THURSDAY, AUGUST 8, 1872

THE GOVERNMENT AND THE SOCIETY OF ANTIQUARIES

THE Government has outdone itself. Mr. Lowe and Mr. Ayrton have added another to their many claims on the esteem of their admiring fellow-countrymen, another to their many efforts to place England at the front in all matters relating to culture, and let us add another to the many indications that if science and culture are to go on in any large sense here at all, there must be some very considerable change in our present arrangements.

This time it is not a question of refusing a monument to Faraday or a search after Livingstone, of insulting a distinguished man of science at Kew, or any point relating to the investigation of any phenomena, such as the tides, which it will be recollected "My Lords," after having given their "anxious attention" to, were good enough to characterise as of an "interesting nature." This time the Government has changed its tactics altogether. Not content with hurling refusals at those societies whose duty it is to remind the Government of the claims of the sciences to which they devote themselves, the Government has singled out a society, begged it to do certain work, of course at the expense of the members, and after this work has been well and promptly done, it has turned round, and practically told the society that it is a fool for its pains. This, of course, is a *coup de maitre*, one admirably adapted to keep the societies, as well as architects, sculptors, and gardeners down, and we can well imagine that Messrs. Lowe and Ayrton have enjoyed their Bank holiday with a greater relish with this on their mind. But there is another point of view in which the transaction is less satisfactory, and to point this out it is necessary to mention some details.

We gather from the *Times* that prior to Mr. Layard's appointment as Chief Commissioner for Works and Buildings in 1868, "the office had usually been bestowed on some member of the party in power for whom there was no convenient place in the Cabinet, yet whose claims could not safely be disregarded. Sir William Molesworth had occupied the position as a distinguished champion of Radical opinions. So had Lord Morpeth as a scion of the Whigs, and Lord John Manners as a representative of the Tories. Sir Benjamin Hall succeeded to the place not so much because he represented, like his predecessors, a great political party, as that he secured for the Ministry of which he was a member the confidence of the metropolitan vestries. After Lord John Manners' second term of office the place ceased to be one of Cabinet rank; but when, after a third trial of Lord John Manners, Mr. Layard came into office with Mr. Gladstone, a new theory as to the duties of the place appears to have been initiated. Mr. Layard, setting aside his political claims, was well known to the public as a distinguished archæologist and man of letters." One of Mr. Layard's first acts was to courteously request the Society of Antiquaries to furnish him with "a list of regal and other historical tombs or monuments existing in cathedrals, churches, and other public places and buildings," such as it might be desirable to "place under the protection and supervision of the Government, with a view to their proper custody and preservation."

Thereupon the Society of Antiquaries, whose aid Mr. Layard's predecessors—whose only thoughts had been of place and party—had never required before, set to work in a most vigorous manner. They passed resolutions which were forwarded to the Government; they corresponded with their local secretaries, they appointed a numerous "Sepulchral Monuments Committee;" they divided England and Wales into districts, and made most minute inquiries; prepared a list of 531 monuments, which they considered to be included in the terms of Mr. Layard's letter; and communicated them to the Government with a report pointing out the desirability of the proposed Government action as evidenced by the demolitions which had already occurred, and stating that the work had been one of enormous labour.

By the time the report was sent in, however, Mr. Layard had left the Office of Works, and Mr. Gladstone having apparently come to the conclusion that no culture was requisite for the head of that office, Mr. Ayrton had been appointed. When the Prime Minister rewarded the important services rendered by Mr. Ayrton to his country by placing him in a position of considerable emolument, it can readily be understood that the lucre formed but a small part of the reward; and on the receipt of a letter from the Society of Antiquaries, in March, this gentleman entered upon the sweets of office with a vengeance. The Society was very quickly informed (1) that Mr. Layard's letter, on which they had acted with such alacrity and diligence, had been written "without the authority of the Treasury having been at any time obtained;" (2) "that the First Commissioner has now been informed by their Lordships that they must decline to authorise him to undertake any duties in respect to the regal and historical tombs or monuments referred to;" (3) "that the object contemplated could not apparently be accomplished without legislation;" and (4) that there was "no intention either of introducing a Bill or of laying before Parliament the report which has been made by the Sepulchral Monuments Committee."

The *Times*, in commenting upon this strange conduct, distinguishes, in reviewing Mr. Ayrton's conduct, between "the responsibilities which weighed upon him and those which encumbered his predecessor;" because "Mr. Layard, plainly owing to the enervating influence of his artistic training and literary associations, felt that in the Office of Works it was his business to encourage the fine arts, to protect the great historic monuments of the country, and to preserve from the ravages of time or ignorance those priceless memorials of the past which may be neglected by their casual owners;" while "Mr. Ayrton came into office inspired with a faith the very opposite of this, and flushed with the success which his convictions, not wholly to the satisfaction of those with whom he came into contact, had obtained at the Treasury."

But we think that the *Times* is hard upon Mr. Ayrton, inasmuch as the Lords of the Treasury are let off scot-free. Any one acquainted with the ordinary working of our political system will have a shrewd suspicion that, if it had been a question of giving a place to some little

living personage who had helped his party instead of looking after the monuments of those great men who have made England what she is, "My Lords, under the exceptional circumstances of the case," would have "been pleased to sanction the action of the First Commissioner." Moreover, it must be remembered that Mr. Layard was only First Commissioner, and that Mr. Gladstone as a Commissioner is responsible for Mr. Layard's action.

After all, however, perhaps it is well that, considering what we know of Mr. Ayrton's treatment of the living, he should have as little to do with our great dead as possible. Let their records vanish, let their sepulchral monuments disappear. What is this to the English Government? But there is a moral in all this which concerns the present. This treatment of a scientific society is the *ne plus ultra* of official Philistinism. It shows that any assistance rendered to the Government by scientific men or scientific bodies is rendered, as matters stand at present, at their peril; and until some alteration is made, any expenditure of time and energy for Government purposes should be respectfully declined.

NEW RESEARCHES IN ENTOZOA

Beiträge zur Anatomie der Plattwürmer. (Leipsic: Engelmann. 1872.)

IN the first part of this serial work, just issued, the authors—Dr. F. Sommer and Dr. L. Landois, Professors in the University of Greifswald — confine their attention to the structure of the sexually mature joints or segments of *Bothriocephalus latus*. With excellent judgment they record the results of their own investigations in the first twenty-six pages, the remainder of the *brochure* being devoted to a critical comparison of the writings of other helminthologists from the time of Eschricht down to the latest period. This method, as they remark (s. 27), not only preserves the continuity of the record of a great number of frequently repeated observations and statements, but it also has the advantage of enabling their readers to discriminate between the results obtained by themselves and those acquired by earlier and equally independent observers.

So considerable a portion of our knowledge of the structure and economy of the tapeworms is due to the researches of their own countrymen, that no surprise need be expressed at the completeness of the analysis which they afford of the writings of Siebold, Leuckart, Böttcher, Stieda, and Knoch, of St. Petersburg. Nevertheless, we may remark that, although their analysis is for the most designedly confined to the facts observed in a single species, there would have been no impropriety in noticing some of the anatomical facts given in Van Beneden's account of *Bothriocephalus punctatus;* and also, more particularly, certain facts of a similar order given in Krabbe's description of the general structure of several species of parasites belonging to the same genus. Dr. Olssen, of Lund, and other helminthologists, have likewise recorded detached observations on the structure of the Bothriocephali and their allies, some reference to which might very well have been introduced in Drs. Sommer and Landois' admirable summary.

On account of the complex character of the organisation of the proglottides of Bothriocephalus, we have hitherto been in doubt respecting many particulars connected with the intimate structure of the adult parasite. Now, happily, these are well-nigh all removed, owing principally to the investigations of Leuckart, supplemented by the present "contributions." If, in matters of biological investigation, any proof were wanting of the necessity of extending the principle of division of toil, it would be sufficient to point to Drs. Sommer and Landois' labours as affording ample proof of the value of patient research within a given limited area.

The authors commence with a description of the exterior of the proglottis, conveniently recognising at the ventral surface a clear central space which corresponds with the region occupied by the mass of the reproductive organs, and on either side of this a marginal space whose comparatively dark colour is due to the presence of numerous large corpuscles lying immediately beneath the integument. These are the yelk chambers.

Their account of the mode of termination of the ducts of the reproductive organs at the ventral surface is in harmony with the descriptions of Eschricht and Leuckart; but it is in reference to the precise nature of the connection subsisting between the *vas deferens* and the various ducts proceeding from the female reproductive organs that these contributions lend such important aid.

The male generative apparatus consists, in the first place, of a number of testicular chambers, or minute testes, individually measuring about $\frac{1}{102}''$ in diameter. Each of these is furnished with an excretory duct; all the outgoing passages uniting to form a central cistern-like reservoir; the latter emptying itself into a single tortuous *vas deferens*, or common seminal duct. Near the final outlet it expands into the well-known globular or bottle-shaped muscular organ, as previously described by Leuckart and Böttcher. Our authors ascertained that a single joint was supplied with from ten to twelve hundred of these little testes. Truly the provision made for ensuring the propagation of these intestinal worms is astonishing; for if we reckon a full-grown Bothriocephalus to consist of three thousand proglottides (an estimate decidedly below the mark), that would give us over three millions as the number of testes supplied to a (so-called) single parasite. Shakespeare was not far wrong in the remark that "evil things do fastest propagate"—a conclusion which becomes all the more striking when we make ourselves acquainted with the exceeding complexity of the female reproductive organs of the *Tæniada* and their allies.

The sexual apparatus comprises not only the vagina and uterus (which in this class of creatures form totally distinct passages, with separate outlets), but also three special sets of organs severally concerned in the production of the germ, the yelk, and the egg-shell. Moreover, each organ is itself made up of numerous parts, being, at the same time, supplied with its own proper excretory channels. All this, of course, we knew before; but in tracing out the relations subsisting between these various channels and the organs whence they proceed, and also in establishing the mode in which their final connection with the vagina and uterus is brought about, Drs. Sommer and Landois have displayed consummate ability, and have thus materially added to our knowledge.

T. SPENCER COBBOLD

OUR BOOK SHELF

Description of a Specimen of Balænoptera musculus, in the possession of the Boston Society of Natural History. By Thomas Dwight, jun., M.D. (Boston Society of Natural History.)

THE eleventh volume of the "Memoirs of the Boston Society of Natural History" contains a descriptive account, by Dr. Thomas Dwight, of the external characters and skeleton of a young razor-back whale, the skeleton of which is preserved in the Society's Museum. This animal was captured alive in October 1870, off Gloucester, Massachusetts, and its skeleton is the best preserved specimen of a large whale in any of the American museums. The animal was 48 ft. long, the flipper was 5 ft. 4 in., and the height of the dorsal fin, measured along the anterior edge, was 1 ft. 2 in. The baleen was of a very light straw colour anteriorly, whilst further back dark stripes appeared on it, until the hindmost blades were of a uniform dark slate colour. From the very careful description which Dr. Dwight has written of the skeleton, and from the figures given in illustration, there can be no question that the animal is a young example of the fin-whale, which Dr. Gray has named *Physalus antiquorum*, but which is more appropriately named *Balænoptera musculus*. In some remarks on the classification of the specimen, he refers to the tendency to variation in the forms of the bones exhibited in the skeletons of cetacea, undoubtedly belonging to the same species, and he agrees with those cetologists who have shown the danger of accepting mere individual variations in the forms of the bones of particular specimens as affording data for establishing specific or generic differences. W. T.

LETTERS TO THE EDITOR

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

Bree on Darwinism

PERMIT me to state—though the statement is almost superfluous—that Mr. Wallace, in his review of Dr. Bree's work, gives with perfect correctness what I intended to express, and what I believe was expressed clearly, with respect to the probable position of man in the early part of his pedigree. As I have not seen Dr. Bree's recent work, and as his letter is unintelligible to me, I cannot even conjecture how he has so completely mistaken my meaning: but, perhaps, no one who has read Mr. Wallace's article, or who has read a work formerly published by Dr. Bree on the same subject as his recent one, will be surprised at any amount of misunderstanding on his part.

August 3 CHARLES DARWIN

Ants and Aphides

AMONG other misstatements in Dr. Bree's "Fallacies of Darwinism," so ably criticised by Mr. Wallace in NATURE of July 25, occurs the following:—"All the stories about aphides being treated as milch-cows are myths, the result of inaccurate observation" (p. 166). I can personally refute this statement, having on many occasions watched the process. Speaking of the attraction of male emperor moths by a captive female, Dr. Bree observes:—"All this was clearly, and without doubt, done by the sense of smell" (p. 209). I, in common with most other entomologists, should much value the evidence on which this very positive assertion rests; for the explanation of the attractive power of female insects has hitherto remained a mystery. R. MELDOLA

Atmospheric Effect

THE phenomenon mentioned by Prof. Tyndall as recently occurring at the Bel Alp is not infrequent at the coast. At Folkestone in the month of June last, we saw several more or less striking instances. Some years since I witnessed, while driving, on a summer's evening, between Guildford and Godalming, an equally beautiful though different effect. The evening was stormy, and the sun, still some distance above the western horizon, threw its sheaf of rays *downwards* from behind a light cloud. In the eastern horizon was a dense, dark thunder-cloud, and upon this was seen a reflection of the opposite horizon, the shadows being absorbed by the dark background, while the intervening spaces or rays shone out with a brilliancy considerably exceeding that of those in the west. The whole of the circumstances were different from those described by Prof. Tyndall, there being, as far as I can recollect, no *upward* rays from the sun, and the rays seen on the cloud being neither convergent nor divergent, but merely parallel, and apparently a complete reflection of those which shot from the sun to the horizon. Their wonderful brightness, as contrasted with the rays of which they were the image, was, no doubt, the effect of contrast upon the almost blank screen on which they were seen. This latter, however, was lighted up to a certain extent by a sort of golden haze, in which the rays shone. The whole phenomenon was one of great beauty, and was witnessed by some friends of mine at Guildford at about the same time as I saw it from a point near to Godalming. J. RAND CAPRON

Guildford, Aug. 30

The Carbonic Acid in Sea-water

IN the Deep-sea explorations undertaken of late years in England, the gases obtained from sea-water at various depths, and under different conditions, have been the subject of investigation. As coadjutor in the German expedition to the Baltic, I have been engaged in the analysis of the sea-water gases. There have occurred circumstances which I have thought it desirable to communicate to you with reference to your forthcoming future Deep-sea explorations.

I must premise that the expulsion of the sea-water gases was undertaken in a similar manner to that of the English expedition, the pans of water being boiled for a long time in vacuum, the expelled gases being collected and afterwards analysed. The result of these analyses pointed unmistakeably to a hitherto unrecognised source of error, for the prevention of which a series of supplementary experiments was necessary. The principal results of these latter can be comprised under the following heads:—

1. The complete expulsion of the oxygen and nitrogen from sea-water presents no difficulty; it is accomplished as easily as with fresh water. The proportion of oxygen to nitrogen is not sensibly different in the first and last portions of the expelled gas.

2. The carbonic acid is only partially expelled by boiling the sea-water for hours in vacuum; the proportion of carbonic acid found in the expelled gas justifies no conclusion as to the amount in the water. It is, in the first place, dependent on the length of time during which the ebullition has been continued; the portions of the sea-water gas first driven off is almost entirely free from carbonic acid, the later portions are richer in it.

