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

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THE ROYAL COMMISSION ON SCIENCE

THE Council of the British Association for the Advancement of Science was received on Friday last by Earl de Grey, Lord President of the Council, as a deputation to urge on the Government the issuing of a Royal Commission to inquire into the state of Science in England.

That such a body, representing as it does, not only the science but the intellect of the nation, more fully than, perhaps, any other association in the kingdom, should take so decided a step is sufficient proof that in the judgment of those best qualified to guide public opinion on the subject, our scientific system needs reform.

The truth is that we have no scientific system, properly so called. Nothing can be more distinct than Prof. Stokes's statement to Earl de Grey as to the incompleteness of our arrangements. We have it on his authority that a certain class of Astronomical observations is carried on at the Royal Observatory and that natural objects are displayed at the British Museum; but that experimental research receives "little or no support" from the State. It is not easy to frame a plausible distinction between these branches of science, which shall justify support in one case and neglect in the other. The existing anomaly may be explained by the facts that astronomy and natural history have engaged the attention of man from the earliest ages and that they appeal palpably to his senses; whilst chemistry and physics are comparatively recent studies, whose aims and processes and even many of their results are understood and appreciated only by the few, though ministering to the welfare of all. Chemistry, in the modern sense of the word, is not a century old; electricity and electro-magnetism are younger still. Mainly by private means, these and cognate branches of science have been advanced in England to their present stage; "but," says Prof. Stokes, "it was perfectly obvious that there were many investigations which it was desirable to carry out and which would require the main part of a man's time; but which involved appliances on so large a scale as to be beyond the power and scope of a private establishment." The plain inference from this pregnant statement is that these desirable investigations cannot be carried on for want of means. It is notorious, indeed, that progress is stayed in many important directions for want of those "appliances and establishments" and that "time" which it is hopeless to expect from private sources.

Still, it may be urged that there is not so much need for these investigations as to demand that the State should undertake them; or, that the help of the State has something noxious about it which tends to paralyse the spirit of philosophical inquiry. Let us examine these two very different objections. The simple answer to the first is given by the very proposal of the deputation. They do not, on their sole representation, weighty though that must be admitted to be, demand that Government physical laboratories shall be established. They say, "We think such things are wanted; but do not take our word for it. Inquire; constitute a commission composed of persons of station, independence and statescraft, to receive our statements and to sift from them our interested enthusiasm, reducing what may be our too soaring aspirations to practical and business-like proportions. Inquire first and then act, if you see fit; but do not persist in neglecting, without inquiry, things that ought to be done."

With regard to the second objection, namely the paralysing effect of State aid, we can only treat it as a purely sentimental notion. Does Mr. Airy's salary paralyse astronomy? Does Sir Henry James's salary paralyse Geodesy? Does the money spent on art at South Kensington, on pictures for the National Gallery and on collections at the British Museum, paralyse those establishments? Is there something so peculiar in experimental labours as to place them in a category by themselves, subjecting them to malign influences from which the whole of the rest of the business of life is exempt? Are such labours so exceptional in their nature that whilst a public body like the Royal Institution shall purchase apparatus and pay salaries and thus stimulate the genius of Davy, Faraday and Tyndall, the same apparatus and stipends given to them by the State must have reduced these men to torpor?

But to return to practical matters. The main points for a Royal Commission to throw light upon are these. First, is it right that science should be aided at all by the State? Secondly, is the aid now given exactly what is needed—neither too much nor too little? Thirdly, the degree and direction in which science should become a State business having been settled, what will be the best organisation for the purpose? Not one of these points has ever yet been thoroughly considered in England. At present all is arbitrary, inconsistent and incomplete: or, to use Prof. Huxley's comprehensive word, "chaotic." The British Association wishes naturally to reduce chaos to order and they wisely begin—not by definite requisitions for things which few out of their charmed circle know the value of; but by a moderate demand for inquiry. This cannot possibly be refused to them. The nation is thoroughly awakened to a sense of its shortcomings as to education and it will be quite prepared to further those ends to which education is merely a means. The outlay which it will be called upon to provide need not be great; indeed, at first we shall have to deal more with the utilisation of what we already possess, than with the creation of new means. The great point is first to establish a sound principle of working and then to apply it by degrees, with caution and economy.

The word education reminds us of its occurrence in the course of the proceedings before Lord de Grey. Education and Science so naturally associate themselves in the mind that it is hardly possible to discuss the latter as independent of the former. Almost all the great continental scientific endowments include instruction in some form or other. And in this country the greater number of our most distinguished men of science are professors and teachers. The question of scientific instruction must, therefore, necessarily be considered by those who inquire into the question of scientific research. This will be by no means the easiest part of their labour. The complaint now is that men eminently qualified for research have too much of their time occupied in teaching. It will be difficult so to apportion the two functions that they shall reinforce and not obstruct each other. And again, there are some departments of science which experience has shown may be safely dissociated from instruction. Astronomy furnishes an example. Mr. Airy would probably not consider that the teaching of a class would aid him much in his peculiar duties.

We have said that this part of the inquiry will be difficult. The whole inquiry is indeed fraught with difficulty. It means nothing less than the constituting of a department of the State of which even the nucleus cannot be said, as yet, to exist. To do this liberally and efficiently and yet, with such regard to economy as shall make the result visibly beneficial to the community on whom the cost will fall, will be an achievement worthy of any statesman's ambition; but beyond no real statesman's reach.

We do not doubt that the Commission will be granted. Lord de Grey and Mr. Forster are too experienced to attach undue importance to the apparent want of harmony between some of the opinions expressed, or to suppose that all the grounds on which the Commission was asked for could be given in an hour's conversation. They will rather be swayed by the representative character of those who asked for it.

PETROLEUM AND ITS ALLIES

CONSIDERABLE anxiety has for some time past prevailed as to the existence of danger attending the use, storage and transport of the mineral oil now used for illuminating purposes and, as the questions involved are not only of great importance in many respects ; but likely to be soon brought prominently before the public, some account of the sources of mineral oil and of its characteristics will probably be acceptable to our readers.

Thirty years ago, or less, the materials which form the subject of this article were almost unknown to either commerce or manufacturing industry. With some few exceptions, such as the use of the petroleum of Miano, in Italy, for lighting the streets of Parma and Genoa in 1800, natural mineral oil was only in scanty demand, under the name of Persian naphtha, for some few minor purposes and it was generally rare, even as a curiosity, in mineralogical collections. The analogous oils obtained artificially, by the distillation of coal and other bituminous materials, were even less familiar ; for no material was then known that would yield them in sufficiently abundant proportion to admit of their being manufactured on a commercial scale. For this reason mainly, the various attempts to produce such oil were a succession of failures commercially and it was not until about the year 1840 that Mr. James Young, of Glasgow, had the good fortune to meet with a peculiar bituminous mineral—the precise character of which has been the occasion of much controversy—capable of yielding a very much larger proportion of oil by distillation than any other material of a similar kind. The discovery of this material and the recognition of its oil-yielding capability, were speedily turned to account by Mr. Young and his colleagues, forming the basis of a manufacture that has now assumed gigantic proportions and furnishing a commodity which is, for many thousands of people, a daily necessary.

But scarcely had this paraffin oil, now so well known, begun to come into general use as an illuminating material, than a formidable competitor appeared in the market in the shape of natural mineral oil, derived, at first and for a brief period, from Burmah and subsequently, in overwhelming abundance, from certain districts of North America, chiefly Pennsylvania and Canada. Since the first working of the petroleum deposits of America—about the year 1860, the exportation of this material, or of products manufactured from it, has increased rapidly and it now amounts to little less than one hundred million gallons a year.

The character of the refined petroleum imported from America has had much influence in extending its use ; for, its pleasing appearance and comparative freedom from disagreeable smell, have gained for it a popular preference that so far is not unfounded.

American petroleum, however, contains a large proportion of a very volatile oil or spirit and, consequently, since the introduction of American refined petroleum into the market, the greater part of the oil derived from that source has been characterised by a greater degree of inflammability than the oil manufactured from Rangoon petroleum and from coal or shale ; this difference being due to the fact that the volatile spirit, so abundant in American petroleum, is not completely separated in the process of refining. By leaving this spirit in the refined oil, a larger produce is obtained by the manufacturer and there is a further advantage gained in this way, owing to the fact that the volatile spirit, when separated, generally sells for only half the price of lamp oil.

The practical question in regard to the safety of mineral oil and its fitness for domestic use, is as to the extent to which the more volatile portions of the crude materials should be separated in the refining operation. Although in reference to this question, the possibility of careless and improper usage of the oil cannot reasonably be regarded as justifying any considerable restrictions in the application of a material so useful ; still some allowance requires to be made even for that possibility, taking into account the conditions under which mineral oil is carried, stored and used in a general way. The point to be ascertained is not merely what oil may be used without necessary danger ; but what description of oil will best answer the purposes for which it is intended, without requiring a greater degree of caution in its use than can fairly be expected, or any unreasonable restriction on the trade. Hence it would seem to be desirable for the convenience of those engaged in the mineral oil trade, as well as for ensuring public safety, that every branch of this trade should be subject to appropriate regulation: that the degree of inflammability of mineral oil should be limited; a definite standard established and, a mode of testing the oil adopted, which would not admit of discrepant results being obtained, either by accident or otherwise.

With this general object an Act of Parliament "for the Safe Keeping of Petroleum" was passed in 1862, prohibiting the storage of more than forty gallons of petroleum within fifty yards of a dwelling-house or building in which goods were stored, except in virtue of a license granted by local authorities who had the power to annex to their licenses any conditions thought necessary for diminishing risk of damage by fire or explosion. The application of the term "petroleum" in this Act was specially limited to crude petroleum, or any product of it giving off inflammable vapour at a temperature less than 100° Fahr. This Act may be said to have been entirely without effect on the refined petroleum sold for use in lamps and, another Act, passed in 1868 to amend it, has been but little more effective in this respect; so that the facts as to the storage and sale of mineral oil, of all degrees of inflammability, remain much the same as they were before.

The abortive character of this Act is probably to be ascribed, in great measure, to a conflict of interests, supposed to be opposite, when the bill was before Parliament and a further reason for its inoperative character, consists in the absence of any sufficient or fitting organisation for carrying out its provisions and regulating the trade in mineral oil. Strange to say, the licensing bodies have, generally speaking, no power under the Act to inspect and test mineral oil, except as a condition of licenses granted by them and the persons who are specially authorised by the Act to inspect and test, are not in most cases under the control of the licensing bodies. Of still greater influence in nullifying the provisions of the Petroleum Acts, is the want of any properly-constituted authority for instituting proceedings in cases where those provisions have been infringed. Any person may prosecute; but, as is generally the case with a duty so general, everyone leaves it for some one else to do so.

But perhaps one of the chief reasons why the Petroleum Act of 1868, has proved inoperative, is to be found in the unsatisfactory nature of the test by which the fitness of mineral oil for domestic use is directed to be ascertained and in the vague terms by which the operation of testing is described in the schedule appended to the Act. The point to be ascertained is the temperature at which mineral oil gives off inflammable vapour and, since any danger that may arise in this way, would exist chiefly in the ordinary use of the oil in lamps, it would seem to be an obvious necessity that the test, applied to ascertain that point, should be conducted under conditions as nearly resembling those obtaining in the actual use of the oil as could possibly be devised. The Act, however, prescribes a test under conditions which are the direct opposite of these. In using a mineral oil lamp, the oil is heated in a closed vessel partly filled with air; in testing the oil it is directed to be heated in an open vessel with the surface of the oil freely exposed to the atmosphere. In the test, any vapour that is given off from the oil is liable to be blown away by draughts and by diffusing into the surrounding air, to become so much diluted as to lose its inflammable character; while, in the lamp, any vapour given off is confined and forms an explosive mixture with the limited quantity of air contained in the oil reservoir. There is indeed, generally speaking, little real danger attending such a result as this, for the quantity of inflammable vapour produced in the reservoir of a lamp would rarely be sufficient to cause any dangerous explosion; but the flash resulting from the ignition of this vapour, would certainly be enough to startle almost any persons and cause them to drop the lamp. It is probably in this way that many of the accidents with mineral oil have taken place, since the lamps are very generally made of glass and since the oil readily takes fire when spilt upon linen, paper, or any such material.

