if one definite selection of three fundamental units be made once for all, and accepted by the general consent of scientific men. We are strongly of opinion that such a selection ought at once to be made, and to be so made that there will be no subsequent necessity for amending it.

We think that, in the selection of each kind of derived unit, all arbitrary multiplications and divisions by powers of ten, or other factors, must be rigorously avoided, and the whole system of fundamental units of force, work, electrostatic, and electromagnetic elements, must be fixed at one common level—that level, namely, which is determined by direct derivation from the three fundamental units once for all selected.

The carrying out of this resolution involves the adoption of some units which are excessively large or excessively small in comparison with the magnitudes which occur in practice; but a remedy for this inconvenience is provided by a method of denoting decimal multiples and sub-multiples, which has already been extensively adopted, and which we desire to recommend for general use.

On the initial question of the particular units of mass, length, and time, to be recommended as the basis of the whole system, a protracted discussion has been carried on, the principal point discussed being the claims of the gramme, the *metre* and the second, as against the gramme, the *centimetre*, and the second; the former combination having an advantage as regards the simplicity of the name *metre*, while the latter combination has the advantage of making the unit of mass practically identical with the mass of unit volume of water; in other words of making the value of the density of water practically equal to unity. We are now all but unanimous in regarding this latter element of simplicity as the more important of the two; and in support of this view we desire to quote the authority of Sir W. Thomson, who has for a long time insisted very strongly upon the necessity of employing units which conform to this condition.

We accordingly recommend the general adoption of the centimetre, the gramme, and the second, as the three fundamental units; and until such time as special names shall be appropriated to the units of electrical and magnetic magnitude hence derived, we recommend that they be distinguished from "absolute" units otherwise derived, by the letters "C. G. S." prefixed, these being the initial letters of the names of the three fundamental units.

Special names, if short and suitable, would, in the opinion of most of us, be better than the provisional designations "C. G. S. unit of . . . . ." Several lists of names have already been suggested; and attentive consideration will be given to any further suggestions which we may receive from persons interested in electrical nomenclature.

The "ohm," as represented by the original standard coil, is approximately 10^9 C. G. S. units of resistance. The "volt" is approximately 10^8 C. G. S. units of electromotive force, and the "farad" is approximately $\frac{1}{10^9}$ of the C. G. S. unit of capacity.

For the expression of high decimal multiples and sub-multiples, we recommend the system introduced by Mr. G. J. Stoney—a system which has already been extensively employed for electrical purposes. It consists in denoting the exponent of the power of 10 which serves as multiplier, by an appended cardinal number if the exponent be positive, and by a prefixed ordinal number if the exponent be negative. Thus:—

10^9 grammes constitute a *gramme-nine*,

$\frac{1}{10^9}$ of a gramme constitutes a *ninth-gramme*.

The earth's circumference is approximately four metre-sevens, or four centimetre-nines.

For multiplication or division by a million, the prefixes *mega* * and *micro* may conveniently be employed, according to the present custom of electricians. Thus the *megohm* is a million ohms, and the *microfarad* is the millionth part of a farad. The prefix *mega* is equivalent to the affix *six*. The prefix *micro* is equivalent to the prefix *sixth*. The prefixes *kilo*, *hecto*, *deca*, *deci*, *centi*, *milli* can also be employed in their usual senses before all new names of units.

As regards the name to be given to the C. G. S. unit of force, we recommend that it be a derivative of the Greek δυναμις. The form *dynamy* appears to be the most satisfactory to etymologists. *Dynam* is equally intelligible, but awkward in sound to English ears. The shorter form *dyne*, though not fashioned according to strict rules of etymology, will probably be generally preferred in this country. Bearing in mind that it is desirable to construct a system with a view to its becoming international, we think that the termination of the word should, for the present, be left an open question. But we earnestly request that, whichever form of the word be employed, its meaning be strictly limited to the unit of force of the C. G. S. system; that is to say the force which, acting upon a gramme of matter for a second, generates a velocity of a centimetre per second.

