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

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SCIENCE REFORM

A MOVEMENT has been for some time on foot, of a character so important to the Science of England, that we can no longer delay consideration of its object and prospects. It is proposed to submit to a Royal Commission the entire question of the relation of Science to the State; both what now is, and what should be, that relation.

In order to centre the attention of the scientific world on the leading features of the proposed inquiry, we will confine this present opening of the subject, as much as possible, to a narrative of the events which have brought the movement to its present stage.

At the meeting of the British Association at Norwich in 1868, a paper was read by Lieut.-Colonel Strange, in the Mathematical and Physical Section, entitled, "*On the Necessity for State Intervention to Secure the Progress of Physical Science;*" an abstract of which was published in the Report of the Association of that year. Colonel Strange stated verbally that he desired to be considered as merely putting into language the thoughts which had long occupied the minds of many eminent men of science. No one who mixes much in the scientific circles, indeed, can fail to recognise in his paper ideas which, in one form or other, have for some years been gathering strength. Discussion followed the paper, but, as might be expected, it branched off into many of the innumerable details which are involved in so large a question. A practical result, however, was arrived at by the Section, namely, that a committee should investigate the whole matter during the recess, and report to the Association at its next meeting.

This committee accordingly presented its report to the Association this year, at its late meeting at Exeter; and, since the future steps that may be taken must be based, more or less, on this document, we cannot do better than here print it *in extenso*.

The Recommendation adopted by the General Committee at the Norwich Meeting was, that Lieut-Col. Strange, F.R.S., Professor Sir W. Thomson, F.R.S., Professor Tyndall, F.R.S., Professor Frankland, F.R.S., Dr. Stenhouse, F.R.S., Dr. Mann, F.R.A.S., Mr. Huggins, F.R.S., Mr. Glaisher, F.R.S., Professor Williamson, F.R.S., Professor Stokes, F.R.S., Professor Fleeming Jenkin, F.R.S., Professor Hirst, F.R.S., Professor Huxley, F.R.S., and Dr. Balfour Stewart, F.R.S., be a Committee* for the purpose of inquiring into, and of reporting to the British Association the opinion at which they may arrive concerning the following questions:—

I. Does there exist in the United Kingdom of Great Britain and Ireland sufficient provision for the vigorous prosecution of Physical Research?

II. If not, what further provision is needed? and what measures should be taken to secure it?

and that Dr. Robert James Mann be the Secretary.

The Report was as follows:—

Your Committee, having sought the counsel of many of the most eminent men of science of the United Kingdom upon these questions, so far as it was found practicable to do so, and having carefully deliberated thereon, have arrived at the following conclusions:—

I. That the provision now existing in the United Kingdom of Great Britain and Ireland is far from sufficient for the vigorous prosecution of Physical Research.

II. It is universally admitted that scientific investigation is productive of enormous advantages to the community at large; but these advantages cannot be duly reaped without largely extending and systematising Physical Research. Though of opinion that greatly increased facilities are undoubtedly required, your Committee do not consider it expedient that they should attempt to define categorically how these facilities should be provided, for the following reason:—

Any scheme of scientific extension should be based on a full and accurate knowledge of the amount of aid now given to science, of the sources from which that aid is derived, and of the functions performed by individuals and institutions receiving such aid. Your Committee have found it impossible, with the means and powers at their command, to acquire this knowledge. A formal inquiry, including the inspection of records to which your Committee have not access, and the examination of witnesses whom they are not empowered to summon, alone can elicit the information that is required; and, as the whole question of the relation of the State to Science, at present in a very unsettled and unsatisfactory position, is involved, they urge that a Royal Commission alone is competent to deal with the subject.

Your Committee hold that this inquiry is of a character sufficiently important to the nation, and sufficiently wide in its scope, to demand the most ample and most powerful machinery that can be brought to bear upon it.

Your Committee therefore submit, as the substance of their Report, the recommendation that the full influence of the British Association for the advancement of Science should at once be exerted to obtain the appointment of a Royal Commission, to consider:—

1. The character and value of existing institutions and facilities for scientific investigation, and the amount of time and money devoted to such purposes.
2. What modifications or augmentations of the means and facilities that are at present available for the maintenance and extension of science are requisite; and,
3. In what manner these can be best supplied.

To proceed with our historical narrative. The report passed through the ordeal to which all such matters are subjected according to the rules of the British Association; namely, First, the consideration of the committee of the Section in which it originated (Section A); Secondly, that of the Committee of Recommendations; Thirdly, that of the General Committee. By this last it was submitted to the Council of the Association, "*for consideration and action if it seems desirable*," and the report was considered by a sub-committee of the Council on Saturday last.

As the matter now stands, it is for the Council of the British Association to determine whether science in this country stands, or does not stand, on a settled, satisfactory foundation; and if not, then the further question, whether anything short of an inquiry conducted by the State will suffice to redress existing evils and to initiate desirable reforms.

If we refer to the list of names of the Norwich Committee, given above, we find that it includes men of the highest eminence in almost every branch of scientific inquiry,—men whose whole lives are, and have long been, devoted to actual scientific work—professors, investigators, and writers, members of many learned societies, and of universities, leaders of philosophical thought, and persons possessing every available means of insight into all that passes in the scientific world,—and what do they tell us? Why, virtually this, that the provision for extending science in England is derived from so many sources, is subject to so many authorities, is so entirely without consistency and system, that even their joint knowledge fails to grasp and arrange the heterogeneous mass of confusion; they say, however, with an absence of circumlocution that bears the stamp of well-founded conviction, that this

* The following names have since been added to the Committee:—Alfred Tennyson, F.R.S.; Lyon Playfair, F.R.S., M.P.; J. Norman Lockyer, F.R.S.

provision, such as it is, not merely fails as to system and quality, but that, as to extent and quantity, "*it is far from sufficient for the vigorous prosecution of Physical Research.*"

Now, the opinions of men like these, so clearly and strongly expressed, must have carried great weight, whatever recommendations they might have founded on them; but when we consider their recommendation our faith in the soundness of their advice receives a strong accession. They do not say, as they might have done,—Establish such institutions, abolish others, alter the constitution of some, create great scientific offices, elevate the condition of scientific men, form us into a body for setting everything to rights, ourselves included. No; with an impartiality that does them honour, they say,—Place this matter before the highest tribunal known to our constitution for the deciding of such questions—before men selected for their high station and unquestionable independence; let all branches of science come in succession under their scrutiny; let the truth appear openly before the world without a possibility that an imputation of partiality and favouritism, which might attach to *our* decision, should cast a shade over their proceedings and their judgment and so damage the cause.

If we next consider the composition of the Council of the British Association, we shall feel the most positive assurance that a Report coming to them from so strong a Committee will be considered with the utmost care. For our own part we cannot feel doubtful of the result. But the question whether or not the Government shall be asked for a Royal Commission on Science is at this moment in their hands, and having said this we have brought down the history of the movement to the present moment.

A few words in conclusion. This is precisely one of those subjects which is liable to be dealt with in detail by minds before which it is definitely presented for the first time. Let us, therefore, indicate briefly the main questions, the discussion of which is, in the present stage of the matter, desirable. These are: First, does scientific investigation labour in England under disabilities and disadvantanges for want of the necessary funds and material appliances? Secondly, on what principles should the State assist scientific exertion; are these principles settled and acknowledged; and are they acted on? Thirdly, if the answers to these questions be, as we may almost assume they will be, unfavourable, is there any chance that piecemeal rectification will suffice to correct existing evils, or must we go to the root of the matter with the help of a Royal Commission?

When these questions are settled, it will be time to go more into details—but not before.

PHYSICAL METEOROLOGY

II.—SUGGESTIONS

AT the end of a previous article, I ventured to say I should make some suggestions touching a method by which I think meteorology might perhaps be made a branch of physical inquiry. In doing so, I will borrow the thought, and very many of the words which were brought before the Exeter meeting of the British Association. And furthermore, no allusion will be made in the present article to the elements of pressure and temperature.

With respect to the motion of our atmosphere, it cannot be anticipated that we shall ever possess the same complete knowledge which astronomy gives us of the motion of the heavenly bodies; for in the latter case the identity of the object is not lost sight of, while in the former case it is clearly impossible to ascertain the motions of individual particles of air. Our inquiries into the distribution and motion of the elements of our atmosphere must, therefore, be pursued by that method which enables us to ascertain the distribution and motion of any other substance or product with the individual components of which we find it impracticable to deal.

Suppose, for instance, we wish to ascertain the wealth of our country in grain or in spirits, and the distribution of this commodity over the earth's surface. We should first of all begin by taking the stock of the commodity corresponding to a given date; we should next keep a strict account of all the imports and exports of the material, as well as of its home production and home consumption.

Now, if we have taken stock properly at first, and if our account of the imports, the exports, the production, and the consumption of our material is accurate and properly kept, it will obviously be unnecessary to take stock a second time. But if these accounts are not kept with sufficient accuracy, or if we suspect that our material leaves us by some secret channel which we wish to trace, it will clearly be necessary to take stock frequently; and thus a comparison of our various accounts may enable us to detect the place and circumstances of that secret transit which has hitherto escaped our observation.

Applying these principles to the vapour of our atmosphere, what we wish to know is the amount of this material present at any one station at any moment, and also the laws of its motion. It would appear that the best way of measuring the amount present at any moment is by ascertaining the *mass* of vapour present in a *cubic foot* of air, mass and volume being fundamental physical conceptions.

Next, with regard to the motion of the atmosphere, including its vaporous constituent, the method of co-ordinates suggested by Dr. Robinson would appear to be the natural way of arriving at this. Let us set up at a station two imaginary apertures (strictly imaginary, of course), one facing north and south and the other east and west, and gauge the mass of dry air and the mass of moisture that passes each of these openings in one hour; we shall by this means get the nearest attainable approach to the elements of motion of the atmospheric constituents from hour to hour. We shall not, however, obtain by this means a complete account of this motion, for we have at present no means of measuring its vertical component. This vertical component corresponds in fact to the secret channel in the illustration given above, which we must endeavour to detect by some indirect method. Another thing that ought to be determined is the production or consumption of the vaporous element of our atmosphere as it passes from place to place. This might be done could we keep an accurate account of the evaporation and the precipitation, the two processes by which this element is recruited and consumed. This would, however, be a very difficult observation.

Let us now recapitulate what information regarding moisture we can obtain from such complete meteorological observations as are at present made. We have to begin with, as I have shown—

(1) The mass of vapour actually present at a station from hour to hour.

(2) The mass that passes a station in one hour, going east and west.

(3) The mass that passes a station in one hour, going north and south.

There is wanting—

(4) The vertical component of the motion of vapour.

(5) Its production or consumption as it passes from place to place.

These deficiencies may, however, be to some extent overcome by the following considerations :—

First, the atmosphere moves as a whole when it moves, the dry and moist air moving together; *secondly*, dry air is neither capable of production nor of consumption, but always remains constant in amount.

To illustrate this part of the subject, let it be supposed that we wish to investigate the vertical motion of the atmosphere at a certain station. Make this station the imaginary centre of a circle, the circumference of which may be supposed to be studded with other stations at sufficiently frequent intervals, so that we can tell, hour by hour, how much dry air passes in towards the centre of the circle through its circumference, and also how much passes out.

Let us suppose that more is passing in than is passing out, or that the imports into the area of the circle are greater than the exports out of it. Now, the dry air that passes in is incapable of production or of consumption, and hence the stock of the material at the central station, and in the area generally, ought to be on the increase, since we have imagined the imports to be greater than the exports. If, however, we ascertain from actual observation that the stock of dry air is diminishing instead of increasing, we may be sure that some is carried off by an upward current, which of course carries the moisture with the dry air.

The establishment of accurate observations is so recent that I cannot at this moment produce any definite example in illustration of this mode of analysis. We may, however, take a cyclone. As I have said, there are two hypotheses with regard to the motion of air in this phenomenon : one set of philosophers advocating a strictly rotatory motion, and the other set an indraught of air from the circumference towards the centre ; and yet frequently we have a falling barometer in the centre. Now, what can carry off the air, if there be not an ascending current at the very heart of the cyclone? This is, however, I may remark, merely put forward in illustration of the method.

So much for the vertical component ; and now, in the next place, with regard to the production or consumption of aqueous vapour as it passes from place to place. Our consideration has hitherto been confined to *quantity ;* let me now define what is meant by the *hygrometric quality* of the air. It may be represented by the following quotient :—

$$\frac{\text{mass of vapour in a cubic foot}}{\text{mass of dry air in a cubic foot}}.$$

Now, this quotient can only alter by evaporation, by precipitation, or by mixture. This hygrometric quality of the air may perhaps be considered a quality sufficiently constant to aid us in tracing the actual motion of air, just as we may make use of the element of saltness to trace the actual path of an oceanic current. It gives us, in fact, a chemical analysis of the air, and one, moreover, which is independent of pressure, so that we can tell by its means the various qualities of air which we meet with in a balloon or mountain ascent. But besides this aid, we may make use of it to enable us to tell the precipitation or evaporation. For instance, a very damp air, in passing over a very dry country, may be supposed to emerge less damp, having its hygrometric quality changed; or a very dry air, in passing over a very damp country, may be supposed to emerge less dry, having its quality changed in the opposite direction. Thus, by actual observation of the quality of the air at the time of its reaching some particular tract of land or ocean, and at the time of its leaving it, we may possibly get much better observations of what goes on in the country, as far as this particular research is concerned, than if it were studded with gauges.

I would therefore suggest that meteorological observations should, by a system of reduction, be made to show—

(1) The mass of dry air and of moisture in one cubic foot actually present at each station from hour to hour.

(2) The mass of dry air and of moisture that passes each station, hour by hour, in two lines of direction at right angles to each other, namely, north and south and east and west.

When these hourly elements are obtained, they might for seasonal changes be reduced after the method of five-day means; or for the investigation of changes of weather, they might be utilised in some other way, as, for instance, in that lately suggested by the Astronomer Royal.

I ought to remark of this method of *gauging*, that all I claim to have done is to have put it in a somewhat new form; for it has been acted on by Maury and others before now, and has, in fact, given us one proof of the anti-trades. For we know that there is a constant indraught of air from the tropics to the equator on both sides ; and as it does not accumulate there it must be carried off somehow, that is to say, it must return by the upper regions.

Before concluding,—one word of recapitulation as to the present stage of development of meteorology. We have seen that, judging by astronomy, there ought to be three stages : the object of the first being to ascertain the actual motions of the air, the second the causes of those motions, while we prophesy in the third. We have also seen how little progress we have made in the very first of these ; and we may naturally conjecture that the third or prophetical stage is so very far in advance of us that we may not reach it for a long time. Nevertheless there is one crumb of comfort for weather prognosticators ; for just as astronomers predicted certain phenomena in a rough way before the law of gravitation was established, so here also we may make certain rough and ready predictions of much practical utility before the advent of the Newton of meteorology.

BALFOUR STEWART

SERMONS IN STONES

Les Pierres, Esquisses Minéralogiques. Par L. Simonin. Pp. 516, with 91 woodcuts, and 21 chromo-lithographs for coloured plates. (Paris, 1869. Hatchette et Cie.)

THIS volume is another of the recent works on popular science which, like "La Vie Souterraine" of the same author, "Les Volcans" of Boscowitz, and others of a similar character, the publishers of Paris seem of late to compete with one another in bringing out, and of which it may be said that they are peculiarly French, for neither here, elsewhere on the Continent, nor in England do we find their exact representatives.

Copiously illustrated by chromo-lithographs, coloured plates, and woodcuts of a most spirited, and occasionally what may be termed a somewhat sensational, character, these works apparently seek to impart scientific information mainly by appealing to the eye of the reader, and it must be admitted that in this they are sometimes very successful, the illustrations often conveying at a glance impressions which it would be tedious, or at times even difficult, to communicate in words. As an example of this, and also at the same time of the style of the woodcuts themselves, which are so abundant in the volume now under consideration, we reproduce two of them in our pages. The first of these is a most successful attempt to depict the general features of one of those polar glaciers which in prehistoric times have played so important a part in the earth's geological history, by the transporting of vast accumulations of rocks and their *débris* to other parts of the globe far distant from their original sites. This woodcut may be said to be, as it were, supplemented by the second, representing a Swiss landscape, showing in the foreground one of the great erratic blocks, or boulders, carried far from the glaciers themselves, and deposited in its present situation upon the melting of the icy raft which had floated it southwards. It may

POLAR GLACIERS

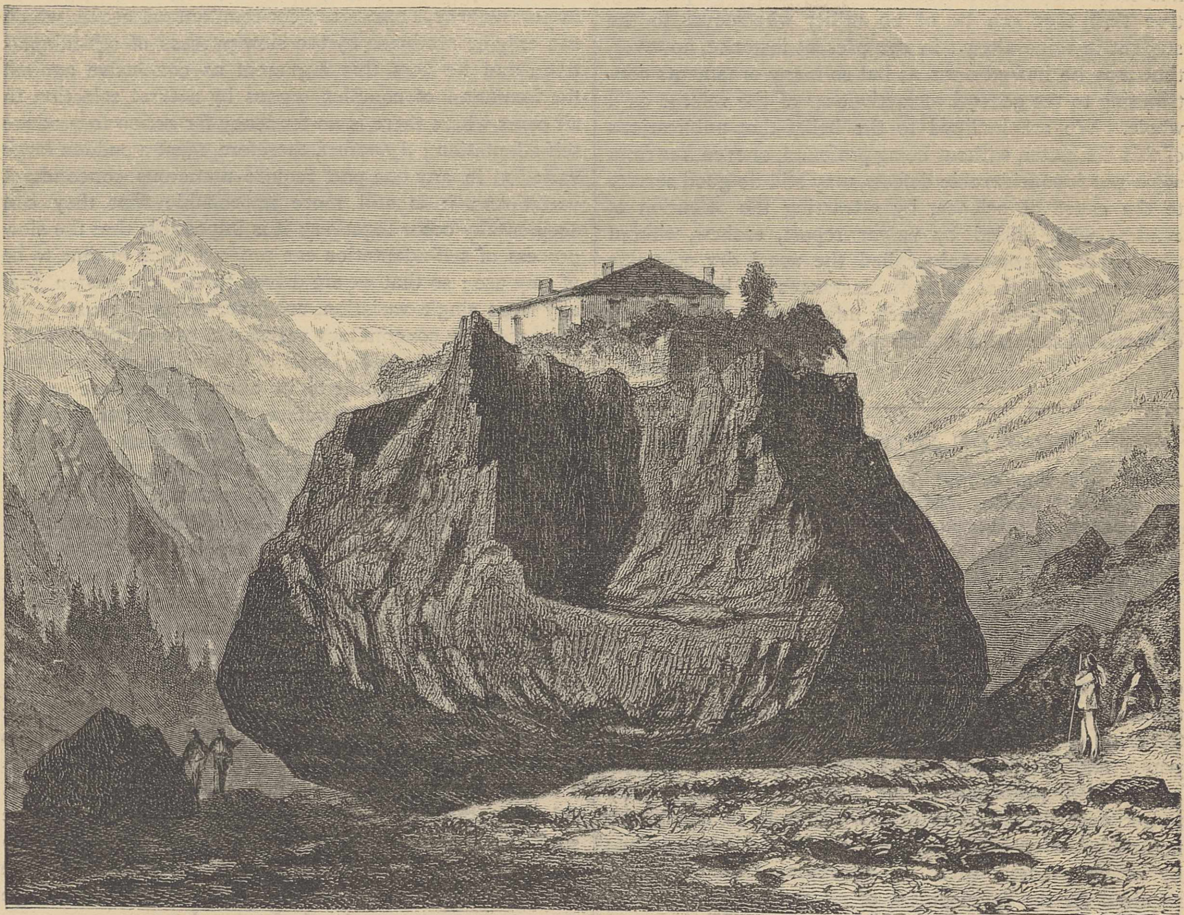
fairly be asked whether any description would be likely to produce on the mind of the geologically-inclined reader the effect which the mere sight of this woodcut must do? Does not the appearance of this gigantic pebble, with the dwelling-house perched upon its summit, instantly convey the most vivid impression of the more than grand scale of those glacial phenomena which at one period of the earth's history exhibited themselves in full activity?