Besides this cardinal defect in the prescribed test of mineral oil, the various directions given for conducting it are so vague and general, that they leave much to the fancy and option of the operator. Moreover, it is to be doubted whether inspectors of weights and measures, who are the persons authorised under the Act to test mineral oil, are generally competent to conduct these tests in a satisfactory manner.

Although the Act has been in operation only a few months, it has already given rise to much difficulty and inconvenience, without being productive of any benefit. Within the last few weeks, a series of trials of mineral oil, purchased indiscriminately at shops in various parts of the metropolis, has brought to light the fact that, out of 75 samples thus obtained, 39 of them were below the legal standard in regard to inflammability, when tested in strict accord with the directions of the Act.

These facts are sufficient to show that there is great need of further legislative action in this matter; this need has long been felt by those engaged in the mineral oil trade and there is every reason to believe that a well-digested enactment, providing for the safe transport, storage and use of mineral oil, would be of great benefit, not only to the public at large; but also to those engaged in all branches of the trade connected with this useful commodity.

HOSPITAL CONSTRUCTION

An Address on the General Principles which should be Observed in the Construction of Hospitals. Delivered to the British Medical Association at Leeds, by Douglas Galton, C.B., F.R.S. (London: Macmillan and Co., 1869.)

THIS able address with the discussion which followed it, brings fully before us the question of hospital construction. The Address itself is exclusively practical: it goes direct to its object and, by appealing to the results of every day's experience of the benefit of cleanliness, space and fresh air; it points out how these essential elements in the management of the sick, have been embodied in recent hospitals and it indicates by implication, what errors should be avoided.

After stating briefly the work done in this matter by different Sanitary commissions in this country, Mr. Galton gives the following enumeration of objects which must be attained in hospital buildings:—

"1. Pure air, that is to say, there should be no appreciable difference between the air inside the ward and that outside the building.

"2. The air supplied to the ward should be capable of being warmed to any required extent.

"3. Pure water, so supplied as to ensure the removal of all impurities to a distance from the hospital.

"4. The most perfect cleanliness within and around the building."

To realise these conditions the first step in hospital improvement is to select healthy sites, away from irremovable sources of air impurity and, having by this means obtained a pure moving atmosphere, the author proceeds to show how the site is to be used so that the pure atmosphere may not become a disease generator in the wards. The building must be so arranged as to interfere as little as possible with the free, natural movement of the outer air and this free outside movement should be kept up, as far as practicable, within the wards. "Stagnant air is foul air," especially in a hospital.

It has been experimentally shown that ward-air moves most readily when care is taken to combine as far as possible the following requirements:—1st, To let the prevailing outer air currents strike the *sides* of the wards; 2nd, To provide that the sun shall shine on the opposite sides of the wards every day he shines: 3rd, To have windows on opposite sides of the wards, with the beds arranged between them. A proper use of these opposite windows is the *sine qua non* of ward ventilation and of ward healthiness. But, in cold variable climates, provision has to be made for graduating the ventilation and for warming a portion of the air.

The subsidiary means which have been found to answer in practice are foul air shafts, fresh air inlets close to the ceiling, and warm air stoves—of a peculiar construction described in detail—so contrived that, while the ward is heated by radiant heat, the air warmed is not ward air but fresh air.

The cubic space per patient is determined primarily by the superficial area per bed, which, in its turn, is determined by the area required for efficient nursing. From 90 to 100 square feet per bed is sufficient, except in hospitals where there are medical schools. The cubic space per bed hence depends on the height of the ward.

There is but one test of ventilation and that is freshness of the ward air. No quantity test is of any avail, hence ventilation, that is, the proper use of the means of ventilation, is an essential part of ward administration. No man or woman who has not a sensitive nose and who has not also a perfect horror of bad smells or closeness, should ever take office in a hospital.

The central point in hospital construction is the ward itself and the following figure shows the usual arrangement of the ward and its offices, in the new class of hospitals.

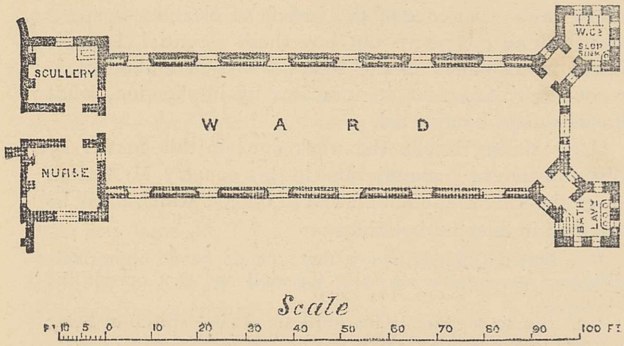


FIG. 1.

On one side of the entrance is placed a nurses' room; on the other side of the entrance is placed a small scullery. In the ward itself the beds are arranged two and two along the wall spaces between the windows, with a bed at each corner. At the further end of the ward is a large end window. On one side of this window there is a building, thrown out from the corner, in which are placed the water-closets. The other building, at the opposite corner, contains the lavatory and bath-room.

The next figure shows the simplest arrangement of these ward units in a regimental hospital. Such a building can be constructed on one or two floors. The administrative portion, together with two or four small wards for special cases, occupies the centre of the block and the kitchen is detached. The larger wards project at either end. (A, fig. 2.)

A very important question, raised by Mr. Galton, is the manner in which hospital accommodation should be provided for recurring epidemics, fevers, cholera and the like. He shows that the cheapest and most effectual provision consists of temporary huts, a result which we commend to those who consider that large, costly, permanent fever hospitals are necessary for London.

With this general statement of the principles we must refer our readers to the address itself for the numerous points of detail which require to be attended to for securing due care and prompt attendance on the sick. They are all in strict accordance with scientific requirements and, if intelligently applied, will save many valuable lives.

We wish we could say as much of some portions of the discussion which followed the address. We allude to the obtrusion of the "germ" disease hypothesis into the hospital question. This theory, it is true, met with little countenance from the meeting; but there it was. In one sense its introduction was useful as showing what the final results of such a doctrine are. Of disease itself we know little scientifically as yet; nevertheless, it has become a fashion of late to supplement lack of knowledge by assuming that certain diseases are separate specific existences like animal or vegetable species, each springing from a "germ" or seed introduced from without; hence in the discussion it was averred that the supposed destructive influence of carbolic acid on these "germs" can be made to supply the place of fresh air in hospital wards, and, as a consequence, that the danger has to be encountered, not in foul air but in disease "germs."

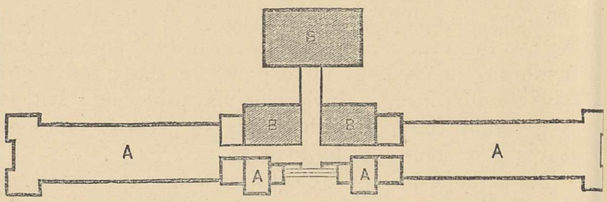


FIG. 2.

There may be disease "germs" for anything we know; but, until their existence is proved physically and until it is shown that there are germs with different distinctive specific characters, each of which germs can be shown to produce always the same group of symptoms in the human body, which symptoms can arise from no other cause; we can in no sense recognise the existence of disease germs. In scientific questions of this kind, "*de non apparentibus et de non existentibus eadem est ratio.*"

To neglect the ventilation and other sanitary arrangements of hospitals for a mere theory, would be to undo all that has been done in hospital improvements in Europe, with the inevitable result of destroying life.

Mr. Galton concludes his paper with some pertinent remarks on the cost of useless ornament in hospitals, which we commend to the consideration of hospital architects. Hospital resources are limited, patients are many—too many we should say.

Miss Nightingale begins her admirable "Notes on Hospitals"—a book which has done great good—with this startling passage:—"The very first requirement of a hospital is that it should do the sick no harm." Have hospitals, then, done harm to the sick? We are sorry to say that there are few of the older, badly constructed, ill-ventilated hospitals in any country which have not their calamitous records of immense death rates at all times and, especially, during epidemic seasons.

No one can read Mr. Galton's address without recognising that, from first to last, it is a protest against hospitals. Why are all these precautions and costly appliances necessary, unless it be to enable the sick poor to be grouped together in hospitals without destroying their lives?

Are not all these precautions a tacit admission that in breaking the family tie, in sickness, we are acting against Nature? She has bestowed the "family" with its common joys, sorrows and duties, on the human race. If, in order to aid the poor in sickness, it is necessary to break up the family tie and to expose the sufferers to risks in hospitals which they might escape at home, we would suggest whether there be not a prior question—namely, whether we cannot improve the dwellings of the people, make them better adapted for sickness as well as for health and thus look forward to the abolition of hospitals altogether.

We are, as yet, far from this consummation and, if we must have hospitals, we are bound to make them not only harmless, but useful. Mr. Galton has added a valuable contribution to the literature of hospitals in showing how this may be done.

ENTOMOLOGY IN AMERICA

A Guide to the Study of Insects and a Treatise on those Injurious and Beneficial to Crops: for the Use of Colleges, Farm-Schools and Agriculturists. By A. J. Packard, Jun., M.D. With upwards of 500 Engravings. Parts I.-VIII. (Salem: published by the Essex Institute, 1868-69. London: Trübner and Co.)

IT must be confessed that our American brethren are inclined in the present day to advance in the study of natural history, as in everything else. We can call to mind a dozen or more thriving institutions for the advancement of Science, especially natural history, in various towns in the United States, some of the names of which are hardly known to us, except by their scientific publications.

The Governments, both of the whole Confederation and of the different States, show a liberality in patronising scientific researches and in diffusing the results of those carried on under their auspices, which we should be glad to see imitated nearer home. A great number of American naturalists enter boldly upon investigations which but few of their distant relations on this side of the Atlantic, seem inclined to take up: their papers are generally of interest, and, not unfrequently, of great value.

In no department of zoology are the zeal and energy of the American naturalists more clearly shown than in the study of entomology. Doubtless, in the United States, as elsewhere, there are a great many amateurs, who rush into print with crude notions and write perhaps too hastily; but amongst the American entomologists there are several who are doing excellent work in the elucidation of this branch of the natural history of their country and even attacking groups, such as the *Ichneumonidæ*, in face of which German or Scandinavian pertinacity recoils baffled, or makes but little way.

Dr. Packard, the author of the "Guide to Entomology," of which eight parts (out of ten) are now before us, is well known as a writer on American insects, chiefly Hymenoptera and Lepidoptera,—he has also made some original investigations upon the anatomy and physiology of insects. The first portion of his book, occupying nearly two parts, is devoted to general entomology and furnishes an admirable, though necessarily brief, account of their organisation, of their reproduction and development in the egg and of their metamorphoses. The most recent memoirs connected with these subjects, have been made use of by the author and this part of his work is certainly the best manual of entomology which the English reader can at present obtain. The author concludes the general section of his work with directions for collecting and preserving insects, followed by a short bibliography and then proceeds to discuss the classification of insects.