The work done by this force, working through a centimetre, is the C. G. S. unit of work, and we propose to denote by it some derivative of the Greek ἐργον. The forms *ergon*, *ergal*, and *erg* have been suggested; but the second of these has been used in a different sense by Clausius. In this case also we propose for the present to leave the termination unsettled; and we request that the word *ergon* or *erg* be strictly limited to the C. G. S. unit of work, or what is, for purposes of measurement, equivalent to this, the C. G. S. unit of energy, energy being measured by the amount of work which it represents.

The C. G. S. unit of power is the power of doing work at the rate of one erg per second, and the power of an engine (under given conditions of working) can be specified in ergs per second.

For rough comparison with the vulgar (and variable) units based on terrestrial gravitation, the following statement will be useful:—

The weight of a gramme at any part of the earth's surface is about 980 dynes, or rather less than a kilodyne.

The weight of a kilogramme is rather less than a megadyne, being about 980,000 dynes.

Conversely, the dyne is about 1·02 times the weight of a milli-

* First Report of the British Association Committee on Units.

* Before a vowel, either *meg* or *megal* (as euphony may suggest), may employed instead of *mega*.

gramme at any part of the earth's surface, and the megadyne is about 1·02 times the weight of a kilogramme.

The kilogram-metre is rather less than the erg-eight, being about 98 million ergs.

The gramme-centimetre is rather less than the kilerg, being about 980 ergs.

For exact comparison, the value of g (the acceleration of a body falling in vacuo) at the station considered, must of course be known. In the above comparisons, it is taken as 980 C.G.S. units of acceleration.

One horse-power is about three quarters of an erg-ten per second. More nearly, it is 7·46 erg-nines per second, and one *force de cheval* is 7·36 erg-nines per second.

The mechanical equivalent of one gramme-degree (centigrade) of heat is 41·6 megalergs or 41,600,000 ergs.

SCIENTIFIC SERIALS

In the current number of the *Quarterly Journal of Microscopic Science*, Mr. E. T. Newton commences with a paper on the Structure of the Eye of the Lobster, his observation being the result of suggestions from Prof. Huxley. The structure of the eye is minutely discussed, and the accompanying illustrations are abundant. As a concluding remark, we read that "Notwithstanding all that has been written up to the present time concerning the mode of action of the compound arthropod eye, we are still unable satisfactorily to solve this difficult physiological problem."—A paper by Prof. Betz, of Kieff, on the methods of investigating the structure of the central nervous system in Man, will be found of special interest, the hardening, cutting, and tinting of specimens being discussed.—M. Pasteur's new contributions to the theory of Fermentation, are translated from the "Comptes Rendus," and Prof. H. L. Smith's paper on Archebiosis and Heterogenesis, is reprinted from the *Lens*.—A Résumé, by Mr. W. Archer, of recent observations on Parasitic Algæ, is followed by Dr. Klein's Contributions to the Anatomy of Auerbach's Plexus in the Frog and Toad, and this by a valuable series of observations by Prof. Lister on the Natural History of Bacteria, in which a study of the life of Bacteria under different circumstances as regards the fluid in which they grow, shows that their general appearance, size, and shape depend in great measure on the fluid in which they are growing, their removal from one to another fluid causing them to take on quite a different form, and their replacement the reassumption of the original condition. Many important facts are to be learned from this paper.—Mr. E. R. Lankester describes in detail the microscopic and spectroscopic appearances of a new Peach-coloured Bacterium, named by him *Bacterium rubescens*. The colouring matter he names Becterio-rubrin. This Bacterium does not generally occur in isolated plastids, but generally forming films, encrustations, or tufts. Most are aggregated in adherent masses, several excellent drawings of which accompany the paper.