3. The complete expulsion of the carbonic acid from the sea-water is attained by its distillation in a current of air free from carbonic acid. Even under this operation, the carbonic acid is detached so slowly, that only after the evaporation of a considerable amount of water carbonate of lime begins to separate; the distillation must then be continued till, at the most, a fourth of the original quantity of water remains. The carbonic acid which is passed into baryta water can be conveniently estimated by volumetric analysis.

The fact that carbonic acid is present in large proportion in sea water, not as a dissolved gas in the same sense as oxygen or nitrogen, but in a peculiar condition of closer combination, must be of great importance, not only as respects the animal and vegetable life, but also the geological relations of the sea.

I am now proposing to myself the problem to ascertain to which constituent of sea-water is due its power of close combination with carbonic acid; and to what extent the amount of carbonic acid is proportional to its saltness. Full details will be given in the Report of the German Baltic expedition. In the expedition to be sent from here to the North Sea, application of the experience hitherto obtained will be made to the estimation of carbonic acid.

Kiel, July 5 OSCAR JACOBSEN

MR. AYRTON AND DR. HOOKER

IT has been determined that this question shall not be brought on in the House of Commons at this late period of the session, as so many members are already absent that it is possible the debate might fail somewhat to represent the actual feelings of the House. At the same time it is known that had the discussion come on some weeks ago, the Government, if they had ventured to support Mr. Ayrton, would have been beaten.

Of the return moved for by Sir John Lubbock, and prepared by Mr. Ayrton, it is difficult to speak or write without expressing strong indignation. We have not what we want, and we have what no one wants. The whole object of the compilation is to leave the reader in a fog, and from this point of view the compiler deserves credit. We regret also to see the respected name of Prof. Owen dragged into the discussion on a point which has nothing whatever to do with the question under discussion, which is simply Mr. Ayrton's monstrous behaviour to a man of science. It is gratifying to see from the Treasury letter which we reprint that "My Lords" have not hesitated to hint with sufficient pointedness for an official document their opinion on the matter. It must not be forgotten that for a time Mr. Ayrton was at the Treasury, *and that he is there no longer*.

COPY OF TREASURY MINUTE, dated 24th of July, 1872.

My Lords have under their consideration the Memorandum of the First Commissioner on the rearrangement of Kew Gardens by the Office of Works, and of the changes therein.

This Memorandum embraces three subjects :—

1. The manner in which matters connected with the management of Kew Gardens have been conducted, and in doing so, refers to instances in which complaints have been made by the Director of Kew Gardens.

2. The arrangements under which this management ought to be conducted.

3. Suggestions and questions of the First Commissioner as to changes therein, and as to connecting the Kew Gardens with the Kensington Museum, which, however, the First Commissioner does not propose should be taken into consideration at present.

To the last part of the Memorandum, therefore, my Lords do not propose to refer in the present Minute.

In discussing any arrangement for the management of the establishment and gardens at Kew, it must be remembered that there is a considerable space of ground beyond the hot-houses, buildings, and ground appropriated to the cultivation of shrubs and plants for the promotion of botanical science.

Part of this ground has been used as a nursery for young trees, and the remainder has been laid out as ornamental pleasure grounds.

The establishments at Kew have always been under the superintendence of the Office of Works, subject, of course, to the superior control of the Treasury, to which department the annual estimates of expenditure are submitted for their sanction, and this control it is indispensable to maintain.

With regard to the local management at Kew, the First Commissioner's Memorandum divides it, for the purposes of administration, into four branches, Botany, Horticulture, Police, and Works.

It is unnecessary, in the present Minute, to refer to Police.

The Department of Botany the First Commissioner states to be "under the immediate direction and control of the Director of Kew Gardens;" the Department of Horticulture to be "under the immediate cultivation of the Curator, subject to the orders and control of the Director, as the responsible head."

The works are carried out by an officer of the Office of Works.

My Lords consider this statement to represent with sufficient accuracy the proper arrangement for the establishment, and that if fairly carried into execution, n the friendly and conciliatory spirit which ought to prevail amongst the different members of all public departments, no difficulty will occur.

It is essential to maintain the superior authority in all respects of the First Commissioner, *but the nature of the case makes it evident that this authority should of course be exercised with due regard to the feelings and position of the officers under him.*

The Botanical Department has been formed by the exertions of Sir W. Hooker, and of his son Dr. Hooker. It stands high in the estimation of men of science both here and abroad, and both these eminent men are entitled to the gratitude of the country for their services in this department of science.

In all matters connected with this department of the establishment, whether as regards the hot-houses, buildings, or the cultivation of shrubs and plants for botanical purposes, the opinion of Dr. Hooker should be followed, subject only to the consideration of expense. It is for him to represent to the First Commissioner what he considers necessary for the advancement of botanical science, and it is then for the First Commissioner and the Treasury to determine whether the expense necessary for the purpose shall be incurred.

No alterations in existing arrangements in the scientific branch of the department should be made without the Director's concurrence.

The actual execution of the works to be undertaken must be under the direction of the proper officer of Works, but the opinion of the Director of the Gardens should be taken as to the efficiency of what it is proposed to do, and any requisition of his for work or repairs necessary for the preservation of the valuable plants in the houses should on all occasions receive prompt attention.

With regard to those parts of the grounds which are not used for the purpose of botanical science, but as nursery grounds or pleasure grounds, it will be the office of the First Commissioner to give such directions as he may think advisable.

My Lords, however, think it desirable that even on these points he should communicate with the Director of the Gardens, through whom, as head of the establishment, all orders to the curator and to other subordinate officers should, in regular course, be conveyed.

My Lords gather from the Memorandum of the First Commissioner that, speaking generally, the business connected with Kew Gardens has been conducted in accordance with the views thus entertained by their Lordships.

My Lords do not consider that it would be conducive either to the public advantage or to the maintenance of that good and friendly feeling which they are anxious to see prevailing in every public department, if in closing this correspondence they were to go in detail into the cases where any disagreement has taken place between the First Commissioner and the Director.

But adverting to the facts contained in the Memorandum of the First Commissioner, they are not surprised that in various cases Dr. Hooker should have thought that he had just cause of complaint, though this may have grown in some instances out of arrangements for which the First Commissioner was not responsible, and in others they learn from the Memorandum of the First Commissioner that the cause of complaint has been removed.

My Lords see no reason why under these conditions there should be any serious difficulty in discharging the respective duties of the First Commissioner and of the

Director of the Gardens in a manner satisfactory to both, whoever may be the occupants of those offices, maintaining the proper authority of the First Commissioner, with due regard to the position and character of the Director of the Gardens.

Let a copy of this Minute be sent to the First Commissioner, with a request that it may be communicated to the Director of Kew Gardens.

THE ROYAL ARCHÆOLOGICAL INSTITUTE MEETING AT SOUTHAMPTON

THE annual meeting of the Royal Archæological Institute was opened in the Hartley Institution, Southampton, on Thursday last. The members of the Institute were welcomed by the Mayor and Corporation of the borough, the chair being taken by Lord Talbot de Malahide, the permanent president.

Archdeacon Jacob furnished some interesting information respecting the tomb of William Rufus. He was, he said, accessory to the removal of the tomb of William Rufus, and he had not heard the last of it. He thought, however, he was sufficiently pachydermatous not to mind this. There was William Rufus's tomb, an eyesore and a footsore, for persons dashed their feet against it to their injury, and the place was particularly wanted, by reason of the enlargement of Winchester Cathedral, for the boys to sit. The question raised was—Is that the grave of William Rufus? Is there anything in it? If there is, whose bones are they? If there are bones, are they William Rufus's? Might it not be perfectly empty, and, if so, why should it stand there an obstruction? He, then, having skilled persons about him, ventured to take up the slab, and found that the tomb had been rifled and dishonoured in every way. There were bones there thrown about and trodden. It was suggested by some that the Parliamentarians had done this, whereupon he sent for and consulted the chief science men in Winchester. They had the bones taken out and placed on the pavement, so as to see the height of the man, and, gauged by the height which Thackeray says does the work of the country, he was found to be 5ft. 8in. Having examined them microscopically, they came to the conclusion (it was not stated how) that they were the bones of William Rufus, and were quite certain the tomb had been moved again and again before. When they visited Winchester they would find where he had had it placed, and if they had not been told otherwise they would probably have believed it had always been there. Believing in the *dictum* of Bishop Andrews, who said the church was for the living and not for the dead, and knowing that King Rufus had not been a benefactor to his country, he thought it not unbecoming to move him a little further, but he was still within the sacred walls. Therefore, anticipating their judgment, he trusted they would not pitch him into the river Itchen for the so-called disturbing of the bones of William Rufus.

At three o'clock the members of the society and friends, including the Marquis of Bristol, Lord Talbot, Colonel Pinney, and many others, visited the town under the guidance of Mr. Parker, who described most of its ancient features.

The Mayor, and Mayoress, gave a *soirée* to the members of the Institute at the Hartley Institution in the evening. It proved to be a very successful affair. Over 800 invitations were issued, and a large number of these were accepted, several officers from the United States fleet being present.

The sections met on Friday. The Bishop of Winchester presided for a short time, and introduced Lord Henry Scott, who read an introductory address in the Historical Section.

Lord H. Scott confined his remarks to a history of the County of Hampshire. As to the origin of Southampton, he said there was an ancient British town called Hampton, which was probably situate higher up the Itchen, at Bitterne. The town was even now often called Hampton by the country people. In "Domesday Book" the county was called Hampton-shire and the town Hampton. It suffered severely from the incursions of the Danes. Henry I. made it a borough, and King John gave it its first charter and had a palace there. Thence sailed the expedition for Palestine, and Henry embarked for Cressy and Agincourt. Philip of Spain also landed there to meet his Queen at Winchester. It was also from thence that the great apostle of Germany, afterwards better known as St. Boniface, departed on his mission. After referring to Leyland's "History of Southampton," he came to the general history of the county. One of the most valuable historical monuments that had been left to them was the New Forest; and however much they might condemn the severe laws which were made for the protection of what were called "the King's beastes," yet they felt some gratitude that it had been preserved to their use as it was now. He then gave a sketch of the historical associations connected with the Forest. He disbelieved the old supposition that houses and churches had been destroyed by William Rufus to make the Forest, though some small holdings might have been enclosed. The connection of Tyrrel with the death of Rufus was preserved by a ford which at this day was called Tyrrel's Ford. In the Forest was Beaulieu Abbey, which was described in the charter of King John as the *bella loca regis*. It was founded by King John in 1234. It was forty years in building, and Henry III. and all his Court attended the dedication. It was the sanctuary of Perkin Warbeck for many years. His lordship observed that this part of our coast had always in our early history been exposed to invasion. Hampshire also suffered much during the civil wars, and after the Restoration Charles II. used to come down from London to enjoy holiday in it. William III. was the first after Charles II. to attempt to repair the damages which the Civil War had created in the Forest; and later, in the era of the Georges, the county had been connected with our naval victories under Nelson. Hampshire also contained the Strathfieldsaye so closely connected with the later days of the Iron Duke; and in Hampshire the poet Keble found a quiet and honourable grave.

The Rev. F. W. Baker then read a memoir of Beaulieu Abbey.—Lord Henry Scott, in moving a vote of thanks to Mr. Baker, gave the Institute an invitation to Beaulieu for the following day, and said that Mr. Baker would be in attendance to explain every point worthy of their consideration in this most interesting abbey.—The proposition having been heartily accorded, the sitting was then suspended. In the afternoon there was an excursion of the members of the Institute to Romsey and Porchester, which occupied until eight P.M. At Romsey the vicar (the Rev. E. L. Berthon) gave a discourse on the Abbey of Romsey, and showed the result of recent excavations; and at Porchester Mr. G. T. Clark lectured upon the Castle there. Saturday was devoted to the excursion to Beaulieu Abbey, and a visit to Christchurch and Rufus's Stone.

On Tuesday, the members of the institute visited Silchester (Saxon "Sil," great or best, and "castrum"), which has the largest area of any of the Roman fortifications in England. The walls at present are about 13 ft. high and 8 ft. thick. The city had four gates—north, south, east, and west—and beyond the wall was a deep ditch, and beyond the ditch a vallum 15 ft. high. The amphitheatre is situated outside the city, 150 yards from the north-east corner of the wall. The members also visited the remains of the Chapel at Basingstoke, dismantled by the Parliamentarians, and Basing House, formerly the abode of the Marquis of Winchester, by whom it was defended against the Parliamentarians. In

the evening the members held an evening session for the reading of papers.

Exeter has been fixed upon as the place of meeting next year.

THE ELECTRIC TELEGRAPH—ITS IMPROVEMENT AND CAPABILITIES

IN the beginning of the present year a Society of Telegraph Engineers was established for the general advancement of electrical and telegraphic science, intended to include not only those persons who are professionally connected with telegraphy, but those also who from their position and pursuits are enabled to render assistance in telegraphic enterprise. The institution has made a successful and promising commencement, the members at the opening meeting in February last numbering 110, the list including the historical names of Wheatstone and Cooke, the distinguished names of Thompson, Tyndall, and others scarcely less renowned for their important contributions to electrical science. The President, Mr. C. W. Siemens, D.C.L., in the course of his inaugural address, said :—

History teaches us how to read the events of the present day, and what we may reasonably look forward to even in the future; let us, therefore, review shortly in our minds the remarkable history of the Electric Telegraph, in order that we may be better prepared to deal with questions of immediate interest.

A generation has hardly passed away since the remarkable discoveries of Oersted, Ampêre, Faraday, and Weber, which laid the foundation of the electro-magnetic telegraph. The names of Steinheil, Schilling, Ronalds, Wheatstone, Cooke, and Morse furnish us with striking illustrations of the readiness with which the thinking men of different nations turn scientific discovery to practical use. While these pioneers in the field of telegraphic progress were still contending against practical difficulties, other earnest labourers entered the same field, amongst whom Werner Siemens, Bain, and Brequet should not pass unmentioned here. But so rapid has been the progress of our branch of science, that, while I am obliged to speak of these men as belonging to our early history, they are still, almost without exception, living amongst us in full enjoyment of their faculties, and, I am happy to add, members of our new society. They have the rare satisfaction to see their early day-dreams carried out upon so vast a scale that there is to-day hardly a country, however remote, that is not within a few minutes', or at all events a few hours' call, from every central point of the civilised world, that diplomatic conferences have to be held to regulate international telegraphy, and that a proposal is seriously entertained by the leading powers of the earth to place telegraphic property upon the highest, I may also say a sacred basis, by declaring it inviolable in case of war. The electric telegraph has, indeed, attained to the dignity of a commercial, a social, and an international institution of the highest importance; it is a civiliser of the first magnitude, and we may well be proud to meet here together in furtherance of such a cause.

You will pardon me if I abstain from making special reference to the numerous claims to recognition of the fellow-labourers of the present day whom I am now addressing; they are well known within our own circle and to the public at large, but neither my ability nor the time at my command would suffice for such a task. I will only endeavour, before concluding this address, to summarise the subject-matters which, judging from my experience, should engage our principal attention.