In his classification, Dr. Packard departs somewhat from the generally received views, especially in regarding the class of insects as including, along with the true six-footed and generally winged forms, the Spiders and Myriapods, which have either eight or many feet. It is true that the Myriapods approach the true insects very closely; but the passage indicated by Dr. Packard from the Diptera to the Spiders appears to be founded solely on superficial resemblances and it by no means warrants the union of the *Arachnida* with the Insecta, although that of the *Myriapoda* may perhaps be accepted. Of course, as the boundaries of the class of insects are thus enlarged, the true insects of other authors have to occupy a lower rank in the system and Dr. Packard treats them as forming a single order of his class insects. He then adops the usual seven ordinal divisions as "sub-orders" and indicates their arrangement in two slightly divergent series as follows:—The Neuroptera, or lace-winged flies, form a common starting point, from which issue, on the one hand, the Orthoptera, Hemiptera and Coleoptera; on the other, the Diptera, Lepidoptera, and Hymenoptera, the latter series being the highest. The author does not state that he regards this as a genealogical tree, or as expressing the course of evolution of the groups; in any case the relationship of the Hemiptera to the Coleoptera does not seem very clear.

These slight objections to some of our author's theoretical views of classification do not, however, apply in the least to his exposition of the classification itself, which is admirably clear and complete. Under each order he gives a general account of the structure and habits of its members, followed and illustrated by a more detailed description of the characters and mode of life of particular species, arranged under their respective families. The examples selected by the author consist, for the most part, of the commonest species inhabiting the United States, a circumstance which will necessarily form a little drawback to its usefulness in this country; although, from the fact that great numbers of the North American insects have their allies, if not representatives, in Britain, the descriptions of habits, at any rate, will be generally applicable.

The study of economic entomology, especially with reference to insects injurious or beneficial to agriculture, has long been zealously followed in the United States, and the writings of Harris and Fitch are well known on this side the Atlantic.

OUR BOOK SHELF

The Sun. By Amédée Guillemin. Translated by T. L. Phipson, Ph. D. Pp. 296. 58 illustrations. (Bentley.)

MONSIEUR GUILLEMIN is favourably known among us by his beautiful book "The Heavens" and the present volume may be regarded as a considerable expansion of his chapters on the sun in that work, with additional matter, giving an account of the recent solar discoveries. The expansion has been very judiciously done; but the new matter introduced has been added, in too much haste and consequently the recent conquests of Science do not come out so satisfactorily as they might otherwise have done. In "The Heavens," M. Guillemin did what Frenchmen very rarely do—he took the trouble to inform himself on what was done in England, America and Germany. In the present instance he has taken his information from French sources exclusively and the result is poor.

Still, for those whose purpose it is to inform themselves on the sun generally, the book fills a gap and may be safely recommended. Mr. Phipson has done his part well—except where he has added notes and the book in its English dress is pleasant to the eye.

Handbook of Physical Geography. By Keith Johnston, Jun., F.R.G.S. Pp. 220. (W. and A. K. Johnston, Edinburgh and London. 1870.)

THIS is the text to accompany the altogether satisfactory half-a-crown atlas we noticed some time ago and in saying that the text is as good as the maps, we intend to convey high praise. Within the limits of somewhere about 200 pages, Mr. Johnston has contrived to give a very admirable account of the various natural phenomena with which physical geography has to deal; the facts are well and widely chosen. The style is clear and the arrangement a very model.

Of the four divisions of the book—Topography, Hydrography, Meteorology and Natural History, the two central ones possibly present evidences of the greatest care; for instance in Map 18 (the Mediterranean basin), the contour lines both of height and depth have been investigated by Mr. Johnston expressly for this work and in Map 13 (Physical Geography of Palestine) the isotherms have been worked out from observations at Alexandria, Cairo, Jerusalem, Beirut, Damascus, Aleppo and other places.

We heartily commend this book both to teachers and students.

The Advanced Atlas: consisting of Thirty-two Maps, containing all the Latest Discoveries and Changes in Boundaries; *The Progressive Atlas:* consisting of Thirty-two Maps—and *The Primary Atlas:* consisting of Sixteen Maps. All constructed and engraved by J. Bartholomew, F.R.G.S. (William Collins, Sons, & Co. Glasgow, Edinburgh and London.)

ALL these maps, even including the sixteen in the "Primary Atlas" which sells for sixpence, are printed in colours; their engraving is of a high order, the maps being rendered clear by a judicious omission of names. It would have been better for the young student if the boundaries between States, *e.g.*, Turkey and Greece, had been made more decided in the "Advanced Atlas." Great care has been taken in many cases, Africa for instance, to introduce the most recent discoveries.

Echoes in Plant and Flower Life. By Leo H. Grindon, Lecturer on Botany at the Royal School of Medicine, Manchester. (London: Pitman, 1869.)

WE opened this little book in the hope of finding some new light thrown on the fascinating subject of Mimetism. The writings of Mr. Darwin, Mr. Wallace, and Mr. Bates have made even the non-scientific reading public familiar with the existence of wonderful external resemblances between animals belonging often to widely different natural orders; resemblances which those writers have sought to explain on the theory of Natural Selection. Though the most remarkable instances of Mimetism to which attention has been drawn, are chiefly to be found in the tropics, scarcely less interesting examples are furnished by certain families of our own native Hymenoptera and Diptera: even in the vegetable kingdom we need not seek far for superficial resemblances which are not underlain by any corresponding similarity of organic structure. To trace these "echoes" in plant life (why "Plant *and* Flower Life" we do not know), is Mr. Grindon's hobby and to say that he rides his hobby too hard is only what might perhaps be expected. There is only a very limited number of ways in which anthers can open to discharge the pollen and to call the dehiscence by recurved valves of the bay tree, an "echo" of the same method in the barberry, seems to us an instance of decidedly hard riding. Nevertheless the writer has collected together a large number of very interesting facts which will be of service to anyone who hereafter attempts a scientific explanation of these phenomena. The writer does not; we hope some one else will and he will then find this little book of some value. The style in which it is written, is not such as to commend it to the man of science. In his preface the writer says, "to be a philosophical treatise, the treatment must be æsthetic." When we find the flowers of plants described as "those sweet harp-strings which, vibrating for ever, preserve to us the melodies of ancient Eden and by which they will be floated down the ages yet to come," the treatment of the subject may be æsthetic; we can hardly admit it to be philosophical. Would Prof. Huxley or Dr. Hooker recognise the following description? "Every true naturalist enjoys a renewed puberty of the soul. While other people are young but once, he, like the cicada, in age recovers his spring-time. In this respect he is abreast of the man of genius, whose privilege, like that of the sunshine, is to weave as lovely a sky for the evening as for the morning."

A. W. B.

British Lichens—Lichenes Britannici; scripsit Rev. Jacobus M. Crombie, M.A. (London: L. Reeve and Co 1870.)

MR. CROMBIE is well-known as an indefatigable hunter after lichens and one who has added a considerable number of new species to the British flora. This little book contains a record of the habitat and distribution of the 658 species of lichens at present known as inhabitants of Great Britain and Ireland, together with references to the authorities where descriptions are to be found and the synonymy. The classification followed is that of the veteran lichenologist Nylander, to whom the work is dedicated and the whole is written in Latin. It ought to be in the hands of everyone interested in this branch of our cryptogamic flora. A. W. B.

Chimie Organique en 1868.—*Rapport méthodique sur les progrès de la Chimie organique pure en* 1868. Par L. Micé. Large 8vo. pp. 446. (Paris: Baillière. 1869.)

WHEN we opened this work and found that the author had attempted, for the first time, what he truly designates as "neither an easy nor a glorious task" and that he intends his book to be a sufficiently concise and yet detailed annual report, a suitable "vade-mecum for a professor of high-class instruction," we formed expectations which were not quite realised on further perusal. M. Micé wrote this report at the request of the *Société des Sciences Physiques et Naturelles*, who purpose publishing similar reports annually. The title, it will be perceived, is perfectly general and it might have attracted any student of organic chemistry. But the author informs us (p. 1) that his book "can only be useful on condition of being methodical and *containing no more than a Faculty professor can deliver, from memory, in his lectures.*" We should strongly recommend M. Micé, especially as he proposes to extend this plan to the entire domain of chemistry, to alter his title-page before again proceeding to publication. "Lecture Notes for Professors of Chemistry" would be a much more appropriate designation ; less pretentious, certainly, but having the great advantage of accuracy. Undoubtedly, the author has succeeded in producing a *rapport méthodique;* but it is decidedly not a *rapport sur les progrès de la Chimie organique pure*, nor has it that nice adjustment between details and conciseness which is the essential requirement of such a treatise. The only work which fulfils and ably fulfils these conditions, is the German "Jahresbericht der Chemie," a model of patient and deliberate composition. M. Micé will find prefixed to it a list of some sixty or seventy periodicals, containing the various original papers to which it refers. We may fairly ask him whether many French professors (*du haut enseignement*) will be satisfied with the basis he has selected, viz., five French journals and the 3rd edition of MM. Pelouze and Frémy's "Traité de Chimie." Considering that the author has had recourse to such a method of shortening his labours, it is not surprising that the performance should exhibit a generally hasty character. At p. 117, for example, we find the following passage :—"Théine gives up a quarter of its nitrogen, creatine a third, the other natural and artificial alkaloids one-half." It so happens that the experiments in this particular case, instead of being carried out with *all* nitrogenous organic bodies, were pardonably limited to nineteen instances. We regret we cannot commend this work, as fulfilling either the promise held out on its title-page, or the more limited intention expressed in its opening paragraphs.

History of Creation.—*La Création d'aprés la Géologie et la Philosophie Naturelle.* Par J. B. Rames. (Paris: Hachette.)

THIS is an odd book. Even in these days of sensational works on science we are not sure that, in his own style, M. Rames has been surpassed. His purpose is to describe in a kind of prose epic, the history of our planet and its inhabitants, from the nebulous condition of the solar system down to the present day. Apostrophising sun, moon and stars by turns, he tells them how they have been fashioned and of what uses they are. Tyrants and philosophers come in for appropriate addresses and then the writer plunges into the depths of the primeval ocean in which the Laurentian rocks were formed. He finds its waters hot, charged with silica and in the act of depositing crystalline rocks in the form of gneiss and schist. One day—whether in the depths of the thermal ocean, or in the lakes that dotted the lonely islets, he cannot tell—"Life, one of the special forms of solar heat pervading the universe like all the other natural forces, finds, for the first time upon our globe in little aggregations of inert matter, the conditions which allow of its manifestation, and thus rises dimly the dawn of an organic kingdom." The subsequent development of these primal germs into the complex genera and species of the animal and vegetable world, through its succeeding geological formations, forms the subject of the remaining portions of the book, of which, however, only the first part, reaching into the Permian period, is published. M. Rames seeks no adventitious aid from sensational pictures : not a single illustration occurs in his book. He trusts wholly to the powers of his pen and has certainly produced a lively, if not very trustworthy, narrative.—A.G.

THE WORK OF THE SEA

THE work done by the Sea is infinitely various, immeasurable in quantity and of inexpressible value to the inhabitants of the earth. It is the one ceaseless worker, never resting and ever accomplishing the tasks it has to perform. The land and the sea may appear to some to be for ever fixed and unalterable, and the map of the world represents to them the geography of the globe of 6,000, or 60,000 years ago, the geography of to-day, and the geography of 60,000 years hence. Still not only does Geology show by the testimony of the far-distant past the impossibility of this being so ; but it has been given to man to see and record the constant rising and falling of the land, within the periods of history and even to measure the movement with sufficient accuracy and such certainty as to enable him to venture predicting, to some extent, on the probable geography of the future.