The Journal of the Franklin Institute, Sept. 1873.—This number contains a useful paper by Mr. Hugo Bilgram, on the theory of steam governors.—In government reports on the decay and preservation of timber, Generals Cram and Gillmore recommend the Seely process as the best. It consists in subjecting the wood to a temperature above the boiling point of water, and below 300° Fahr. while immersed in a bath of creosote a sufficient length of time to expel the moisture. When the water is thus expelled the pores contain only steam; the hot oil is then quickly replaced by a bath of cold oil, by means of which change the steam in the pores of the wood is condensed, and a vacuum formed into which the oil is forced by atmospheric pressure and capillary attraction. Gen. Gillmore thinks a wooden platform, *thoroughly creosoted*, would last twenty to thirty years, and be better than a stone platform during that entire period.—An important paper by Prof. Thurston (extracted from the *Iron Age*), treats of the molecular changes produced in iron by variations of temperature.—Mr. Mott points out the conditions of good construction in lightning rods, and Dr. Feuchtwanger gives some information as to nickel and its uses in the arts, coinage, and nickel plating.—An oil discovery of unusually rich character is announced from the neighbourhood of Titusville, Pa.; the production of the new region being estimated at 30,000 barrels per day.

Der Naturforscher, September 1873.—We note, in this number, two striking observations in animal physiology. One of these refers to the torpedo, which has been a puzzle to physiologists, inasmuch as, while giving shocks strong enough to lame or kill another animal, its own muscles do not show the least contraction. Du Bois Reymond's hypothesis is, that while the stimulation to discharge goes forth from the central organ, the same organ sends out at the same time a counteractive influence through the nervous system, which neutralises the excitability of the nerves. M. Franz Boll took a recent opportunity of experimenting with the fish on the Italian coast, and, among other things, he tested this theory by cutting some nerves, and watching their muscles when he stimulated the electric nerves. The neutralising stimulation being thus cut off, the muscles should, he thought, contract, if the hyphothesis were true; and they did so, the muscles of the unsevered nerves remaining at rest. Still, he hardly thinks the experiment decisive, because nerves are more excitable after section.—The other observation is by Prof. Fick, who has found, by manometric measurement, a less pressure of blood in the left ventricle than in the aorta; 80 mm. of mercury in the one case, 104 to 128 in the other (in a dog). He supposes the blood, only partially filling the ventricle, at the apex, to be shot against the semilunar valves, forcing them open by its *vis viva*. In the neighbourhood of the valves the pressure must quickly rise. In short, as the author puts it, the blood is not pressed, but hurled (*geschleudert*) into the aorta.—There is a useful abstract of the chief points in a paper by Prof. Abbé (to Schulze's *Archiv*) on the capability of the microscope and its limits. He seeks to show, by physical deductions, that the limit of magnification is as good as reached, in our best systems. Some curious observations by M. van Tieghem are given in a note on the independence of the individual organs of the embryo of plants.—M. Ebermayer, we find, has been examining the influence of forests on ozone-contents of the air; he states there is more ozone in and near forests than in the open, but among the denser branches there is somewhat less than in the open closely bordering the forest; and in the tops of the trees there is more than in the lower parts.—Several French Academy notes are abstracted: on the magnetic force of annealed steel, on development of electricity in liquid mixtures, on the planet Mars, &c.; also Royal Society papers. Some meteorological observations as to distribution of heat in Switzerland deserve notice.