Bearing in mind that the word "stone" is throughout this work employed in an altogether popular sense—*i.e.* used promiscuously to designate any fossil, loose stone, rock, or mineral species whatsoever—the book itself is divided into two parts, treating respectively—(1) of stones, as a group or family, and (2) of the history of certain stones. Under the former of these heads, after a somewhat vague introduction to mineralogy proper, and a more detailed description of the somewhat complicated and cumbrous equipment considered by the author as necessary for the travelling mineralogist, or rather geologist, we find, in the second chapter, what might be called the condensed essence of geological science. Starting with cosmogony, we have laid before us, in turn, the nebular hypothesis of the origin of the earth; its subsequent condition of igneous fluidity, and consolidation upon cooling; the appearance of life upon its surface; and the various subsequent changes which it experienced through successive geological ages down to the present day,—the text being but a sort of running commentary upon the numerous and often admirably-executed illustrations which occur in its pages.

From this we are, in the third chapter, carried to the consideration of what are termed the stones of France; under which head we find a hurried but interesting account of the coal and iron mines of France, and of the utilisation of their products in the metallurgical industries of the country, interspersed with sketches of their history, statistics, &c., of the mining and manufacturing population; concluding with a still shorter account of the other more strictly denominated metallic mines of France.

A fourth chapter completes this first division of the work by a description of what are termed "Les Pierres du Globe," arranged under the heads of—(1) Carbon, (2) Metallic substances, (3) Building stones, (4) Gems, (5) Earths and salts, (6) Petroleum and subterranean water; all of which are treated of in a very interesting, but necessarily, from want of space, equally superficial manner.

The second part of the work, or what is termed the "Histoire de quelques Pierres," is subdivided into four chapters, each of which is in itself a somewhat more detailed account of the mining industry carried on in certain districts more specially noted for their mineral productions. These are as follows:—(1) The gold and silver deposits of the Rocky Mountains; (2) The marble quarries of Italy; (3) The iron mines of Elba; and (4) The coal mines of the centre of France. The descriptions of these are given in a very characteristic and instructive manner, and here again we may remark that they are profusely illustrated.


PIERRE DES MARMETTES AT MONTHEY (VALAIS)

In reviewing this book, it must be remembered that Simonin's "Les Pierres" is not to be regarded in the light of a strictly scientific work, nor is it put forward with any pretensions to such a character. Although treating of subjects within the domain of their respective sciences, it is evidently, and admittedly, *not* written for the use of either mineralogist, geologist, or metallurgist; it claims but to provide those readers who are not at home in mineralogical or geological science, with information, arranged in a popular, or, to them, readable form, concerning such mineral substances as are likely to come under their attention either at home or in the course of their travels, and as such we cannot but recommend it.

The worthlessness of coloured illustrations of minerals has frequently been descanted upon, and it is perfectly true that they can be of no utility whatsoever to the student in mineralogy; in the present instance, however, they may be looked upon as but so many ornaments contributing to the general attractiveness of the volume as a whole. We are inclined to the belief that publications of this character, without being profound, or even free from some not inconsiderable defects, may still do good service to the cause of science, by attracting the attention of readers who, misled by vulgar report, eschew, without trial, what is commonly called the usual dry scientific literature; and that in some instances at least it may induce them to follow up their introduction by the study of more substantial scientific pabulum.

DAVID FORBES

THE ORIGIN OF SPECIES CONTROVERSY

Habit and Intelligence, in their Connection with the Laws of Matter and Force. A Series of Scientific Essays. By Joseph John Murphy. (Macmillan and Co., 1869.)

II.

IN his chapter on "The Rate of Variation," Mr. Murphy adopts the view (rejected after careful examination by Darwin) that in many cases species have been formed at once by considerable variations, sometimes amounting to the formation of distinct genera and he brings forward the cases of the Ancon sheep, and of remarkable forms of poppy and of *Datura tatula* appearing suddenly, and being readily propagated. He thinks this view necessary to get over the difficulty of the slow rate of change by natural selection among minute spontaneous variations; by which process such an enormous time would be required for the development of all the forms of life, as is inconsistent with the period during which the earth can have been habitable. But to get over a difficulty it will not do to introduce an untenable hypothesis; and this one of the rapid formation of species by single variations can be shown to be untenable, by arguments which Mr. Murphy will admit to be valid. The first is, that none of these considerable variations can possibly survive in nature, and so form new species, unless they are *useful* to the species. Now, such large variations are admittedly very rare compared with ordinary spontaneous variability, and as they have usually a character of "monstrosity" about them, the chances are very great against any particular variation being useful. Another consideration pointing in the same direction is, that as a species only exists in virtue of its being tolerably well adapted to its environment, and as that environment only changes *slowly*, small rather than large changes are what are required to keep up the adaptation. But even if great changes of conditions may sometimes occur rapidly, as by the irruption of some new enemy, or by a few feet of subsidence causing a low plain to become flooded, what are the chances that among the many thousands of *possible* large variations the one exactly adapted to meet the changed conditions should occur at the right time? To meet a change of conditions this year, the right large variation *might* possibly occur a thousand years hence.

The second argument is a still stronger one. Mr. Murphy fully adopts Mr. Herbert Spencer's view, that a variation, however slight, absolutely requires, to ensure its permanence, a number of concomitant variations, which can only be produced by the slow process of self-adaptation; and he uses this argument as conclusive against the formation of complex organs by natural selection in all cases where there is no tendency for action to produce self-adaptation; *à fortiori*, therefore, must a sudden large variation in any one part require numerous concomitant variations; it is still more improbable that they can accidentally occur together; it is impossible that the slow process of self-adaptation can produce them in time to be of any use; so that we are driven to the conclusion, that any large single variation, unsupported as it must be by the necessary concomitant variations, can hardly be other than hurtful to the individuals in which it occurs, and thus lead in a state of nature to its almost immediate extinction. The question, therefore, is not, as Mr. Murphy seems to think, whether such large variations occur in a state of nature, but whether, having occurred, they could possibly maintain themselves and increase. A calculation is made by which the more rapid mode of variation is shown to be necessary. It is supposed that the greyhound has been changed from its wolf-like ancestor in 500 years; but it is argued that variation is much slower under nature than under domestication, so that with wild animals it would take ten times as long for the same amount of variation to occur. It is also said that there is ten times less chance of favourable variations being preserved, owing to the free intermixture that takes place in a wild state; so that for nature to produce a greyhound from a wolf would have required 50,000 years. Sir W. Thomson calculates that life on the earth must be limited to some such period as one hundred million years, so that only two thousand times the time required to produce a well-marked specific change has, on this theory, produced all the change from the protozoon to the elephant and man.

Although many of the data used in the above calculation are quite incorrect, the result is probably not far from the truth; for it is curious that the most recent geological researches point to a somewhat similar period as that required to change the specific form of mammalia. The question of geological time is, however, so large and important that we must leave it for a separate article.

The second volume of Mr. Murphy's work is almost wholly psychological, and can be but briefly noticed. It consists to a great extent of a summary of the teachings of Bain, Mill, Spencer, and Carpenter, combined with much freshness of thought and often submitted to acute criticism. The special novelty in the work is the theory as to the "intelligence" manifested in organisation and mental phenomena, and this is so difficult a conception that it must be presented in the author's own words :—

"I believe the unconscious intelligence that directs the formation of the bodily structures is the same intelligence that becomes conscious in the mind. The two are generally believed to be fundamentally distinct: conscious mental intelligence is believed to be human, and formative intelligence is believed to be Divine. This view, making the two to be totally unlike, leaves no room for the middle region of instinct; and hence the marvellous character with which instinct is generally invested. But if we admit that all the intelligence manifested in the organic creation is fundamentally the same, it will appear natural, and what might be expected, that there should be such a gradation as we actually find, from perfectly unconscious to perfectly conscious intelligence; the intermediate region being occupied by intelligent though unconscious motor actions—in a word, by instinct. . . . . The intelligence which forms the lenses of the eye is the same intelligence which in the mind of man understands the theory of the lens; the intelligence that hollows out the bones and the wing-feathers of the bird, in order to combine lightness with strength, and places the feathery fringes where they are needed, is the same intelligence which in the mind of the engineer has devised the construction of iron pillars hollowed out like those bones and feathers. . . . . It will probably be said that this identification of formative, instinctive, and mental intelligence is Pantheistic. . . . . I am not a Pantheist: on the contrary, I believe in a Divine Power and Wisdom, infinitely transcending all manifestations of power and intelligence that are or can be known to us in our present state of being. . . . . Energy or force is an effect of Divine power; but there is not a fresh exercise of Divine power whenever a stone falls or a fire burns. So with intelligence. All intelligence is a result of Divine Wisdom, but there is not a fresh determination of Divine thought needed for every new adaptation in organic structure, or for every new thought in the brain of man. Every Theist will admit that there is not a fresh act of creation when a new living individual is born. I go a little further, and say that I do not believe in a fresh act of creation for a new species. I believe that the Creator has not separately organised every structure, but has endowed vitalised matter with intelligence, under the guidance of which it organised itself; and I think there is no more Pantheism in this than in believing that the Creator does not separately cause every stone to fall and every fire to burn, but has endowed matter with energy, and has given energy the power of transposing itself."

I am not myself able to conceive this impersonal and unconscious intelligence coming in exactly when required to direct the forces of matter to special ends, and it is certainly quite incapable of demonstration. On the other hand, the theory that there are various grades of conscious and personal intelligences at work in nature, guiding the forces of matter and mind for their purposes as man guides them for his, is both easily conceivable and is not necessarily incapable of proof. If therefore there are in nature phenomena which, as Mr. Murphy believes, the laws of matter and of life will not suffice to explain, would it not be better to adopt the simpler and more conceivable solution, till further evidence can be obtained?

The only other portion of the work on which my space will allow me to touch, is the chapter on the Classification of the Sciences, in which a scheme is propounded of great simplicity and merit. Mr. Murphy does not appear to be acquainted with Mr. Herbert Spencer's essay on this subject, and it is somewhat remarkable that he has arrived at so very similar a result, although less ideal and less exhaustively worked out. In one point his plan seems an improvement on all preceding ones. He arranges the sciences in two series, which we may term primary and secondary. A primary science is one which treats of a definite group of *natural laws*, and these are capable of being arranged (as Comte proposed) in a regular series, each one being more or less dependent on those which precede it, while it is altogether independent of those which follow it. A secondary science, on the other hand, is one which treats of a group of *natural phenomena*, and makes use of the primary sciences to explain those phenomena; and these can also be arranged in a series of decreasing generality and independence of those which follow them, although the series is less complete and symmetrical than in the case of the primary sciences. The two series somewhat condensed are :—

Primary Series.	Secondary Series.
1. Logic.	1. Astronomy.
2. Mathematics.	2. Terrestial Magnetism.
3. Dynamics.	3. Meteorology.
4. Sound, Heat, Electricity, &c.	4. Geography.
5. Chemistry.	5. Geology.
6. Physiology.	6. Mineralogy.
7. Psychology.	7. Palæontology.
8. Sociology.	8. Descriptive Biology.

Taking the first in the list of secondary or compound sciences, Astronomy, we may define it as the application of the first five primary sciences to acquiring a knowledge of the heavenly bodies, and we can hardly say that any one of these sciences is more essential to it than any other. We are, perhaps, too apt to consider, as Comte did, that the application of the higher mathematics through the law of gravitation to the calculation of the planetary motions, is so much the essential feature of modern astronomy as to render every other part of it comparatively insignificant. It will be well, therefore, to consider for a moment what would be the position of the science at this day had the law of gravitation remained still undiscovered. Our vastly multiplied observations and delicate instruments would have enabled us to determine so many empirical laws of planetary motion and their secular variations, that the positions of all the planets and their satellites would have been calculable for a moderate period in advance, and with very considerable accuracy. All the great facts of size and distance in planetary and stellar astronomy, would be determined with great precision. All the knowledge derived from our modern telescopes, and from spectrum analysis, would be just as complete as it is now. Neptune, it is true, would not have been discovered except by chance; the nautical almanack would not be published four years in advance ; longitude would not be determined by lunar distances, and we should not have that sense of mental power which we derive from the knowledge of Newton's grand law;—but all the marvels of the nebulæ, of solar, lunar, and planetary structure, of the results of spectrum analysis, of the velocity of light, and of the vast dimensions of planetary and stellar spaces, would be as completely known to us as they now are, and would form a science of astronomy hardly inferior in dignity, grandeur, and intense interest, to that which we now possess.

Mr. Murphy guards us against supposing that the series of sciences he has sketched out includes all that is capable of being known by man. He professes to have kept himself in this work to what may be called positive science, but he believes equally in metaphysics and in theology, and proposes to treat of their relation to positive science in a separate work, which from the author's great originality and thoughtfulness will no doubt be well worthy of perusal.

ALFRED R. WALLACE

OUR BOOK SHELF

Nature contemplated Philosophically.—*Die Natur im Lichte philosophischer Anschauung.* By Maximilian Perth. (Leipzig and Heidelberg, 1869.) Large 8vo. pp. viii. and 805.

THE modern developments of the study of natural science have led to the separate and too exclusive consideration of branches of knowledge. This result necessarily follows from the defects inherent in our methods of investigation; but everyone will admit the importance and advantage of contemplating Nature as a whole, instead of attending to a fragment of her works. Hence she must be contemplated philosophically; for it is the business of philosophy alone to work out the greater problems which are common to, and underlie, the great problems of the sciences.

Such are the views which led Prof. Perth to write this book, a task for which he had fitted himself by many-sided study from boyhood, and the accomplishment of which has exacted the labour of several years. It is a purely philosophic work, belonging to a class of which there are few specimens, and cannot be easily read except by those who have some technical acquaintance with philosophic terms. The following are titles of a few of the topics treated in the volume:—"Matter, Organism, Spirit;" "The Relation of Nature to the Moral Idea;" "The Chemical Process;" "Species;" "The Chronological Perfection of Organic Nature;" "The Geographical Distribution of Plants;" "The Spiritual Life."

The author does not attach himself to any particular school of thought; but Kant, Hegel, and Spinosa have, perhaps, a predominance. His information is universal; but the erudition displayed is accompanied, as generally happens, by a want of point, precision, and climax. Here and there, a somewhat sad and sombre eloquence relieves and ornaments the picture. E. J. M.

An Introduction to the Science of Heat.—By Temple Augustus Orme. (London: Groombridge & Sons.)

IT is not many years since the appearance of the first thoroughly scientific treatise on heat in the English language, and now we hail the advent of a well-written introduction to more advanced works: a book intended for the beginner who is supposed to possess nothing but a fair knowledge of arithmetic and an average amount of intelligence. This book is full of excellent examples of the various laws of heat, in which the author makes use of the metrical system of measurements, and the centigrade scale of temperature; and the student who has worked through these questions cannot fail to have acquired a good practical knowledge of the subject of heat, as well as an appreciation of the advantage of the metrical system. Nor are theoretical views left out, and although the treatise only professes to be an introductory one, we have a good elementary account of the dynamical theory of heat, including the grand laws of the conservation and dissipation of energy. The author is undoubtedly right in accustoming the student at an early age to think of, and if possible apprehend, this great generalisation, for in truth it forms the appropriate supplement to and completion of the ordinary laws of motion, and should be studied along with these; otherwise the student may be led to conceive that when two equally massive inelastic balls strike one another with equal and opposite velocities, the result is *nil*, and to entertain many similar absurdities. And inasmuch as the laws of motion find their way into introductory treatises on natural philosophy, so should the laws of energy find a place in these. In the study of such laws, the student cannot too soon become accustomed to those technical terms which are necessary to give accurate expression to his conception; and we are glad the author has introduced the terms *kinetic* and *potential*, although we think that on one or two occasions he has used the word *force* where *energy* would have been preferable.

B. S.

Sicilian Fungi.—*Funghi Siciliani.* Per Guiseppe Inzenga. Centuria Prima. 4to. pp. 95, with 8 coloured plates, price 10*s*. (Palermo, 1869. London: Williams and Norgate.)

A WORK which will be very welcome to English fungologists, and especially to those who are interested in fungophagy. We have here descriptions of 100 of the more conspicuous Fungi of Sicily, with coloured plates of some of the more important or newly-described species, an account of their localities, and of the uses to which they are applied; and, what is of no small importance in a work on Fungi, a list of the synonyms belonging to each species. Sig. Inzenga has paid special attention to the economic properties of the Sicilian Fungi; among this first century he enumerates 30 species, which he can vouch for as being perfectly wholesome, more or less delicate in flavour, and easily distinguished from any noxious species, many of them being largely used as articles of food by the Sicilian peasantry, and sold in the markets of Palermo and Messina; while only eight are named as being absolutely poisonous, or so suspicious as to be prudently rejected. Our common mushroom, which is forbidden to be sold in the markets of Rome, is freely eaten in Sicily, though not so much esteemed as several other species.

A. W. B.

The Microscope and its Applications.—*Das Mikroskop und seine Anwendung.* Von Dr. L. Dippel. Zweiter Theil. Anwendung des Mikroskopes auf die Histiologie der Gewächse. 8vo. pp. 328, with 188 woodcuts, and 6 lithographic plates, price 12*s*. (Brunswick, 1869. London: Williams and Norgate).