Problems of pure electrical science meet the telegraph engineer at every turn, the methods of testing insulated wire, of determining the position of a fault in a submarine cable under various circumstances, or of combining instruments so as to produce recorded messages by the mere fluctuation of electrical tension in a long submarine conductor, are problems worthy of the most profound physicist and mathematician. On the other hand, there is hardly a problem in electrical science that is not of practical interest to the Telegraph Engineer; and, considering that electricity is not represented at present by a separate learned society, ranking with the Chemical or Astronomical Societies, I am of opinion that we should not exclude from our subjects questions of purely electrical science. The phenomena of electrification and polarisation, of specific induction and conduction, the laws regulating the electrical wave, the influences of rise of temperature on conduction or the potential force residing in a coil of wire of a given form, when traversed by a current, involves questions belonging just as much to pure physical science as to the daily practice of the Telegraph Engineer, and would at any rate be inseparable from our proceedings. Next in order come questions of selection of materials for conduction or insulation, of apparatus for the best utilisation of feeble currents, of apparatus for producing, alternating, and directing electrical currents, which, although still intimately connected with physical science, call into play considerations of mechanical combinations. This brings us to questions of purely mechanical import, such as the mechanical construction of instruments for recording or printing messages, of protecting and supporting insulated conductors by sea or land, or of constructing machinery for the manufacture, the laying, and the repairing of submarine cables.

These questions again lead up to the more general ones of transport of materials through difficult and inhospitable countries, of navigation, of investigations into the depth and the nature of the bottom of the seas, into the nature and effect of sea currents, and so forth, all of which belong, under certain aspects at least, to the province of the Telegraph Engineer.

I would go further, and include even statistical information respecting the nature and growth of telegraphic correspondence, without which it is impossible to adapt the construction of lines and of working instruments to the acquirements of particular cases. The invention of a telegraphic instrument, for instance, is only of practical value if it is suited to the circumstances of the particular traffic for which it is intended, and to the electrical condition of the lines which it is proposed to work, and when the early pioneers of telegraphic progress elaborated ingenious instruments for sending and recording messages automatically or for printing them in Roman type, they invariably failed, because the then-existing lines were insufficient in every way for such refinement, and the simple needle instrument seemed to suffice for all practical purposes. It was only when the exigencies of the traffic demanded a change that instruments of this nature proved to be valuable inventions.

In like manner the long underground lines that were established on the Continent at an early date had to give way to suspended line-wire, whereas the present practice and necessities undoubtedly tend toward a reversion to the former, as being less liable to interruption by accident or by atmospheric influences, and because an unlimited number of underground wires may be established between any two stations without encumbering the public thoroughfares. The best mode of insulating and protecting these underground wires with a view to reducing the inductive influence of the one upon the other, and of facilitating access to the one, for the purpose of repairs, without disturbing the others, are questions of practical interest for the present day.

The Electric Telegraph is applicable with the greatest positive advantage for the intercommunication between two points a great distance apart; through its agency New York and Calcutta are as near to us in point of time as are the suburbs of our metropolis from one another.

It is probable, indeed, that in telegraphing from one suburb to another the message has to be oftener retransmitted than in going from the City of London to India or America, because a direct transmission from any one part of London to another would involve almost an infinite number of line-wires in all directions. For this reason there must be a limit to the applicability of the Electric Telegraphs in populous districts, and it behoves us to examine whether another agent may not be preferable in dealing with a traffic of this description. The pneumatic tube seems to be well adapted to these circumstances, and having been first applied for short distances by Latimer Clark, and subsequently modified and extended by others, it will fall within the province of our society to examine fully into this and kindred methods that may be devised for effecting rapid interchange of intelligence in towns.

THE BRITISH COAL-FIELDS

ONE distinguished geologist, at least, disbelieves in the speedy exhaustion of our coal-measures, so frequently predicted of late. At the annual meeting of the Dudley and Midland Geological and Scientific Society, Prof. Ramsay delivered an address on the existence of coal beneath the New Red and Permian strata, in the course of which he observed that for fifteen years he had been preparing to attack this subject, but it was not until he became a member of the Royal Coal Commission he had given it a really searching consideration. There could be no doubt that the various coal-fields of the Northern and Midland districts once formed one great coal-field, but had been separated by extensive denudation. Another great coal-field was formed by the now distinct fields of Devonshire, South Wales, Somersetshire, and the Forest of Dean. Between these two great divisions, the north and the south, there was no connection formed by the coal-measures, the poorer measures possibly having been deposited there, but not the rich deep ones in the carboniferous era. Referring more especially to the Midland district, he thought it highly probable that coal-measures would be found to exist between the present boundary of the South Staffordshire district and the Forest of Wyre; but it was questionable whether it would be of a workable depth. On the west side of the South Staffordshire boundary, in the direction of Bridgenorth, Shropshire, he also believed coal to exist beneath the Permian strata, at a depth of 1,500 feet, or possibly more in some places. At the north of the South Staffordshire boundary, a line drawn from Wyrley right across to the Shropshire district would, he believed, include some valuable coal-beds, a considerable part, but not all, of which would be at a workable depth. He entertained no doubt that the coal-measures were continuous between the South Staffordshire and Shropshire districts, which, although in some places disturbed by denudations, might, throughout the greater part of the area, be profitably worked. In the North Warwickshire coal-field were found, in the direction of the Staffordshire boundary, five beds of coal, which gradually amalgamated, until on nearing Coventry they formed only two measures. The shale and sandstone were split up in like manner. These features constituted most important evidence in support of the theory that the Warwickshire, Staffordshire, and Shropshire districts were united by continuous coal-measures, the peculiarities referred to in the coal, shale, and sandstone strata being identical in all three districts. In that theory Prof. Ramsay was a firm believer. From Warwickshire to the south end of the South Staffordshire boundary, there was, he believed, coal, but not profitable. Towards the northern end of the South Staffordshire boundary, however, a line drawn from Coventry would include rich and valuable coal-measures. Between Staffordshire and Leicestershire the measures were also, he believed, continuous. From Wales to the Forest of Wyre there was profitable ground; but from Wyre on to Charnwood Forest, and east of that, there were no coals of value. The speaker expressed opinions equally assuring as to the presence of coal under the area lying between the north of the South Staffordshire boundary and the mountain limestones of Derbyshire. In one part of that district—viz., north-west of Cannock Chase—Prof. Ramsay said he should not feel the slightest hesitation in recommending a search for coal; and his belief in the presence of coal at a workable depth in the neighbourhood of Uttoxeter was equally strong. Now, supposing that his calculations were only approximately correct, the result would be surprising. It would amount to this—the coal now reckoned as available in the South Staffordshire and Shropshire districts was, in round numbers, 3,201,000,000 tons. If his belief were a true one, this supply would be further augmented by 10,000,000,000 tons. In Warwickshire the proved coal-measures are estimated to yield 458,000,000 tons, and the measures he believed to exist in addition would be 2,494,000,000, or five times more than the present estimate. The Leicestershire field was calculated to possess 836,000,000 tons, and this would be supplemented to the extent of 1,790,000,000. What was the case in regard to these districts was, he believed, equally applicable to many other parts of Great Britain. The South Wales, Forest of Dean, Bristol and Somerset districts were exceptions to this rule, the coal there lying in basins caused by denudations, the surrounding measures being destroyed. In the Midland districts these small basins are not found, the whole forming one great basin. Lancashire, Derby, and the Yorkshire coal-fields were, however, subdivided by the process of denudation. Still, he had no hesitation in believing that the estuary of the Dee and the Mersey have lying between them beds of coal, although probably at too great a depth to be of practical value.

MR. TODHUNTER ON THE ARC OF THE MERIDIAN MEASURED IN LAPLAND

MR. TODHUNTER has forwarded us a reprint from the "Transactions of the Cambridge Philosophical Society," in which he discusses the observations made in connection with the measurement of the arc of the meridian in Lapland in the last century. He states that having recently had occasion to study the details of the two measurements of the arc, he has been surprised to find that the accounts of these operations, although written by very distinguished astronomers, contain numerous and serious errors. We must refer our readers to the memoir itself for a complete account of the various points raised, for it is too long for adequate notice in the space at our disposal. A curious point, however, is raised as to the effect of theory upon observation in a paragraph which we quote *in extenso*:—

"It would be a curious subject of speculation whether the theoretical opinions of persons engaged in geodetical surveys could have exercised any influence on their observations; I mean of course unconsciously, for it would be wrong to suspect any deliberate unfairness in any of the operations which I have examined. From a passage in the article 'Figure de la Terre,' by D'Alembert in the original *Encyclopédie*, it would appear that the school of Cassini originally believed that in consequence of the oblate form of the earth, the length of a degree of the meridian *would decrease* from the equator to the pole. It seems strange, perhaps, now to suppose that such an error could be seriously maintained; but there can be no doubt of it; for example, the error was vehemently maintained by Keill, a man of some reputation, who was ultimately a

Savilian professor at Oxford. See Keill's 'Examination of Dr. Burnet's Theory of the Earth,' page 140. It is certainly a remarkable coincidence that the school of Cassini starting with the erroneous theoretical notion that the degrees of the meridian *ought* to decrease from the equator to the pole arrived at the same result by observation and measurement.

"There can, I think, be no doubt that at least Maupertuis and Clairaut, who were the most eminent of the French party, held the correct Newtonian theory as to the figure of the earth; and their result was rather too decided in its confirmation of this theory. Now the geodetical angles could scarcely be influenced by the theoretical opinions of the observers; because it would not be obvious in what way the result would be affected by an error in an angle. But in measuring the base it would of course be obvious that the larger was the value obtained, the stronger was the evidence for an oblate form. Similarly in estimating the amplitude, the smaller the value obtained the stronger was the evidence for the oblate form. In these two parts of the survey then it would be necessary to be on the watch lest the conviction of what the result ought to be should influence the impression of what the observation really gives.

"It is curious that Maupertuis and his party seem to have thought at first that their success was too decided, and therefore their amplitude too small; and that on their second determination they should have made it between 3″ and 4″ larger than at first."

THE BEGINNINGS OF LIFE *

I.

AFTER a careful perusal of this important and suggestive work, a prominent feeling is one of regret that its value and popularity should be endangered owing to purely technical faults of composition and arrangement. It is so full of curious and novel facts and experiments, it contains so much excellent reasoning and acute criticism, and it opens up such new and astounding views of the nature and origin of life, that one feels it ought to and might have ranked with such standard works as the "Origin of Species" and the "Principles of Biology," if equal care had been bestowed upon it as a literary composition. But, unfortunately, it altogether lacks their powerful condensation and lucid arrangement. Its vast masses of facts are stated too diffusely, and are often so scattered as to lose the cumulative force that might have been given to them; while the arguments are broken up and weakened by a too minute classification of the subjects treated, leading to repetition and confusion rather than to clearness. Haste of composition is further indicated by the quantity of additional matter given in foot-notes that should have found a place in the text; and we often find it difficult to follow the special argument in hand, or to see the connection and relevance of much of the detailed evidence brought forward.

Notwithstanding these defects, which will undoubtedly diminish its popularity, it is a book which will make its mark, and must produce a powerful sensation.

It brings together a large body of facts, either new or hitherto almost ignored, which, unless they can be otherwise explained, prove much more than the mere production of low living organisms from dead matter; for these low forms have been seen to combine and give rise to higher forms, and these again to still higher and more complex organisms. Vegetable cells or their contents develop into various low animals; while animal as well as vegetable organisms of specialised forms and some elaboration of structure seem to be mutually transformable by processes quite unlike any of the hitherto accepted modes of multiplication or reproduction. These processes have been traced stage by stage, so that there seems no possibility of mistake; and they do not rest on the observations of Dr. Bastian alone. Facts of this nature have been repeatedly published for more than twenty years by many Continental and English naturalists, but, being so entirely opposed to current theories, have been all silently ignored, just as true facts and careful observations relating to the antiquity of man were so long ignored. Our author has, however, repeated and tested many of these observations, and finds them to be strictly accurate; and they harmonise perfectly with the views on the origin of life founded on his own experiments, and so energetically advocated by him.

Looked at merely as curiosities of science, and as an unveiling of mysteries hitherto thought to be inscrutable, these observations are of supreme interest; while their importance in connection with modern theories of development and the origin of species can hardly be overrated. Setting aside all the prejudices and dogmas of the existing schools of biology, it must be admitted that the views here presented of the perpetual origination of low forms of life now, as in all past epochs, is in perfect harmony with the doctrine of evolution, and does away with many of the physical and geological difficulties which are undoubtedly among the most serious which beset those special views of the origin of life which Mr. Darwin holds, but which are by no means necessary inferences from his theories.

The present work is essentially one that to be judged soundly cannot be judged hastily. The subject is of overwhelming importance to the future progress of scientific biology, and the facts and observations on which it is founded are so numerous and so precise, and have been tested by such a body of distinct and competent observers, that no *à priori* arguments and no authoritative dicta can have any weight against them. Observation alone can demonstrate whether they are facts or delusions. They will no doubt be fully criticised by those whose special studies render them competent to do so; but if the past history of science has any value whatever, the result cannot be doubtful. Facts observed and tested by a succession of careful and accurate observers, such as those whose evidence is adduced by Dr. Bastian, have never yet proved to be fallacies.

We now propose to lay before our readers a sketch of the more interesting matters treated of in these volumes, citing a few of the most striking of the new facts and the most important of the arguments founded upon them.

More than half of the first volume is devoted to an account of the Nature and Source of the Vital Forces and of Organisable Matters, and we have an excellent summary of modern views on the correlation of vital and physical forces, on the vital principle, on theories of organisation, and on the modes of origin of reproductive units and cells. As bearing upon subjects to be discussed further on, there is an important remark on the origin of germs or specks of living protoplasm in the fluids of the living body. These fluids, it is maintained, are not alive, and, therefore, the living germ does originate in a dead organic fluid. Even if it is held that blood and all the other secretions are alive, yet as they have been formed out of dead matter taken into the stomach there must be some point at which the particles of dead matter become transformed into living matter, and the circumstance of this occurring *within* an organism does not alter the fact of its occurrence, or render it at all more easy to conceive or explain. Why, then, should it be so absolutely incredible that specks of living protoplasm should arise in suitable fluids out of a living body? It is certain that as soon as the fact that they do so arise is established, the one will be as easy to conceive and be as credible as the other. The only other point that calls for notice in this part of the work is the discussion on the supposed "vital force," in which the views of the "vitalists" seem to be

* "The Beginnings of Life: being some account of the Nature, Modes of Origin, and Transformations of Lower Organisms." By H. Charlton Bastian, M.A., M.D., F.R.S. (2 vols. London: Macmillan and Co. 1872.)

hardly fairly stated. Dr. Bastian says :—"If the vital or directive power resident in each particle of a living being be other than a transformed physical force it must be one which—in spite of the well-known formula '*ex nihilo nihil fit*'—is capable of indefinite self-multiplication. Either such force must be continually springing into being without cause—originating itself or growing out of nothing—which is an absurdity ; or else, within the ovum of any animal, there must be locked up the whole of the peculiar vital power which is afterwards to diffuse itself throughout the body," &c. But this is by no means a necessary conception of the "vital force" or "vital principle." That force or principle need not, and cannot "reside" in any particles of matter. If it exists it is cosmical, and acts *on* matter just as gravitation does. Is it any argument against the reality of gravitation that any particle of matter, however small, attracts any mass, however great ; that, as Prof. De Morgan puts it, each grain of salt and pepper in a million salt-cellars and pepper-castors, individually and separately *pull*, and actually move, the sun and every fixed star? This is a *reductio ad absurdum* against the notion that the force of gravitation resides *in* matter ; but it does not touch the notion of gravitation as an inscrutable cosmical force (probably the source of *all* force) acting on matter. It appears to me, therefore, that as long as consciousness, thought, and will cannot be conceived of as manifestations of the "correlated series of physical forces," we must postulate some universal "vital principle" as co-extensive with, if not superior to and the source of, the "physical forces ;" and if such exists it is natural to impute to it some share in the production of these wonderful *organisms* through which alone we see consciousness manifested. In another place Dr. Bastian says that living protoplasm is believed by a large section of the physiological world "to contain no special and peculiar 'force ;' but to owe its qualities entirely to the ordinary physical properties of the elements entering into its composition." It may not *contain* a peculiar force, but surely it does *manifest* some other properties than the ordinary physical properties of its elements, just as the thundercloud, when it sends out a destructive lightning flash to the earth beneath, manifests other than the "ordinary physical properties" of the oxygen and hydrogen of which it is composed. Electricity is an extra-ordinary property of matter, and *vitality* seems to me to be still more extra-ordinary. The *force* both exhibit may be correlated with other forces ; but that does not account for the special *mode* in which the force is manifested in the one case more than in the other.