The Earth is born of the Ocean. Continents and islands rise out of the sea, new, luxuriant and vigorous ; and like ourselves they grow, mature and do their appointed work ; then wane and seem to die, though they do *not* die. They sink beneath the waves, apparently for ever ; but only to be regenerated, renewed, quickened into life and born again remodelled. And the sea—the invigorating and ever-toiling Mother—works this wonder.

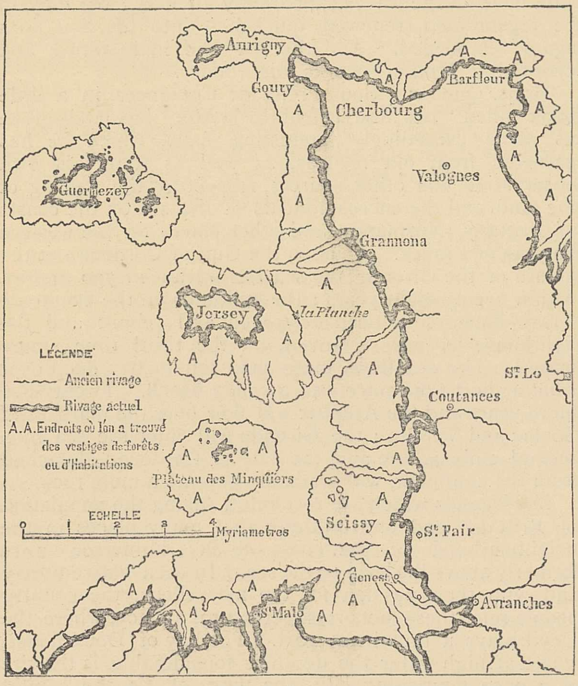
Mons. Quenault, Sous-Préfet de Coutances, in a little book called "Les Mouvements de la Mer," has lately given us some exceedingly interesting facts, which he has gathered from old records, as well as from his own observation and other sources, respecting the sinking of the land and the encroachments of the sea on the coasts of Brittany, Normandy and other places on the western borders of France. Thus, in the Gulf of Cordouan at the mouth of the Gironde, the sea has advanced 730 metres, within twenty-eight years ; the buildings on the Pointe de Grave have often been destroyed and rebuilt and the lighthouse is now removed, for the third time, more inland. The sea flows more than ten metres deep over what a short time since was a sandy beach. Twenty-five more years and the Atlantic will flow over the marshes of Soulac and Verdun ; the Gironde will enter the sea by a second embouchure and the Isle of Cordouan, detached from the continent, will gradually become a mere rock.

The legends which are recounted among the population of Brittany lead one to think that many places in the neighbourhood of the coast—to-day immersed—were formerly above the level of the sea. In their native poetry and with their passion for the marvellous, the country people refer these facts to supernatural agency, where the Devil plays a prominent part. The bay of Douarnenez, where at high water the depth is considerable, is the site of a once flourishing city, the town of Ys, the capital of Cornouaille. At the south side, when the tide is low, are distinguished clearly, five or six metres under water, Druidical remains, altars, portions of walls and ruins of various monuments. Again, on the opposite side, near Cape Chèvre, they are to be found, though not so easily seen and not so numerous ; but that they can be seen under favourable circumstances there is no doubt whatever. The fishermen there believe all the reefs and rocks in the bay to be portions of the ruins. In the 16th century, when the water in the bay was not so deep as now, the Canon Moreau was able then to follow the lines of a vast enclosure (enceinte) of masonry, and above the sand, in the shallower places, he discovered funeral urns, stone sarcophagi, &c. The traveller Comby also adds, that after a storm which excavated and scooped out portions of the sands, one could perceive traces of elm trees, disposed with a regularity which shows that a plantation existed at this spot.

Submerged forests have been found on the coasts of Brittany and particularly in Finisterre, in the neighbourhood of Morlaix. There are historical documents to prove that at the bay of Mont Saint-Michel the coast has been submerged within a period subsequent to the Roman domination. Rouault, Curé de Saint-Pair, says:—"About the year 400 there was in the Basse Normandie towards the west a large forest named Scicy, extending from the rocks of Chausey to the Mont de Tomba"—now Mont Saint-Michel. In the twelfth century the troubadour Guillaume de Saint-Pari referred to this submerged forest in a quaint bit of old French, which may be freely translated thus:—

"Not far from Avranches, on Brittany's shore,
Quokelonde forest spread out of yore;
But that famous stretch of fertile land
Is hidden now by the sea and the sand,
No more will its venison grace the dish—
The ancient forest yields nought but fish."

This forest of Scicy, or Scissiacum, was said to have been full of wild beasts—"præbens altissima latibula ferarum"—and peopled by half-savage natives, to whom succeeded, in Christian times, a number of Anchorites who sought retirement there, far from the tumult of the



world. The parishes of St. Louis, Mauny and La Feuillette have disappeared beneath the waves since the 13th century. A story is told of a priest of the diocese of Dol, that, having in 1685, learned by tradition that there was formerly, in the place then (and now) occupied by the sea, a parish named St. Louis, informed the Court of Rome that this living was vacant "*per obitum.*" Upon this they consulted the registers and found actually that there had been presentations to this living by former Popes. A priest of Basse-Bretagne was therefore appointed and he departed at once to take possession. But on arriving in sight of Mont Saint-Michel, what was his surprise when he was shown on the sands and in the sea, the place where was formerly situated his pretended parish.

There is every reason to believe that the whole of the Channel Islands were, at one time, part of the mainland of France and there is positive proof of the island of Jersey having been so. There are certain existing manuscripts belonging to the monastery of Mont Saint-Michel, which tell us that, in the sixth century, the district of Jersey was separated from the mainland of Coutances by only a narrow rivulet, bridged by a single plank which the inhabitants were bound to keep in repair for the Archdeacon of the mother church to pass over on his periodical visitations. In the register of the taxes of the island, there is an entry referring to rents received from various persons for the privilege of allowing pigs to feed on the acorns in the forest of St. Ouen—now the bay of that name—but, M. Quenault's informant adds rather unnecessarily, "elles ne sont plus payées aujourd'hui!" There are also many other manuscripts quoted and instances given of the great alteration that has taken place in the outline of the Channel Islands and the coasts of France, of which there is given an exceedingly interesting map by M. Deschamps-Vadeville—a *fac-simile* of a chart copied in the year 1406 from one of a much older date. This map, which we reproduce in miniature, shows the coast line from Cape Finisterre down to St. Malo to have been, at that time, from six to twelve miles farther west than at present. The island of Jersey is part of a peninsula, ten or twelve miles wide, stretching out from the French coast to a point some three or four miles west of that island as it at present exists. Guernsey also is shown to have then been considerably larger than the Isle of Man now is. Throughout the whole area of this departed coast, are depicted the positions of some score of places where evidences of the existence of submerged forests have been discovered.

The sinking of the land which has taken place within the periods of history, has occurred only between the parallels of 10° S. and 55° N. lat. North of this, it is gradually becoming more and more elevated. Of this phenomenon M. Quenault gives an equally interesting and detailed account, with numerous facts and voluminous evidence which cannot be recounted within the limits of the present article. M. Quenault concludes—with regard to the depression of the land—"One gathers from all these evidences, that the movement, since the eighth century, has been about two metres a century. If it continues at the same rate for ten centuries more, the peninsula of Cotentin will be an island and all the ports of La Manche will be destroyed. Some centuries later and Paris will be a seaport, waiting only to be submerged in a score of centuries. Thus in a period, less than half as long as that during which the pyramids of Egypt have braved the ravages of time, Paris itself—if it is not burned down during one of the revolutions of its inhabitants, as amiable and *spirituel* as they are inconsistent—Paris will probably be engulphed in the Atlantic, a master before whom the intractable Parisian must haul down his flag. Let him take warning!"

CHARLES W. WHITAKER

MICROSCOPICAL INVESTIGATION OF METEORITES

A PAPER on the above subject, forming part of an investigation commenced two-and-a-half years ago by its author, Prof. Maskelyne, of the British Museum, was read at a recent meeting of the Royal Society. We are indebted to the author for enabling us to lay before our readers the following full abstract of the paper:—

With a view to obtain some more satisfactory means of dealing with the aggregates of mixed and minute minerals, which constitute meteoric rock, the author sought the aid of the microscope, having in the first place sections of small fragments cut from the meteorites so as to be transparent. By studying and comparing such sections, one learns that a meteorite has passed through changes and that it has had a history of which some of the facts are written in legible characters on the meteorite itself and, one finds, that it is not difficult roughly to classify meteorites according to the varieties of their structure. One also recognises constantly recurring minerals; but the method affords no means of determining what these are. Even the employment of polarised light, so invaluable where a crystal of which the crystallographic orientation is at all known, is examined by it, fails, except in rare cases, to be a certain guide to even the system to which such minute crystals belong. It was found that the only satisfactory way of dealing with the problem, was by employing the microscope chiefly as a means of selecting and assorting out of the bruised débris of a part of the meteorite, the various minerals that compose it and then investigating each separately by means of the goniometer and by analysis—finally recurring to the microscopic sections to identify and recognise the minerals so investigated. The present memoir is concerned with the former part of this inquiry. Obviously the amount of each mineral that can be so obtained is necessarily small, as only very small amounts of a meteorite can be spared for the purpose. On this account one has to operate with the greatest caution in performing the analysis of such minerals and the desirableness of determining the silica with more precision than usually is the case in operations on such minute quantities of a silicate, suggested the process which, after several experiments in perfecting it, assumed the following form. After the separation, by alternate treatment with hydrogen chloride and potash, of all silicate that gelatinises with acid, the pounded and weighed mineral was placed in a small retort of platinum with a little ball of the same metal and digested with an excess of pure hydrogen fluoride, containing some 32 per cent. of absolute acid, for two hours, at 100° C. By little platinum delivery tubes with which the retort was provided, a current of hydrogen was allowed to traverse the apparatus and afterwards to bubble through some concentrated aqueous solution of ammonia. After the lapse of the two hours the retort was placed in a bath of paraffin and its temperature slowly raised till 132° C. was reached, at which point the silicium difluoride is evolved and is carried by the current of gas into the ammonia. In a few minutes the operation is complete and it must be repeated with fresh charges of acid and ammonia, till all silicium has been driven into the receiver. This done, a little hydrogen sulphate is introduced into the retort and the retort once again heated in paraffin. If 0·2 gramme of silicate be taken, twice charging of the retort with hydrogen fluoride will suffice; if half a gramme, the process may have to be repeated three or four times. The greater portion of silicium is removed by the first operation and the ammonia becomes semi-solid with deposited gelatinous silica. This is slowly evaporated together with the later ammoniacal charges and the washings of delivery tube and receiver in a platinum dish, and, as the excess of ammonia passes off, a point is reached where the last flock of suspended silica is taken up by the hot solution; the dish is now removed from the water-bath and to its contents, when cold, are added a slight excess of potassium chloride and the requisite volume of absolute alcohol. After 24 hours have elapsed, the precipitated potassium hydro-fluosilicate is filtered off and weighed in the usual manner. The metallic oxides present in the mineral, remain in the retort as sulphates.

The Busti Meteorite.—This meteorite fell on the 2nd of December, 1852, about six miles south of Busti, a station half-way between Goruckpoor and Fyzabad, in India. The fall was attended by an explosion louder than a thunder-clap and lasting from three to five minutes. The explosion that shattered the meteorite, must have occurred soon after its passing the longitude of Goruckpoor. There was no cloud in the sky at the time. The stone, which weighed about 3lb., was presented to the collection at the British Museum by the Secretary of State for India. The Busti aërolite bears a great resemblance to the stone that fell on the 25th of March, 1843, at Bishopsville, South Carolina, U.S.