Bulletin Mensuel de la Société d'Acclimatation de Paris. August.—In a paper on the "Causes of the Depopulation of our Rivers," M. C. R. Wattel enters at length into the question of the French river fisheries, which will be read with interest by fish-culturists. Some interesting information as to the effect of navigation and trade on the rivers is given; but the great danger to the fisheries lies in the unrestricted destruction of immature breeding-fish: and M. Wattel recommends that steps should be taken to prevent over-fishing and to facilitate the erection of fishways on the rivers.—The notes of Dr. P. Marès on the acclimatisation of various sorts of Eucalyptus in Algeria, are interesting.—The results of the experiments to produce different coloured silks go to show that silk-worms fed on cherry-leaf produce a bright chromo-yellow-coloured silk, those on pear-leaves a darker shade of the same colour, those on apple-leaves a nearly white silk, but coarser than that of the silk-worms fed on mulberry-leaves.—An extract is given of a work by M. E. Perris, on "Birds and Insects," in which he considers the advisability of protecting small birds. M. Perris, granting all the birds are insectivorous, either continually or occasionally, acknowledges the good they may do, but doubts whether a large proportion of the insects destroyed are hurtful to man; and he raises the question whether, therefore, it is desirable to protect birds to kill what would otherwise do no harm.

The September number commences with a paper by the Secretary on some Australian vegetables, the introduction of which into Algeria is proposed.—An interesting paper on the breeding of ostriches in captivity is contributed by Capt. Crepu, who has kept several pairs of these birds. His observations throw much light on the natural history of the ostrich. M. Comber describes the mortality which has seized the deer and other animals in King Victor Emmanuel's park at La Mandria. The calamity is attributed partly to over-crowding and partly to the want of shelter and proper protection. In 1865, when the park and grounds were carefully cultivated, 13 deaths occurred. In 1873, the park being left in its natural state, 172 deaths are recorded.—An important paper on the production of milk is the

result of a conference at the Jardin d'Acclimatation in July, and appears opportunely at the present moment, when the subject is attracting so much public attention.—M. E. Perris continues his remarks on "Birds and Insects."

SOCIETIES AND ACADEMIES

MANCHESTER

Literary and Philosophical Society, October 7.—E. W. Binney, vice-president, in the chair.—"Atmospheric Refraction and the last rays of the Setting Sun," by Mr. D. Winstanley. It is recorded in the Proceedings of this Society that a letter dated from Southport and written by Dr. Joule was read at the meeting held on the 5th October, 1869. In that letter it is remarked that "Mr. Baxendell noticed the fact that at the moment of the departure of the sun below the horizon the last glimpse is coloured bluish green." Dr. Joule also observes that on two or three occasions he had himself noticed the phenomenon in question, and that "just at the upper edge where bands of the sun's disc are separated one after the other by refraction, each band becomes coloured blue just before it vanishes." During the past eighteen months the writer, from his residence in Blackpool, has had frequent opportunities of observing the setting sun, and has noticed the phenomenon of the final coloured ray certainly more than fifty times. To the naked eye its appearance has generally been that of a green spark of large size and great intensity, very similar to one of the effects seen when the sun shines upon a well-cut diamond. The colour, however, is by no means constant, being often, as in the case of Mr. Baxendell's observation, bluish green, and at times, as mentioned by Dr. Joule, quite blue. The period of its duration, too, is likewise variable. Sometimes it lasts but half a second, ordinarily perhaps a second and a quarter, and occasionally as much as two seconds and a half. When examined with the assistance of a telescope, it becomes evident that the green ray results at a certain stage of the solar obscuration, for it begins at the points or cusps of the visible segment of the sun, and when the "setting" is nearly complete, extends from both cusps to the central space between, where it produces the momentary and intense spark of coloured light visible to the unaided eye. From the fact of the green cusps being rounded I apprehend that irradiation contributes to the apparent magnitude of what is seen. The range of colour too as seen in the telescope is more varied, and the duration of the whole phenomenon more extended, than when the observation is made only with the naked eye. Respecting the increased range of colours seen when the phenomenon is observed with telescopic aid, I may mention that on the 28th of June the sea was calm and the sky quite cloudless at the setting of the sun. Of the final coloured rays fifteen diameters showed the first to be a full and splendid yellow, which was speedily followed by the usual green, and then for a second and a half by a full and perfect blue. Respecting the increased duration of the colour, I have found that when the atmosphere is sufficiently favourable to allow a power of sixty diameters being employed with a three-inch object-glass, the green effect is seen at that part of the sun's limb in contact with the horizon even when one half the sun is still unset, and of course from then till final disappearance. The different colours seen, together with the order of their appearance, are suggestive of the prismatic action of the atmosphere as the cause of their production, and the interception of the horizon or the cloud as the cause of their separation. Assuming the correctness of this view, it becomes evident that an artificial horizon would prove equally efficacious in separating the coloured bands, and also that if employed during an inspection of the sun's lower limb, the least refrangible end of the spectrum would be disclosed. By projecting a large image of the sun into a darkened room I was enabled to get the whole of the spectrum produced by the prismatic action of the atmosphere in a very satisfactory manner. In this case a semicircular diaphram was used, so placed that its straight edge divided the field of view into equal parts, from one of which it obscured the light. The diaphram was placed in the focus of the eyepiece, and by rotating it every portion of the sun's limb could be in turn examined, and that too in the centre of the field, so as to be equally subjected to the minimum of the peculiarities of the instrument. When the sun's lower limb was allowed to descend into the field of view the first rays were intensely red. After a momentary duration they gave place in succession to orange, yellow, and green, which were then lost in the ordinary refulgence of the sun. The upper limb gave green, blue, and finally purple, which latter colour I have thus far never seen upon the natural horizon. I apprehend that the results here given sufficiently prove that atmospheric refraction is the cause of the coloured rays seen at the moment of the sun's departure below the horizon.