In the second division of his work, "Archebiosis," Dr. Bastian commences with a history of the discussion on Spontaneous Generation from the time of Aristotle to that of Pouchet and Pasteur. He then gives an outline of the evidence as to the production of low organisms in infusions. These are chiefly Bacteria and Torulæ, names which are of such frequent occurrence that we reproduce a woodcut (Fig. 1), in which they are represented, the straight objects *c* and *d* being Bacteria, while *h*, *i*, and *k* represent Torulæ; the small dots *a* are Monads, Microzymes, or plastide particles, or they may be Bacteria seen endways ; while the other objects are Torula cells, or fungus germs variously combined. These are the simplest and most minute organisms ; but others a little larger and more complex are shown in the next cut (Fig. 2), under the names of Vibriones, Leptothrix, Spirilla, and Mycelial filaments. These all exhibit unmistakeable signs of life, growth, and reproduction, and they appear in immense abundance in a great variety of infusions of animal and vegetable matter, however perfectly they may be shut out from the surrounding atmosphere. Most experimenters have conceived that the presence of air was necessary in order to develop organisms, and with the air it has been supposed that germs or ova have been always introduced. These germs are, however, admitted to be invisible by the highest powers of our microscopes ; their very existence is therefore hypothetical, and our author shows very forcibly that Pasteur's supposed demonstration of their existence, and of their being the source of the organisms which appear in infusions, is wholly fallacious. He assumes at critical points of the argument the impossibility of his opponent's views being the true ones ; and imputes his negative results to his having eliminated germs, when they can be equally well shown to be due to unfavourable conditions for development. But in order to avoid such complicated and inconclusive experiments as those carried on during the celebrated discussion between Pasteur and Pouchet, Dr. Bastian adopts a totally distinct method, which so narrows the issue as to render it possible to arrive at something like absolute certainty in the results. Instead of introducing air, purified by various chemical means, into the flasks after the infusions have been boiled, he hermetically closes their narrow necks during violent ebullition, thus producing an almost perfect vacuum above the liquid contents. After this he submits the whole flask to a heat varying from 212° to over 400° F., and then places them in favourable positions as regards light and heat. Under these rigid conditions he finds large quantities of organisms produced, which exhibit such unmistakeable signs of life as growth and multiplication. Now here the issue is reduced to its very narrowest limits, viz., what degree of heat will destroy all these low forms of life ; and to determine this he adduces a series of experiments, detailed in his chapter on "The Limits of Vital Resistance to Heat." M. Pasteur found that the greatest tenacity of life was possessed by the spores of certain fungi of the family *Mucedineæ*, which germinated after being exposed to a dry heat of 248° to 257° F. for a few minutes, but half an hour's exposure to the same dry heat killed them. A Commission appointed in 1860 by the Société de Biologie found that of the lower animals, the Rotifers, "Sloths," and Anguillules found in moss, &c., were most tenacious of life, but they were all killed by a lower temperature than that above stated, so that we may fairly conclude a heat of 266° F. for thirty minutes in dry air to be the limit of vital resistance hitherto ascertained. In fluids, however, a much lower temperature suffices. Hardly any low organisms can resist 167° F., while 212° F. for even one minute is admitted by all experimenters on this subject to be fatal to all classes of organisms met with in infusions, with which alone we have now to deal. Bacteria and Vibriones, however, are killed by a much lower temperature (130°-140° F.) for ten minutes, as ascertained by a careful series of experiments ; while several degrees lower was equally fatal if prolonged for four hours. It has been objected that the flasks being only partially filled, some germs or organisms may escape the liquid and survive on the sides of the glass ; but as they must be exposed to almost pure steam of the same temperature as the water, and as the heat actually employed was often greater than any such organism can withstand, even in dry air, the objection cannot be held to be valid.

What, now, are we say to such experiments as the following :—Prof. Jeffries Wyman found Vibrios and Bacteriums moving with great rapidity in mutton juice which had been exposed in a hermetically-sealed flask to a heat of 120·6° C. for five minutes. Prof. Mantegazza found living Bacteria in a decoction of lettuce which had been similarly exposed for 30 minutes to 284° F. Prof. Cantoni, of Pavia, heated a solution of yolk of egg in a hermetically-sealed flask up to 242° F., and found in it after two days a large number of Vibrios. Dr. Bastian himself exposed a strong infusion of turnip in a hermetically-sealed flask to a temperature of 270°-275° F. for twenty minutes. After two months the contents were examined, and found to contain numbers of organisms, of which the annexed cut (Fig. 3) represents a specimen. Again, a solution of ammonic tartrate and sodic phos-

phate in distilled water was heated to a temperature of 295°-307° F. for four hours. It was at first colourless and clear, and being carefully watched was found after some days to become slightly flocculent; a small speck then appeared, which grew for several days till it could be seen with the naked eye. On being opened and examined, the

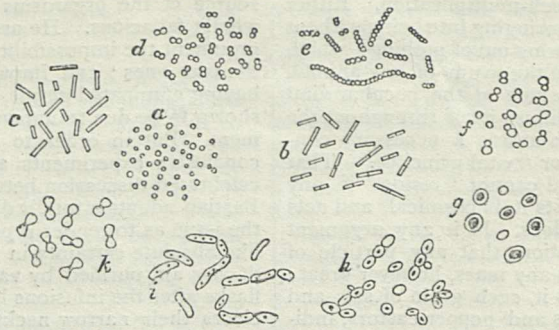

FIG. 1.—SOME OF THE MOST COMMON PRIMORDIAL FORMS OF LIFE: BACTERIA, TORULÆ, &c. (× 800)

speck was found to be the remarkable fungus represented in Fig. 4.

Besides this class of experiments, others have been made with the same infusion heated to different temperatures, by which it has been ascertained that for each substance there is a different maximum, if heated beyond which no

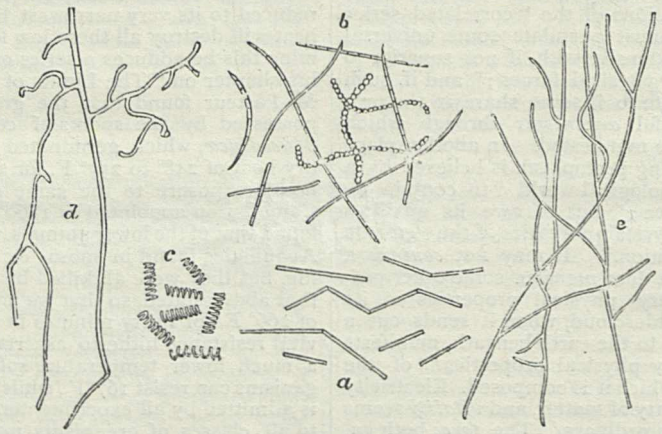

FIG. 2.—OTHER EARLY FORMS OF LIFE FROM ORGANIC INFUSIONS.

a. Vibriones. *b*. Different kinds of simple Leptothrix. *c*. Spiralla. *d*. Mycelial Filaments of an Incipient Fungus (Hallier). *e*. Branched Leptothrix or Mycelia Filaments (Pasteur).

organisms appear. The juice of meat, for instance, produced Vibrios if heated to 112° C., but none if heated to 114° C. Cows' milk produces them, if heated to 113·5 C., but remains unproductive if heated to 114·5 C.; while a decoction of pumpkin produces them at 110° C., and not at 112° C. Prof. Cantoni naturally asks why, if the Vibrios

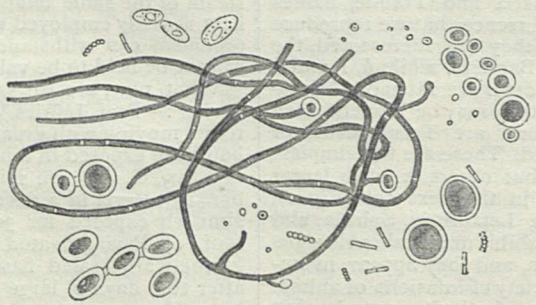

FIG. 3.—BACTERIA, TORULÆ, FUNGUS-MYCELIUM, AND SPORES OF DIFFERENT SIZES, FROM A NEUTRALISED TURNIP INFUSION (× 800).

are produced from germs, it requires such different amounts of heat to kill them in different solutions; and why these hypothetical germs should require such a vastly higher temperature to kill them than suffices to destroy their parents? A large number of comparative experiments made by Dr. Bastian further shows that the presence or

absence of Bacteria and other low organisms in infusions often bears little or no relation to the facilities for the admission of germs from the atmosphere, but seems to depend on a variety of special conditions only to be learnt by long practice. The temperature at which the infusion was made, its quantity, the presence of dense or rarefied air in the flask, a few degrees more or less of temperature of the room where the flasks are kept, and a variety of other circumstances, so affect the results, that in some cases organisms refuse to appear when there is every facility for the hypothetical germs to gain admission ; while, as we have seen, they are often plentifully produced when every possible precaution is taken to keep them out and to destroy them. The only way of escaping from the results of such a series of experiments as that here recorded is by asserting that, although the *organisms* which are produced in the flasks are killed by a temperature much below that to which the flasks have been subjected, the *germs* from which they have been produced are not so killed. We are asked, therefore, to accept as facts three pure suppositions : first, that such excessively minute and simple organisms as Bacteria, whose only mode of multiplication is by fission or gemmation, have germs which possess different physical proper-

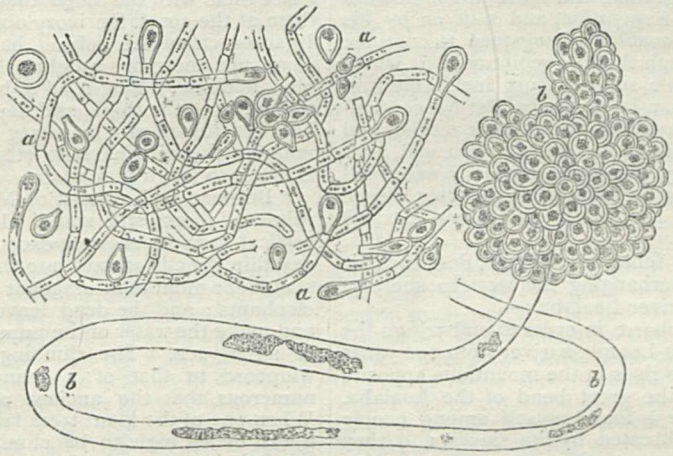

Fig. 4.—Fungus found in a Solution of Ammonic Tartrate and Sodic Phosphate (× 600).

ties from themselves ; secondly, that these germs, as well as many others, are omnipresent in the atmosphere ; and, thirdly, that they are not injured by an exposure for four hours to vapour heated to over 300° F. ; and, finally, we are to accept all these suppositions as facts in order to avoid admitting that specks of living protoplasm are originated *de novo* in some fluids just as specks of crystalline matter originate in other fluids, and although some organisms can be seen to make their appearance in fluids independently of all pre-existing visible germs, just as crystals do.

It must, we think, be admitted that in the portion of his work we have now been considering, Dr. Bastian has fairly met and fully answered all the objections that were made to his earlier experiments. He has, moreover, shown the fallacy of many of the arguments of M. Pasteur and his supporters ; and, by a series of careful and well-devised experiments, the results of which agree with those arrived at by a large number of other workers both in this country and on the Continent, has proved the *de novo* origin of various living organisms in air-tight flasks. This alone is a great step gained ; but it is, as we propose to show in our next article, only the stepping-stone to more important observations and more startling facts.

DR. LIVINGSTONE

THE despatches and private correspondence of Dr. Livingstone, after a long detention, have at last been delivered, and we are now able to give extracts from the explorer's reports which throw further light on his discoveries. He appears to have ascertained, by a journey round the south-eastern side of Tanganyika, that that lake has no outlet. He has also explored the drainage to the eastward for nearly 600 miles. We learn also that his present object is to examine the hills to the south-west of Lake Bangweolo, where he had been told that there are four fountains, which he confusedly connects with the sources of the Nile, as described by Herodotus. There is marvellous heroism in this persistency, and it is sad to reflect that the grand old traveller is doomed to disappointment. But there can scarcely be any doubt that these rivers to the eastward of Tanganyika have no connection with the Nile. Apart from other considerations, Livingstone's own observations show that his Lualaba, where he saw it, was only at the same height above the sea as Gondokoro, and the error of his instrument would increase rather than diminish the height. This makes it impossible that his discoveries can be connected with the Nile. Doubtless the mass of waters is lost in some inland swamp.

The measures for Dr. Livingstone's relief were conducted with zeal and good faith, and he is now well supplied from stores sent up by Dr. Kirk and by his son. Mr. Stanley has also done excellent service in pushing on to Ujiji, in accompanying Livingstone to Unyanyembe, and in bringing home the letters and despatches. The President of the Geographical Society, in the name of the council, has promptly and cordially acknowledged this service, and the perseverance and energy with which it has been performed, in a letter addressed to Mr. Stanley as soon as the despatches were received. There was no delay or hesitation in giving him the credit that was his due ; and equal promptitude has been shown by the Secretary of State for Foreign Affairs, whose letter has already been published. But the American correspondent's subsequent conduct, though doubtless agreeable to his employers, deserves no thanks from the countrymen of Livingstone. The ungenerous attack upon Dr. Kirk is sufficiently refuted by the evidence of Dr. Livingstone's own son, whose letters will, we trust, dispell the delusions with which his father's mind had been filled. Even now we can scarcely believe that Mr. Stanley is justified in his assertion that Dr. Livingstone, the great enemy of slavery, commissioned him to send up sets of slave chains to be used by Her

Majesty's Consul! The statement of Lieutenant Henn, which induced him to abandon the Relief Expedition, that Dr. Livingstone desired all such parties to be turned back, led directly to the miserable alternative of sending up supplies in charge of a native; while Mr. Stanley's secresy and concealment of all particulars respecting Livingstone's wants and intentions while at Zanzibar was unnecessary and injurious. These proceedings, the objects of which are transparently obvious, necessarily detract from the warmth of our gratitude to the man who has certainly done no small service in accompanying Livingstone to Unyanyembe, and in bringing home his letters and journal.