The meteorite consists for the most part of the mineral enstatite; at one end, however, were embedded a number of small chesnut-brown spherules, in which again one detected minute octahedral crystals, having the lustre and colour of gold. These two minerals seem scarcely to have been affected by the heat that fused the silicates which surround and encrust them. The brown spherules are sulphide of calcium (named by the author Oldhamite) and they also occur sparsely in the Bishopsville aërolite. This mineral forms small, nearly round spherules, whose outer surface is generally coated with calcium sulphate. It cleaves with equal facility in three directions, which give normal angles averaging 89° 57′ and are no doubt really 90°. Its system, therefore, is cubic; indeed, in polarised light it is seen to be devoid of double refraction. Its specific gravity is 2·58 and its hardness 3·5 to 4. With boiling water it yields calcium polysulphides and in acids it easily dissolves with evolution of hydrogen sulphide. Chemical analysis indicated the following as the composition of the spherules:—

		I.	II.
Oldhamite	Calcium monosulphide	89·369	90·244
	Magnesium monosulphide	3·246	3·264
Gypsum		3·951	4·189
Calcium carbonate		3·434	——
Troilite		——	2·303
		100·000	100 000

The presence of such a sulphide in a meteorite, shows that the conditions under which the ingredients of the rock took their present form, are unlike those met with in our globe. Water and oxygen must have alike been absent. The existence of iron in a state of minute division, as often found in meteorites, leads to a similar conclusion. But, if we bear in mind the conditions necessary for the formation of pure calcium sulphide, the evidence imported into this inquiry by the Busti aërolite seems further to point to the presence of a reducing agent during the formation of its constituent minerals; whilst the crystalline structure of the Oldhamite and of the Osbornite next described must certainly have been the result of fusion at an enormous temperature. The detection of hydrogen in meteoric iron by Professor Graham tends to confirm the probability of the presence of such a reducing agent. Osbornite is the name given by the author to the golden-yellow microscopic octahedra imbedded in the Oldhamite, in honour of Mr. Osborne and in commemoration of the important service that gentleman rendered to science in preserving and transmitting to London, in its entirety, the stone which his zeal saved at the time of its fall. These minute octahedra gave the angles of the regular octahedron; but the amount, about 0·002 gramme, was too small for anything but qualitative experiments. These showed the little metallic-looking crystals to contain calcium, sulphur and a metal which gives the reactions of titanium in some singularly stable state of combination. The next mineral described was an augite, of which the measurements and analyses were given in detail. Its formula was ($\frac{2}{3}$ Mg, $\frac{2}{3}$ Ca) Si O_3. The greater part of the meteorite, however, consisted of enstatite, which presents itself in three apparently different characters: in each, however, the mineral is nearly pure magnesium monosilicate. Of this mineral, the measurements and analyses were recorded. The iron contained in small amount in this remarkable meteorite, gave as the result of its analysis 79·069 per cent. iron, 3·205 nickel, and 1·00 per cent. schreibersite.

The Manegaum Meteorite of 1843 was next described and was shown to consist almost entirely of an enstatite, with the formula ($\frac{4}{5}$ Mg, $\frac{1}{5}$ Fe) Si O_3, associated with small quantities of Chromite and of meteoric iron. In publishing the results obtained in the attempt, so far as this memoir goes, to treat exhaustively of the mineralogy of two important meteorites, the author wished to record his obligations to Dr. Flight, assistant in his department at the British Museum, for his valuable aid in the chemical portion of the inquiry.

In March, last year, Prof. Maskelyne recorded in a preliminary note, read before the Society, his discovery in the Meteorite of Breitenbach, of silica in *the rhombic system* with the specific gravity of *fused* quartz. It was associated with enstatite with the formula ($\frac{4}{5}$ Mg, $\frac{1}{5}$ Fe) Si O_3. It is singular that the measurements of the crystals of this enstatite, made at the British Museum and published by Prof. Viktor von Lang (Sitzungsb. Akad. Wien, vol. lix., 1869, p. 848), accord closely with those recently published by Von Rath as the crystallographic constants of a kind of enstatite to which he has given the name Amblystegite.

LETTERS TO THE EDITOR

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

Japanese Sea Shells

SINCE writing the notice of Dr. Lischke's work which appeared in No. 13 of NATURE, I have received from Dr. Lea of Philadelphia a typical specimen of his genus *Hippagus* and the volume of his "Contributions to Geology." For such a valuable communication I would publicly acknowledge my obligation to that veteran conchologist. I was misled by Philippi and Searles Wood, in considering *Hippagus* and *Verticordia* the same genus. *Hippagus* is closely allied to *Crenella*, as the latter is represented by *C. glandula* of Totten and, indeed, I cannot detect any character to distinguish them generically. These agree in shape, sculpture, hinge, muscular impressions and inflexion of the beaks. The genus *Verticordia* of S. Wood is very different and belongs to another family, viz. that of *Lyonsia*.

Mr. Arthur Adams informs me that he has several Japanese species, which he believes are also found in the Mediterranean, and I have identified many British species with those of North Japan. J. GWYN JEFFREYS

An Oversight by Faraday

IT is not often that Faraday committed an oversight; but such I think he must have done in his well-known paper concerning the existence of a limit to vaporisation. ("Experimental Researches in Chemistry and Physics," p. 119.*) Faraday showed experimentally, that mercury emitted no appreciable vapour below 20° F. and accounted for this on the ground that "the elastic force of any vapour which the mercury could have produced at that temperature, was less than the force of gravity upon it and that, consequently, the mercury was then perfectly fixed." He adds, "I think we can hardly doubt that such is the case, at common temperatures, with respect to silver and with all bodies which bear a high temperature without appreciable loss by volatilisation, as platina, gold, iron, nickel, silica, alumina, charcoal, &c., and that, consequently, at common temperatures, no portion of vapour rises from these bodies or surrounds them."

Has not Faraday overlooked the fact that though gravity might prevent the *rise* of vapour, it would assist the *fall* of vapour from the sides or under surface of a body suspended *in vacuo?* If Faraday's theory had any grounds in truth, it would be possible to distil a substance from above downwards by the sole force of gravity, but I know of no experiment to support the idea. Were all the other forces which could act upon the molecules, exactly balanced in unstable equilibrium, the force of gravity might undoubtedly upset this equilibrium, so that vapour would be produced from the under surface of a suspended solid when it could not be produced from the upper surface. But a very slight estimation of the forces which may enter into such a problem, shows how unlikely it is that the case could ever happen.

I do not mean to say that the force of tenacity of solid substance, is identical with that which is opposed to volatilisation; but it is possibly comparable with it in amount. Now a copper wire, having a section of one square millimetre, will bear a weight of 90 lbs. and this force of tenacity only acts between portions of metal in absolute contact and continuity. Compare now the weight of a film of copper, say $\frac{1}{100}$ part of a millimetre thick, with the force by which it adheres to the remainder of the mass of copper with which it is continuous. Taking the specific gravity at 8·9, the weight will be, per square millimetre, 0·000089 gramme; the force which would be required to tear it from the remainder of the mass would be, for the same surface, 40819· grammes. The force of tenacity, therefore, exceeds the weight rather more than 450,000,000 (450 million) times. This seems to show that the molecular forces which tend to maintain the integrity of a solid metal, are almost infinitely greater than the gravitation of the same molecules towards the earth. To cause these molecules to fly off in free vapours, we must call in the aid of forces of heat, electricity, or chemical affinity which can cope with the prodigious force of solid cohesion. It is practically impossible that we should ever meet with a case, where these forces were so exactly balanced that the exterior force of gravity, many million times less in amount, should produce a perceptible disturbance.

These considerations do not, however, appear to affect the validity of Wollaston's speculations concerning a definite limit to the earth's atmosphere as caused by the gravity of the aërial particles. J.

Where are the Nebulæ?

I AM unaffectedly glad to find that one whose opinion has such weight as Mr. Spencer's must have, should have anticipated me in the matters to which he directs your attention in his interesting letter. There can be no question as to his priority; since in 1863 I had not only formed no views respecting the nebulæ; but had no further knowledge of astronomy than I derived from a very faint recollection of what I had learned in a hasty two hours' perusal of Goodwin's Astronomy (Course of Mathematics) the night before our examination on the subject in the "Three days" at Cambridge.

In considering the subject of the nebulæ recently, however, the points touched on by Mr. Spencer had not escaped me. In five papers in the *Intellectual Observer and Student* called "Notes on Nebulæ," "Notes on Star-streams," and "A New Theory of the Universe" (three parts), I touched on these and many other proofs that the nebulæ are not external galaxies; but part and parcel of the sidereal system.

I have since found that Dr. Whewell, in his "Plurality of Worlds," had adopted the same view. But as a matter of fact, we owe the enunciation of clearly convincing evidence respecting the true nature of the nebulæ to Sir John Herschel; while Sir W. Herschel, when as yet the available evidence was incomplete, indicated his belief that the Orion nebula (amongst others) is within the sidereal system.

Strangely enough, the point first dwelt on by Mr. Spencer was boldly quoted by the Rev. C. Pritchard (V.P.R.A.S.) as a proof that the nebulæ are external galaxies, immediately after I had read my communication on the distribution of the nebulæ to the Astronomical Society. I asked at once if we were to regard those vacant spaces as the spy-holes, so to speak, of the sidereal system, through which alone the nebulæ could be hopefully looked for and Mr. Pritchard said "*Yes.*" Mr. Stone, also, pointed out subsequently, that the glare from the stars might elsewhere obliterate the nebulæ (at least the fainter ones) from view. This would be a point to be attentively considered were it not that in the Nubeculæ we have evidence that the glare from many stars does not obliterate faint nebulæ.

The second point dwelt on by Mr. Spencer affords a remarkable instance of the way in which considerations that should be perfectly obvious, escape even practised astronomers. Strangely enough, I dwelt on this point, only three days ago, in a letter I addressed (not for publication) to the editor of the *Spectator*. It is commonly understood and stated that telescopes which are only just able to show stars of the tenth, twelfth, or fourteenth magnitude as the case may be, are able to exhibit the component stars of certain external galaxies, which must (according to the theory) be thousands of times farther from us than the fourteenth magnitude stars. Not a thought has been given to the obvious conclusion that these component stars, to be thus visible, must be millions of times larger than the members of our galaxy.