THE first part of Dr. Dippel's treatise on the microscope was devoted to a description of its different forms, with practical directions for its use and for the preparation of specimens; in the present volume we have an account of its application to the observation of the minute parts of plants. It is divided into four sections. The first consists of investigations of cells as distinct organisms, including the cell-membrane, the cell-nucleus, the cell-fluid, protoplasm, and salts; the formation of cells; and their transformation into tubes and vessels. The second part relates to the more complicated tissues of the higher cryptogamia and of the phanerogamia. The third records the results of investigations on the elementary organs and tissues in polarised light. The fourth part is occupied by an account of the anatomical structure or comparative anatomy of the different compound organs, the stem, root, leaves, and organs of reproduction. With this volume the work closes for the present, but an additional one is promised at some future time on animal histiology. It contains a clear record of the present state of microscopical science as applied to the minute structures of the vegetable kingdom, free from those abstruse speculations which often fill so large a portion of continental works of this description. The illustrations, both wood-cuts and lithographs, are of the excellence to which we are accustomed in German scientific works, and to each section is appended a list of all the important works and papers already published on the subject. A. W. B.

The Physical Phenomena of Life.—*Les Phénomènes Physiques de la Vie.* Par J. Gavairet, &c. (Paris: Masson et Fils. London: Williams and Norgate.)

WE do not quite see why this little book should have been written. It is too technical to be useful as a popular volume; it is too diffuse, and yet too incomplete, to be a text-book; and it has neither the critical grasp nor the originality of an independent essay. There is a grand opening for some one to gather up all the recent advances in physiological physics, and weld them up together into a single book. When we took this volume in hand, we hoped to find something of the kind; but it really consists of little more than a straggling discourse on animal heat, and another on muscular contraction. M. F.

THE DEEP-SEA DREDGING EXPEDITION IN H.M.S. "PORCUPINE"

I.—NATURAL HISTORY

MY part of the expedition in H. M. S. *Porcupine* commenced on the 18th of May, and ended on the 13th of July last. It comprised the Atlantic coast of Ireland, from the Skelligs to Rockall (a distance of about 6½ degrees, or 400 miles), Loughs Swilly and Foyle on the north coast, and the North Channel on the way to Belfast. I took with me as assistant Mr. B. S. Dodd (who had accompanied me in former dredging expeditions); and as dredger Mr. W. Laughrin, of Polperro, an old coast-guardman, and an Associate of the Linnean Society. Both did their share of the work carefully and zealously.

The first dredging was on the 24th of May, about 40 miles off Valentia, in 110 fathoms; bottom sandy with a little mud. The fauna was mostly northern, and the following are the more remarkable species there procured: Mollusca—*Ostrea cochlear*, *Neæra rostrata*, *Verticordia abyssicola*, *Dentalium abyssorum*, *Aporrhaïs Serresianus*, *Buccinum Humphreysianum*, *Murex imbricatus*, *Pleurotoma carinata*, and *Cavolina trispinosa*; Echinodermata—*Echinus elegans*, *Cidaris papillata*, and *Spatangus Raschi*; Actinozoa—*Caryophyllia Smithii*, var. *borealis*. Of these, *Ostrea cochlear*, *Aporrhaïs Serresianus*, and *Murex imbricatus* are Mediterranean species; and *Trochus granulatus* also imparted somewhat of a southern character, although that species was afterwards found living in the Shetland district. *Ostrea cochlear* is a small Mediterranean species of oyster; and it is one of the shells which Milne-Edwards noticed as adhering to the telegraph-cable between Sardinia and Algiers from a depth of about 1,100 fathoms. Although considered peculiar to deep water, I found it attached to the columns of the temple of Jupiter Serapis at Pozzuoli, which are reputed not to have been submerged to any depth. The above-mentioned results of this dredging will give a fair idea of the fauna inhabiting the 100-fathom line on the west of Ireland.

After coaling at Galway we steamed south; and (the weather being very coarse and unpromising) we dredged in Dingle Bay, at a depth of from 30 to 40 fathoms; bottom rocky and muddy. As before, in comparatively shallow water, we had two dredges out, one at the bow, and the other at the stern; this was what I always did in my own yacht, when dredging in from 20 to 200 fathoms. In Dingle Bay the dredges several times caught in rocks or large stones, but were saved by the usual yarn-stops, and by the extraordinary strength of the two-inch Chatham rope which was used. On one occasion, when the dredge was fast, the steamer, which was nearly of 400 tons burden, was pulled round, and swung by the rope as firmly as if she were at anchor and moored by a chain cable. Here, again, the Mollusca were mostly northern. *Siphonodentalium Lofotense*, *Chiton Hanleyi*, *Tectura fulva*, *Odostomia clavula*, *Trophon truncatus*, and *Cylichna nitidula* fall within this category; and *Eulima subulata*, *Trophon muricatus*, *Pleurotoma attenuata*, and *Philine catena* may be reckoned southern species. But the most remarkable shell obtained in this dredging was *Montacuta Dawsoni*, which I had described and figured from specimens found by Mr. Robert Dawson in the Moray firth. I subsequently detected in the Royal Museum at Copenhagen specimens of the same species in the collection of Greenland shells, made by the late Dr. H. P. C. Möller. The species was briefly described or noticed by him in the addenda to his 'Index Molluscorum Groenlandiæ,' as "*Testa bivalvis*"; but he did not give it any other name. The size of the Greenland specimens is considerably greater than that of British specimens, thus adding another to the numerous cases of a similar kind which I have from time to time adduced in illustration of the fact, that with regard to those species of Mollusca which are common to northern and southern latitudes, and which inhabit the same bathymetrical zone, northern are usually larger than southern specimens. It may, perhaps, be a not unfair inference, that the origin of such species is northern, and that they dwindle or become depauperated, in proportion to the distance to which they have migrated, or been transported from their ancestral homes.

The following week was occupied in sounding and dredging off Valentia, and on the way to Galway, at depths varying from 85 to 808 fathoms. The fauna throughout was northern. Several interesting acquisitions were made in all departments of the Invertebrata. Among the Mollusca I may mention—*Nucula pumila* (Norway), *Leda frigida* (Spitzbergen and Finmark), *Verticordia abyssicola* (Finmark), *Siphonodentalium quinquangulare* (Norway and Mediterranean), and an undescribed species of *Fusus* allied to *F. Sabini*; Echinodermata—*Brisinga endecacnemos*; Actinozoa—*Ulocyathus* (or *Phyllodesmia*) *arcticus*. That fine sponge *Phakellia ventilabrum* was also met with so far south, in 90 fathoms. The 808 fathoms' dredging was then a novelty, being the greatest depth ever explored in that way. The length of rope paid out was 1,100 fathoms, and the time occupied in hauling in was 55 minutes. The same proportional time was observed in other dredgings during my part of the expedition, viz. 5 minutes for every 100 fathoms of rope. The dredge contained about 2 cwt. of soft and sticky mud, in appearance resembling "China clay." The animals brought up on this occasion were quite lively; and I examined more than one specimen of a small Gastropod (described and figured by me as *Lacuna tenella*), which had very conspicuous eyes: there was also an active little stalk-eyed crab.

The next cruise was for ten days, and comprised the examination of the sea-bed between Galway and the Porcupine Bank, as well as beyond the Bank, at depths varying from 85 to 1,230 fathoms. All the Mollusca were northern, except *Aporrhaïs Serresianus*; and even that I am now inclined to consider identical with *A. Macandreæ*, which inhabits the coasts of Norway and Shetland; the latter appears to be a dwarf variety or form. The more remarkable species were, *Limopsis aurita* (a well-known tertiary fossil), *Arca glacialis*, *Verticordia abyssicola*, *Dentalium abyssorum*, *Trochus cinereus*, *Fusus despectus*, *F. Islandicus*, *F. fenestratus*, and *Columbella haliæeti*, (a tertiary fossil), among the Mollusca; *Cidaris papillata* and *Echinus Norvegicus* among the Echinoderms, and the beautiful branching coral, *Lophohelia prolifera*. In the deepest dredging made in this cruise (1,230 fathoms), occurred several new species and two new genera of the *Arca* family, *Trochus minutissimus* of Mighels (a North American species) having two conspicuous eyes, a species of *Ampelisca* (Crustacea) with the usual number of four eyes, comparatively gigantic Foraminifera, and other animals belonging to undescribed species and genera. An enormous fish (*Mola nasus*), which is not uncommon on the coasts of upper Norway, was slowly swimming or floating on the surface of the sea; but we did not succeed in capturing it for want of a harpoon.

We then put into Killybegs, county Donegal, and coaled there for our Rockall cruise. In anticipation of this cruise taking a clear fortnight, coals were stacked on the deck, in addition to the usual stowage in the bunkers, so as to provide a sufficient supply. Some delay was caused by the non-arrival of a proper galvanometer to work Siemens' electro-thermometrical apparatus, which we were anxious again to try. We left Donegal Bay on the 27th of June, and returned to the mainland on the 9th of July, after experiencing severe weather. The vessel sustained some injury from the heavy cross seas which struck her on her homeward passage. During this cruise we dredged seven days at depths exceeding 1,200 fathoms, and on four other days at less depths; the greatest depth was 1,476 fathoms. In this last-mentioned dredging we got several living Mollusca and other animals, a stalk-eyed crustacean with two prominent and unusually large eyes, and an Echinoderm of the Holothuria family, of a blue colour. The bottom, at the greatest depths, consisted of a fine clayey mud, which varied in colour (in some dredgings being brownish, in others yellow, creamcolour, or drab, and occasionally greyish), and invariably having a greater or less admixture of pebbles, gravel, and sand. The upper layer formed a flocculent mass, which appeared to be animal matter in a state of partial decomposition. This was in all probability derived from the countless multitude of *Salpæ*, oceanic *Hydrozoa*, Pteropods, and other gelatinous animals, which literally covered the surface of the sea, and filled our towing net directly it was dipped overboard. Their remains must fall to the bottom after death. Such organisms doubtless afford a vast store of nutriment to the inhabitants of the deep. It must be borne in mind that it is extremely difficult to dredge in very deep water. The dredge must be unusually heavy to counterbalance the tendency of the necessary bulk of rope to buoy it up under the descending pressure; and when it reaches the bottom, it sinks by its own weight, like an anchor, into the mud. This would give only the same result as the cuplead or any sounding machine, but on a larger scale; and it would tell us very little about the fauna. Further, if by the drift-way of the vessel, or by a few turns of the engine now and then, we are enabled to scrape the surface of the sea-bed, the dredge gets choked up with the flocculent mass above described. The fertile ingenuity of our experienced and excellent commander devised a method which was a great improvement in deep-sea dredging, and which enabled us to obtain at least a sample of the substratum. This was to attach two iron weights, each of 100 lbs., to the rope, at a distance of 300 or 400 fathoms from the dredge (when the depth exceeded 1,200 fathoms), so as to dredge from the weights instead of from the ship, the angle thus made causing the blade of the dredge to lie in its proper position: in fact it reduced the depth by the distance of these weights from the vessel to the easy and manageable limit of 300 or 400 fathoms. Another method was to fasten the bag to the dredge in such a way that, when it was hauled in it could be unlaced, emptied, and afterwards washed quite clean. I was thus assured that the specimens really came from the place where each dredging was made, and the risk of intermixture with previous dredgings was avoided. My sieves were also framed with a similar object, every sieve having a beading round the inside rim, to prevent specimens remaining inside the edges when the sieves were washed after every dredging. Two other kinds of sieve I also found useful. One was spherical, with its lid fastened inside by bolts; its frame consisted of a strong network of copper ribs, which was lined with very fine gauze-wire of the same metal; and it had a ring through which a rope would pass. Its use was to sift and wash away in the sea the impalpable mud got in such quantities at great depths, so as to leave only for examination all organisms exceeding in size $\frac{1}{32}$ of an inch, this being the greatest diameter of the wire-mesh in the lining. Some of the residuum or strained mud was likewise preserved after sifting the material in the usual way. This apparatus, which we called the "globe-sieve," saved a great deal of the time and useless labour required for washing that sort of dredged material through the ordinary sieves in a tub of sea-water, which would immediately become so turbid that, unless the tub were continually emptied and refilled, it was extremely difficult (if not impossible) to detect any specimens. Another kind of sieve had a similar framework; but the body was semi-globose, with a funnel-shaped neck. It was fastened to a long pole, and served for catching Pteropods, *Salpæ*, and other animals on the surface of the sea. This went among us by the name of the "vase-sieve." We tried on this and other occasions a contrivance of Mr. Easton, the celebrated engineer, consisting of gutta percha valves, which closed inwards in a wedge-like form, and were fitted to the mouth of the dredge. The object was to retain the contents of the dredge while it was being hauled in, as I had found by frequent and disappointing experience that a large portion of the contents generally escaped through the mouth during this part of the operation. The contrivance, although admirable in a theoretical point of view, was found impracticable; perhaps it may yet succeed after more trials, and with some alterations. In their present form the valves close the mouth of the dredge, so that it has no contents to be retained. The deep-sea dredgings in this cruise yielded no end of novelties and interesting results in every department of the Invertebrata. They were enough to take one's breath away. Among the Mollusca were valves of an imperforate Brachiopod with a septum in the lower valve, which I propose to name *Cryptopora gnomon*. Some shells were of a tolerable size; and the fry of *Isocardia cor* (*Kelliella abyssicola* of Sars) were not uncommon. Many Crustacea (Amphipoda) were scarlet, and others bright red with feathered processes of a golden colour at the tail. A magnificent Annelid was pinkish, with purplish-brown spots on the line of segmentation. A *Holothuria*, from 1,443 fathoms, was 5 inches long and $2\frac{1}{4}$ in circumference. None of the animals, especially the Mollusca, were living when they were brought on board and examined; this was perhaps owing to the great change of temperature (sometimes as much as 20°) between that of the sea-bed and that of the atmosphere.

But to return from the bottom to the surface. At a distance of from 130 to 140 miles from the nearest part of the Irish coast I observed quantities of floating seaweed (mostly *Fucus serratus*) and feathers of sea-fowl, covered with *Lepas fascicularis*, and occasionally *L. sulcata*; and on the seaweed were also two kinds of sessile-eyed Crustacea. The wind having been previously easterly, it is difficult to say what share the wind or tide had in the drift; but it did not appear to have been caused by any circulation from the equator. The fauna nowhere showed the least trace of that wonderful and apparently restricted current known as the Gulf Stream. The beautiful Pteropod, *Clio pyramidata*, flitted about in considerable numbers; a delicate cuttle-fish (*Leachia ellipsoptera*), which is supposed to prey on *Salpæ*, was caught in the vase-sieve, as well as several specimens of a small and very slender pipe-fish or *Syngnathus*. One peculiar feature of this cruise was Rockall, an isolated and conical excrescence of the Atlantic, 70 feet high, and situate at least 200 miles from the nearest land. We lay to within a quarter of a mile of it on the evening of Saturday the 3rd of July, when fishing parties were formed, and continued their sport till midnight. The supply of fresh fish thus procured was very acceptable. The rock was inhabited by a multitude of sea-fowl; and a huge gannet perched on the highest pinnacle, looking like a sentinel, or the president of the feathered republic. On our return to Ireland, we dredged in Lough Swilly, Lough Foyle, and the North Channel, on the way to Belfast, where we arrived on the 13th of July. Here I parted with my shipmates and excellent companions, and enjoyed the hospitality and sympathy of my friends Professor Wyville Thomson and Mr. Waller.

After my part of the expedition was concluded, I went for the second time to Scandinavia, and compared notes with Dr. Koren at Bergen, Prof. Sars (now, alas! no more) at Christiania, Prof. Lovén at Stockholm, Prof. Lilljeborg at Upsala, Prof. Torell at Lund, Prof. Steenstrup and Dr. Mörch at Copenhagen, and with Prof. Möbius and Dr. Meyer at Kiel. All these zoologists had investigated the Mollusca in the Arctic and North-European seas; and the result of my interviews with them, and of examining the extensive collections in the public museums at the above places, was extremely useful in connection with the subject of the present report.

Prof. Wyville Thomson succeeded me on the 19th of July, and made a short but very successful cruise to the northern part of the Bay of Biscay, where he dredged at the extraordinary depth of 2,435 fathoms, or 14,610 feet. Some particulars of this dredging I have already given. Dr. Carpenter replaced Prof. Wyville Thomson on the 12th of August, and explored the sea-bed lying between the north of Scotland and the Faröe Isles. The depths there dredged did not exceed 650 fathoms; but the results are most interesting and important in a biological as well as physical point of view. Prof. Wyville Thomson accompanied Dr. Carpenter in the last part of the expedition. It terminated on the 7th of September.

J. GWYN JEFFREYS

(*To be continued.*)

UTILISATION OF SEWAGE

WE have been requested by the Secretary of the Committee* of the British Association on the Treatment and Utilisation of Sewage, to print the following letter, which has been sent to the Municipal Authorities throughout the country:—

22, Whitehall Place, London, S.W.
November 18th, 1869.

SIR,—I have the honour to inform you that, last year, at the meeting of the British Association at Norwich, a Committee was appointed to report on the Treatment and Utilisation of Sewage. In the first instance, a grant of £10 was placed at the disposal of the Committee, with which to defray the cost of printing and postage incidental to the collection of preliminary statistical information. Through the kindness of Her Majesty's Government, the Committee was enabled to obtain Reports respecting the methods of dealing with town refuse practised in most civilised countries, and that information has now been collected in a more complete form than hitherto existed in any country.

This preliminary work being completed, the Committee was re-appointed at the meeting of the British Association this year at Exeter, and the inquiry was considered to present such important features of social and scientific interest, that the sum of £50 was voted towards enabling the Committee to enter more fully and practically upon the investigation of this subject. The British Association being a purely scientific body, has not at its disposal funds which would be adequate or applicable for the full prosecution of this very large and pressingly-important inquiry. The Committee nevertheless desires to take advantage of the opportunity created by the British Association, to investigate the entire subject in all its bearings—whether chemical, physiological, or engineering, sanitary, municipal, or agricultural—and in a manner worthy of the body they represent.

It is unnecessary to point out the enormous importance, especially at the present time, of a full and complete investigation of this question by the light of the knowledge and experience now gained in the several departments above alluded to; but properly to carry out such an inquiry with a practical end, numerous observations, gaugings, and experiments, aided by simultaneous analyses, are essential; and these cannot be accomplished, especially the analyses, without the continued aid of efficient and therefore highly-paid assistants. Moreover, from time to time it may be necessary for the Committee to purchase extensive apparatus, and to subject various inventions and processes to a thorough and complete test; for it is the desire of the Committee, not only to ascertain, as far as possible, the causes of the sanitary inefficiency of existing works, but also to inquire into every suggestion which affords promise of practical utility, in order that this investigation may be searching, the report practical, and any recommendations that may be made authoritative.