The supplies at Unyanyembe, and those procured from the funds of the Relief Expedition, and sent on by his son, will doubtless have enabled Livingstone to continue his exploration, and, though the disappointment to which his notions about the Nile sources must inevitably lead is to be regretted, there can be no doubt that his contemplated further discoveries will lead to valuable results, and we sincerely trust that the brave old traveller will, after one more difficult journey, live to be cordially welcomed home, and to see some good fruits from his truly heroic perseverance. We now proceed to give some extracts from his despatches.

Dr. Livingstone, in the following passage, describes his march from the ridge overhanging the western shore of Tanganyika to the great river Lualaba:—

"In going west of Bambarre, in order to embark on the Lualaba, I went down the Luamo, a river from 100 yards to 200 yards broad, which rises in the mountains opposite Ujiji, and flows across the great bend of the Lualaba. When near its confluence I found myself among people who had lately been maltreated by the slaves, and they naturally looked on me as of the same tribe as their persecutors. Africans are not generally unreasonable, though smarting under wrongs, if you can fairly make them understand your claim to innocence, and do not appear as having your 'back up.' The women here were particularly outspoken in asserting our identity with the cruel strangers. On calling to one vociferous lady, who gave me the head trader's name, to look at my colour and see if it were the same as his, she replied, with a bitter little laugh, 'Then you must be his father!' The worst the men did was to turn out in force, armed with their large spears and wooden shields, and show us out of their districts. Glad that no collision took place, we returned to Bambarre, and then, with our friend Muhamad, struck away due north, he to buy ivory, and I to reach another part of Lualaba and buy a canoe. The country is extremely beautiful, but difficult to travel over. The mountains of light grey granite stand like islands in new red sandstone, and mountain and valley are all clad in a mantle of different shades of green. The vegetation is indescribably rank. Through the grass—if grass it can be called, which is over half an inch in diameter in the stalk, and from 10 to 12 feet hight—nothing but elephants can walk. The leaves of this megatherium grass are armed with minute spikes, which, as we worm our way along elephant walks, rub disagreeebly on the side of the face where the gun is held, and the hand is made sore by fending it off the other side for hours. The rains were fairly set in by November, and in the mornings, or after a shower, these leaves were loaded with moisture, which wet us to the bone. The valleys are deeply undulating, and in each innumerable dells have to be crossed. There may be only a thread of water at the bottom, but the mud, mire, or (*Scottice*) 'glaur' is grievous; 30 or 40 yards of the path on each side of the stream are worked by the feet of passengers into an adhesive compound. By placing a foot on each side of the narrow way one may waddle a little distance along, but the rank crop of grasses, gingers, and bushes cannot spare the few inches of soil required for the side of the foot, and down he comes into the slough. The path often runs along the bed of the rivulet for 60 or more yards, as if he who first cut it out went that distance seeking for a part of the forest less dense for his axe. In other cases the Muale palm, from which here, as in Madagascar, grass cloth is woven, and called by the same name, 'lamba,' has taken possession of the valley. The leaf stalks, as thick as a strong man's arm, fall off and block up all passage, save by a path made and mixed up by the feet of elephants and buffaloes; the slough therein is groan-compelling and deep. Every now and then the traders, with rueful faces, stand panting; the sweat trickles down my face, and I suppose that I look as grim as they, though I try to cheer them with the hope that good prices will reward them at the coast for ivory obtained with so much toil. In some cases the subsoil has given way beneath the elephant's enormous weight; the deep hole is filled with mud, and one, taking it all to be about calf deep, steps in to the top of the thigh, and flaps on to a seat soft enough, but not luxurious; a merry laugh relaxes the facial muscles, though I have no other reason for it than that it is better to laugh than to cry.

"Between each district of Manyema large belts of the primeval forest still stand. Into these the sun, though vertical, cannot penetrate except by sending down at midday thin pencils of rays into the gloom. The rain-water stands for months in stagnant pools made by the feet of elephants; and the dead leaves decay on the damp soil, and make the water of the numerous rivulets of the colour of strong tea. The climbing plants, from the size of whipcord to that of a man-o'-war's hawsers, are so numerous that the ancient path is the only passage. When one of the giant trees falls across the road it forms a wall breast high to be climbed over, and the mass of tangled ropes brought down makes cutting a path around it a work of time which travellers never undertake."

In another despatch we have a more general review of the results of his explorations, as follows:—"I have ascertained that the watershed of the Nile is a broad upland between 10° and 12° south latitude, and from 4,000 feet to 5,000 ft. above the level of the sea. Mountains stand on it at various points, which, though not apparently very high, are between 6,000 feet and 7,000 feet of actual altitude. The watershed is over 700 miles in length, from west to east. The springs that rise on it are almost innumerable—that is, it would take a large part of a man's life to count them. A bird's-eye view of some parts of the watershed would resemble the frost vegetation on window-panes. They all begin in an ooze at the head of a slightly depressed valley. A few hundred yards down, the quantity of water from oozing earthen sponge forms a brisk perennial burn or brook a few feet broad and deep enough to require a bridge. These are the ultimate or primary sources of the great rivers that flow to the north in the great Nile valley. The primaries unite and form streams in general larger than the Isis at Oxford or Avon at Hamilton, and may be called secondary sources. They never dry, but unite again into four large lines of drainage, the head waters or mains of the river of Egypt. These four are each called by the natives Lualaba, which, if not too pedantic, may be spoken of as lacustrine rivers, extant specimens of those which, in pre-historic times, abounded in Africa, and which in the south are still called by Bechuanas 'Melapo,' in the north, by Arabs, 'Wadys;' both words meaning the same thing—river-bed in which no water ever now flows. Two of the four great rivers mentioned fall into the central Lualaba, or Webb's Lake River, and then we have but two main lines of drainage as depicted nearly by Ptolemy. The prevailing winds on the watershed are from the south-east. This is easily observed by the direction of the branches, and the humidity of the climate is apparent in the number of lichens, which make the upland forest look like the mangrove swamps on the coast. In passing over 60 miles of latitude, I waded

32 primary sources from calf to waist deep, and requiring from 20 minutes to an hour and a quarter to cross stream and sponge; this would give about one source to every two miles. A Suaheli friend, in passing along part of the Lake Bangweolo during six days, counted 23 from thigh to waist deep. This lake is on the watershed, for the village which I observed on its north-west shore was a few seconds into 11° south, and its southern shores and springs and rivulets are certainly in 12° south. I tried to cross it in order to measure the breadth accurately. The first stage to an inhabited island was about 24 miles. From the highest point here the tops of the trees, evidently lifted by the mirage, could be seen on the second stage and the third stage; the mainland was said to be as far as this beyond it. But my canoe men had stolen the canoe, and got a hint that the real owners were in pursuit, and got into a flurry to return home. 'They would come back for me in a few days truly,' but I had only my coverlet left to hire another craft, if they should leave me in this wide expanse of water, and being 4,000 feet above the sea, it was very cold, so I returned. The length of this lake is, at a very moderate estimate, 150 miles. It gives forth a large body of water in the Luapula; yet lakes are in no sense sources, for no large river begins in a lake, but this and others serve an important purpose in the phenomena of the Nile. It is one large lake, and unlike the Okara, which, according to Suaheli, who travelled long in our company, is three or four lakes run into one huge Victoria Nyanza, gives out a large river which, on departing out of Moero, is still larger. These men had spent many years east of Okara, and could scarcely be mistaken in saying that of the three or four lakes there only one, the Okara, gives out its waters to the north. The 'White Nile' of Speke, less by a full half than the Shire out of Nyassa (for it is only 80 or 90 yards broad), can scarcely be named in comparison with the central or Webb's Lualaba, of from 2,000 to 6,000 yards, in relation to the phenomena of the Nile. The structure and economy of the watershed answer very much the same end as the great lacustrine rivers, but I cannot at present copy a lost despatch which explained that. The mountains on the watershed are probably what Ptolemy, for reasons now unknown, called the Mountains of the Moon. From their bases I found that the springs of the Nile do unquestionably arise. This is just what Ptolemy put down, and is true geography. We must accept the fountains, and nobody but Philistines will reject the mountains, though we cannot conjecture the reason for the name. Mounts Kenia and Kilmanjaro are said to be snow-capped, but they are so far from the sources and send no water to any part of the Nile, they could never have been meant by the correct ancient explorers, from whom Ptolemy and his predecessors gleaned their true geography, so different from the trash that passes current in modern times. Before leaving the subject of the watershed, I may add that I know about 600 miles of it, but am not yet satisfied, for, unfortunately, the seventh hundred is the most interesting of the whole. I have a very strong impression that in the last hundred miles the fountains of the Nile mentioned to Herodotus by the Secretary of Minerva in the city of Sais do arise, not like all the rest, from oozing earthen sponges, but from an earthen mound, and half the water flows northward to Egypt, the other half south to Inner Ethiopia. These fountains, at no great distance off, become large rivers, though at the mound they are not more than ten miles apart. That is, one fountain rising on the north-east of the mound becomes Bartle Frere's Lualaba, and it flows into one of the lakes proper, Kamolondo, of the central line of drainage; Webb's Lualaba, the second fountain rising on the north-west, becomes (Sir Paraffin) Young's Lualaba, which, passing through Lake Lincoln and becoming Loeki or Lomame, and joining the central line too, goes north to Egypt. The third fountain on the south-west, Palmerston's, becomes the Liambia or Upper Zambesi; while the fourth, Oswell's, fountain becomes the Kafue, and falls into Zambesi in Inner Ethiopia. More time has been spent in the exploration than I ever anticipated."

He then sums up the results of his work as follows:—"The Geographical results of four arduous trips in different directions in the Manyema country are briefly as follows:— The great river, Webb's Lualaba, in the centre of the Nile valley, makes a great bend to the west, soon after leaving Lake Moero, of at least 180 miles; then turning to the north for some distance, it makes another large sweep west of about 120 miles, in the course of which about 30 miles of southing are made; it then draws round to north-east, receives the Lomame, or Loeki, a large river which flows through Lake Lincoln. After the union a large lake is formed, with many inhabited islands in it, but this has still to be explored. It is the fourth large lake in the central line of drainage, and cannot be Lake Albert; for, assuming Speke's longitude of Ujiji to be pretty correct, and my reckoning not enormously wrong, the great central lacustrine river is about 5° west of Upper and Lower Tanganyika. In my attempts to penetrate further and further I had but little hope of ultimate success, for the great amount of westing led to a continual effort to suspend the judgment, lest, after all, I might be exploring the Congo instead of the Nile, and it was only after the two great western drains fell into the central main, and left but the two great lacustrine rivers of Ptolemy, that I felt pretty sure of being on the right track. The great bends west probably form one side of the rivers above that geographical loop, the other side Upper Tanganyika and the Lake River Albert. A waterfall is reported to exist between Tanganyika and Albert Nyanza, but I could not go to it; nor have I seen the connecting link between the two—the upper side of the loop—though I believe it exists."

His despatches conclude with the following account of his future intentions:—"Geographers will be interested to know the plan I propose to follow. I shall at present avoid Ujiji, and go about south-west from this to Fipa, which is east of and near the south end of Tanganyika; then round the same south end, only touching it again at Pambette, thence resuming the south-west course to cross the Chambeze and proceed along the southern shores of Lake Bangweolo, which being in latitude 12° south, the course will be due west to the ancient fountains of Herodotus. From them it is about ten days north to Katanga, the copper mines of which have been worked for ages. The malachite ore is described as so abundant, it can only be mentioned by the coalheavers' phrase, 'practically inexhaustible.' About ten days north-east of Katanga very extensive underground rock excavations deserve attention as very ancient, the natives ascribing their formation to the Deity alone. They are remarkable for all having water laid on in running streams, and the inhabitants of large districts can all take refuge in them in case of invasion. Returning from them to Katanga, 12 days N.N.W. take to the southern end of Lake Lincoln. I wish to go down through it to the Lomame, and into Webb's Lualaba and home. I was mistaken in the information that a waterfall existed between Tanganyika and Albert Nyanza. Tanganyika is of no interest, except in a very remote degree in connection with the sources of the Nile. But what if I am mistaken, too, about the ancient fountain? Then we shall see! I know the rivers they are said to form—two north and two south—and in battling down the central line of drainage, the enormous amount of westing it made caused me at times to feel as if running my head against a stone wall. It might after all be the Congo, and who would care to run the risk of being put into a cannibal pot and be converted into black man for anything less than the grand old Nile? But when I found that Lualaba forsook its westing, and received

through Lake Kamolondo Bartle Frere's great river, and that afterwards farther down it takes in Young's great stream through Lake Lincoln, I ventured to think that I was on the right track. Two great rivers arise somewhere on the western end of the watershed, and flow north—to Egypt (?). Two other large rivers rise in the same quarter and flow south, as the Zambesi, or Liambai, and the Kafue, into Inner Ethiopia. Yet I speak with diffidence, for I have no affinity with an untravelled would-be geographer who used to swear to the fancies he collected from slaves till he became blue in the face. I know about six hundred miles of the watershed pretty fairly. I turn to the seventh hundred miles with pleasure and hope. I want no companion now, though discovery means hard work. Some can make what they call theoretical discoveries by dreaming. I should like to offer a prize for an explanation of the correlation of the structure and economy of the watershed with the structure and economy of the great lacustrine rivers in the production of the phenomena of the Nile. The prize cannot be undervalued by competitors even who have only dreamed of what has given me very great trouble, though they may have hit on the division of labour in dreaming, and each discovered one or two hundred miles. In the actual discovery so far, I went two years and six months without once tasting tea, coffee, or sugar; and, except at Ujiji, have fed on buffaloes, rhinoceros, elephants, hippopotami, and cattle of that sort; and have come to believe that English roast beef and plum pudding must be the real genuine theobroma, the food of the gods, and I offer to all successful competitors a glorious feast of beefsteaks and stout. No competition will be allowed after I have published my own explanation, on pain of immediate execution without benefit of clergy! I send home my journal by Mr. Stanley, sealed, to my daughter Agnes. It is one of Letts' large folio diaries, and is full except a few (five) pages reserved for altitudes which I cannot at present copy. It contains a few private memoranda for my family alone, and I adopt this course in order to secure it from risk in my concluding trip."

NOTES

We are in a storm of Congresses. Scarcely has the British Archæological Institute finished its work at Southampton before the British Archæological Association, the Iron and Steel Institute, and the British Medical Association have thrown Wolverhampton, Glasgow, and Birmingham respectively into unwonted excitement; while by this time next week the British Association will be in full swing at Brighton. With regard to this latter Congress, we are happy to announce that admirable arrangements for the reception of visitors are being made, and that a large and satisfactory meeting, under the presidency of Dr. Carpenter, may be anticipated.

At the moment of going to press we hear that a M. Delaunay, "director of the Astronomical Observatory" (*sic*), has been drowned by the upsetting of a boat at Cherbourg. We sincerely trust this does not refer to the distinguished director of the Observatory of Paris. But the telegram is ominous.