In a letter addressed last August to Sir John Herschel (a portion of the answer to which was quoted in my article in NATURE for January 27), I pointed out half-a-century of reasons for believing that the sidereal system is differently constituted than has been supposed and that the nebulæ are not external to it. (This would have involved an egregiously long letter had I been writing to an ordinary correspondent, but in the actual case a few words served sufficiently to indicate each reason.) These reasons were not interdependent—each afforded good and most afforded perfectly sufficient ground for rejecting the accepted theory. In his reply, Sir John (always kind, courteous and encouraging) was good enough to speak of the "number and variety of the striking facts brought together and the evident bearing of a large proportion of them on the great problem offered by the sidereal system to man's contemplation." Amongst the facts which afford the strongest evidence of all, are two I left unnoticed in my late paper, viz., (1) the relatively large proper motion of the fainter stars and (2) the drift of whole groups of stars in a definite direction. These facts apply to the structure of the sidereal system, rather than to the position of the nebulæ; but, as a matter of fact, the two matters are so closely related, that evidence bearing on one carries with it conclusions affecting the other also. RICHD. A. PROCTOR

February 4

Analogy of Colour and Music

I FIND in your number of January 13 an interesting paper by Mr. Barrett on the Correlation of Colour and Sound. It seems to me that Mr. Barrett depreciates the phenomenon of Newton's rings by saying that the "connection between the relative spaces occupied by each colour and the relative vibrations of the notes of the scale" . . . . "cannot be more than a coincidence." The diameters of the rings are functions of the wave-lengths and, therefore, expressions of a physical condition. Mr. Barrett's own process is, to say the least, very rough and, after taking "the mean of two limits," rather wide apart for the length of the waves of each colour, he obtains a series of numbers which

* Phil. Trans. 1826, p. 484.

differ not inconsiderably from those which belong to the musical scale and he is obliged, after all, to place blue and indigo together, taking their "mean rates" as corresponding with G. I do not know how far Newton's measurements are correct; but I find that Professor Zannotti, of Naples, gives for the diameters of the rings from red to red the cube-roots of the numbers 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{9}{16}$, $\frac{1}{2}$. The intervals between these, taken successively, are $\frac{9}{8}$, $\frac{16}{15}$, $\frac{10}{9}$, $\frac{9}{8}$, $\frac{10}{9}$, $\frac{16}{15}$, $\frac{9}{8}$; that is—major-tone, semi-tone, minor-tone, major-tone, minor-tone, $\frac{1}{2}$-tone, major-tone. Calling the major-tone *M*, the minor tone *m*, and the semi-tone ×, for the sake of brevity. I will give the five different forms of which the musical scale is capable—expressed by the succession of intervals —and show that the above series of intervals is one of them :—

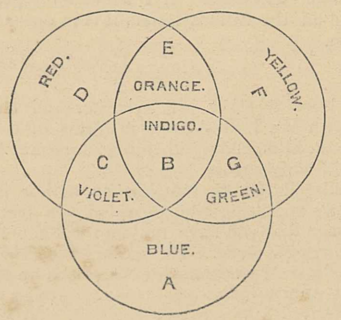
	D, E,	F,	G,	A,	B,	C,	D
(1)	m	×	M	m	M	×	M, or Sintono.
(2)	M	×	m	M	m	×	M, or Newton's scale of colours.
(3)	M	×	M	m	M	×	m
(4)	m	×	M	M	m	×	M
(5)	M	×	m	M	M	×	m

Varieties depending upon the permutation of the quantities M, m, and ×. The 1st contains the imperfect fifth, DA; the 2nd two such fifths, EB and FC; the 3rd GD; the 4th A_2E_2; and the 5th the imperfect fifth, C_2G,—all of course with their corresponding augmented fourths.

Thus, Newton's scale of colour is one of a series of five scales of sound, all requiring modification by a *comma* of one, or at the most two-fifths; but all are found of perfect major and minor tones and major semitones. If the correlation between colour and sound exists, I think it will be found here. If this be admitted, the colours and notes corresponding are as follows :—

D, E, F, G, A, B, C, D

Red, Orange, Yellow, Green, Blue, Indigo, Violet, Red; or better according to the figure—



Thus the series of colours corresponds with the Gregorian Scale of the *first mode* and not with the modern scale of C. I may remark, by the way, that the ancient Greek *plain chant* is said sometimes to have a notation in which the notes are distinguished by different colours. It would be interesting to know whether such a notation has any scientific foundation.

In conclusion, I would say, that Newton's rings give a far more clear division of the colours that we get in the spectrum and the distinction between blue and indigo is too well defined to warrant them to be treated as Mr. Barrett has done. No doubt the neighbourhood of indigo is a difficult one and to make the correlation with sound complete, this colour itself ought to be divided into two; indigo-blue and indigo-violet corresponding to the notes B♭ and B♮, both of which are required to obtain the fourths and fifths all perfect. Allow me to inquire if there be any marked line in the red, dividing it into two reds separated by the interval $\frac{81}{80}$? I ask this question because the Sintono Scale (1) requires two D's differing by this interval, to complete its intervals of fourths and fifths. Also, would the correction of the fifths, &c., in the other four scales given above, by the introduction of one or two new notes, be such that these notes can be made to correspond to marked divisions in the spectrum or to like divisions in the series of colours determined by Newton's method?

W. S. OKELY

THE supposed analogy between the spectrum and the musical scale is not strictly accurate, because in the former the colours blend into one another imperceptibly, while the notes of the latter are separated by distinct intervals.

Yet it is precisely on this blending of the colours that the pleasing effect of the spectrum depends. If we place red, orange, yellow, &c., in their order, in immediate juxtaposition, as distinctly defined bands, we obtain precisely that arrangement which is admittedly distasteful.

The chromatic scale, as its name implies, approaches more nearly to the spectrum than does the diatonic; but the spectrum would be still better represented by the sliding tones produced by running the finger up the sounding string of a violin.

But leaving this objection, which may be thought too critical, I would remark, that the analogy which Mr. Barrett points to is rather one of melody than of harmony.

In the case of a musical concord, the two notes fall simultaneously on the ear and are perceived as one compound sound, the effect of which is very different from that produced by sounding the notes in succession, however rapid; yet this last is what rather seems to correspond to the sensation produced by two colours placed in juxtaposition, the eye passing rapidly from the one to the other. To obtain the optical analogue of a musical concord, the colours ought to be received simultaneously on the retina—in other words, should be blended. Could not this be accomplished by producing two distinct spectra by means of two prisms and causing the so-called harmonious colours in either to overlap one another on the screen? Blending thus, for example, those rays of the two spectra whose vibrations are to one another in the ratio of 100 to 75, their resultant (a purple of some sort, I suppose) would give us the true analogue of the fifth in music.

Similar experiments, I am aware, have been made by causing patches of colours to rotate upon a disc so rapidly that they are in effect blended upon the retina; but some modification of the method above suggested would seem to have the immense advantage of enabling the experimenter to combine colours whose wave-lengths would be in any desired ratio.

I should be curious to know whether the result of such an experiment would be that the compound tint produced by the two rays would be more or less agreeable, the more or less nearly its component parts were in the exact musical ratio; also whether, when the two colours were slightly "out of tune," we should have the phenomena of "interference" presenting themselves analogous to the "beats" in music.

A curious speculation here suggests itself. It is well known that what are called complementary colours—red and green, for instance—produce, if combined in due proportions, white.

Proceeding by the above method, then, should we find that the particular tints of red and green necessary to produce white, are those whose ratio is exactly that of the musical fourth? If so, white is as much entitled to a place in our catalogue of colours as purple or any other harmonised compound.

If white is not the optical representative of the musical fourth, where shall we look for its analogue in the latter science? Can any of your readers suggest a method of producing a *white sound?* "White," we know, is the resultant of the blending of the whole rays of the spectrum—*i. e.*, of the same part of the retina simultaneously receiving rays whose wave-lengths pass imperceptibly through every conceivable shade of difference.

If it were possible for a violinist to slide his finger up the string of his instrument in such a way that, instead of producing a sound varying in pitch, every part of the string passed over should continue to sound simultaneously with every other part; or, if we can suppose some millions of violinists each sounding a note inappreciably higher than his neighbour, but comprehending among them every conceivable shade of pitch within the octave, we might possibly obtain the purest and most ætherial of tones, a "White Sound!"

Edinburgh, Jan. 24 FRANCIS DEAS

Government Aid to Science

WILL you allow me, with the utmost respect, to remind your able correspondent, that *every individual* in the state pays taxes for ignorance and inefficiency; while so interwoven are the interests of man with man—so often does inquiry after the most abstract principles lead to valuable practical results, that it is impossible to predict in which department of Science discoveries may be made that shall materially lighten these unsatisfactory imposts. Hence the field of research should be open to all and every facility afforded. If this be not the duty of the State it is difficult to explain its *raison d'être.*

The question from the economical point of view is—Shall we pay heavy rates for prisons and workhouses, or shall we try to lighten them by the spread of education? It is well to remember that the law of supply and demand will not avail here, for they who most want it are the least likely to ask for instruction. Perhaps, Mr. Wallace's chief objection is to the unsatisfactory way the money raised by rating, is expended. And here is room for large reforms, if not retrenchment. His proposal regarding the British Museum seems admirable. It is painful to see what excellent opportunities for teaching those who really require it, are lost in that magnificent collection, for want of a little, a *very little*, more expense and trouble.

These remarks are made from the very lowest stand-point, the principle of self-interest—a principle, I believe, your correspondant would heartily despise; for the man of science is essentially liberal, essentially averse to huckstering calculations of profit and loss, essentially unqualified for scrambling after loaves and fishes. E. G. A.

Kant's View of Space

I AM quite willing to leave the readers of NATURE and the students of Kant to decide on the propriety, in English philosophical discourse, of calling Space and Time "forms of Thought," the more so as Sir W. Hamilton—a great stickler for philosophic precision—uses the term in that sense and would have been surprised to hear that he had misrepresented Kant in so doing. My opponents persist in limiting the term Thought to the restricted meaning given to it in Kant's terminology, which, in English, is restricting it to Conception or Judgment: on this ground they might deny that Imagination or Recollection could be properly spoken of as Thought. Throughout I have accepted Thought as equivalent to mental activity in general and the "forms of Thought" as the conditions of such activity. The "forms of Thought" are the forms which the thinking principle (Kant's *pure* Reason) brings with it, antecedent to all experience. The thinking principle acts through three distinct faculties: Sensibility (Intuition), Understanding (Conception), and Reason (Ratiocination): to suppose Thought absent from Intuition, is to reduce Intuition to mere sensuous impression. Therefore, whatever is a form of Intuition must be a form of Thought.

The following passage from Mr. Mahaffy's valuable translation of Kuno Fischer's work on Kant, may here be useful: "Sensibility and understanding are cognitive faculties differing not in degree but in kind, and form the *two original faculties of the human mind*" . . . . The general problem of a Critick of the Reason "is subdivided into two particular objects, as human Reason is into two particular faculties of knowledge. The first object is the investigation of the sensibility; the second, that of the understanding. The first question is, How is rational knowledge possible through sensibility? The second question, How is the same knowledge possible through the understanding?" (pp. 4, 5.)

Those who maintain that it is improper to speak of Space and Time as forms of Thought, must either maintain that Kant held Sensibility *not* to be a faculty of the Mind (thinking principle); or that the term Thought is *not*, in English discourse, a correct expression for the activity of the thinking principle. I believe that the student will agree with me in saying that, although Kant restricted the term Thought to what we call Conception or Judgment, he understood by the activity of the mental faculties (Pure Reason) what we understand by Thought.

It is not, however, to continue this discussion that I again trespass on your space; but to reply to the personal part of Mr. Sylvester's letter. He charges me with misquoting myself and with misquoting him. I said that, in my exposition, Space and Time were uniformly spoken of as forms of Intuition and I say so still. Mr. Sylvester has taken the trouble of reading that exposition without taking the trouble of understanding it; he declares that he "has marked the word intuition as occurring once and forms of sensibility several times; but forms of intuition never." His *carefulness* may be estimated by the fact that the word intuition occurs *four* times on the two pages: his *comprehension* by the fact that it is perfectly indifferent whether Sensibility or Intuition be the term employed, since sensibility is the faculty and Intuition the action of that faculty. Mr. Sylvester, not understanding this, says "If form of sensibility is as good to use as form of intuition, form of understanding ought to be as good as form of thought; but Mr. Lewes owns that the former is indefensible, whilst he avers that the latter is correct." Considering that this passage occurs in a letter which charges me with unfair misquotation, it is curious. So far from owning that the former is "indefensible," it is what I declare to be true; and, with regard to the latter, though I do think a form of Understanding is a form of Thought, my statement was altogether *away* from it, namely, that Space and Time as forms of Sensibility, would be incorrectly spoken of as forms of the Understanding.