Cambridge Philosophical Society, Oct. 20.—The following communications were made to the Society:—By Mr. J. C. W. Ellis, Sydney College: Mechanical means for obtaining the real roots of algebraical equations.—By Mr. A. Marshall, St. John's: Graphic representation by aid of a series of hyperbolas of some economic problems having reference to monopolies.—By Mr. H. H. Cunyngame, St. John's: A machine for constructing a series of rectangular hyperbolas with the same asymptotes.

PARIS

Academy of Sciences, October 27.—M. de Quatrefages, president, in the chair.—The following papers were read:—Sixth note on guano, by M. Chevreul.—Answer to Respighi's note on the magnitude and variation of the sun's diameter, by Father Secchi. The author defended his method from Respighi's criticisms as regards the effect of heat in distorting the image during the passage through the prisms. He found that the effect of heat on compound prisms was very considerable, and therefore used his object-glass prism; and stated that in a future letter he intended to show that there were true variations in the solar diameter.—On crystalline dissociation, by MM. Favre and Valson. The authors continued the account of their researches, the present portion of the paper dealing with the valuation of the work done in the various solutions.—Note on the tertiary supra-nummulitic formation of the Carcassone basin, by M. Leymerie.—On certain cases of human double monstrocity, by M. Roulin.—Note on the origin and method of development of omphalosic monsters, by M. C. Dareste.—New method of condensing liquifiable substances held in suspension by gases, a reply to M. Colladon, by MM. E. Pelouze and P. Audouin.—M. Guérin-Méneville sent a letter in which he asserted that the *Phylloxera* is not the cause, but a consequence of the vine disease.—Note on the swellings produced on vine rootlets by the *Phylloxera*, by M. Max. Cornu.—Results of experiments on the destruction of the *Phylloxera* by means of carbonic disulphide, by M. Bazille. The author found that this agent was very successful, and that the doses could be reduced considerably but that different soils require different doses.—On the action of the condenser on induction currents, by M. Lecocq de Boisbaudran.—On the purification of hydrogen, by M. Ch. Viollette.—On the Cape diamond fields, by M. Hugon.—On the sugar contained in vine-leaves, by M. A. Petit. The author found in 1 kilo of leaves as much as 33 grammes of cane sugar and 12 of glucose; this was, however, exceptional, the latter generally exceeding the former and the total quantity of both being less.—On the Rhizocephalous *Cirripedes*, by M. A. Giard.—On the irritability of stamens, by M. E. Heckel. The author has distinguished two orders of movement in these organs.

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