The French Association for the Advancement of Science will hold its first annual meeting at Bordeaux, from the 5th to the 12th of September. The Administrative Council, consisting of MM. Claude Bernard, Broca, Delaunay, A. d'Eichthal, De Quatrefages, Wurtz, Cornu, secretary of the Association, Masson, treasurer, and Gariel, secretary of the Council, have issued a circular inviting many of our most eminent men of science to be present; and, as the new French society is based upon an old English one, it will be both graceful and useful that as many shall attend as possible. We have also received the first publication of the society, containing a *compte rendu* of the inauguration meeting of the society, held in April in Paris, and the statutes of the society, which have already appeared in NATURE nearly in their final form. We wish the society every success; its object is essentially decentralisation. Would we in England were in a position to decentralise!

Dr. Cobbold, F.R.S., has been appointed to a Professorship of Helminthology at the Royal Veterinary College. During the ensuing winter months he will give a course of lectures on the Parasites and Parasitic Diseases of our domesticated animals.

Dr. Brown-Sequard has resigned the Chair of Comparative and Experimental Pathology in connection with the Faculty of Medicine in Paris, which he has occupied several years. M. Vulpian has applied for the Chair.

Dr. Gerhart, of Jena, has been appointed successor to Dr. Bamberger as Professor of Clinical Medicine at Würzburg.

We regret to learn that Mr. M. C. Webster, the acting collector at Trichinopoli, to whose exertions the Eclipse Expedition owed so much, has been ordered home without delay for two years on sick certificate.

One of the most recent applications of science to practical purposes, which, according to most people is the only part of science which is worth anything, is sufficiently curious. In the "Mors Electrique" of M. Sidot, we have electricity employed in a manner to combine the study of electricity with a ride or drive into the country in company with a restive horse. Nothing is more simple. In the carriage, or even in the saddle, we have a pile *système hermétique Trouvé*, and a small induction coil, along the reins the magic wires are laid, and on either side the animal's lower jaw we have a *couronne metallique*. These are the data. The inventor is under the impression that when the quadruped's motion becomes too rapid it will be instantly brought to zero by the passage of the spark through the aforesaid jaw, but we do not learn that he has tried it. We would suggest that in a cavalry charge it would be most effective. This should be tried at the forthcoming manœuvres. In war the principle might be extended. The horses might be armed unicorn-wise, with blunderbusses and Abel's fuzes, the *couronne metallique* being of course removed from the lower jaw to the novel weapon. Probably in this way the functions of the riders might be abolished altogether; this would bring about a great saving in the army estimates, and in this way cause the Government to think that there may be something in science after all.

No. 6 of the Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College, just come to hand, contains the supplement to the Ophiuridæ and Astrophytidæ by Theodore Lyman, with two plates, in which figures are given of the most important of the singular deep-sea Ophiurans brought up by the dredgings off the coast of Florida, and described in Bulletin No. 10, vol. i. of the Catalogue.

Our common sparrow, as most of our readers are aware, has been for some time naturalised in the New York parks and elsewhere in the United States, for the purpose of keeping in check a plague of caterpillars, in which office it is doing yeoman service. We regret to learn by a paragraph in *The New York Industrial Monthly* that our compatriots are in danger of extermination by a race of feathered rowdies, also bent upon turning the balance of creation their own way. The sparrow's enemy is the great northern shrike; and the *Industrial Monthly* states that one of these "butcher-birds," which eat only the brains of their victims, recently killed a sparrow "by squeezing its head into a crotch made by the fork of two branches, each about half an inch thick."

THE Paris Academy of Sciences has submitted the names of MM. Loewy and Wolf to the Minister of Public Instruction to fill the vacancy in the Bureau des Longitudes, occasioned by the death of M. Langier.

M. FOLIE has recently called the attention of the Royal Academy of Sciences of Belgium to the question of the density of the earth. He criticises some points in Sir George Airy's discussion of his observations, which gave the value 6·566, and states his opinion that 6·439 is nearer the mark.

IN the *Canadian Journal* for July, Prof. H. Alleyne Nicholson discusses the Contemporaneity of Strata and the Doctrine of Geological Continuity with the view of demonstrating "that groups of strata presenting the same fossils, if widely removed from one another in point of distance, can only exceptionally be 'contemporaneous' in the strict sense of the term. On the contrary," he contends, "in so far as we can judge from the known facts of the present distribution of living beings, the recurrence of exactly the same fossils in beds far removed from one another, is *prima facie* evidence that the strata are *not* exactly contemporaneous; but that they succeed one another in point of time, though by no long interval, geologically speaking." Dr. Nicholson concludes "that it is not correct to say that we are living in the Cretaceous period in any other sense than one might say we are living in the Silurian period; with this difference only, that the Cretaceous period is much nearer to us in point of time than the Silurian, and that we can thus trace a relationship between certain living types and certain Cretaceous forms, such as we cannot hope to establish in the case of Silurian forms." Farther, "the conditions present in the deep Atlantic cannot be exactly similar to those of the Cretaceous seas; for the *Cephalopoda* of the chalk seem to have no representatives in the abyssal mud of the Atlantic, while this class was well represented in the Carboniferous times; so that there is, if anything, a closer genetic connection between the chalk and the Carboniferous limestone than between the chalk and the Atlantic 'ooze.'"

THE principal articles in the Transactions of the Royal Microscopical Society for August are the conclusion of Dr. L. S. Beale's paper on the Nerves of Capillary Vessels and their probable action in Health and Disease, a discussion of the vexed question of the Nomenclature of Objectives, by Dr. J. J. Woodward, of the U. S. Army, and a useful paper, by Dr. R. H. Ward, on Our Present Medical and Students' Microscopes.

THE July number of the Proceedings of the Geologists' Association contains a paper, by Mr. Henry Woodward, on Relics of the Carboniferous and other old Land Surfaces, and an essay, by Mr. M. Hawkins Johnson, towards a solution of the chalk-flint enigma.

THERE are only two papers in the recent issue of the Transactions of the Institution of Engineers and Shipbuilders in Scotland, one on the Manufacture of Cast Steel, by Mr. B. D. Healey, the other, by Mr. Alexander Morton, on the Expansion of Water. The former is copiously illustrated.

OTHER things besides history have a tendency to repeat themselves. Vice-Consul Green, in his report concerning the Tunisian fisheries, states that a large portion of the fish supply of the capital of that African state comes from the Bisuta Lake, a distance exceeding forty miles, on pack animals, and, consequently, frequently arrives in an unmarketable state. It is calculated that if proper and expeditious conveyance could be obtained, the supply of the fishery would be sufficient to augment its yearly value by 15,000*l.* or 20,000*l.* But owing to the present fish farmer being able, without any considerable outlay in guards and assistance from preservative enactments, to secure a handsome return from the fisheries conceded to him, great waste and destruction of fish exist.

THE Proceedings of the Asiatic Society of Bengal for May consist mainly of the third instalment of Dr. F. Stoliczka's Notes on the Reptilian and Amphibian Fauna of Kachh or Cutch.

ACCORDING to Dr. Henry Seueur, the twenty-eight weeks' siege of Paris cost upwards of 50,000 lives to the civil population. He ascertains that 300,000 Parisians left Paris by rail before the investment; but 190,000 regular troops and 170,000 refugees from the suburbs entered the city; so that the population of Paris, on the whole, was raised from 1,890,000 to about 2,000,000, the excess consisting chiefly of men between twenty and forty years of age. The mean mortality of the four preceding years and of the following year for these twenty-eight weeks was 24,928; that for the twenty-eight weeks of 1870-71 was 77,231—an excess of 52,303. The mortality fell unevenly on persons of various ages. Between fifteen and twenty-five, it was multiplied sixfold. The general mortality was tripled. The mortality was least among men from forty to sixty; they took no part in active service, and had comparatively greater facilities for resisting cold and privation. The diseases which contributed chiefly to the immense mortality were six—small-pox, bronchitis, pneumonia, typhoid fever, diarrhœa, and dysentery.

THE seventh annual meeting of the Quekett Microscopical Club took place on the 26th ult., when Dr. L. S. Beale, F.R.S., the retiring president, delivered his valedictory address. The club now numbers about 550 members. Dr. R. Braithwaite, F.L.S., is the president for 1872-3. The four vice-presidents are Dr. L. S. Beale, F.R.S., Mr. Arthur E. Durham, Mr. Henry Lee, and Dr. Matthews. The following gentlemen have been re-elected to serve during the ensuing year:—As treasurer, Mr. Robert Hardwicke, F.L.S.; as secretary, Mr. T. Charters White; and as secretary for foreign correspondence, Mr. M. C Cooke, M.A.

THE *British Medical Journal* thinks "it cannot be doubted that one moral will be finally drawn from the difficulties of the southern districts of London as to their water-supply. An adequate supply of drinking water to a crowded part of a great city is of as great importance as a supply of fresh air; and it may reasonably be doubted whether any pains or penalties will suffice to protect a great population from the shortcomings of companies who undertake to furnish a water-supply on purely commercial grounds, and who neither have nor can be expected to have any benevolent interest in the health and comfort of their customers. The water companies of the metropolis hold in their hands the lives of a very large mass of people; and very slight *lâches*, as in the case of the East London epidemic of cholera, suffice to slay hundreds of helpless and perfectly innocent water-drinkers." The *Journal* holds out to "the consideration of all classes of statesmen and of electors, whether the water-supply of great cities, such as London, should be left to the tender mercies of companies, whose opinion as to the importance of 'living organisms' and 'previous sewage contamination' are notoriously sceptical, and are much influenced by the annual arguments presented by the auditors." The Lambeth Water Company, it remarks, "is alike a terror to drunkards and teetotallers; it adds a fresh terror to adulteration, and another curse to the list of those that afflict great cities."

WE have received Part iv. of the fourth edition of Yarrell's "British Birds," edited by Prof. Newton, and in course of publication by Van Voorst. The birds described in this part are chiefly of the families *Turdidæ* and *Silvidæ*.

AT the recent half-yearly meeting of the Grand Trunk Railway Company of Canada, in respect to the rails being exposed to severe cold for a great length of time, the President said that from 3,500 to 4,000 rails on the line break every winter! But he found comfort in the fact that, in about 110 miles of steel

track, only eight or ten rails have broken. This would seem to indicate that Bessemer rails are suitable for cold climates.

CAPTAIN MAJENDIE, in his report of the Stowmarket explosion, says that he resisted as long as possible the suggestion that the catastrophe was due to foul play on the part of some one who wilfully added acid to properly purified and manufactured gun-cotton. Step by step, however, his examination established the theory of foul play as the correct one; and in face of the evidence no other verdict than that given by the jury was possible. He thinks the balance of probability leads to the belief that whoever added the acid was unaware of the terrible consequences it would produce.

THE pupils of the Trade School at Keighley, in Yorkshire, established by the Schools Inquiry Commissioners for the higher education of the children of the artisan classes of that town, have distinguished themselves in the recent examinations. The results are as follows:—Acoustics, Light and Heat: Nine first-class, thirteen second-class.—Theoretical Mechanics: Three first-class, thirteen second-class.—Physical Geography: Twelve first-class, twenty-two second-class.—Steam and the Steam Engine: Three first-class, twenty-five second-class.—Applied Mechanics: Four first-class, twenty-five second-class.—Building Construction: Two first-class, eight second-class.—Animal Physiology:—Two first-class, thirty-one second-class.—Machine Drawing: Nine first-class, twenty-three second-class.—Inorganic Chemistry: Eight first-class, fifteen second-class. (Six second-class by students from Cullingworth.)—Laboratory Practice: Six first-class, four second-class.—Mathematics: Three first-class, twelve second-class. In all, sixty-one first-class passes, and one hundred and ninety-one second-class passes. The Keighley School of Art is attended by about one hundred young men of the town. The examiners at South Kensington have passed the drawings of eighteen of them in the elementary section, and of five in the advanced section, while the works of three—Annie Preston, Thomas Ramsden, and J. Midgley—have been laid out for national competition.

THE fruit crop of 1872 (says the *Gardeners' Magazine*) s probably the smallest that the most experienced and observant cultivator can call to remembrance. It is certainly but little better than no crop at all, and in many fruit-growing districts will not pay for gathering, and, therefore, perhaps, will be lost entirely. The imports of fruit from the Continent have been very much below the average hitherto this year; and the fact suggests itself that our neighbours across the Channel are in much the same plight as ourselves as respects this season's product of fruit. Usually in seasons notable for short supplies of fruit, some kinds are sufficiently plentiful to compensate in part for the general deficiency, but the present is an exceptional season in that respect, for the failure is complete. There can be no mystery about the cause of this general barrenness. The trees made a good growth last year, and the wood was sufficiently ripened. Hence there was a good show of bloom when vegetation was roused into activity by the genial weather which occurred in the month of February. The crop was ruined by the second winter that distinguished the month of March and greater part of the month of April.

IT is estimated that the whole available stock of the famous "Torbane Hill mineral" does not now exceed 50,000 tons, for the extraction of which a pit is about to be sunk. A trustworthy authority states the quantity already worked at about 1,800,000 tons.

IN a communication from Natal, Mr. G. R. Blanche states that Mr. B. Bouwer had seen, in a stone cave in Namaqua-land, about twelve days from Lake Ngami, pictures of all sorts of animals, drawn by Bushmen, in which the unicorn was distinctly delineated. Mr. Bouwer added that an old Bushman at Ghanze told him that he had many years ago seen the animal, that it was very fierce, but that it had now gone away. He had heard, besides, other Bushmen speak in similar terms, of the reputed fabulous beast. Mr. Blanche concludes:—"My opinion is, that the unicorn existed recently in Africa, and that it is *not proved* to be extinct now, but that the probability of its being in existence now is not very great." He rests this conclusion on the general accuracy of such rude sketches by savages in other parts of the world besides Africa, asking, if the unicorn never did exist, why should drawings of it be made in Namaqua-land, Natal, the Transvaal Republic and Cape Colony, possessing the same general and one particular characteristic.

* FRANK CLOWES, Esq., B.Sc., London, F.C.S., has been appointed Science Master at Queenwood College, Hants.

THE *American Naturalist* for July contains a pretty exhaustive account of the Wyandotte Cave and its fauna, by Prof. E. D. Cope. The animals catalogued are fifteen in number, but as this collection was the result of only two days' exploration, Prof. Cope considers that the Wyandotte is richer in life than the better known Mammoth Cave, which has yielded only seventeen species after frequent examination. He describes a curious parasite—a Lernæan—on the blind fish of the cave. The representatives in the Wyandotte of two of the blind genera in the Mammoth Cave are furnished with eyes.

IN his paper on the Wyandotte Cave, in the July number of the *American Naturalist*, Prof. Cope incidentally remarks:—"I believe that wild animals betake themselves to caves to die, and that this habit accounts in large part for the great collections of skeletons found in the cave deposits of the world. After much experience in woodcraft, I may say that I never found the bones of a wild animal which had not died by the hand of man lying exposed in the forest."