With regard to the alleged misquotation of his own words, which he characterises as unfair and as "too much like fighting with poisoned weapons," it was a charge which both astonished and pained me. There are few things for which I have a bitterer contempt than taking such unfair advantages of an adversary. I beg to apologise to Professor Sylvester for any misrepresentation which, unintentionally, I may have been guilty of. But, in accepting his denial of the construction I placed upon his language, I must still say that, after re-reading his letter, I am at a loss to see what other construction it admits of, that has any bearing on the dispute, and that he has not expressed his meaning with sufficient clearness. Intuition and Thought are there compared with Force and Energy as terms "not convertible"; Force is detached from Energy as potential from actual and Intuition without Thought, is made to hold an analogous position. Here is the passage; let the reader judge:—

"Can Mr. Lewes point to any passage in Kant where Space and Time are designated *forms of Thought?* I shall indeed be surprised if he can do so—as much surprised as if Mr. Todhunter or Mr. Routh in their Mechanical Treatises were to treat *energy* and *force* as convertible terms. To such a misuse of the word energy it would be little to the point to urge that *force without energy is a mere potential tendency.* It is just as little to the point, in the matter at issue, for Mr. Lewes to inform the readers of NATURE that *intuition without thought is mere sensuous impression.*"

Is it to use "poisoned weapons" to interpret this as assuming that Intuition and Thought differ as potential and actual? I repeat that, since Mr. Sylvester disclaims the interpretation, my only course is to apologise for it; but, after his own misinterpretations of me, he will not, I hope, persist in attributing mine to a desire to take an unfair advantage. If I make no reply to the other points roused in the various letters it is in order not to prolong the discussion.

GEORGE HENRY LEWES

I DO not know whether Mr. Sylvester and Dr. Ingleby will be satisfied with Mr. Lewes' letter in yours of the 27th. I am not and I think, in defending his former mistake, Mr. Lewes has fallen into additional errors.

It is undoubtedly fair to translate an author into your own language before criticising him, provided you found no criticism on the language that you have put into his mouth. But this I think Mr. Lewes has done. He accuses Kant of inconsistency in speaking of pure *à priori* cognitions, when, on his own system, pure thought only supplies one element to these cognitions, the other being derived from sense or intuition. Now (not to insist here that Kant constantly uses the term cognition in a wider sense than that which Mr. Lewes insists on fastening upon him), this criticism is evidently invalidated by the simple remark that Kant admits pure intuitions, as well as pure concepts and explains the nature of mathematics, as a system of *à priori* cognitions, by the fact that its object-matter consists of nothing but pure intuitions.

Mr. Lewes now informs us that Kant's Intuition and Thought "differ as species and genus." According to Kant they differ in kind; and Liebnitz was as wrong in making sensibility a species of thought as Locke was in making Thought a species of sensibility. Space and Time, Mr. Lewes adds, are forms of "mental activity" and, therefore, are properly termed "forms of Thought," in the meaning of the latter term which is usually current in this country. If they were forms of mental activity they would be forms of Thought, according to Kant, likewise; for the criterion by which Kant distinguishes between Intuition and Thought (under which term he includes both the understanding proper and the reason proper) is that, in the former, the mind is passive (receptive) while, in the latter, it is spontaneously active; and it is precisely on this ground—the passive reception of them by the mind—that he refers Space and Time to Sensibility rather than Thought. This is repeatedly brought out in the Transcendental Deduction of the Categories. See in particular Sections 11 (Meiklejohn, p. 80) and 18 (Meiklejohn, p. 90).

I think if Mr. Lewes will turn to the preface to the first edition of the "Critick," he will see that the transcendental logic only (and perhaps I might limit it to the transcendental dialectic) grapples *directly* with the problem indicated by the title of the book. The Æsthetic is a preliminary inquiry, which proves afterwards of great use; but is not to be considered as a Critick of Pure Reason in this particular department. His using the term "concept" of space, is certainly confusing; but its explanation, I think, is to be found in a passage in the "Transcendental Exposition" of this "concept" (Meiklejohn, p. 25), where he says, "It must be *originally* intuition, for from a *mere* conception no propositions can be deducted which go out beyond the conception and this happens in geometry." In the preceding page he similarly qualifies his statement that Space is an intuition. "No conception *as such*," he says, "can be so conceived as if it contained, within itself, an infinite multitude of representations." We may *now* have a concept as well as an intuition of Space and Time; but the intuition was the original form of the idea and it is to the intuition that we must always have recourse in mathematics when we wish to discover a new truth.

I think, if Mr. Lewes will again read over the Transcendental Æsthetic and the parts of the Transcendental Analytic which are closely related to it, he will see that Kant never designates the *original* representations of space and time "concepts," or refers their origin to "pure reason." W. H. STANLEY MONCK

Trinity College, Dublin, Jan. 29

[This correspondence must now cease.—ED.]

NOTES

THE Gold Medal of the Royal Astronomical Society will be presented to M. Delaunay, the president of the Paris Academy of Sciences, to-morrow. It is to be regretted that the stay of the distinguished French savant in England is but short.

WE referred last week to the "situation" at the Paris Observatory. The action of the French Government has been of the promptest and M. Le Verrier is no longer Director. This step indicates very clearly—too clearly we fear—the strength of the case put before the Minister of Public Instruction, in the memorial, of which a copy has been sent to us. This document, which is signed by all the *chefs de service*—Villarceau, Marié-Davy, Wolf, and Loewy—and the *astronomes adjoints* without exception, discusses all points connected with the administration of the Observatory, scientific and otherwise. It is to be sincerely hoped that M. Le Verrier may be able yet to do service to astronomy, in some other capacity, some position where his great talents alone will be called into play. His is a name that will never die, let us hope it is but momentarily eclipsed.

THE Trustees of the Johnson Memorial Prize for the encouragement of the study of astronomy and meteorology propose "the laws of wind" as the subject for the next essay:—1. With regard to storms; 2. With regard to average periodical phenomena at given places on the earth's surface. The prize is open to all members of the University of Oxford and consists of a gold medal of the value of ten guineas, together with so much of the dividends, for four years, on 338*l.* Reduced Annuities as shall remain after the cost of the medal and other expenses have been defrayed. Candidates are to send their essays to the registrar of the university under a sealed cover, marked "Johnson Memorial Prize Essay," on or before the 31st day of March, 1871, each candidate concealing his name, distinguishing his essay by a motto and sending at the same time his name, sealed up under another cover, with the same motto written upon it. No essay will be received after the 31st day of March, 1871.

A NEW office has been constituted under the Public Works Department and Mr. Douglas Galton, C.B., F.R.S., has been appointed to it with the title of Director of Works and Buildings. We may congratulate ourselves that our public building will be looked after by one so eminently qualified by his high scientific attainments and great experience in such matters.

AT the meeting of the French Academy on January 31, the two candidates recommended for the vacancy in the Bureau des Longitudes were M. de la Roche-Poncié and M. Gaussin. The former received 40 votes out of 43. At the same meeting the mineralogical section presented a list of candidates for the vacancy in the list of correspondents to replace Sir Roderick Murchison, who has recently been nominated a foreign associate. The candidates were, in the first rank, Prof. C. F. Naumann; in the second, in alphabetical order, MM. Abich, Gustav Bischoff, Ami Boué, Dana, von Dechen, Domeyko, James Hall, von Hauer, von Helmersen, C. T. Jackson, Kjerulf, von Kokscharow, W. E. Logan, W. H. Miller, Ferdinand Römer, Scacchi, A. Sismonda, and Studer.

THE *Goloss*, of St. Petersburg, says that a special commission will shortly be appointed by the Academy of Sciences there, for the purpose of observing the transit of Venus on the 26th of November, 1874 (old style). The members of the commission are to be Messrs. Struve, Savitch and Wild, of the Russian Academy; Messrs. Döllen and Wagner, superintendents of the Observatory at Pulkova; Vice-Admiral S. J. Seleny and Major-General Forsch. The *Goloss* adds that the reason the commission will be appointed so early, is that much time will be required for making the necessary preparations and that similar commissions have been already appointed in England, France and Germany.

PROF. W. H. FLOWER, who has recently been appointed Hunterian Professor of Comparative Anatomy and Physiology, will commence a course of eighteen lectures introductory to the study of the anatomy of the class Mammalia, on Monday, February 14, 1870, in the Theatre of the Royal College of Surgeons. The lectures are to be delivered on succeeding Mondays, Wednesdays and Fridays, at four o'clock and will treat of methods and aims in the study of morphology: classification of the mammalia; osseous system of the mammalia: Axial skeleton—vertebral column; modifications of the characters of the vertebræ in the cervical, thoracic, lumbar, sacral and caudal regions in different mammals; sternum, cranium, hyoid arch. Appendicular skeleton—essential structure and modifications of the bones composing the shoulder-girdle and anterior extremity; structure and modifications of the pelvic girdle and posterior extremity; comparison between the structure and the functions of the anterior and the posterior extremities. Tegumentary system and its appendages: the dermis; modifications of the integument mainly due to peculiar conditions of the dermis; ossifications in the integument; the epidermis and its modifications; callosities, scales, nails, claws, hoofs, horns, hairs, spines, antlers, glandular organs connected with the integument, or opening on the external surface of the body; scent glands; mammary glands. Dental system: structure and essential characters of teeth; classification and nomenclature of teeth; development and succession of teeth; modifications of the characters of the teeth in the different groups of the Mammalia; horny structures taking the place of teeth in certain mammals. Baleen, &c. These lectures are open to Fellows and Members of the College of Surgeons and of learned and scientific bodies in the United Kingdom.

THE death is announced of E. W. Brayley, many years connected with the London Institution, and a frequent lecturer on scientific subjects. Mr. Brayley was well known for his scientific attainments and has contributed to scientific literature, some valuable papers on geology, astronomy and other subjects.

THE second course of Cantor Lectures for the present Session will be given by Dr. Benjamin Paul, F.C.S. The course will consist of four lectures, "On the Phenomena of Combustion and the Chemical and Physical Principles involved in the Use of Fuel and in the Production of Artificial Light," to be delivered on Monday evenings, the 7th, 14th, 21st, and 28th of March, at 8 o'clock.

THE third part of the nineteenth volume of the *Jahrbuch der kais.-kön. geologischen Reichsanstalt*, including the more important papers communicated to the Austrian Geological Institute during the months of July, August, and September, 1869, has just reached us. It contains some valuable memoirs for the students of general geology. M. D. Stur describes the characters and mode of occurrence of the brown-coal in the district of Budafa, in Hungary. He has ascertained the existence of two layers of useful coal, the upper one varying from two to three feet in thickness, the second being usually from four to six feet and sometimes as much as eleven feet thick. Borings indicate a third horizon having coal from eight-and-a-half to ten feet thick; but the quality of this coal has not been ascertained. Dr. M. Neumayr's contributions to the knowledge of the fossil fauna of the Austrian dominions consist of lists and numerous descriptions of fossil shells, from the late Tertiary freshwater marl of Dalmatia and from the Congerian beds of Croatia and West Sclavonia. This paper is illustrated with four plates. M. D. Stur reports upon the geological survey of the environs of Schmöllnitz and Göllnitz, in Hungary, including especially the mountain-mosses of the Volovee and Branisko. It includes an "Eozoonal" rock and deposits belonging to the Carboniferous, Permian, Triassic and Liassic formations. The other papers are: A description of the Amphibole-Trachyte of the Mátra in Central Hungary, by Dr. Joseph Szabó; an account of mineralogical investigations in the chemical laboratory of the Institute, communicated by Karl Ritter von Hauer and a translation, by Dr. E. Bunzel, of the account given by Drs. Carpenter and Wyville Thomson of their dredging operations on board the *Lightning*, in 1868.