It is the wish of the several members of the Committee to devote, to the utmost of their ability, their personal attention to the work thus sketched out; but the expenses absolutely necessary to enable them to conduct so extended an inquiry cannot but be very heavy, and, unless they are able to secure an adequate fund, they must abandon the attempt to investigate the subject in this broad and comprehensive manner. However, since there is no subject of greater practical and social importance to the public generally, and thus to the various municipal authorities and other governing bodies throughout the country, it is believed that many will share the opinion expressed at the recent meeting of the British Association at Exeter, that the existence of this Committee affords a specially favourable opportunity for such a wide inquiry, and for that reason its members confidently appeal to those authorities who are officially interested in the subject to supply the funds necessary for the investigation.

I am therefore desired to request that you will kindly submit this letter to the body you represent, and I venture to hope you will give the Committee the benefit of your good offices in procuring a subscription proportionate to the population of your town or district.

It is suggested that the subscriptions of towns of different populations might be graduated somewhat in the following proportions:—

Where the population does not exceed 10,000 .	£5	5	0
Between 10,000 and 25,000	10	10	0
Between 25,000 and 50,000	21	0	0
Between 50,000 and 75,000	30	0	0
Between 75,000 and 100,000	50	0	0
Above 100,000	100	0	0

I beg to call your attention to the accompanying list of members of the Committee, and to inform you that all public bodies subscribing not less than 5*l*. 5*s*. 0*d*. will have the benefit of the information from time to time, as the results of the inquiry partake of a conclusive character, and will receive a copy of the report of the Committee when published.

I have the honour to be, &c.,

GEORGE F. BARNES,
Honorary Secretary pro tem.

* The following are the names of the Committee:—Richard B. Grantham, Esq., M. Inst. C.E., F.G.S., Chairman; J. Bailey Denton, Esq., M. Inst. C.E., F.G.S.; J. Thornhill Harrison, Esq., M. Inst. C.E.; Benjamin H. Paul, Esq., Ph.D., F.C.S.; Profess Wanklyn, F.C.S.; William Hope, Esq. V.C.; Professor Williamson, Ph.D., F.R.S; Professor Marshall, F.R.S., F.R.C.S.; Professor Corfield, M.A., M.D.; M.C. Cooke, Esq.; and Sir John Lubbock, Bart., F.R.S., Treasurer. Subscriptions should be paid to the credit of Sir John Lubbock, on behalf of the Committee, at Messrs. Robarts, Lubbock, and Co.'s, 15, Lombard Street, London, E.C.

TELEGRAPHIC COMMUNICATION WITH FRANCE

LAST Tuesday, November 30, the S.S. *William Cory* left Greenhithe with a heavy submarine cable, to be laid between Salcombe in Great Britain and Cape Finisterre in France. This cable, 105 miles long, has just been made by the Telegraph Construction and Maintenance Company, at their works at North Woolwich, and its special object is to establish direct telegraphic communication between London and Brest, so as to expedite the transmission of messages between Great Britain and America by the French Atlantic Cable.

The new cable is very strong and heavy. The shore ends weigh 20 tons to the mile, and the deep-sea portion weighs very nearly 10 tons to the mile. It contains one conductor only, consisting of a strand composed of seven copper wires, and weighing, when twisted together, 107 pounds to the mile. The insulating medium is gutta-percha, and weighs 166 pounds to the mile. The contractors undertook that the electrical resistance of the conducting strand should not exceed 12·25 ohms per mile, and that the insulation resistance should not be less than 200 megohms (million ohms), at the standard temperature of 24 degrees centigrade. So well have the contractors done their work, that the quality of the cable is better than agreed upon, the conductivity resistance being only 11·8 ohms, and the insulation resistance nearly 400 instead of only 200 megohms per knot. The inductive capacity of this cable is as nearly as possible ·333 Farad. per mile.

The *William Cory*, since 1858, has laid many submarine cables; she carried and laid portions of the French Atlantic cables last summer, and is now employed solely in this new branch of industry. Captain Donaldson has been in charge of her throughout the whole of this period, and he took her out again last Tuesday, on which day she left Greenhithe for Salcombe. For the above details relating to the conductivity, insulation, and capacity of the cable, we are indebted to Mr. C. F. Varley, C.E., engineer to the French Atlantic Telegraph Company, who accompanies the expedition. The apparatus used in testing the cable was that described by his brother before Section A of the British Association at Exeter. By the time these lines are in print the cable may possibly have been laid, but much depends upon the weather. When the weather is fine, it usually takes half a day to lay each of the shore ends of a cable, and the deep-sea portion is ordinarily paid out at the rate of five knots per hour. The time occupied in paying out the deep-sea portion of the cable now under notice should be about twenty hours in all.

DR. PENNY, F.R.S.E.

IN our first number we had to record the death of Thomas Graham, one of the greatest chemists of the century, and formerly an occupant of the chair of chemistry in Anderson's Institution, Glasgow. We have now to announce the death of Frederick Penny, who, with the exception of the short interval between 1837 and 1839, when Gregory was its occupant, has filled it with increasing reputation and success ever since Graham vacated it to go to London, thirty-two years ago. Born in London in 1817, he was devoted to chemistry from his earliest years; and studied in the Apothecaries' Hall under Henry Hennell, F.R.S. It was while here that he was led to inquire into the combining weights of certain of the elements, by finding that the amount of potassic chloride obtained by acting upon pure potassic nitrate with excess of hydrochloric acid did not correspond with the quantity which theory showed should be obtained. Having made sure that the difference was not due to errors in his experiments, he ascribed it to inaccurate equivalents assigned to the elements. As the result of his investigations, he showed that the equivalents current at the time for chlorine, nitrogen, potassium, sodium, and silver were not in strict accordance with experiment, and that the "hypothesis of all equivalents being simple multiples of hydrogen is no longer tenable." [Phil. Trans. 1839. Part i. p. 32.] There can be no question as to the clearness of this paper and the value of the results obtained, and our interest in them is in no way diminished when we find that the equivalents determined by Penny agree in a very remarkable manner with the mean numbers published by Stas, and that this agreement has been pointed out by that chemist. [Fresenius, Zeits. für Annal. Chem. 1868, pp. 164, 168. Compare Penny's Table, Phil. Trans. 1839, i. p. 32, with Stas's Fres. Zeits. 1868, p. 170.]

The paper was published in January 1839, and the same year he was appointed to the vacant lectureship in Anderson's Institution. Dr. Penny himself has had but recently to give an account of his struggles and successes in Glasgow, since settling in it thirty years ago. Recommended by Graham, he went down to a sphere of life and action, more strange at that time to a native of London than it has since become; but he devoted himself strenuously to his work, and at the time of his death had won in Glasgow and the West of Scotland a wide reputation as one of the clearest and most emphatic lecturers, and one of the most painstaking teachers.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents.*]

Lectures to Working Men

I HEARTILY concur in Mr. Stuart's opinion, that the working men of England—speaking at least for the North—are fully aware of the value of Scientific Instruction in its strict sense. The subject has a special interest for me; as in the winter of 1866-7, I started in this city a series of Science Lectures for the People, which, with the kind help of Prof. Jevons, Dr. Alcock, and Dr. Morgan, were undertaken for the purpose of ascertaining whether the working men of Manchester really appreciate the value of science instruction when given in a plain, but scientific form, illustrated with diagrams and experiments made on a scale such as could be seen by a large audience. The experiment proved highly successful. Upwards of 4,000 people attended the thirteen Lectures which we gave, and the class of persons present was exactly that for whom the lectures were designed; whilst the marked attention and interest invariably exhibited by the audiences showed how keenly they appreciated the information they received, and the insight into true scientific methods which they obtained.

The lecturer's words were taken down by Mr. Pitman, and the lectures were each week printed and published by Mr. John Heywood, of Manchester, and largely sold at one penny each at the door of the lecture-room and elsewhere. I printed syllabuses of the chief points of my four lectures, and one was given to each person entering the room. When I say that the subject of my first lecture was the explanation of the principles of the Indestructibility of Matter and of Energy, with a description of Joule's Determination of the Mechanical Equivalent of Heat, I think you will see that mere amusement was not the aim; the same remark applies to all the other lectures, and yet I never met with a more attentive and appreciative audience than these Manchester working men.

Professor Jevons gave us a most excellent lecture on "Coal, its Value and Importance in the Arts and Sciences;" Dr. Alcock gave four capital lectures on Elementary Zoology, and Dr. Morgan a course of four on Elementary Physiology, a subject in which the greatest interest was evinced.

We charged one penny per head for admission, and the penny fees did not nearly cover the necessary outlay, which was defrayed by some friends. Not only was the expense a difficulty, but the work of carrying on such a system was more than could be regularly and gratuitously borne by men whose strength was already sufficiently taxed by their own professional duties. Otherwise the lectures would have certainly been continued, for we were all fully persuaded that no mode of commencing science teaching for the people is so effective as this, or so likely to ripen into a permanent demand for scientific education amongst the working classes. As a proof of this, I may add that for two winters a class was formed in connection with these lectures for regular instruction in Chemistry under an able Government science master—one of my pupils, who had gradually raised himself from the position of a common factory hand. For this instruction sixty working men each paid 2*s.* 6*d.* for thirteen lessons. I often looked in upon them, and a more hard-working and enthusiastic class I never had the good fortune to see.

If such science lectures, *followed up by regular science instruction*, could be permanently established every winter, under careful and thoroughly competent teachers, in each of our great centres of industry, what invaluable results might not be accomplished! This is truly a subject worthy of the attention of some of our wealthy philanthropists; if, indeed, Government does not take the matter up. How much better would it be to devote money to the establishment of such a series of science classes, than, as is too often the custom, to employ it for building an almshouse! H. E. ROSCOE

Owens College, Manchester, Nov. 23, 1869.

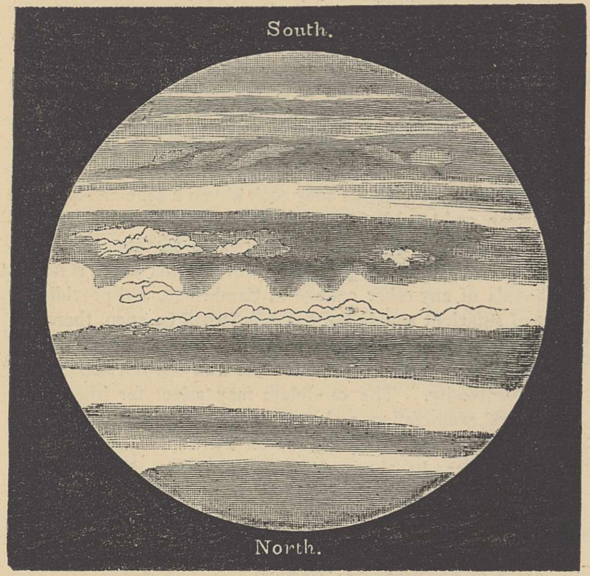
Changes in Jupiter

DURING the months of October and November the planet Jupiter has presented a spectacle of singular and almost unexampled beauty. The belts on the planet are more than usually numerous, and they display a greater variety of colours than I have ever yet seen ascribed to them. The equatorial belt, which has been for years the brightest part of the planet, is now not nearly so bright as the light belts to the north and south; usually it has been free from markings, now it is often covered with markings, which resemble piled-up cumulus clouds: it has generally been colourless, shining with a silver-grey, or pearly lustre—now it is of a rich deep yellow, greatly resembling the colour of electrotyped gold.

The woodcut represents Jupiter as it was seen on the night of the 9th of March in a reflecting telescope with a silvered glass mirror of 12½ inches diameter. The upper part of the planet is the S. pole. On this portion of the disc there are three dark belts, while on the N. there are only two.

The poles of the planet are ashy blue, and the darker belts nearest to them present a darker tint of the same colour. The bright belts next these are pearly-white, and shine more brilliantly than any other portion of the planet. The dark belts next to the central bright belts are coppery red. As already mentioned, the central belt, which has been for years a pearly-white, is now a rich golden yellow.

Three or four dark markings on the lower part of the southern dark belt nearest the equator will be seen to incline to the left. If our earth were removed to Jupiter's distance, its disc would appear no larger than these dark masses, so enormous is their extent. The rotation of the planet is carrying them towards the right: we may assume that the bright vapour between them is left behind by the planet, which is here travelling at the rate of nearly 3,000 miles an hour.



JUPITER, OCTOBER 9, 1869, 11 P.M. G.M.T.

Spectrum analysis has taught us to suspect that any change in the colour of light proceeding from an object, indicates a change in the object itself. If Jupiter, the largest planet in the solar system, has still retained so much heat as to shine partially by his own light, the present considerable change in colour may enable spectroscopists to obtain some information on this interesting subject. JOHN BROWNING

Cuckows' Eggs

WILL you kindly grant me space for a few remarks in reference to the very interesting paper on the eggs of the cuckoo, by Professor Newton, in your last issue? I have no intention to criticise so able and accomplished a naturalist: my object is simply to elicit information on some points of difficulty; and as Mr. Newton promises a second paper, I should be very glad if he would throw any light on them.

And first as to the colour and markings of cuckoos' eggs. *Are* they so variable as some assert? I must take leave to doubt this. I never met with such extreme varieties, nor can I hear amongst my oölogical friends of any who have done so. One of the most eminent and experienced of living oölogists has stated: "As far as my own experience goes, it teaches me that there are not many birds the eggs of which differ less than those of the cuckoo." On the other hand, Mr. Newton says: "It has long been notorious to oölogists, that the eggs of the cuckow are subject to very great variety of colour." This, then, is a point on which I think further evidence is wanting. Dr. Baldamus mentions sixteen varieties of eggs which he alleges are cuckoos'. Were these seen to be deposited by the bird, or how were they identified as those of the cuckoo? Dr. Baldamus does not appear to have taken them all himself. Is there not room for error here?

Mr. Newton saw these eggs, appears satisfied that they *were* those of the cuckoo, and agrees with Dr. Baldamus in his conclusions, that the object of the practice was that the cuckoo's egg should be "less easily recognised by the foster-parents as a substituted one." How then is this process effected? Mr. Newton's explanation is that each hen cuckoo deposits her eggs only in the nests of one species, that her eggs resemble those of the species whose nest she uses, and that this process is hereditary.

Here it is that I am most in doubt. How is this hereditary habit of laying a particular style of egg maintained? It is quite possible that habits may become hereditary; but is there any instance of a wild species of animal inhabiting one locality and freely intermingling, where some members possess peculiarities of habit which are hereditary which their fellows do not? Mr. Newton will excuse me for saying, that the Golden Eagle he mentions scarcely fulfils these conditions. Is it likely there are sixteen varieties of our common cuckoo which are only to be distinguished from each other by laying a differently marked and coloured egg? Few birds are more vagrant or possess less conjugal or parental affection than the cuckoo. How then are these sixteen varieties to be kept from crossing? And if, as I believe, interbreeding does take place, how can the alleged distinctive style of eggs be preserved? Here I am at fault, and I shall be very glad if Mr. Newton will help me out of my difficulty.

In the face of the alleged object that the egg shall be less easily recognised as a substituted one, how are we to account for the fact that, in this country at least, a larger number of cuckoos' eggs are deposited in the nests of the hedge sparrow than in those of any other species, the speckled brown egg contrasting *strongly* with the greenish blue ones?

W. J. STERLAND

The Corona

IN connexion with Mr. Lockyer's paper "On the Recent Total Eclipse of the Sun," the following observations may be useful.

I observed the total eclipse of July 1860, in company with my friends Professor Chevallier and Mr. B. E. Hammond, at the village of Pancorbo, in Spain. We were on the summit of a mountain of considerable height, about 5,000 feet above the sea, and were therefore under somewhat peculiar atmospheric conditions. I observed specially four things:—

(1) Venus; which was then extremely near the sun, the thickness of the crescent being only 1 or 2 seconds, and therefore very favourably placed for observing whether it has an atmosphere.

(2) The extent of the corona, and its form. This I am sure was very irregular; very nearly, if not quite, permanent during the three minutes of totality; was nowhere less than 25′ in breadth; in one part, the top in an inverting telescope, 40′ in breadth; and in another, the right, was more than 60′ in breadth, running out in a long wavy line like floss silk. I have before me the drawing I made at the time, during the totality.

(3) The amount of light given by the corona. This was estimated by a photometer, consisting of a wedge of dark glass, with a moveable slit, contrived by Mr. Chevallier, and now, I believe, in the possession of the Astronomical Society, with the place marked through which I saw the corona. It was as bright as a small cloud, distant 8° from the sun, 10 minutes after reappearance; or as the moon when 2½ days old, as the sun was setting.

(4) The colours shown by a variety of coloured ribbons during totality. Of these, the only observation that bears on Mr. Lockyer's paper, was that on the extent of the corona. I estimated it twice; once as reaching, to the right, 2¾ diameters of the sun, and once, later on, at nearly 2½ diameters. I had no micrometer, but could not possibly have been wrong by so much as 10′. I wrote down at the time, that it underwent no perceptible change during the eclipse. It remained visible for six seconds after the reappearance of the sun.

I had, and have, little doubt that the corona is in the solar, and not terrestrial atmosphere.

Rugby School, Nov. 11 JAMES M. WILSON

Lightning in a Clear Sky

WE constantly find allusions in ancient classical authors, to lightning and thunder occurring in a clear sky. The former is often explained as referring to the phenomenon commonly known as "summer lightning," or the reflection in the sky of lightning from clouds below the horizon, which becomes visible at night. I have also seen it stated that in the calm and clear atmosphere of Italy, thunder might be audible under similar conditions. These explanations, however, do not meet the case as stated by good observers amongst the ancients themselves. They do not explain, for instance, what is stated by Cicero amongst the portents which preceded the conspiracy of Catiline—"that a Roman citizen was killed by lightning on a cloudless day." Pliny also mentions this case, adding that it happened at Pompeii. If such a phenomenon as lightning, falling from a cloudless sky, is disbelieved by men of science, may not the circumstance stated above be explained by supposing the man to have been killed by the fall of an aërolite? Humboldt, in his *Kosmos*, mentions two such instances.

We also read in Cicero that the earthenware statue of the god (Summanus), which stood on the top of the Capitol of Rome, was shivered by lightning, and its head sent into the Tiber. Is not the distance very great? I have myself seen fragments of an elm-tree struck by lightning, in Eton Playing-fields, about ten years ago, driven to a distance of twenty-five yards. The fragments were several feet long, and some of them must have weighed ten or twelve pounds. I shall be thankful for any information on these matters. C. W. D.