THE small white butterfly (*Pieris rapæ*) which has quite recently become naturalised in North America, is likely to spread over the more temperate parts of that continent, to the serious detriment of farmers and gardeners. In a paper on the subject in the *Canadian Entomologist*, Mr. G. J. Bowles, of Montreal, states that the insect has already spread over the province of Quebec and the New England States, and is estimated to have destroyed 500,000 dols. worth of cabbages last year in the vicinity of New York alone. Mr. Bowles communicates some interesting facts in the life history of the immigrant butterfly. "The species," he says, "in its new habitat, has to pass through extremes of temperature to which it has not been accustomed in England, from which country it was most probably introduced; and while the increased summer heat of Canada appears to have made it more prolific, by augmenting the number of broods, the greater cold of winter has balanced the account by killing off, while in the chrysalis state, the surplus which otherwise would have rendered the insect an intolerable pest. The 'compensating' principle in the laws of nature," he adds, "is thus in useful operation with regard to *P. rapæ*; and as the power of cold decreases in effectiveness through the butterfly becoming acclimatised (which will probably happen in course of time), no doubt other agencies will arise, in the shape of new parasitic enemies, to keep the species within due bounds."

MR. H. HAUPT, C.E., in an article in *Van Nostrand's Engineering Magazine* (N.Y.), proposes a system of narrow gauge wooden railways in rural districts and sparsely-settled localities in America, which he describes at some length, and asserts can be constructed more cheaply than ordinary country roads, and upon which transportation can be conducted at less expense than on ordinary railroads. The system, he adds, has been tested to a limited extent, and found to answer admirably.

A SUPPLEMENT to the fifth annual report of the United States' Geological Survey has just been published. It consists of an enumeration, with descriptions by M. Lesquereux, of tertiary fossil plants collected by Dr. F. V. Hayden in 1870, from which some important climatic and other conclusions are drawn.

IT is stated that a plan has been submitted to the Spanish Government for a tunnel under the Straits of Gibraltar, which might be connected with the shortest route to India. The length to be traversed would be 13,800 metres, while that of the contemplated Dover and Calais tunnel is stated as 32,000.

THE late thunderstorms have done considerable damage to the Postal Telegraphs of the United Kingdom. Demagnetisation of needles, and in a large number of instances the fusing and complete destructions of the instrument coils, show that the want of an efficient lightning protector is still much felt.

CORK trees are being extensively introduced into Southern California.

FORMS OF SOLAR PROTUBERANCES *

PROFESSOR TACCHINI gave a full account of some of the work recently done by the Italian Society of Spectroscopists, which will be read with interest. At the beginning of his discourse he dealt specially with the observations on the solar protuberances, made with the view of throwing light on the question, whether the strata below the sun's chromosphere are solid, liquid, or gaseous. If we suppose that the protuberances have the form of jets, that is to say, narrow at the base and spreading out like a fan, as in the jets of gas which issue from terrestrial volcanoes, and if, moreover, instead of being composed of one element or a small number of elements, they are composed, from base to summit, of numerous materials, then it will appear probable that they are produced by eruptions taking place through a strongly resisting medium; and consequently that there must be already formed, on the surface of the sun, a crust solid enough to resist, for the most part, the powerful tension of the internal incandescent gases, which, breaking through this crust at certain points, give rise to violent eruptions, constituting the phenomenon of the solar protuberances. On the other hand, if all or most of the protuberances have a wide base and taper upwards like a pyramid, if their composition is simple, perhaps of the same materials as the chromosphere—a complex composition occurring only in a few of them, and at the base or at a small height above it—then the protuberances, properly so called, must be regarded, not as true eruptions, but as alterations of the chromosphere in those parts, where, through special circumstances, the composition of the subjacent strata becomes modified, either by an outflow of the internal constituents of the solar sphere—in which case the phenomenon is brought about by internal causes—or by disturbances arising in particular zones in consequence of movements developed in the sun's atmosphere, in which case the protuberances are produced by external causes; in other cases both these causes may concur in the production of the phenomena in question.

These considerations are sufficient to show the great importance of establishing the general character of the solar protuberances, and for this purpose, and to avoid certain sources of error, Prof. Tacchini invited P. Secchi, at Rome, and Prof. Lorenzoni, at Padua, to join with him in making contemporaneous observations of the solar protuberances. The proposal was favourably received, and it was agreed that from the 1st to the 13th of July, 1871, observations of the entire limb of the sun should be made from 7 to 10 o'clock.

The spectroscope employed by Tacchini at Palermo is formed of three direct vision prisms, constructed by Tauber, of Leipzig; that of P. Secchi is an instrument with angular vision, somewhat inferior in power to the Palermo instrument; and that of Prof. Lorenzoni is a direct-vision spectroscope which was used in Sicily in the observation of the total eclipse of 1870.

A comparison of the observations made at Rome and at Palermo led to the following results:—

1. All the masses are found indiscriminately in the drawings made at Rome and at Palermo; the most remarkable peculiarities of the chromosphere are likewise reproduced in both.

2. The principal characters of the forms of the protuberances are identical in the two sets of drawings; the direction and position of the plumes, the luminous masses, and frequently the regions of the chromosphere where the flames have a peculiar appearance, are perfectly identical.

3. The heights of the protuberances are for the most part the same, notwithstanding the diversity of the methods employed for measuring them.

4. The differences in the two sets of delineations are of two kinds: the first arising from the mode of drawing, the second from the greater distinctness of vision at Palermo. Other differences are real, being due to the rapid changes taking place in the protuberances.

At Padua the observations were limited to the delineation of individual protuberances; these were found to be the same in form and altitude as those seen at Rome and Palermo, thus affording proof that at the three stations, with different means of observation, the objects seen were identical, and removing any doubt that might previously have existed as to the power of the spectroscope to afford accurate results respecting the chromosphere and the forms of the protuberances.

Tacchini next proceeded to consider the general form of the protuberances. By observations with the spectroscope, continued from March 1871 to February 1872, he found that out of 2,903 protuberances, only 234, or abour 8 per cent., have the form of a tree or of a fan, that is to say, are narrow at the base and spread out towards the upper part, as if they were produced by volcanic eruptions, whereas the remaining 92 per cent. have a broad base and taper upwards like a pyramid, seem, therefore, to be due rather to a simple throwing up of the substance of the chromosphere. He, therefore, regards the general form of the protuberances as inconsistent with the existence of a solid crust on the surface of the sun. This is entirely in accordance with the English work.

When the chromosphere is observed with large instruments—and under peculiarly favourable conditions—it does not present the appearance of a continuous level stratum, as should be the case if it were solid, pasty, or liquid, but often appears to be formed of a continuous series of very distinct flames.* It looks indeed like a general conflagration, more or less developed, which is incessantly renewed with greater or less force, and with especial violence in particular parts, where it gives rise to the protuberances. In small instruments, on the contrary, the chromosphere appears smooth, excepting certain parts where the flames rise to an unusual height. In like manner the details of the protuberances, and especially their outlines, as observed with small instruments, are not comparable with those made with large telescopes, which must necessarily afford a higher degree of definition.

Tacchini next described certain observations which tend to show that the so-called jets, projected upwards from the chromosphere, have their counterpart in a descent of matter from above, in a kind of solar rain, when a mass or cloud of luminous hydrogen suspended in the sun's atmosphere throws off filaments on both sides, which gradually descend and unite at the sun's edge, thereby forming a protuberance which exhibits the arborescent or fan-like form usually attributed to an eruptive jet. This is a new point of great interest.

The theory which attributes the solar protuberances to violent eruptions forcing their way through a solid crust, or a liquid of great resisting power, may, Tacchini remarks, appear to derive some support from the chemical composition of the protuberances. If the masses which project above the chromosphere were found to contain many materials different from those which compose the chromosphere itself, there would be good reason for regarding them as projected from the interior of the sun. And, in fact, some of the protuberances have a somewhat complex chemical composition, the bright lines observed in their spectra often corresponding to magnesium, iron, sodium, titanium, calcium, barium, nickel, chromium, copper, together with eight other lines which may belong to as many different substances; in all therefore eighteen elements, besides hydrogen and the element provisionally named Helium, which is never absent, and represents the constant material of the entire chromosphere. On August 27 last in a single protuberance nine different substances, represented by a brilliant spectrum of twenty-four bright lines, nine of which belonged to iron were seen.

* "On the Forms of the Solar Protuberances and the Regions of Magnesium and Iron on the Surface of the Sun." By P. Tacchini (Public Conference held on Feb. 18, 1872, in the Royal University of Palermo).

* See Lockyer, Proc. R.S. vol. xvii. 1870, p. 354.

But is this rich composition common to all the protuberances, or limited to a certain number? and do these materials extend throughout the protuberance, or are they confined to a limited portion of it?

Tacchini's observations show that the varied composition in question is limited to a very small height; in other words, to the mere base of the protuberance, whereas the higher portions are composed exclusively of hydrogen and the element D_3. Now, if the protuberances were the result of violent eruptions, the substances ejected with such force could not fail to attain a considerable height above the base of the protuberance, which is contrary to observation. Moreover, it is not all the protuberances that give a mixed spectrum; that is to say, they are not all formed of numerous materials, as they should be, at least in the majority of cases if they were produced by violent eruptions. According to Tacchini's observations, only 10 out of 100 protuberances give a mixed spectrum, the remaining 90 giving spectra which exhibit only the hydrogen lines and the line D_3. He also finds that in all the spectra which he has observed, either of protuberances near the sun's edge, or of clouds and filaments of greater height, the hydrogen-lines never occurred alone, but always accompanied by the line D_3. In one case only were the hydrogen lines and D_3 accompanied by other bright lines in the distinctly higher portions of the protuberances. This was observed on December 19, 1871, on a magnificent protuberance resembling a great conflagration, the central part of which exhibited two red lines.

If the protuberances were formed of materials violently ejected from the interior of the sun, it would follow that at every point of the sun's edge where a mixed spectrum occurs, that is to say, where there is evidence of the presence of numerous materials, there also the corresponding protuberance should exist; but observation shows the contrary.

From his first examination of the protuberances, indeed, Tacchini had been led to conclude that the bright protuberances alone afforded certain indication of a rich variety of materials; * but observing afterwards some parts of the sun's edge which, though free from protuberances, nevertheless had a peculiar structure, inasmuch as they were formed of a series of flames higher and brighter than usual, he was led to examine the spectrum of these portions more attentively; and he found indeed that there also, in addition to the lines of hydrogen and D_3, lines appeared corresponding to many other substances. A very careful examination of the sun's edge was accordingly made in August and September 1871, the result of which was to show that in very extensive tracts of the edge, amounting to $\frac{1}{4}$ of the whole, the entire chromosphere was invaded by the vapours of various metals, although these same parts of the edge were not covered by protuberances, an observation before made by Lockyer.†

These tracts continued to show themselves more or less extensively for many days afterwards in the same part of the sun's limb, representing in their aggregate vast regions of the surface where the hydrogen of the chromosphere was mixed with many other substances which commonly exist at the base of the chromosphere. Thus on the 28th of August and 17th of September, 1871, throughout an area of 60°, from the position 30° to 90°, the edge gave a mixed spectrum, although the constituent substances were not found to be present in the same number at all points of this arc; the greater number indeed were found at the middle of the arc, while at the ends they were reduced to magnesium, hydrogen and D_3 of the chromosphere, so far as this last-mentioned line may be regarded as belonging to a peculiar substance. This order in the number of substances on the portions of the edge which give a mixed spectrum, has been observed so frequently, that the regions of the sun corresponding to the aggregate of these successive tracts may be regarded as isolated portions of the solar surface, in the centre of which there is found a large number of different substances, this number diminishing towards the edge of each of these regions, where it reaches its minimum; and if we leave out of consideration the materials of the chromosphere which are common to the whole surface of the sun, we may say that at the borders of these regions there remains nothing but magnesium. In these tracts or regions, indeed, though the composition might be different in different parts, magnesium was never absent; for this reason Tacchini designates these portions of the surface as *magnesium regions*.

Instead then of special points marked by eruptions, we find on the sun's surface large regions exhibiting throughout a complex spectrum, but not covered by protuberances; and this affords the strongest argument for not regarding the protuberances as a phenomenon of true eruption. We cannot therefore admit the existence of a solid or highly resisting liquid stratum, but rather a purely gaseous envelope, such as may permit of the ready mixing of the internal materials with those of the chromosphere on a vast scale, thereby giving rise to the regions above designated as regions of magnesium.

This view, however, does not absolutely exclude the occurrence of eruptive phenomena; for if these materials show themselves in the chromosphere at certain determinate points, they must have issued or been ejected from the centre towards the circumference. Tacchini, however, thinks that he has proved that these eruptions are not violent, and do not take place through a strongly resisting medium.

Contemporaneously with the determination of the angles of position of the protuberances, and of the portions of the chromosphere which exhibited a mixed spectrum, similar determinations were made of the positions of the faculæ and regions of faculæ visible or near the edge. A comparison of the two series of determinations thus made showed the coincidence of the magnesium regions with the regions of the faculæ. The positions of the protuberances on the other hand did not coincide with either.

The limits of the regions of magnesium and of the faculæ, on either side of the sun's equator, were found to be as follows:—

Regions of Magnesium, August 1871	+ 60°
	− 27
September	+ 60°
	− 32
Regions of the Faculæ, August	+ 43°
	− 32
September	+ 64°
	− 32

Considering now the magnesium regions above described, and the intensity of the phenomena there exhibited, it is clear that at any given epoch, the luminous intensity of the solar disc may vary considerably, and exhibit great differences as compared with that of the general envelope. At such times the solar atmosphere will not be uniformly illuminated, but will include a number of cones, varying in extent and brightness according to the different magnesium regions existing on the sun; and Tacchini suggests that in the case of total eclipses of the sun, during which the solar atmosphere becomes visible to us in the form of an aureola, this aureola which is differently illuminated in different parts, and therefore presents the appearance of plumes perpendicular or oblique to the edge of the moon, may arise from the cones embracing a large extent of surface corresponding to that of the magnesium regions.

Whilst Tacchini was studying the magnesium regions, Lorenzoni obtained evidence that the temperature of the sun's surface is least at the poles. The regions occupied by the metallic vapours corresponding to a certain line, which probably belong to the spectrum of iron, are called by Tacchini iron regions; they do not coincide with the regions of magnesium and of the faculæ, or with those of the protuberances, which are more limited.

Since the vapours of iron are diffused in the chromosphere on so vast a scale, and the magnesium regions also are so large as has been previously shown, Tacchini asks is it possible to admit the existence of a state of solidity or viscosity in those envelopes, or a temperature so low as some persons suppose? He regards such a view as totally inadmissible, and considers that all the observations above detailed point to the conclusion that the time is yet very distant when the sun will approach to those transformations which have reduced the earth to its actual state; and that the sun is still an entirely gaseous mass, relatively hotter at the centre, and cooler in the superficial strata, which we distinguish by the names of photosphere and chromosphere.

* Tacchini's observations divide prominences as Lockyer has divided them.

† Proc. R.S. vol. xviii. p. 75 1879

ASTRONOMY

On the Meteors of April 30-May 1*

PROF. SCHIAPARELLI, in his list of meteoric showers whose radiant-points are derived from observations made in Italy within the last few years, describes one as occurring on April 30 and May 1, the apparent position of whose radiant is in the Northern

* From *Silliman's Journal* for July, 1872.