NOTES

We give elsewhere an account of the Anniversary Meeting of the Royal Society last Tuesday; one of the announcements made, however, we prefer to detail here. Dr. John Davy, brother of Sir Humphry Davy, has bequeathed to the Royal Society, in fulfilment of an expressed wish of his illustrious brother, a service of plate, presented to Sir Humphry Davy for the invention of the Safety Lamp, to be employed in founding a medal to be given annually for the most important discovery in chemistry made in Europe or Anglo-America. The directions given in the will, respecting the manner in which the plate should be disposed of, have been fulfilled, and the proceeds invested in India securities, yielding a little more than 30*l*. a year. The Council will determine the form of the medal, and specify the conditions under which it will be awarded.

The Royal Institution Friday Evening Meetings are arranged to commence on the 21st of January. The evening discourses before Easter will probably be given by Prof. Tyndall, Prof. Odling, Prof. Ruskin, Dr. Carpenter, Mr. Clifford, Prof. Sylvester, Dr. Rolleston, Prof. Roscoe, Prof. Huxley, Prof. Williamson, and Dr. Blackie. The Christmas lectures (adapted to a juvenile auditory) will be by Prof. Tyndall, who has chosen Light for his subject: the first will be delivered on the 28th inst. at 3 o'clock. Arrangements have been made for the following courses before Easter:—On the Architecture of the Human Body, by Prof. Humphry, F.R.S.; on the Vegetable Products of Chemistry, by Prof. Odling, F.R.S.; on Meteorology, by Mr. Robert Scott; on Plant Life as contrasted with that of Animals, by Dr. Masters, F.L.S.; Deductions from the Comparative Anatomy of the Nervous System, by Prof. Rolleston, F.R.S.; an Introduction to the Science of Religion, by Prof. Max Müller; on the Sun, by J. Norman Lockyer, F.R.S. After Easter, the following courses will be delivered:—On the Principles of Moral and Political Philosophy, by Prof. Blackie; on Physics, by Prof. Tyndall, F.R.S.; on Astronomy, by Prof. Robert Grant, F.R.S.; on History, by Prof. Seeley.

It is now generally understood that the Earl of Dunraven will not be a candidate for the presidentship of the Royal Irish Academy, and that the Rev. Professor Jellett, B.D., will be elected. Should this be so, we may look for a great revival in the scientific forces of the Academy.

An important meeting has been held this week at Cambridge, for the purpose of considering the question of the abolition of university tests. The Master of Trinity quoted a remark made thirty-five years ago by the present Bishop of St. David's, to the effect that science, as well as literature, morality, and religion, would gain by such a measure; and from what we gather, the reading of this extract gave a tone to the meeting. Here are the resolutions passed:—Proposed by the Master of Trinity, seconded by the Venerable Professor Sedgwick: "That in the opinion of this meeting the time has come for settling the question of university tests; that the mode in which the question is dealt with in the permissive Bill introduced by Sir. J. Coleridge is open to grave objections, and that any measure designed to effect such a settlement should include an enactment that no declaration of religious belief or profession should be required of any person upon obtaining a fellowship, or as a condition of its tenure." Proposed by the Master of Trinity, seconded by Prof. Maurice: "That a representation be drawn up and presented by a deputation to the Prime Minister embodying the resolution just passed; that a committee be appointed to draw up such a representation, consisting of the Master of St. John's, the Master of Trinity, the Master of Christ's, Professor Sedgwick, Professor Maurice, the University Librarian, Mr. Ferrers, Mr. Porter, and Mr. Phear; and that the representation, when drawn up, be circulated for signature among all masters, resident fellows, or resident ex-fellows, of colleges, or officers of the University or of any college."

Christ's College, Cambridge, makes a most liberal offer to students of natural science, viz. scholarships and exhibitions, in number from one to four, and in value from 30*l*. to 70*l*., according to the number and merits of the candidates; that is to say, four well-informed students may each obtain a scholarship worth 70*l*. a year, and tenable for some years. The examinations will be on April 5th, 1870, and will be open to any one, whether a member of Christ's College or not, provided his name is not on the boards of any other college in Cambridge, and provided he is not of sufficient standing for B.A. It will be open, therefore, to all undergraduates of Oxford, and to non-collegiate students of Cambridge, as well as to all students who are not members of either University. The candidate may select for himself the subjects of examination, and must send his name, &c., to the Master of the College before March 29th. Further necessary information may be obtained from the Rev. W. Gunson, Tutor of the College.

Professor Pringstein has been elected a correspondent of the Academy of Sciences of Paris, to fill the vacancy caused by the death of Professor von Martius.

We have received the following from our Dublin correspondent:—The Council of the Royal Dublin Society have appointed Mr. H. W. Dunlop, B.A. Dub., C.E., as temporary assistant librarian. The Science and Art Department, on condition that the Library of the Royal Dublin Society should be open to readers from 10 o'clock A.M. to 10 o'clock P.M. each day, Sundays and Holy Days excepted, assented to provide for the extra services of the staff of porters and for a temporary assistant librarian. Perhaps there is no other public library in Great Britain and Ireland that is so completely at the service of the public as this library; and there is none that for its size possesses a larger selection of modern foreign works on literature and science. Its great defect is a useful working catalogue, and it is to be hoped that the Science and Art Department, seeing how successfully the Committee has managed the affairs of this library, will not grudge them the small sum required to compile a catalogue. It may not be uninteresting to mention that the expense incurred in the binding of the works issued by the Patent Office amounts to an average of 50*l*. a year. The works are presented by the Patent Office to several public institutions in Ireland. But while some towns, such as Belfast, store them away in a lumber-room, in Dublin they are carefully arranged and substantially bound. The Library is now open from 10 o'clock A.M. to 10 o'clock P.M.

The Board of Trinity College proceeded on Saturday last to the election of a librarian, and, somewhat to the surprise of the literary circle in Dublin, they adhered to their ancient custom, and elected one of their own body to this important post. The newly-elected librarian is the Rev. Dr. Malet, Senior Fellow and Senior Lecturer of Trinity College. Dr. Malet is well known as a numismatist. He is the author of a catalogue of Roman silver coins in Trinity College, Dublin, and there is no doubt will make both an efficient and popular librarian. The Rev. Dr. Dickson retains his position as assistant-librarian.

A SUBSCRIPTION list has been opened for the purpose of having a model of a bust of the late Professor J. Beete Jukes, by Mr. Watkins, copied in marble, the marble bust to be placed in the Gallery containing the collections of the Geological Survey of Ireland, of which survey Mr. Jukes was so long the acting director. Subscriptions are limited to a guinea, and only about 30*l.* remains to be collected out of the 70*l.* required.

THE death is announced of M. Henry Testot de Ferry, of Bussières, near Macon, the author of more than one treatise on archæo-geology. The work by which he is best known is an illustrated quarto pamphlet, "L'Anciennete de l'homme dans le Maconnais," published in 1867, which gives an account of some of his discoveries of flint implements both in caverns and in superficial deposits in the neighbourhood of Macon. He died at the early age of 43.

A SCIENTIFIC and literary society has just been formed at Winchester. The first meeting was held in the Hall of the Mechanics' Institute on Thursday evening last, at which an inaugural address was delivered by the Rev. C. A. Johns, of Winton House. Mr. Johns, in his address, which is published in one of the local newspapers, reviewed briefly some of the latest scientific discoveries, and suggested several subjects of inquiry within the range of the members of the new society. It appears that the microscope is one of the principal instruments of research with the Winchester naturalists, and hints were thrown out how this instrument might be usefully employed in this locality for the general promotion of science. In particular, a careful examination of the chalk of the neighbourhood was recommended for the purpose of determining to what extent it differed from, or was identical with, the *Porcupine* dredgings. After the address the meeting set to work to frame laws for the government of the society. Some discussion arose with regard to the name of the society, and the admission of ladies to the meetings. It was ultimately decided not to allow ladies to attend the ordinary monthly meetings, and the name agreed upon was "The Winchester and Hampshire Scientific and Literary Society." Mr. Johns was elected president, Dr. Neal treasurer, and Mr. Angall secretary; and ten other gentlemen consented to act with them as managing committee. The use of a large room was kindly offered to the society by Mr. Savage, and as the number of members is already 50, there seems every probability that the society will flourish.

WE learn from the Viennese correspondent of the *Standard* Newspaper that Karl Vogt is giving a course of six lectures at a Roman Catholic College in Vienna, on the Primitive Condition of Man. The first lecture was attended, we are told, by a crowded and highly respectable audience.

TWO Russian travellers, MM. Ewast and Logist, have applied to their Government for a concession to work some gold fields which they say they have discovered in Lapland. They passed a month in the district in question last summer. It is almost uninhabitable, being without vegetation of any kind, and the travellers were obliged to leave it, after obtaining nearly 60 ounces of fine gold, because they had exhausted all their provisions, and none were to be had on the spot.

Land and Water announces that Mr. Frank Buckland, Inspector of English Salmon Fisheries, and Mr. Archibald Young, Commissioner of Scotch Salmon Fisheries, have been appointed by the Government to inquire into the condition of the salmon fisheries of Scotland.

ACCORDING to the *British Medical Journal* the annual salaries of the professors in the Universities of Austria are in future to be uniform—1,800 florins, with an increase of 200 florins every fifth year. Hitherto, the rate of salary has been very various; being at Innsbruck and Lemberg 945 florins, in Vienna 1,680, in Prague 1,635; with a decennial increase of 300 florins.

THE Royal Horticultural Society of Ireland have decided on holding an extra spring show in March for hyacinths and other spring flowers.

THE whales which have been lately stranded on our own shores, one at Longniddry in the Firth of Forth, another at Langstone Harbour, near Portsmouth, and others elsewhere, have given rise to a discussion which promises to become interesting. Mr. Flower holds to the Longniddry whale being either *Balænoptera musculus*, or *B. Sibbaldii;* while Professor Turner of Edinburgh, together with other eminent Scotch naturalists, incline to regard it as an undescribed species. There is, we are glad to learn, every reason to hope that the skeleton will be preserved, in which case the species will be finally set at rest. The measurements of the whale are given by *Land and Water* as follows:—Extreme length 82ft., girth 34ft., length round jaws 39ft., from front of lower jaw to back of mouth 17ft. 9in., breadth across jaws 7ft. 9in., greatest expanse of tail 15ft. 9in., length of flipper 11ft., average length of baleen 30in. to 33in.; length of calf 20ft.

IT appears from the reports of the Viennese meteorologists on the storm which broke over the Austrian capital and other parts of the empire, that it was accompanied by a very remarkable variation in the atmospheric pressure at different points close to each other. Thus, at Lesina, the pressure was 13·5 millimetres, and at Lemberg 10·7 millimetres, under the normal pressure. The greatest variation was in the district round Vienna, where the storm was most violent. Between Bludenz and Ischl there was a difference of 1 millimetre in $6\frac{1}{2}$ German miles, between Ischl and Vienna of one in $3\frac{1}{4}$, and between Vienna and Lemberg of one in 11 only. In Northern Europe the barometer was low, and the thermometer high; in Southern Europe it was the reverse.

THE *Lyttelton Times* of June last gives a report of a meeting of the Philosophical Institute of Canterbury, N.Z., at which the President, Dr. Haast, F.R.S., read a paper on the Saurian Remains lately discovered by Mr. T. Cockburn Hood, F.G.S. in that province, and taken by him to Europe. The paper was accompanied by specimens and drawings: the latter were by Mr. Triphook, and represented the most valuable of the specimens. They differed from other saurian remains, and consisted of large slabs of stone enclosing the upper and lower jaws and part of the skull of a large saurian reptile of the Amphicælian sub-order of crocodilia, to which genera Teleosaurus belonged. It was calculated to have been from 18 to 20 feet in length. The author also stated that in Mr. Hood's collection there were a great many vertebræ, in one specimen fourteen dorsal vertebræ still connected together, which, from their bi-concave character, might have belonged to the same reptile, the impression of whose skull he had exhibited. There were also many bones belonging to Plesiosaurus, of which the principal ones formed part of the paddles or fins of those marine reptiles. The paper concluded by stating that many other bones of crocodilian reptiles were included in this collection, showing that New Zealand was at one time, like parts of the northern hemisphere, the abode of numerous large reptiles.

WE learn from the *Times* of Saturday last, that Canon Greenwell has recently been prosecuting his researches in the prehistoric tumuli with great success. The barrows examined are two very large round ones near Bridlington: they contained an unusual number of secondary interments, accompanied by a fine series of implements, pottery, &c. These tumuli possess a special point of interest in reference to the apparent displacement of the primary interment. We await with interest Canon Greenwell's report on this point. It is to be hoped that the numerous human remains discovered will be described by Dr. Thurnham, or some other competent anatomist skilled in craniology.

BALLOONERS will rejoice at hearing that Messrs. Hachette and Co. have issued a magnificent work on the Aërial Voyages of Glaisher, Camille Flammarion, W. de Fonvielle, and Gaston Tissandier. The illustrations are excellent.

Two handsome volumes devoted to the "Life and Letters of Faraday" have been issued by Messrs. Longmans, and received by us just as we were going to press. The author is the Secretary of the Royal Institution, Dr. Bence Jones, whose delightful memoir of Faraday communicated to the Royal Society last year has been perused with pleasure by all scientific men.

THE committee of the Council on Education have placed at the disposal of the University of Oxford two of the thirty exhibitions, value 25*l.* each, given by Sir Joseph Whitworth, to assist deserving students in competing for his scholarships in mechanical science.

BOTANY

Spontaneous Movements in Plants

M. LECOCQ, of Clermont Ferrand, records in the *Belgique Horticole* some singular spasmodic movements in the leaves of *Colocasia esculenta.* These motions bear no resemblance to those produced in the Sensitive plant by the warmth of the hand, but occur spontaneously independently of the action of the wind or of any external cause, at irregular intervals, and at different periods of the day and night. M. Lecocq describes the movement as a kind of trembling or quivering affecting the whole plant, sufficiently powerful to tinkle little bells attached to the branches, and on one occasion even to shake the pot in which the plant was contained, and to resist a pressure of the hand, the number of the pulsations varying from 100 to 120 per minute. He states that the *Colocasia* is destitute of the stomata with which the leaves of plants are generally provided, especially on their under-surface, and attributes the phenomenon to the incessant pulsations of the imprisoned sap.

Decomposition of Carbonic Acid by Leaves

M. P. P. DEHERAIN has been continuing his researches on the evaporation of water from the leaves of plants, and the decomposition by them of carbonic acid. His previous investigation had established the fact that these two functions of the leaves proceed *pari passu*, the same conditions favouring the one as the other; and that both are determined by the degree and nature of the light to which the leaves are exposed, and not by the temperature. He now attempts to show that it is not the intensity only of the light which determines the rapidity of the evaporation of the water, and of the decomposition of carbonic acid; but that certain rays of light are far more efficacious than others. A careful series of experiments on the submerged leaves of *Potamogeton crispus*, accurately weighing the quantity of gases emitted, showed that under the influence of yellow light 26·2 c.c. of gas were exhaled, while under the influence of blue rays of the same intensity the plant disengaged only 5·8 c.c. of gas in the same time. A repetition of the experiment established the following laws,—1st. That all the rays of light are not equally efficacious in determining the decomposition of carbonic acid. 2d. That even with the same intensity yellow and red rays act more powerfully than blue or violet. 3d. That the relation which has been established between decomposition and evaporation is maintained also with respect to the relative influence of different rays of light. [Comptes Rendus.]

New Coffee Fungus

THE Rev. M. J. Berkeley forwards to the *Gardener's Chronicle* a letter from the well-known botanist, Mr. Thwaites, of Ceylon, in which he speaks of the consternation caused among the coffee-planters of that island in consequence of the rapid increase of a parasitic Fungus in the coffee-plantations, causing the leaves to fall off before their proper time, and endangering the safety of the crop. It is a singular fact that among more than one thousand species of Fungus which have been received in this country from Ceylon this particular one does not occur; not only is it an entirely new species, but it is with difficulty referable to any recognised section, being intermediate between the true moulds and the *Uredos.* Mr. Berkeley establishes from it a new genus *Hermileia.*

A. W. B.

CHEMISTRY

Thallium Salts.—II.

MM. LAMY AND DES CLOISEAUX have again examined the thallous salts named below. The *ferro-cyanide*—

$$Tl_4FeCy_6 + 2Aq.$$

has a beautiful yellow colour, a density of 4·641, and is readily dehydrated by heat. Exposed to dry air, the crystals gradually lose their transparency. Water dissolves more of this than of potassic ferro-cyanide; the actual solubility is shown by the following numbers—

100 grm. water dissolve at 18° . . . 0·37 grm. ferro-cyanide
,, ,, ,, at 101° . . . 3·93 ,, ,,

The crystalline type to which this salt belongs is a doubly oblique prism. It exhibits a high degree of double refraction; fine plates of it, cut parallel to the plane of cleavage, show a well-defined system of rings under the polariser. The crystals are very fragile.

Thallous tartrates and paratartrates are remarkable for the readiness with which they yield large and brilliant crystals. *Hydro-thallous tartrate*, $C_4H_5TlO_6$, generally crystallises in beautiful white prisms, which have a silky lustre, due to the presence of a number of longitudinal striæ; it is soluble in 122 parts of water at 15°, and in 6 parts of water at 101°. The density of the crystals is 3·496, and they are, as already found by Lang, optically and geometrically isomorphous with hydro-potassic tartrate. The *neutral tartrate* is prepared by adding thallous carbonate to boiling aqueous hydric tartrate, until alkalinity ensues. On cooling, large, transparent, lustrous crystals make their appearance; their specific gravity is 4·658; they are unalterable in air at the ordinary temperature; at 100°, however, they become opaque and anhydrous. They dissolve in five times their weight of water at 15°, and in a tenth of their weight of boiling water. The formula of this salt is—

$$2[C_4H_4Tl_2O_6]. Aq.$$

It crystallises in forms belonging to the clino-rhombic system—

Plane angle of the base	106° 59′ 26″
Plane angle of the lateral faces . . .	101° 57′ 41″
Obliquity of the primitive prism . . .	110° 23′ 00″

The double refraction is very energetic. The plane of the optic axes is normal to that of symmetry. The acute bisectrix is negative and perpendicular to the horizontal diagonal of the base. The horizontal dispersion is pretty decided, as is also the proper dispersion of the optic axes, ρ being $< \nu$. *Sodio-thallous tartrate*— $C_4H_4NaTlO_6 + 4Aq.$ is prepared in the same manner as common Seignette salt, with which it agrees not only in composition, but also in figure; but it differs from that body in the orientation of its optic axes. The crystals are soluble in half their weight of water at 20°, and effloresce when handled. The acute bisectrix of the optic axes is negative and normal to the base; the dispersion, though considerable (with $\rho > \nu$), is much smaller than in the common Seignette salt. When redissolved in water, and allowed to evaporate spontaneously, the above compound yields a more complex tartrate, having the formula—

$$C_4H_4TlNaO_6 + C_4H_4Tl_2O_6,$$

and crystallising in the rhombic system. As regards form, it may be referred to a right rhomboidal prism of 98°40′, differing chiefly in height from the tartrate just described. The acute bisectrix is positive. *Thallio-stibiosylic tartrate*—

$$C_4H_4Tl(SbO)O_6 + Aq.$$

is less soluble in water than the corresponding potassic salt. The crystals are quite permanent, and have the specific gravity 3·99. Although geometrically isomorphous with the potassic salt, the two tartrates differ completely in optical properties. At 15° to 20° the optic axes are perfectly united for all the colours of the spectrum; but at 70° they separate to the extent of 20°—25°, in the plane passing through the principal diagonals of the bases of the primitive prism. Their acute bisectrix is negative; dispersion inappreciable. *Dithallous paratartrate* is anhydrous, has a density of 4·659, and is capable of crystallising in two distinct forms. The two forms, which both belong to the clino-rhombic system, are distinguished by the following numbers—

	Normal.	Irregular.
Plane angle of the base	68° 55′ 56″	80° 16′ 22″
Plane angle of the lateral faces . . .	90° 16′ 24″	95° 9′ 36″
Obliquity of the primitive prism . . .	90° 20′ 00″	96° 45′ 00″

In both, however, the dispersion is weak, with $\rho > \nu$; the acute bisectrix is positive and the separation of the optic axes is considerable. Thallium has three *oxalates*, much resembling those of the potassium series; their solubility, however, increases (instead of decreasing) as the oxalic factor accumulates. The *normal oxalate* dissolves in 68 parts of water at 15°, and in 11 of boiling water. The density is 6·31. On heating, it behaves like plumbic oxalate. The crystals of this salt belong to the clino-rhombic system, but are quite unrelated to any of the corresponding potassic or ammonic oxalates hitherto described. The plane of the optic axes is parallel to the plane of symmetry; the double refraction is very energetic. *Hydro-thallous oxalate*—

$$TlHC_2O_4 + Aq.$$

crystallises in the clino-rhombic system; but its primitive form is irreconcilable with that of hydro-potassic oxalate. The specific gravity is 3·971. It is soluble in 19 times its weight of water at 15°, and in less than its weight of boiling water. There is also an anhydrous salt, whose primitive form is an oblique rhomboidal prism, likewise incompatible with the potassic salt. In both, the double refraction is energetic, and the acute bisectrix positive: but, in the former, the plane of the optic axes is parallel to the plane of symmetry; in the latter, it is normal to that plane. In the former, the proper dispersion is strong, with $\rho < \nu$; in the latter, it is weak, with $\rho > \nu$. The oxalate— $Tl_2C_2O_4 + 3H_2C_2O_4 + Aq.$ ("quadroxalate"), is closely akin to the corresponding potassic salt, both in composition and geometrical form. It shows a powerful double refraction. The plane of the optic axes is almost normal to the base. The proper dispersion of the axes is decided, with $\rho < \nu$; the acute bisectrix is negative, and very oblique to the base. The crystals are very fragile.

Thallous *picrate* is anhydrous. Its colour is yellow, when prepared with but once cooling; but, by Deville's method, this is gradually modified to a vermilion-red. At 150° the dry red salt is soon transformed into the yellow modification. Thallous picrate is less soluble than potassic picrate, one part of it requiring 280 parts of water at 15°, while potassic picrate requires 245. Its density is 3·039. Even a temperature of 270° fails to decompose it, but at 300° it detonates with violence. The red crystals are clino-rhombic; they have a vitreous lustre, and the plane of their optic axes is parallel to that of symmetry. The mean value of the index of refraction is $\beta = 1{\cdot}827$ (for the yellow line of sodium).

Reduction of Cupric Salts by Tannin

E. PALLUCCI has pointed out that tannin in all its forms reduces cupric oxide in alkaline solution, and forms a red precipitate of cuprous oxide, just in the same way as glucose does; and that the neglect of this circumstance has led to many errors in the estimation of sugar and vegetable juices, and especially in the valuation of the must of the grape: for this liquid contains the tannin derived from the skins of the grapes; and consequently, if the quantity of sugar contained in it is determined by that of the cuprous oxide thrown down, without regard to the reducing power of the tannin, the sugar in the must, and therefore also the alcohol which it is capable of yielding by fermentation, will be over-estimated. This source of error may, however, be easily eliminated by first treating the liquid under examination with basic lead acetate, which completely precipitates the tannin; the glucose may then be estimated in the filtrate.

The importance of attending to this matter in saccharimetric researches will be evident, when it is remembered that tannin is a substance very widely diffused in the vegetable kingdom; and that many vegetable substances, in which sugar is frequently sought for, contain at certain stages of their growth a quantity of tannin two, three, four, or even five times as great as that of their sugar; the greater number of fruits, not excepting the grape, belong indeed to this category. Other substances besides tannin, as for example gallic acid, pyrogallic acid, and many colouring matters, including that of wine, are also capable of reducing the alkaline cupric solution; but all these, as well as tannin, are completely precipitated by basic acetate of lead.—[Ann. di Chem. app. alla Med., Sept. 1869, p. 132.]

IN the preparation of quinine and cinchonine, a black, tarry substance is found in considerable quantity. This product, the "quinoidine" of commerce, contains a number of cinchona alkaloids, but is not used to any great extent in medicine. MM. Henry, Duguet, and Perret have much increased its value by converting the alkaloids into picrates, thus forming a mixture which can be used with advantage as a very cheap and efficient febrifuge.

GEOLOGY

The Tithonian Stage

PROFESSOR PICTET has communicated to the Swiss Society of Natural Sciences a most interesting report, containing a detailed discussion of a question which has lately acquired much importance, namely, the limitation of the cretaceous and jurassic periods. The Tithonian beds (Titonische Etage) of Oppel, as is well known, occupy a sort of intermediate position between the great jurassic and cretaceous series of deposits, and they have been referred by different authors sometimes to one and sometimes to the other of these great formations. Thus, Professor Oppel himself considered that his Tithonian stage brought the jurassic period a step forward in time, whilst M. Hébert regarded the deposits studied by him as carrying the lower part of the cretaceous formation further back. Of late years these doubtful deposits have been detected in many places, scattered from the Carpathians to the Mediterranean, through Italy, Switzerland, France, and Spain.

Professor Pictet considers that wherever these beds occur, the arrangement of the strata is in accordance with the following sectional view:—

1. Neocomian stage proper.
2. Valangian stage and marls with *Belemnites latus*.
3. Berrias limestone.
4. Tithonian stage.
5. Bed with large specimens of *Aptychus* (Kimmeridgian).
6. Jurassic fauna with *Ammonites tenuilobatus*.

The question to be settled is where, if anywhere, in this section the line of division between the jurassic and cretaceous formations is to be drawn, between 3 and 4, between 4 and 5, between 5 and 6, or finally through the middle of 4, dividing it into a jurassic and a cretaceous Tithonian.

The Stramberg limestone, which the author regards as nearly identical with the limestone of the Porte de France and Aizy, contains 55 species of Cephalopoda, of which 50 have been described as new by Zittel, whilst the other 5 have their analogues in the cretaceous period. This would seem to be in favour of the cretaceous nature of this bed; but the Brachiopoda, which have been thoroughly worked out, tell a different tale: of 38 species 26 are new, 11 belong to the jurassic period, and 1 (*Terebratula janitor*, Pict.) is common to this deposit and that of the Porte de France. It appears, however, that the strict contemporaneity of these fossils is somewhat doubtful, inasmuch as Zittel has found that the molluscan fauna of Stramberg (omitting Cephalopoda and Brachiopoda) is nearly identical with those of Wimmis and Mount Salève, which have been hitherto regarded as Corallian. But neither at Wimmis nor at Mount Salève does *Terebratula janitor* occur, nor are any of the Cephalopoda of Stramberg found there, so that it is possible the Stramberg deposit consists of two beds, of which the newer contains the above-mentioned Cephalopods and *Terebratula janitor*, and the older corresponds with the Swiss deposits at Wimmis and Mount Salève—the latter might then be the highest term of the jurassic series, and the upper Stramberg bed the lowest of the cretaceous, thus carrying the divisional line through No. 4 of the above section. M. Coquand has found the fauna of *Terebratula moravica*, which is also that of Wimmis and Mount Salève, occupying deposits in Provence which are covered by beds containing Kimmeridgian and Portlandian Ammonites, and therefore evidently jurassic. From the consideration of these facts the author infers that there have been in different regions two different orders of succession. In one (Provence, Salève, Wimmis,) the stages are nearly in conformity with those which occur in the rest of France, and the limits of the jurassic and cretaceous periods appear to be clear. In the other, included between the Carpathians and Italy (with a portion of the French Alps, &c.), the Tithonian stage prevails upon the confines of the two great periods.

By an investigation of the palæontology of the beds thus characterised as forming the Tithonian stage, Professor Pictet arrives at the following divisions in ascending order:—

1. The fauna of *Ammonites tenuilobatus*.
2. The fauna of the inferior Tithonian, known principally from Rogoznik, the blue marble of the Apennines, and probably the Tyrolese limestone with *Terebratula diphya*.
3. The fauna of the upper Tithonian or Stramberg limestone (*Terebratula janitor*).
4. The lower Neocomian stage, especially the Berrias limestone (*Terebratula diphyoides*).

Jurassic characters predominate in Nos. 1 and 2; No. 3 is rather cretaceous; hence the divisional line, *if drawn at all*, will fall between Nos. 2 and 3. But the author is of opinion that there is no necessity for drawing this line, and he remarks that the whole of the four stages are combined by strong palæontological analogies. Species pass from 1 to 2, from 2 to 3, and from 3 to 4; Nos. 2 and 3 especially, which would be separated by the line of demarcation of the two periods have about one-third of their species in common. This line would therefore be a very feeble one, and we should have to admit that in this Tithonian basin at any rate the separation of the cretaceous from the jurassic periods is singularly compromised.

[We have given so long an analysis of the argumentative part of Professor Pictet's paper, that we cannot refer to his concluding remarks, except to say that they contain some important observations on the method to be followed in geological investigations.]

PHYSIOLOGY

Reaction of Nerve-Substance.

FUNKE some years ago affirmed that nerve, like muscle, became acid after work, and at death. In this he was supported by Heidenhain, and opposed by Ranke and others. He now reasserts his former statement, using the delicate reagent *cyanin* instead of litmus, and finds strong proofs of the correctness of his views. The matter is not unimportant, as it is one of the few bases on which rests the broad general assertion that nervous [and mental] action is accompanied by material changes. [Centralbt. med. Wissensch. 1869, No. 46.]

Action of Muscarin.

SCHMIEDEBERG and KOPPE have published an account of the pharmacy and physiological action of *muscarin*, the active constituent of *agaricus muscarius* (*amanita muscaria*). This mushroom poison seems to be not unlike the Calabar bean in its action, and belladonna is in many respects antagonistic to it.

MAX SCHULTZE'S *Archiv für Microscopische Anatomie* v. 4, contains, among other papers:

"Ueber die Nervenendigung in der Netzhaut des Auges bei Menschen und bei Thieren." Von Max Schultze. Description of certain fibrillæ ensheathing the rods and cones of the vertebrate retina, and believed by Max Schultze to be the real nerve endings. An important memoir, tending to harmonise the results obtained from the study of invertebrate and vertebrate eyes. "Untersuchungen über den feineren Bau des Pancreas." Von Dr. Giovanni Saviotti aus Turin. Description by a pupil of Köllicker's, of fine intercellular passages in the pancreas, similar to those discovered by Hering in the liver. "Die haaretragenden Sinneszellen in der Oberhaut der Mollusken." Von Dr. W. Flemming in Rostock. A detailed description of certain fimbriated cells in the epidermis of acephalous mollusks, and gasteropods, not wholly unlike, and occuring in the midst of, ciliate cells, but believed by Flemming to be organs of sense. "Ueber Radiolarien und Radiolarien-artige Rhizopoden des süssen Wassers." Von Dr. Richard Greeff, Privatdocenten in Boon. Description of species of *Clathrulina*, *Acanthocystis*, and several species of new genera *Astrodisculus*, *Hyalolampe*, with discussion of their habits, anatomy, &c.

PFLUGER'S *Archiv*, ii. 9 and 10, contains:—"Quecksilberluftpumpe." Von H. Busch. A modification of the mercurial pump employed by Pflüger. The chief novelty is the occlusion of the orifices of the various parts by means of mercurial shoulder cups. "Das Unterscheidungsvermögen des Geschmacksinnes für Concentrationsdifferenzen der schmeckbaren Körper." Von Fr. Keppler in Tübingen. Keppler found it easiest to distinguish by taste variations of strength in "saline" solutions, less easy in "acid" or "sweet" liquids, and least easy in "bitter" liquids, though bitter substances (such as quinine) are those which require the smallest quantity to make a definite impression. "Ueber die Abhängigkeit der Leber von dem Nervensystem." Von E. Pflüger. Nebst Tafel II. und III. An important memoir in which Pflüger extends to the liver, the observations already made by him on the salivary glands and pancreas, affirming the direct continuation of the nerve fibres with the secreting cells. "The hepatic cell is a nucleated swelling of the axis cylinder of a nerve." Contains also many other points of interest, touching the structure of the liver, and strongly supports the views of Dr. Beale. "Ueber den Einfluss des Cyangases auf Haemoglobin nach spectroscopischen Beobachtungen." Von E. Ray Lankester. A short note affirming, in opposition to some German observers, that cyanogen forms a definite compound with Haemoglobin analogous to those of carbonic oxide, &c. "Zur Kenntniss der Wirkungen des Weingeistes." Von Dr. F. Obernier, Privatdocent und Assistenzarzt der medic. Klinik zu Bonn. A somewhat polemic paper contesting the views of Bouvier, &c., noticed in NATURE, No. 2.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, November 30.—Anniversary Meeting.—The President delivered his annual address, in which he touched upon several points of interest. One of the first subjects to which he drew attention was the Royal Society's Catalogue of Scientific Papers, the printing of which proceeds satisfactorily. He remarked: "While the aid to be derived to scientific research from the index according to authors' names is fully recognised, there can be no doubt that the value of the Catalogue will be greatly enhanced by the fulfilment of the second part of the plan announced in the preface, namely, by the publication of an *Alphabetical Index of Subjects.* The preparation of such an "*Index Rerum*" as is contemplated, has been for some time a subject of anxious, as well as careful, consideration by the Library Committee, and they have at length arrived at what, they have reason to hope, will be a most satisfactory solution of the question through a communication with Professor Julius Victor Carus, of Leipsic, who they found would be willing himself to undertake the task. I am happy to announce that the Council, acting on the recommendation of the Library Committee, have entered into a very satisfactory arrangement with Professor Carus, who will be able to commence his labours in the ensuing spring. From the well-known scientific accomplishments of Professor Carus, and his extensive experience in the peculiar work to be performed, as well as the confidence which will be reposed in him by all acquainted with the nature of the undertaking and interested in its success, we may consider the Society most fortunate in securing his services." The Meteorological Department of the Board of Trade, superintended by a Committee of the Royal Society, was next referred to; it is stated to be making good progress. Concerning the great Melbourne telescope the President remarked: "Its performance since erection does not appear to have given the same satisfaction at Melbourne that it did at Dublin; but the defects complained of may arise partly from an imperfect knowledge of the principles of the instrument and inexperience in the use of so large a telescope, partly from experimental alterations made at Melbourne, and partly from atmospherical circumstances. Those who are acquainted with the difficulties which Sir J. F. W. Herschel experienced at the Cape, will not be surprised that they should be felt at Melbourne to a much greater extent, on account of the far greater size of the speculum. But I have no doubt that if the instrument be kept in its original condition and as carefully adjusted as it was at Dublin, it will perform as well in ordinary observing weather. The high impression of its power produced by the trials which were made of it when at Dublin, is maintained by a sketch of a portion of the Great Nebula near η Argus, made by M. Le Sueur during two nights in June last. Some change in this nebula from the time when it was described by Sir J. F. W. Herschel had been indicated by Mr. Powell and other observers, though with instruments so much inferior in power to his 20-foot reflector, that little reliance could be placed on them; however, here the evidences of change are indisputable. The peculiar opening in the nebula which Sir John Herschel has compared to a Lemniscate, is still very sharply marked, but its shape and magnitude have altered. Its northern extremity is opened out into a sort of estuary; one of the remarkable constrictions seen in 1834 has disappeared, and the other has shifted its place. Two stars which were then exactly on the edges of the opening are now at some distance within the bright nebulosity; the nebula has become comparatively faint near η Argus. Another remarkable change is the formation of a V-shaped bay south and preceding the Lemniscate, whose edges are so bright that if it had then existed it could not have been overlooked in the 20-foot reflector. Another feature, which, however, was perhaps not within reach of that telescope, is an oval which M. Le Sueur describes as 'full of complicated dark markings and pretty bright nebular filaments.' The angular magnitude of the changes which have been observed, is so great as to suggest a strong probability that this nebula is *much nearer* to us than the stars which are seen along with it. It may be also noticed that M. Le Sueur saw nothing to make him believe in any development of stars in addition to those seen by Sir J. F. W. Herschel." The Council of the Society believes that an attempt to encourage and aid spectroscopic researches is an object in full unison with the highest purpose of the Royal Society's existence; and they have, therefore, after most careful deliberation, resolved to act on this conviction. A telescope of the highest power that is conveniently available for spectroscopy and its kindred inquiries is being constructed, and will be entrusted to such persons as, in their opinion, are the most likely to use it to the best advantage for the extension of this branch of science; and, in the first instance, there can be but one opinion that the person so selected should be Mr. Huggins. The President said: "The execution of this project was much facilitated by the receipt of £1,300 from a bequest made to the Society by the late Mr. Oliveira; and in the beginning of the year proposals were received from the chief opticians of the time, of which that of Mr. Grubb was accepted last April. The conditions proposed were, that the object-glass of the telescope should be of 15-inches aperture, and not more than 15-feet focus, that the arrangements of its equatorial should be such that it could be easily worked by the observer without an assistant, and that the readings of its circles could be made without leaving the floor of the observatory. Mr. Grubb was fortunate enough to secure two discs which had been exhibited by Messrs. Chance at the French Exhibition. They are of first-rate transparency, and as the construction which has been adopted admits of the lenses being cemented, this object-glass will transmit an unusual portion of light. The respective indices of the glasses were determined by making facets on their edges at an angle of 60", and observing spectral lines through the prisms thus formed with a spectroscope of such magnitude as to admit of their being placed on its table. The distinctness with which even faint lines are seen through 12 inches of the glass is a most satisfactory proof of its purity and clearness. From these Professor Stokes computed the curves for the lenses, and his numbers were almost identical with those which Mr. Grubb had obtained. I may mention that some fears had been entertained that the equality of curvature in the adjacent surfaces might *call up a ghost*, if the lenses were used uncemented, and that this has been tried and no such effect was visible. Subsequently a rather novel addition has been made, bearing upon the radiation of heat from the stars. An object-glass intercepts so much of the heat-rays that, to economise the infinitesimal effect which is expected, a metallic mirror is more promising. The equatorial is, therefore, at the suggestion of Mr. De la Rue, provided with the means of changing the 15-inch achromatic for an 18-inch reflector; and this has been accomplished by means notable for their facility and their safety. The instrument will be ready for trial in December of the present year." The rest of the address referred to the recent dredging expedition. The President then proceeded to the award of the Medals. The Copley Medal was awarded to M. Victor Regnault for the second volume of his "Relation des Expériences pour déterminer les lois et les données physiques nécessaries au calcul des Machines à Feu," including his elaborate investigations on the Specific Heat of Gases and Vapours, and various papers on the Elastic Force of Vapours. The President remarked that the name of M. Victor Regnault had been associated for the last quarter of a century with the most refined and delicate experimental inquiries connected with the measurement of heat. The amount of labour involved in his researches upon the specific heat of simple and compound bodies, upon the dilatation of gases and vapours, upon the comparison of the air-thermometer with the mercurial thermometer, upon the elastic force of aqueous vapour, upon the determination of the density of gases, and upon hygrometry, must excite the astonishment of all who could estimate the difficulty of the problems attacked, the precision of the results attained, and the fundamental character of the data which he had determined. The Council has awarded a Royal Medal to Sir Thomas Maclear, Astronomer Royal at the Cape of Good Hope, for his measurement there of an arc of the meridian. The President reminded his audience that our sole knowledge of the figure of the southern hemisphere rested on the arc of the meridian measured by La Caille, and now remeasured and extended by Maclear. The original measurement, notwithstanding the well-known ability of the great astronomer under whose superintendence it was executed, had not commanded confidence. Maclear's arc has an amplitude nearly four times as great as that of La Caille, and is, on this account, as well as on account of the greater accuracy in detail, far more deserving of confidence. The degree which is derived from it is 1,133 feet shorter than that of La Caille; and as La Caille's is 1,051 longer than that given by the spheroid, which, according to Airy, represents the average of northern arcs, it is evidently a near approximation to the truth. This is even more distinctly shown by the close agreement of the latitudes computed from the geodetic measurements with those given by the sector—that of the north extremity being $0''\cdot4$ in defect, that of the south extremity $0''\cdot5$ in excess.—A Royal Medal has been awarded to Dr. Augustus Matthiessen, F.R.S., for his researches on the electrical and other physical properties of metals and their alloys. The President remarked that these researches embraced the determinations of the specific gravities, the expansion due to heat, the thermo-electric properties, the electric conducting-power, and the effects of temperature upon the electric conducting-power. Dr. Matthiessen's investigation of the electric conducting-power of commercial copper had resulted in very great improvement of the conducting.power of the copper wire used in submarine telegraphy. Closely connected with this branch of his researches were the investigations which Dr. Matthiessen carried out for the Electrical Standard Committee of the British Association, of which he was one of the most active members. The resistance-coils issued by that Committee, which had been very generally adopted as standard instruments, were all constructed of an alloy of platinum and tin, which, after a long series of experiments, Dr. Matthiessen recommended as specially fitted for that purpose. Under the auspices of the British Association, Dr. Matthiessen undertook, a few years ago, the investigation of the chemical constitution of cast-iron, and of the influence exerted upon the physical properties of that metal by the several other elements which generally occur in association with it. He had lately elaborated a method of producing pure iron, which promised to be fruitful in interesting and important results in the hands of himself and the other chemists with whom he has been associated in this inquiry. Dr. Matthiessen's researches published in the *Philosophical Transactions*, on the action of oxidising agents upon organic bases and on the chemical constitution of narcotics (the latter investigation having been conducted in conjunction with Professor G. C. Foster), furnished proofs of the success of his labours in organic chemistry. His researches were distinguished as well for their diversity as for their uniformly complete and trustworthy character. — The following officers are elected for the ensuing year:—President: Sir Edward Sabine, L.L.D.; Treasurer: W. Allen Miller, M.D., LL.D. Secretaries: W. Sharpey, M.D., LL.D.; and G. Gabriel Stokes, LL.D. Foreign Secretary: Professor W. Hallows Miller, LL.D. The other members of the Council are: Frederick Currie, M.A.; Warren De la Rue, Ph. D.; Sir P. de M. Grey Egerton, Bart.; Professor W. H. Flower, F.R.C.S. Eng.; William Huggins; J. Gwyn Jeffreys; John Marshall, F.R.C.S. Eng.; Augustus Matthiessen, Ph. D.; Captain Henry Richards, R.N.; the Marquis of Salisbury, M.A.; C. W. Siemens; John Simon, F.R.C.S.; Archibald Smith, M.A.; Professor H. I. Stephen Smith, M.A.; Professor John Tyndall, LL.D.; and Professor Alexander W. Williamson, Ph.D.