Crown, R.A. 237°, N.P.D. 55°. The same shower has also been recognised by Robert P. Greg, F.R.S., of Manchester, England. This meteor-stream, it is now proposed to show, is probably derived from one much more conspicuous in ancient times.

In Quetelet's "Physique du Globe," pp. 290-297, we find meteoric displays of the following dates. In each case the corresponding day for 1870 is also given,* in order to exhibit the close agreement of the epochs.

1.	A.D.	401,	April 9	; corresponding to	April 29,	for 1870	
2.	,,	538	,, 6	,,	,, 25	,,	
3.	,,	839	,, 17	,,	May 1	,,	
4.	,,	927	,, 17	,,	April 30	,,	
5.	,,	934	,, 18	,,	May 1	,,	
6.	,,	1009	,, 16	,,	April 28	,,	

The epochs of 927 and 934 suggest as probable the short period of seven years. It is found accordingly that the entire interval of 608 years—from 401 to 1009—is equal to 89 mean periods of 6·8315 years each. With this approximate value the six dates are all represented as follows :—

From	A.D.	401	to A.D.	538	we have 20 periods of	6·85	years
,,		538	,,	839	,, 44 ,,	6·84	,,
,,		839	,,	927	,, 13 ,,	6·77	,,
,,		927	,,	934	,, 1 ,,	7·00	,,
,,		934	,,	1009	,, 11 ,,	6·82	,,

This period corresponds closely to those of several comets whose aphelion distances are somewhat greater than the mean distance of Jupiter. So long as the cluster occupied but a small arc of the orbit, the displays would evidently be separated by considerable intervals. The two *consecutive* showers in the tenth century indicate, however, an extensive diffusion of the cluster at that epoch ; so that the preceding part passed the node April 30, 927, and the following part, May 1, 934 ; the interval being somewhat more than one complete period. The comparative paucity of meteors in modern times may be partially explained by the fact that the ring has been subject to frequent perturbations by Jupiter.

It is not impossible that this meteor-stream was connected in its origin with the comet which passed its perihelion on April 29, B.C. 136. DANIEL KIRKWOOD

SOCIETIES AND ACADEMIES

LONDON

Geologists' Association.—The excursion to Ludlow and the Longmynds on July 22 and five following days, the concluding and most important field meeting of the season, was under the direction of Prof. Morris, F.G.S., Mr. R. Lightbody, F.G.S., and the Rev. J. D. La Touche, B.A. After the members had assembled in Ludlow Castle the Upper Ludlow rocks on the right bank of the Teme were examined, and Mr. Lightbody gave his reasons for considering the Aymestry Limestone to be represented at a point near the old bridge, although *Pentamerus Knightii* is not found here. The Upper Ludlow contains *Chonetes lata* in great abundance, and scarcely a fragment of the rock was picked up without this species being seen on the surface. From the high ground by the river side the valley of the Teme may be advantageously seen. The river here flows through a gorge in the Upper Ludlow rocks, with the castle and town of Ludlow picturesquely situated on the left bank ; while the "Old Red" country extends beyond to the Clee Hills, the igneous summits of which commandingly rise to the east, surrounded by the coal measures. The well-known section in Ludford Lane, showing the "bone-bed," was next visited. This bone-bed, or "gingerbread," as it is sometimes called from its appearance, is in places not more than a quarter of an inch thick, and is found only after careful search. The fragments of the remains of fish, of which it is partly made up, were until comparatively recently the oldest fish remains known. The following day (Tuesday) was devoted to an examination of sections of the Aymestry Limestone, Lower Ludlow, and Wenlock rocks, occurring in the course of a route of about twenty miles. The journey was performed by means of carriages, but abundant occupation was given for the hammers of the party at the various exposures of the richly fossiliferous rocks above named. Graptolites from the Lower Ludlow were obtained in abundance, and fine specimens of *Phacops longicaudatus* were found in the Wenlock, exposed in the bed of the Teme, near Burrington ; while *Pentamerus Knightii* was seen in great profusion in the Aymestry Limestone of Ruacktree. Near Comus Wood (so called from being the scene of Milton's "Comus") a very extensive view is obtained of the "Old Red" district of Herefordshire, with the Malverns distinctly seen in the distance. In the evening the members were entertained at a *soirée* given by H. Salway, Esq., of "The Cliff," Ludlow. During Wednesday the Upper Ludlow rocks in the valley of the Teme were subjected to further examination, and the party proceeded as far as Downton, where the uppermost members of the series are seen at the Tin Mills section. At one point on the road to Downton the physiography of the district to the north of Ludlow is well seen, and here Prof. Morris pointed out the principal features of the extensive landscape, and showed how entirely due they were to their geological structure, and that the coal measures of the Clee Hills had been preserved by the old volcanic outbursts which had formed the central masses of hard "Dhu-stone" composing the summits and caves of these lofty hills. On Thursday the party ascended the Longmynds at their southern extremity, where masses of quartzose conglomerate of Cambrian age protrude from the surface. The Rev. Mr. La Touche described the topography and the geology of the district seen from the elevated ground on which his hearers were assembled, and, subsequently, Dr. Hicks explained the order of the succession of the Cambrian and Lower Silurian rocks of St. David's, which he had been re-examining during the previous fortnight, and which he considers to have representatives in some of the beds of the Longmynds. The Llandovery conglomerates lying on the uplifted beds of the Cambrians at an angle of 22° were found to be exposed on the eastern slope of the hill, and the "Pentamerus limestone," with its characteristic *Pentamerus oblongus*, was also seen. The party then proceeded to the quarries of Caradoc sandstone in the Onney valley, at one of which Prof. Morris gave a general description of the Silurian system and the extension in England of its various members. Friday was occupied by a journey in carriages to the mining district of Shelve, and by an inspection of the very interesting hill-country between that place and Church Stretton. Quarries in the Cambrian rocks at the south end of the Longmynds and in Llandovery beds near Norbury occasioned stoppages, and afterwards a visit was paid to Linley Hall, the residence of Mr. Jasper Mare, who courteously invited the party to inspect his fine model of the South Shropshire mining districts, the famous pig of lead of Roman age, with the name of the Emperor Hadrian upon it, found near Shelve, and specimens of the mineral products of the locality of extraordinary size and beauty. The members were then entertained at luncheon, after which they left Linley Hall and traversed a long, narrow, and very beautiful valley in the park, and terminating at the Stiper Stones. At a little distance from the park enclosure a mass of felspathic ash in Lower Llandeilo rocks is quarried for road metal, and the Llandeilo beds thus laid bare were eagerly and most successfully searched for fossils. After a brief visit to the White Grit Mine, the carriages were finally left, and the party commenced the ascent of the Stiper Stone ridge, from the summit of which is seen a fine panorama of the Welsh mountains, with the old volcanic Corndon in the foreground, and Cadir Idris and Plynlimmon in the extreme distance. The extraordinary masses of obtruding hard white quartzite rocks called the Stiper Stones were objects of great interest to the party, some of the members of which were not satisfied with the evidence of their being the equivalents of the Lingula flags. The Longmynds ridge, extending for nearly fifteen miles, bounds the view to the east, and this range had now to be crossed. The intervening valley affords several sections, at one of which was seen what was considered by Murchison to be the junction of the Silurians with the Cambrians. Near the summit of the Longmynds a very fine exposure of Cambrian conglomerates occurs ; and further along the edges of the vertical green and purple shales and slates are seen beneath the feet as the mountain road is traversed. On the eastern side of the range the rocks are well exposed, and the indenting gorges numerous and picturesque. Caer Caradoc stands boldly out at a little distance to the north-east, with the Wenlock and Aymestry limestone ridges beyond, and bounding a valley of great beauty and extent, terminated northwards by the volcano-like cone of the Wrekin, at the foot of which the Severn flows through a deep gorge. The morning of the concluding day, Saturday, was given to an examination of the Upper Ludlow rocks, the "Bone-bed," and the Downton sandstone in the neighbourhood of Morton

* Making proper allowance for the precession of the equinoxes.

Camp and Ovibury; and the week's proceedings concluded with a visit to Stokesay Castle, in which the Rev. James Parker gave an interesting account of the curious old pile. Thanks were most warmly accorded to the Rev. Mr. La Touche and to Prof. Morris for their able conduct of the excursion, and the members then took their departure from the Craven Arms Station, congratulating each other on the very interesting, instructive, and successful character of the visit of the Geologists' Association to Shropshire.

KENT

East Kent Natural History Society, August 1.—A communication was made by Mr. Gulliver, F.R.S., in relation to the shark (*Lamnia Cornubica*) taken last November off Rye. As this is the first description of this important skeleton of this huge fish, which may now be seen at the College of Surgeons, we give it at some length. This shark is the Porbeagle of many authors and the Beaumaris Shark of Pennant. Every anatomist knows more or less how an ordinary natural skeleton is made; but as this of the Porbeagle is an extraordinary one, it is well worth while to note some of the means employed in its preparation. In the first instance careful measurements were made of the different appendages, and kept for guidance in regulating their due position, since in the drying there would be much distortion or displacement which could only be corrected by a constant reference to their state in the fresh fish. Then came the question, how to get out the brain; and this it was found could be easily done through a natural opening—a sort of fontanelle—more than an inch in diameter, in the upper and front part of the skull. Next, it was foreseen that, in such a large fish, there would be great shrinking in its length from the contraction by drying of the intervertebral substances, as had happened to the skeleton of this shark at Haslar; and this fault was prevented by the insertion between the bodies of the vertebræ of temporary wedges or plugs of wood. And as the skull and orbits, being cartilaginous, would shrink and curl into a shapeless and ugly mass, unless means could be devised to preserve their form, all these parts were supported by plaster casts, while the foramina were kept open by wooden plugs. In this state six weeks were passed in the drying, although this was often hastened by artificial heat. The plugs and plaster being removed, the skeleton parts were left in their natural form and position, as now so admirably preserved for the instruction of anatomists. The eyes, too, are shown *in situ* without the least shrinking. The spine has been strengthened by a strong cane introduced along the neural canal, and remaining permanently there, but not visible without curious inspection. It is remarkable that there is but little fatty matter in the skeleton. Among the manifold parts of the skeleton are seen, in their natural position, the five pairs of Branchial Arches; the Hyoid Arch with its three pieces on each side, and the Branchiostegous Rays; the Scapular and Pelvic Arches; and, as appendages of the pelvis, the pair of osseous Claspers, each of two pieces and a curious Spine of hard bone, particularly noticed by Prof. Flower, at the free end. The Vertebræ, of which the number has not hitherto been recorded in this species, are, as counted by Prof. Flower and Mr. Gulliver, no less than 152, of which 60 belong to the tail. These caudal vertebræ turn abruptly upwards at an angle of about forty degrees from the straight vertebral column of the trunk, and run straight along the upper border of the superior lobe of this caudal fin. The frame-work of this fin-lobe is chiefly formed of the caudal vertebræ, with their broad and flat inferior spinous processes; the lower lobe of the caudal fin is composed of a densely-packed layer or plate of parallel rays proceeding from above downwards, and apparently of fibro-cartilaginous texture. The vertebral column has no ribs. The Rays of the front Dorsal Fin are distantly jointed; the joints like those of soft-finned bony fishes, but much further apart in each ray; and this is so remarkable in the Pectoral Fins of this fish as to remind us of the digital phalanges of mammalia. Of course, every ichthyologist well knows that the caudal fins of the Plagiostomes are unequal (heterocercal); but it is not so familiarly known that the caudal vertebræ in several of these fishes, and also in some other fishes, pursue a different course. Indeed, the disposition of the caudal vertebræ of osseous and cartilaginous fishes, both in adults and in the different stages of development, affords, as Agassiz and Huxley have recognised, a very interesting subject for more research than has yet been devoted to this branch of ichthyology. Meanwhile we have in this skeleton of the Porbeagle a noble contribution to the osteology of the Selachians.

PARIS

Academy of Sciences, July 22.—A paper was read by Prof. Cayley on the conditions enabling a family of given surfaces to form part of an orthogonal system.—M. A. de Caligny communicated a note on a liquid vein formed in part by a current, and in part by the blows of the waves against two convergent breakwaters.—A note on the vibrations of cords under the influence of a diapason by M. E. Gripon was read.—M. F. Lucas communicated the results of experiments made by him in the Seine during the siege of Paris for the purpose of ascertaining how far the waters of the river would convey sounds which might be employed for telegraphic purposes. He found that the sounds produced by heavy bells were not transmitted more than 1,500 to 1,800 metres.—M. W. de Fonvielle described a new example of the danger caused by large masses of metal during thunderstorms.—M. Le Verrier read a memoir on the masses of the planets and the parallax or the sun, in which he indicated that in the present day the exact determination of these and some collateral matters had become a necessity, and dwelt especially upon the desirableness of a new direct measurement of the velocity of light. Upon this subject MM. Fizeau and d'Abbadie made some remarks.—M. Boussingault communicated a note on the determination of iron in the blood of an invertebrate animal. The animal employed was the common garden slug; its blood contains only 0·00069 per cent. of iron.—A note was read by M. P. Thenard on a new process for the quantitative determina- of ozone, and a second by the same author on the action of permanganate of potash or oxygenated water in the midst of a freezing mixture.—M. Sace presented a memoir on a new process for the preservation of alimentary substances by means of acetate of soda.—M. Berthelot communicated a note on the constitution of acid salts in solution; and MM. P. Champion and H. Pellet a note on the theory of the explosion of detonating compounds.—M. A. Boillot described a process for the preparation of ozone by means of a new mode of production of the electrical effluvia.—M. C. Bernard communicated a further note by M. Oré on M. Liebreich's endeavour to demonstrate that strychnine is an antidote to chloral.—M. C. Robin presented a note by M. Rabuteau on the physiological properties of quinic acid, and on the reduction of perchloride of iron in the organisms; and M. C. Sainte-Claire Deville communicated a letter from M. Diego Franco on the late eruption of Vesuvius.

PAMPHLETS RECEIVED.

ENGLISH.—Cassell's Book of Birds, Part XXIII.—The Lead and Zinc Mines of the Mendip: H. B. Woodward, F.G.S.—What determines Molecular Molecular Motion? the Problem of Nature.—The Industrial Monthly, No. 5, Vol. vii.—The Journal of Applied Chemistry, No. 7, Vol. vii.—A Letter to the Most Noble the Marquis of Salisbury on the Public Health Bill: G. W. Child, M.A.—The Building and Ornamental Trades of Great Britain and Foreign Countries: E. Hill.—Grevillea, No. 2: M. C. Cooke.—Proceedings of the Geologists' Association, No. 6, Vol. ii.—The Monthly Microscopical Journal, August.—The Astronomical Register, August.—The Publishers' Circular, August.—Journal of the Chemical Society, July.—The Food Journal, No. 31, Vol. iii.

AMERICAN AND COLONIAL.—The American Chemist, No. 12, Vol. ii.—The Canadian Naturalist, No. 4, Vol. xiii.—The American Naturalist, No. 7, Vol. vi.—The American Journal of Science and Art, No. 18, Vol. iii.—The Cincinnati Medical News, Nos. 5 and 6, Vol. i.—The Indiana Journal of Medecine, Nos. 1 and 2, Vol. iii.—Van Nostrand's Eclectic Engineering Magazine, No. 44, Vol. vii.

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