Royal Astronomical Society, November 12.—First Meeting of Session. Mr. Warren De la Rue, F.R.S., vice-president, in the chair. The Chairman opened the meeting by referring to the illness of Admiral Manners, the president of the society, an announcement which was heard by all present with much regret. The minutes of the last meeting having been read and confirmed, and upwards of 100 presents announced, Mr. Carrington read a paper descriptive of his observatory near Farnham, Surrey, and of a variety of ingenious contrivances for securing its efficiency, and especially the correct measurement of time. Mr. Carrington intends observing with an alt-azimuth, which he has designed to ensure the comfort and consequent accuracy of the observer. The telescope-tube rotates freely on its axis, which is always horizontal; it carries the vertical circle, and in front of the object glass a right-angled prism, the front face of which may be directed on any object by the axil rotation of the tube of the telescope.—The Astronomer-Royal was then invited by the Chairman to describe his recent invention of a method of correcting the chromatic dispersion of the atmosphere. He described the various contrivances by which that object might be secured.

The simplest method of all was the employment of a series of different angles suited to the altitude of the object; but as this has some inconveniences Mr. Simms suggested the employment of an adjustable prism, as, for example, adjustable tilting of the field-glass of the eye-piece. This method, though simple, introduced undesirable optical effects. It appeared necessary, therefore, that the correction should be effected outside the eye-piece; and the best method seemed to be the combination of a convexo-concave and a convexo-plane lens, the convexity of the latter fitting into the concavity of the former, and admitting of being rotated within it, so as to vary the corrective effect according to the state of the air or the position of the object observed. Mr. Cayley, F.R.S., afterwards noticed that the desired effect could be secured by combination of two prisms, in one of which there is a convex, and in the other a concave cylindrical surface of the same curvature; when these cylindrical surfaces are made to rotate on each other, the opposite faces of the combination can assume any relative position between parallelism and an inclination equal to the sum of the refracting angles of the component prisms. Both contrivances are described in Brewster's Optics; and it is satisfactory to consider that the troublesome effect of atmospheric chromatic dispersion can be corrected effectually by contrivances so well known.—The Astronomer-Royal then invited the attention of the meeting to a proposition which had been made by the American observers, that the passage of Venus over the solar chromosphere should be observed by spectroscopists during the transit of 1874, for the purpose of determining the solar parallax. Mr. Huggins described the methods of observation available for the purpose. Mr. Proctor expressed doubts as to the accuracy of the suggested method, remarking that the phenomenon, to be observed to the best advantage, would require other stations than those selected for observing internal contacts, and that the effect of parallax, by causing Venus to cross different parts of the chromosphere, as seen from different stations, would be a fatal objection, since we have no reason for believing that the chromosphere is uniformly deep. He remarked also that we are not merely ignorant of the exact point at which Venus will cross the sun's limb, but of the angle at which her path will be inclined to the limb. Mr. Stone intimated his belief that we should find a number of difficulties cropping up around the new method, which might render observations as unsatisfactory as those made in 1769 upon the internal contact.—After some remarks by the Chairman upon the advantages of applying photography to the coming transits, a paper by Mr. Alexander Herschel, on the November meteors, was read to the meeting. Mr. Herschel shows that there is evidence of a triplicity in the meteoric stream, since in 1868 three distinct maxima were observed in England, America, and China. In 1867 and 1866 also, three maxima were observed, but they were not separated by so wide an interval.—Mr. Proctor then read a paper on the application of photography to the transit of 1874. The paper was illustrated by a chart exhibiting the passage of the earth through the shadow-cone of Venus, and showing along what lines stations should be placed, at any time, so that the relative displacement of Venus might be along a radial line of the sun's disk. By so selecting stations (or times) he remarked, the whole question would become simply one of parallax, no appreciable error would come in through misplacement of the fiducial cross-lines, and so photography would do the best work it was capable of, for determining the sun's distance. In reply to Mr. Proctor's comments on the importance of the coming transits, Mr. Stone pointed out the close correspondence of the results he has deduced from the observations in 1769., with the various other determinations of the sun's distance, and expressed his doubts whether any important improvement can be made in 1874 and 1882.—Mr. Birt then read a paper on the spots which are visible on the floor of the lunar crater Plato, of which he exhibited an interesting drawing.—Mr. Browning read a paper on the changes of colour which the equatorial belt of Jupiter has recently exhibited; and indicated the importance of a careful series of observations directed to the determination of any periodicity which may exist in these changes.—In describing the American photographs of the eclipse of last August, Mr. De la Rue remarked that they confirm the evidence already afforded by his own observations in 1860, and those of Major Tennant in 1868, that the corona, in part at least, is a solar phenomenon.—The meeting closed with an announcement on the part of the Chairman, that a medal had been struck at the Imperial Mint of France in honour of Hind, Goldschmidt, and Luther, on the occasion of the discovery of the hundredth planetoid in 1868.

Geological Society, November 24.—Prof. T. H. Huxley, LL.D., F.R.S., President, in the chair.—Robert Arnold Barker, M.D., Civil Medical Officer, Cachar, Bengal, was elected a Fellow of the Society.—The following communications were read:—(1), On the Dinosauria of the Trias, with observations on the Classification of the Dinosauria," by Prof. Huxley, LL.D., F.R.S., President. The author commenced by referring to the bibliographical history of the Dinosauria, which were first recognised as a distinct group by Hermann von Meyer in 1830. He then indicated the general characters of the group, which he proposed to divide into three families, viz.:—

I. The MEGALOSAURIDÆ, with the genera *Teratosaurus*, *Palæosaurus*, *Megalosaurus*, *Poikilopleuron*, *Lælaps*, and probably *Euskelosaurus*;

II. The SCELIDOSAURIDÆ, with the genera *Thecodontosaurus*, *Hylæosaurus*, *Pholacanthus*, and *Acanthopholis*; and

III. The IGUANODONTIDÆ, with the genera *Cetiosaurus*, *Iguanodon*, *Hypsilophodon*, *Hadrosaurus*, and probably *Stenopelys*.

Compsognathus was said to have many points of affinity with the Dinosauria, especially in the ornithic character of its hind limbs, but at the same time to differ from them in several important particulars. Hence the author proposed to regard *Compsognathus* as the representative of a group (*Compsognatha*) equivalent to the true Dinosauria, and forming, with them, an order to which he gave the name of ORNITHOSCELIDA. The author then treated of the relations of the Ornithoscelida to other Reptiles. He indicated certain peculiarities in the structure of the vertebræ which serve to characterise four great groups of Reptiles, and showed that his Ornithoscelida belong to a group in which, as in existing Crocodiles, the thoracic vertebræ have distinct capitular and tubercular processes springing from the arch of the vertebra. This group was said to include also the Crocodilia, the Anomodontia, and the Pterosauria, to the second of which the author was inclined to approximate the Ornithoscelida. As a near ally of these reptiles, the author cited the Permian *Parasaurus*, the structure of which he discussed, and stated that it seemed to be a terrestrial reptile, leading back to some older and less specialised reptilian form. With regard to the relation of the Ornithoscelida to birds, the author stated that he knew of no character by which the structure of birds as a class differs from that of reptiles which is not foreshadowed in the Ornithoscelida, and he briefly discussed the question of the relationship of Pterodactyles to birds. He did not consider that the majority of the Dinosauria stood so habitually upon their hind feet as to account for the resemblance of their hind limbs to those of birds, by simple similarity of function. The author then proceeded to notice the Dinosauria of the Trias, commencing with an historical account of our knowledge of the occurrence of such reptilian forms in beds of that age. He identified the following Triassic reptilian-forms as belonging to the Dinosauria:—*Teratosaurus*, *Platæosaurus*, and *Zanclodon* from the German trias; *Thecodontosaurus* and *Palæosaurus* from the Bristol conglomerate (the second of these genera he restricted to *P. cylindrodon* of Riley and Stutchbury, their *P. platyodon* being referred to *Thecodontosaurus*); *Cladyodon* from Warwickshire; *Deuterosaurus* from the Ural; *Ankistrodon* from Central India; *Clepsysaurus* and *Bathygnathus* from North America; and probably the South African *Pristerosaurus*.—Sir Roderick Murchison, who had taken the chair, inquired as to the lowest formation in which the bird-like character of Dinosaurians was apparent, and was informed that it was to be recognised as low as the Trias, if not lower.—Mr. Seeley insisted on the necessity for defining the common plan both of the Reptilia and of the ordinal groups before they could be treated of in classification. He had come to somewhat different conclusions as to the grouping and classification of Saurians from those adopted by the President. This would be evident, in so far as concerned Pterodactyles, from a work on Ornithosauria which he had just completed, and which would be published in a few days.—Mr. Etheridge stated that the dolomitic conglomerate, in which the Thecodont remains occurred near Bristol, was distinctly at the base of the Keuper of the Bristol area, being beneath the sandstones and marls which underlie the Rhætic series. There were no Permian beds in the area. He regarded the conglomerates as probably equivalent to the Muschelkalk. It was only at one point near Clifton that the Thecodont remains had been found.—Prof. Huxley was pleased to find that there was such a diversity of opinion between Mr. Seeley and himself, as it was by discussion of opposite views that the truth was to be attained. He accepted Mr. Etheridge's statement as to the age of the Bristol beds.—2. The Physical Geography of Western Europe during the Mesozoic and Cainozoic periods, elucidated by their coral faunas, by P. Martin Duncan, M.B.Lond., F.R.S., Secretary. The author commenced with a notice of the typical species of the coral fauna of the deep seas which bound continents remote from coral-reefs, and then made some remarks upon the littoral corals. The peculiarities of reef, lagoon, and shallow-water species were then explained, with the relations of the two faunas to one another. The author then referred to certain exceptional species, indicated the genera, the species of which constitute the existing reefs, and contributed to form those of the past, and noticed the representatives of some modern genera in old reefs. He pointed out that a correspondency of physical conditions during the deposition of certain strata was indicated by their containing analogous forms—the presence of compound cœnenchymal species indicating neighbouring reefs, and their absence in places where simple or non-cœnenchymal Madreporaria are found being characteristic of deep-sea areas remote from the coral-seas. By applying the principles thus elaborated to the evidence as to the condition of the seas of the European area from the Triassic period to the present time, the author then showed what must probably have been the physical condition of this part of the world at different periods. —Prof. Alex. Agassiz accounted for the circumscribed area of many corals in the Atlantic from the young of many coral species attaching themselves within a few hours of their becoming pelagic. He traced to the great equatorial current which must have traversed the Isthmus of Panama and the Sahara in a pre-cretaceous period, the distribution of certain forms, which the rising of the Isthmus of Panama eventually checked. He thought that the limits of the depth at which true reef-building corals existed would be considerably extended in consequence of recent discoveries by means of dredging. He mentioned the formation of a reef at the present time off the coast of Florida, which threw light on the manner in which mudflats were formed, and the sea eventually filled.—Mr. J. Gwyn Jeffreys objected to the term deep sea being applied to a depth of ten fathoms only, when the tide in some places rose to that extent, and the laminarian zone extended to fifteen. He suggested fifty fathoms as a more appropriate measure. He remarked on the great vertical range of some simple species of corals, such as *Caryophyllia*, amounting to at least 150 fathoms from low-water mark. In deep-sea water it frequently was attached to various shells, such as *Ditrypa* and *Aporrhais*. The only other simple coral of our seas was never found at a depth of less than seventy-five fathoms. The compound corals occurred only at great depths. Dr. Duncan drew a distinction between coral-reef areas and those in which different conditions prevailed. His argument had not so much been based on the depth of the sea as on the presence or otherwise of coral-reefs. The term deep sea had been given by Professor Forbes to depths of ten fathoms and upwards. For such depths as those explored at the present day no term short of "abyssal" was appropriate. Specimens illustrative of his paper were exhibited by Professor Huxley.—The President called the attention of the Fellows of the Society to a proposed memorial to the late Baron von Humboldt, and another to the late Prof. J.B. Jukes, in aid of which contributions were desired. He referred to circulars and letters which were laid on the table, and recommended these memorials to the favourable consideration of the Fellows.

Edinburgh

Royal Physical Society, November 24.—This was the first meeting of the session. Dr. Stevenson Macadam, the President, delivered an address on the subject of Chemical Geology, in which he stated that chemistry had much to do in the explanation of geological phenomena, and though not a believer in the chemical doctrine of volcanic action as generally understood, yet he trusted to show that the geologist must accept the hand of the chemist in climbing up to an intelligent explanation of geological changes on the surface of the globe. The day has now gone by for either Plutonists or *firemen*, or Neptunists or *watermen*, to hold undisputed sway in the interpretation alike of ancient and modern changes; and the truth lies in the golden mean, and may be best sought for in the earnest endeavours to cull knowledge from all the contending elements. The first lesson which chemistry teaches us is to proceed cautiously and modestly to work. The geologist, with hammer in hand and a good share of physical force, is almost taught by the nature of his vocation to expect the same results from the same causes, operating in much the same way, and he becomes bold in theory and difficult to dislodge in his opinion; but the chemist is taught by the very nature of his science to proceed with slow and cautious steps, not only in experimenting, but also in theorising, and he learns soon that the same results need not necessarily proceed from the same causes, and that slight alterations in the mode of working may produce different results. More than that, the same results can be achieved by several modes of working. The President then alluded to chemical reaction as affecting geological phenomena; the weathering of rock masses; the influence of water holding certain gases and salts in solution on mineral substances; the production of limestone and other rocks; and the formation of coal. The effect of heat as well as water in the production of crystalline forms was alluded to, as well as the artificial formation of precious minerals, such as the ruby and sapphire. The cause of volcanic phenomena was neither solely connected with the existence of internal molten masses capable of being squeezed or blown through the external crust of the globe, nor to the presence of large quantities of the alkaline and other metals ready to be burned and ignited on the approach of water; but the President believed that the spheroidal theory of the earth's crust, propounded by himself years ago, coupled with the doctrine of the correlation of the physical forces, was sufficient to account for all volcanic phenomena. The earth is constantly under magnetic and electrical disturbance, and knowing, as can now be proven, that the physical magnetism and electricity can become heat, there seems no necessity for fancying the existence of reservoirs of molten matter waiting for ages to be discharged through the crust, or regions of uncombined chemical elements longing for water to quench their thirst. The President showed experimentally the passage of magnetism into electricity and heat, by means of large magneto-electric apparatus, which heated and fused various metals. The address concluded with reference to spectrum analysis, as indicating the composition of the sun and other stars, and as demonstrating that there is a brotherhood of matter and force throughout the universe.

The following gentlemen were elected:—As foreign members on the recommendation of the Council—Mr. C. Hitchcock, State Geologist, Vermont, U.S.; Premier Lieut. Dr. C. F. Lutken, assistant in the Zoological Museum, Copenhagen; Dr. O. A. Loweson Morch, University Museum, Copenhagen. As resident members—Mr. R. Scott Skirving, Camptown—proposed by J. M'Bain, M.D., R.N.; Mr. H. Budge, C.A., 7, Hill Street—proposed by M. R. Brown.

Dublin

Statistical and Social Inquiry Society, Nov. 23.—Robert McDonnell, M.D., F.R.S., read a paper on Patronage and Purchase in making Hospital Appointments. Dr. McDonnell condemned the system of purchase, adducing many reasons for doing so. In discussing the question he avoided all personalities, not alluding to the practice of any one hospital, but relying solely on the importance of appointments being made, not on account of the amount of money that a candidate could produce, but on account of his general ability and merits.

Paris

Academy of Sciences, November 22.—M. Becquerel communicated an eighth memoir upon electro-capillary phenomena, in which he treated of respiration, and the nutrition of the tissues, and of the muscular currents and the current of the other tissues. The author stated his principle as follows: Two different liquids, separated by a tissue, that is to say, a porous body capable of being soaked by the liquids, give origin to electrical currents resulting from the recomposition of two electricities set free in the reaction of the liquid, the walls of the capillary spaces acting as solid conducting bodies. These currents the author denominated *electro-capillary*, and the object of his paper was to demonstrate their action in the vital phenomena above mentioned, in order to establish an electro-chemical theory of life. —The dispute about wine-heating was advanced a stage by the presentation of a note from M. Vergnette-Lamotte in answer to M. Pasteur's last communication.—Of two astronomical papers by Father Secchi, the first related to the spectrum of the planet Neptune, and to some facts in spectrum analysis, and the second described a new arrangement for the observation of the spectra of the smaller stars, and referred also to the meteors of the 14th November. The author stated that the spectrum of Neptune, like that of Uranus, presents bands of absorption which do not occur in the solar spectrum. Of the three principal bands, one occurs at the limit of the geeen and yellow, about half-way between D and b; a second in the place of the line b in the solar spectrum, and the third, which is fainter, in the blue. Beyond the yellow, in the opposite direction, the spectrum suddenly terminates. The author remarked upon the accordance of this spectrum with the colour of the planet, and upon the indistinctness of its outline under high magnifying powers. The author also indicated a means of obtaining two superposable spectra, and stated that he had observed that the spectra furnished by Geissler's tubes were essentially different according as the light was taken from the tubes, the bulbs, or the luminous sheaths of the wire. In his second paper Father Secchi stated that in order to observe the spectra of the smaller stars, he had adopted the plan of placing a large prism before the object-glass of his telescope, and obtained favourable results, some of which he communicated.—A note by M. F. Massieu, supplementary to a paper presented by him on the 18th October, was read. It related to characteristic functions in thermodynamics.—M. P. Gauthier communicated an essay on the movement of a projectile in the air; M. J. Carvallo, an investigation of the stability of beacon towers: M. E. Roger, a note on some general properties of curved surfaces; MM. Curie and Vigier communicated the results of some experiments upon animals, indicating that turpentine is not, as was supposed by M. Personne, an antidote for phosphorus. They also remarked that the hypothesis that the toxical action of phosphorus is due to its depriving the blood of oxygen was not compatible with the small doses of phosphorus which may prove fatal.—A note from M. Zantedeschi on the calorific rays of the moon was read, in which he indicated that the heating effect of the moon's rays was demonstrated in 1685 by G. Montanari, and in 1781 by P. Frisi. The author also cited his own experiments.—A note on the calculation of the going of chronometers to determine longitudes, by M. H. de Maguay, was read, giving the results of observations upon these chronometers, and upon this M. Yvon Villarceau made some remarks.—A note by M. Bontemps on the coloration of glass under the influence of the solar light, was presented. In this paper the author adduces numerous examples of the production of a greater or less change in the colour of glass by long exposure to the sun's rays.—A note on the physical properties of arable soils, by M. Hervé-Mangon, was read, in which the author called attention to certain physical properties of soils, such as their calorific power, their power of condensing and holding gases, and especially their behaviour with regard to water and aqueous vapour, which are of as much importance as their chemical properties in estimating the qualities of the soils. He described the means by which these properties of soils may be investigated. —An extract from a letter by Mr. C. T. Jackson, of Boston, was communicated, giving an account of the copper-mines of Lake Superior, and of a new deposit of tin in the State of Maine. He mentioned a mass of native copper obtained at a depth of 480 feet in the Phœnix mine last June, measuring 65 feet long, 32 feet high, and 4 feet thick at the exposed end. He estimated that this mass would furnish about 1,000 tons of copper, and stated that it was contained in a true vein, cutting at right angles several beds of trap and other rocks. The gangue consisted of calc spar, quartz, and pretruite. The deposit of tin noticed by the author was said to be in the neighbourhood of the town of Winslow, where the mineral occurs in more than 40 little veins, varying in thickness from ¼ inch to 1 foot, occupying a space between the metamorphic limestone and gneiss which constitute the country. The author obtained from the rough mineral 46 per cent. of tin.—A letter from M. A. Rojas entitled "Echoes of a seismic tempest" was communicated. It contained an account of disturbances, chiefly manifested by the rise and fall of water, which occurred in various parts of South America simultaneously with the great Peruvian earthquake of the 13th August, 1868.—A letter by MM. E. Harny and F. Lenormant, dated at Thebes, was communicated, in which they announced the discovery of traces of the Stone Age in Egypt. They found an immense quantity of worked flints of all kinds upon a small space of the plateau separating the valley of Biban-el-Molouk from the escarpments which look over the ruins of Deir-el-Bahari. They compared the place to what is known in France as a "workshop of the Neolithic period."—M. Balbiani communicated an investigation of the development and propagation of *Strongylus gigas*, in which he described the production and structure of the egg, and the development of the embryo of that parasite, the embryo of which he said, remains in the egg for five or six months in winter, and may remain there for a whole year. The author described his experiments, from which it appears that this parasite does not pass directly from the egg into the animal in which it acquires its perfect development.—M. P. Fischer described the copulation and spawning of the *Aplysiæ* and *Dolabriferæ*, as observed by him in the aquarium at Arcachon. In the *Aplysiæ*, the same individual serves alternately as a male and as a female; and the author mentioned his having several times seen five or six individuals united to form a chain, each of them, except the first and last, performing the function of both sexes at once. In the *Dolabrifera*, which is likewise hermaphrodite, the copulation of the two individuals is reciprocal. The author described the emission and mode of attachment of the ribbon of eggs produced by the *Aplysiæ*, which, according to him, is sometimes as much as 120 times the length of the body of the Mollusk.—A note on the aanatomy of the Alcyonaria, by MM. G. Pouchet and A. Myèvre, was presented, as also some other papers of which the titles only are given.

ITALY

Royal Lombardy Institute of Science and Literature. The following Prize Questions are proposed by this Institute:—

ORDINARY PRIZES OF THE INSTITUTE.

Class of Literature and of Moral and Political Science.

For 1870.—To what extent is it the right or duty of Government to interfere in the education of the people, and how ought this interference to be exercised?

1. To determine whether it is a right or a duty.
2. To inquire how the exercise of such right, or the performance of such duty, can be reconciled with the acknowledged and inalienable principle of liberty, civil, political, and religious. (To be delivered in Feb. 1870.)

Class of Mathematical and Natural Science.

For 1871.—Required an Essay on the physical and chemical nature of the various mineral combustibles of different epochs, with the view of determining whether there are any means of establishing a new classification thereof, which may serve to diminish, if not to remove, the ambiguities relating to the importance of the several deposits of mineral fuel, having regard to their quality, and to the extent of their deposits. (To be delivered in Feb. 1871. Prizes for this and the preceding question, 1,200 lire.)

TRIENNIAL MEDALS OF THE INSTITUTE.

The Royal Institute of Lombardy, according to the fifteenth article of its organic regulations, "adjudges every three years two gold medals, each worth 1,000 lire, for the promotion of agricultural and manufacturing industry; one of which is intended for those Italian citizens who have contributed to the progress of agriculture in Lombardy, by means of discoveries, or of methods not yet put in practice, the other to those who have conspicuously improved, or successfully introduced into Lombardy a given manufacturing industry."

Those who wish to compete for these medals are requested to present their claims, accompanied by the necessary documents, to the Secretary of the Institute, at the Palazzo di Brera in Milan, not later than the 1st of March, 1870.

ORDINARY PRIZES OF THE FONDAZIONE CAGNOLA.

For 1870.—Required a Memoir, treating of the attained or possible advantage to the agriculture of any of the provinces of the Kingdom of Italy, and especially of Lombardy, arising from the introduction, accomplished or possible, of the doctrines or practices recommended at the present day by the progress of Physics, Chemistry, or Meteorology. (For Feb. 1870. Prize, 3,000 lire, including a gold medal, worth 500 lire.)

For 1871.—A Monograph on the poisonous and explosive substances extracted from coal, and on the hygienic measures to be adopted in the preparation, commerce, and transport of these bodies. (To be delivered Feb. 1871. Prize, 1,500 lire, with a gold medal of the value of 500 lire.)

For 1872.—A Memoir giving, together with the necessary proofs by fact, a demonstration or a refutation of the curative or prophylactic efficacy of the alkaline and earthy sulphites or hyposulphites in intermittent fevers arising from malaria, comparatively with other means or remedies already known. (To be delivered in Feb. 1872. Prize, 1,500 lire, and a gold medal, worth 500 lire.)

The Memoirs to which prizes are awarded in the ordinary competitions of the Fondazione Cagnola remain the property of the authors; but the latter are bound to publish them within a year, consulting with the Secretary of the Institute as to the arrangements and characters, and consigning to the Institute fifty copies, after which only will the money be paid.

The Institute and the representative of the Fondazione Cagnola reserve the right of printing a larger number of copies at their own expense.

EXTRAORDINARY PRIZE OF THE FONDAZIONE CAGNOLA.

For 1870.—A prize of 1,500 lire, and a gold medal of 500 lire, to the author of any work, MS. or printed, in Italian, Latin, or French, and published since 1860, which shall satisfactorily demonstrate the efficacy of any means for the cure of Gout.

The Memoirs and printed works must be presented in Feb. 1870; of the latter, two copies must be presented, with precise indication of the passages in which the discovery in question is treated. The prize may be awarded in part, and the award will take place on the 7th of August, 1870. The printing or the custody of the manuscripts to be regulated as for the ordinary prizes of the Foundation.

PRIZES OF THE FONDAZIONE SECCO-COMNENO.

For 1870.—Chemico-microscopic investigation of the curd of milk, to determine whether its active principle resides in a biological ferment, or in any other chemical agent, so as to estimate exactly the quantity required in the making of cheese. (To be delivered Feb. 1870. Prize, 864 lire.)

For 1872.—To determine, on chemical principles, and by appropriate experiments, what are the best anti-fermentatives or antiseptic substances; also the best disinfectants and deodorizers, simple or compound, indicating their various uses and relative costs, with special reference to recent investigations. (To be delivered Feb. 1872. Prize, 864 lire.)

The prize-memoir to remain the property of the author; but he must publish it within a year from the date of award, consigning eight copies to the managers of the "Ospitale Maggiore di Milano," and one to the Institute, for comparison with the MS.; after which only will the money be paid.

PRIZES OF THE FONDAZIONE BRAMHILLA.

For 1870.—Prize of 3,000 lire and commemorative silver medal to any one who, by the 30th of Nov. 1869, shall have established in Lombardy a manufacture of phosphates, prepared for agricultural use, on a scale sufficient for the manuring of at least 200 hectares per annum. (To be delivered Jan. 1870.)

For 1871.—Prize of 4,000 lire to any one who has invented or introduced into Lombardy any new machine or industrial process, or other improvement from which the population may obtain a real and demonstrated advantage. (To be delivered Jan. 1871.)

The competitors for the prizes of this Foundation must present their claims, accompanied by the requisite documents, within the time specified, to the Secretary of the "Royal Lombardy Institute of Science and Literature," in the Palazzo di Brera at Milan.

General Regulations for all the Scientific Competitions.

These competitions are open to all persons, native or foreign, excepting the actual members of the Royal Institute; the Memoirs must be written in Italian, French, or Latin, and they must be sent, post-free, at the times specified, to the Secretary of the Institute, at the Palazzo di Brera in Milan; and, according to the academic regulations, they must be anonymous, and distinguished by a motto repeated in a sealed packet, containing the christian name, surname, and residence of the author.* Particular attention is recommended to this regulation, as in default of compliance therewith, the Memoirs will not be taken into consideration.

To avoid mistakes, the competitors are also requested to state clearly *for which* of the prizes proposed by the Institute they intend to compete.

All the manuscripts will be preserved in the archives of the Institute, authors being at liberty to have copies of them taken at their own expense.

Authors of Memoirs to which prizes are not awarded are at liberty to withdraw the corresponding packets within a year after the adjudication of the prizes, which will take place in solemn assembly on the 7th of August following the close of the competitions.

* This regulation does not apply to the competitions for the extraordinary prizes of the Fondazione Cagnola, or for the prizes of the Fondazione Bramhilla.

DIARY

THURSDAY, December 2.

Society of Antiquaries, at 8.30.—A Chalice of the Fifteenth Century, and Chalices generally; Mr. Octavius Morgan, M.P., V.P.S.A.
Linnean Society, at 8.30.
Chemical Society, at 8.30.
London Institution, at 7.30.—Architecture: Prof. R. Kerr.

FRIDAY, December 3.

Geologists' Association, at 8.
Philological Society, at 8.30.
Archæological Institute, at 4.

MONDAY, December 6.

Entomological Society, at 7.
Medical Society, at 8.
Victoria Institute, at 8.
London Institution, at 4.—Elementary Physics: Prof. Guthrie.
Society of Arts, at 8.—The Spectroscope and its Applications: Mr. J. Norman Lockyer.
Royal Institution, at 2.—General Monthly Meeting.

TUESDAY, December 7.

Civil Engineers, at 8.—On Public Works in the Province of Canterbury, New Zealand: Mr. Edward Dobson, Assoc. Instit. C.E.—On Ocean Steam Navigation, with a view to its further development: Mr. John Grantham, M. Inst. C.E.
Pathological Society, at 8.
Ethnological Society, at 8.—Report on the Prehistoric Remains in the Channel Islands: Lieut. S. P. Oliver, R.A.—On the Megalithic Monuments of Brittany: The Rev. W. C. Lukis.
Syro-Egyptian Society, at 7.30.—On the Obliteration of the Name and Figure of Amun, and the Restoration of both in the time of Rameses the Second: Mr. Bonomi.

WEDNESDAY, December 8.

Society of Arts, at 8.—Prints and their Production: Mr. S. T. Davenport.
Geological Society, at 8.—Notes on the Brachiopoda hitherto obtained from the Pebble-bed at Budleigh Salterton, near Exmouth: T. Davidson, Esq., F.R.S.—On the Relation of the Boulder-clay without Chalk of the North of England to the Great Chalky Boulder-Clay of the South: Searles V. Wood, Esq., Jun.—On the Iron-ores associated with the Basalts of the North-east of Ireland: Ralph Tate, Esq., F.G.S., and J. S. Holden, M.D.
Royal Microscopical Society, at 8.—On Deep-sea Dredgings from the Vicinity of China and Japan: Prof. Rymer Jones, F.R.S.
Archæological Association, at 8.

THURSDAY, December 9.

Royal Society, at 8.30.
Society of Antiquaries, at 8.30.
Zoological Society, at 8.30.
Mathematical Society, at 8.
London Institution, at 7.30.

BOOKS RECEIVED

English.—The Life and Letters of Faraday, 2 vols.: Dr. Bence Jones (Longmans).—Ornithosauria and Reptilia from the Secondary Strata: H. G. Seeley (Deighton, Bell, and Co.).—Proceedings of the Royal Physical Society of Edinburgh, 1862–6 (Williams and Norgate).—A System of Mineralogy: J. D. Dana and G. J. Bush (Trübner and Co).—More Light, a Dream in Science (Wyman and Sons).—The Best Method of Developing the National Talent for Music: H. L. Bellini (Mallett).—The Origin of Seasons considered from a Geological Point of View: Samuel Mossman (Blackwood and Sons).—The Advanced Atlas, Progressive Atlas, Primary Atlas (W. Collins, Sons, and Co.).

American.—Annual Report of the Trustees of the Peabody Academy of Science (Trübner and Co).

Foreign.—Voyages Aeriens: Glaisher, Flammerion, W. de Fonvielle and Tissandier (Hachette).—Histoire de la Création: H. Burmeister—La Chambre Noire et la Microscope, Photomicrographie practique: Jules Girard.—Ueber Thal- und See-Bildung: Prof. L. Rutimeyer.—Beobachtungen und Rechnungen über veränderliche Sterne von Dr. F. W. A. Argelander.—Allgemeine Himmelskunde.—Ueber das Zurückbleiben in den Naturwissenchaften.—Karl Ludwig Freiherr von Reichenbach: Dr. A. R. T. Schrötter.—Eierstock und Ei: Prof. W. Waldeyer. (Through Williams and Norgate.)

CONTENTS

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