THE *Canadian Entomologist* for January announces that the Council of the Agricultural and Arts Association of Ontario has appropriated the sum of four hundred dollars to aid the Entomological Society during the present year in forming a cabinet of insects useful or prejudicial to agriculture and horticulture, for continuing the journal and making an annual report. It contains also notes on some of the common species of *Carabidæ* found in temperate North America, by P. S. Sprague; on the currant worm, by W. Saunders; remarks on the history and architecture of wood paper-making wasps, by W. Cowper; a list of *Coleoptera* taken at Grimsby, Ont., by J. Pettit and miscellaneous notes.

THE Nederlandsche Maatschappij ter bevordering van Nijverheid—that is, The Netherlands Society for the Promotion of Industry—offer, for the year 1871, a prize of a gold medal worth 150 florins and three hundred florins in money, for the best method of illuminating floating buoys so that they can be seen at night. The contrivance, whatever its form, is to be self-lighting, for obvious reasons. Here, then, is another task for those who are skilful in sending sparks through long wires. We remember that Mr. Siemens had some project of the sort a year or two ago. Is this a fitting opportunity for trying to work it out? If Dutch mariners feel it desirable that their buoys should be lighted at night, so do those of all other nations. Competitors for the prize are to send their documents and models to the general secretary of the society, M. F. W. Van Eeden, at Haarlem, before September 30, 1871.

WE learn from the *Athenæum* that Dr. Andrews, Vice Principal of Queen's College, Belfast, has been elected an Honorary Fellow of the Royal Society of Edinburgh, in the room of the late Master of the Mint.

A CONTROVERSY is going on in the *Medical Times and Gazette* as to the sufficiency of a test for Morphia, involving serious considerations as regards toxicological inquiries. The point is, whether the production of a blueish purple tint on mixing a substance with a molybdate and sulphuric acid, is sufficient proof of the presence of morphia, or whether the same colours may not be produced by other substances which are quite innocuous.

NEWS has this week been received from Mr. C. F. Tyrwhitt Drake of Trinity College, to whom, last autumn, the University of Cambridge granted a sum of money out of the Worts Travelling Bachelors' Fund, to enable him to collect zoological specimens while accompanying Mr. E. W. Palmer of St. John's College, the distinguished orientalist, in exploring the Tîh country—the "Wilderness of the Wanderings." The Arabs were by no means prepared to find Englishmen travelling without the luxuries to which they are accustomed and, in consequence, were suspicious of their object in visiting the country. It is to be hoped, however, that nothing will hinder our adventurous explorers from accomplishing their wish of reaching the Jordan by the route traditionally followed by the Israelites. Mr. Drake's journal and collections can scarcely fail to be of much interest.

WE understand that one of the two zenith sectors, constructed by Messrs. Troughton and Simms from the designs of Lieut.-Col. Strange, for the Great Trigonometrical Survey of India, has reached its destination—Bangalore, in the Madras Presidency. This instrument differs entirely from all of its class. Ramsden's and Graham's cumbrous though most ingenious structures of timber were superseded by the far more efficient sector designed some years ago for the Ordnance Survey by the Astronomer Royal. But even Airy's zenith sector was too heavy for transit over the rugged and pathless mountain chains of Hindustan. It weighed, without its packing-cases, upwards of 1,100 lbs. The instrument of which we now speak has been reduced to 600 lbs., without loss of power. The telescope has an aperture of 4 inches with a focal length of 4 feet and the sectors are portions of a circle 3 feet in diameter, read by means of 4 micrometer microscopes. This class of instrument is intended solely for the determination of latitude. Hitherto it has been used for this purpose, in measuring the zenith distances of known stars, as its name implies, which we may call the absolute method. But of late years another mode of determining latitude has come much into favour,—this we will call the differential method. It consists in measuring, with a micrometer attached to the eye-end of the telescope, the difference of zenith distance of two stars nearly equidistant from the zenith, one north, the other south. Its merit consists chiefly in the simplicity of the means necessary for the purpose, namely, a telescope firmly mounted with a good micrometer and a good level, no circle or sector being required. Colonel Strange has, we hear, adapted his instrument to both methods, which may therefore be thus submitted to a comparative trial under circumstances equally fair to each. The instrument is in the hands of Capt. J. Herschel, R.E., who is about to employ it for the twofold purpose of furnishing data for improving our knowledge of the figure of the Earth and of throwing light on the interesting physical problem of local attraction. It will be remembered that some years ago the operations of the Russian Survey indicated the presence, in a particular locality, of a huge subterranean cavity, the existence of which would never have been suspected, had not anomalies in observed latitudes established the fact. We may expect to hear of similar phenomena being discovered by the same means in India when observations are multiplied by a more portable instrument than any hitherto used of equal power. The facts that cavities may exist where least suspected and that hidden masses of higher specific gravity than the surrounding rocks are known to occur, render it imperative that in geodetic operations the latitude, which is affected by such irregularities, should be more frequently observed than was formerly thought necessary. It is satisfactory to find that such scientific desiderata are appreciated and so liberally provided for, by the Indian Administration.

THE purity of the metropolitan water supply has been seriously affected by the winter floods. Professor Frankland, in his last monthly report, states that the water supplied by the East London Company was very turbid and contained vibrios. This is the first occasion in which Dr. Frankland has detected these organisms, which are abundant in putrid sewage, in the London water.

A VERY interesting paper on the Pearl, Coral and Amber Fisheries, was read at the meeting of the Society of Arts held on the 19th inst. The chair was occupied by Professor Owen, who in proposing a vote of thanks to the lecturer, Mr. T. L. Simmonds, made some instructive remarks on the origin of pearl, coral and amber. Both the paper of Mr. Simmonds and the observations of Professor Owen, will be found at full length in the last number of the Society's Journal.

WE are glad to know that an "Athenæum" has been established in Belfast. It contains a large reading-room, provided with most of the daily and weekly papers and the monthly and quarterly reviews. There is also a commercial, literary and scientific reference library and all the usual accessories of a club. Such an undertaking deserves every support. A series of lectures on scientific and literary subjects has already been commenced in connection with this institution.

THE Lowndean Professor of Astronomy in the University of Cambridge intends to give a course of lectures on the Lunar Theory, with special reference to M. Delaunay's method of treating the subject.

Land and Water announces that the Prince Pless, who has large possessions in Siberia, has succeeded in crossing the common Red Deer with the Wapiti (*Cervus Canadensis*) and the perfect fecundity of the hybrids appears to be well established.

ACCORDING to *Les Mondes*, the Mont Cenis tunnel will certainly be finished during the present year. On the 1st ult., the galleries opened measured 10,598 metres and there only remained 1,621 metres to be excavated.

THE *Photographic News* announces that a Photographic Society has just been formed at Dresden. Among the members are the names of Krone, president, Hahn, Hanfstængl, &c. The society publishes a monthly journal entitled *Helios*, this being the sixth photographic journal published in Germany.

IS Sicily about to lose the monopoly of sulphur which she has so long enjoyed? By recent intelligence from America, we learn that a bed of pure sulphur, 135 feet in thickness and about 530 feet below the surface, has been discovered on an island in Bayou Choupique, in the delta of the Mississippi. The place is within ten miles of the sea, from which it may be anticipated that shipment of the mineral will be comparatively easy. The extent of the deposit has not yet been ascertained; but the local formations are such as to lead to the inference that it is "immense." Besides the sulphur, there is a deposit of gypsum, of perhaps equal extent; hence we may anticipate that the company formed to work the one, will also turn the other to profit. Sulphur is so much in demand for the manufacture of sulphuric acid and for many other purposes in the arts, that this discovery of a deposit in a country teeming with energy and enterprise, seems opportune. When in full work it will most likely occasion a fall in the price of sulphur and a corresponding falling off in the use of pyrites. This sulphur bed was discovered during the sinking of a well in search for petroleum. But instead of "oil" the boring discharges a copious stream of water, which is described as a saturated solution of sulphuretted hydrogen, combined with a small amount of gypsum and common salt. It is clear that the company which is about to explore the sulphur, will have to provide for an abundant drainage, as well as for ventilation. The locality may be found on a good map, near Lake Calcasien, on the western border of the Mississippi delta.

SCIENTIFIC SERIALS

THE new number of Pflüger's Archiv. (III. i.) contains a paper by Prof. L. Hermann "On the absence of currents in uninjured inactive muscle." Munk's views are criticised and a new experiment described, in which the gastrocnemius of a frog is prepared for investigation, in such a way that no contact between the cutaneous secretion and the surface of the muscle (a source of currents in previous observations) takes place. With a galvanometer of 1,600 windings, giving a deviation of 300 sc. for an ordinary nerve current, the muscle so prepared gave only a deviation of 10 to 20 sc. "We are hereby justified," says the author, "in supposing that with a still more careful method of preparation, by the avoidance of yet other unknown causes of injury, we shall at last get a muscle *perfectly* free from currents."

In another paper "On the course of the development of currents in dying muscle," Prof. Hermann shows that when part of a muscle is killed and rendered rigid by exposure to a temperature of 40° C., the development of the current takes place just at the moment when *rigor mortis* makes its appearance.

The same author has also a paper "On the danger of drinking cold water when the body is heated," in which an attempt is made to submit the matter to an experimental inquiry. The only result obtained, however, was that in curarized animals, the injection of ice-cold water into the stomach caused a sudden and great rise in the arterial tension in the carotid and crural arteries, apparently from spasm of the visceral arteries in the neighbourhood of the stomach. Such a sudden increase of tension would prove dangerous in the case of unsound vessels. When the animals, however, were not curarized, very little rise of tension was observed, suggesting the idea that some compensating mechanism was at work, *e.g.* respiratory movements.

There are also papers "On acute phosphorous poisoning," "On convulsions due to disturbances of the cerebal circulation (venous obstruction)" and "On simultaneous contrasts" by Prof. Hermann and his pupils; "On the action of Hydrocyanic acid on the red blood corpuscles" by Geinitz; "On the interference of the bile with gastric indigestion" by Hammarsten; and, "On serum-albumin" by Zahn.

Revue des Cours Scientifiques, February 5.—This number contains an interesting paper read by M. P. I. Van Beneden, of Louvain, at the Belgian Academy of Sciences, on what he terms "commensalism" in the animal kingdom, or certain associations of animals for feeding purposes, which are not, in the ordinary sense, cases of parasitism. The author gives several illustrations of this fact, and he defines the parasite as an animal which lives upon another, while the commensal or messmate is merely a feeding companion. He distinguishes free and fixed commensals. Of the former there are numerous instances in the class Crustacea. The most interesting examples of the latter are the *Tubicinella diadema* or *coronula* covering the skin of whales; the *Remora*, found in the Mediterranean, and made use of, in fishing, by the inhabitants of Mozambique after the manner of a falcon on land. This number also contains a lecture by M. Ch. Robin, on Histology, delivered at the Faculté de Médicine in Paris.

In *Silliman's Journal* for January, Professor B. Silliman has a paper on the relation between the intensity of light produced by the combustion of coal gas and the volume of gas consumed, read at the Salem meeting of the American Association for the Advancement of Science last year, in which he gives as the result of many trials the theorem that, within ordinary limits of consumption, the intensity or illuminating power of gas flames increases as the square of the volume of gas consumed, according to which the method of computation hitherto adopted in photometry, would involve an error amounting to 40 per cent., in the case of rich gas, burning at the rate of $3\frac{1}{2}$ feet an hour with an observed effect of 20 candles—the illuminating power reduced to the standard consumption of 5 cubic feet an hour, being in this case equal to 40 candles instead of 28·57 candles. Hence it follows that all photometric determinations obtained by computation from volumes greater or less than the standard of 5 cubic feet an hour, in the simple ratio of the volumes consumed, must be considered as absolutely worthless. This applies also to the case of sperm candles burnt at a rate different from the standard of 120 grains per hour. As a consequence of these observations it would appear to be essential for photometric observers, in their determinations, to bring the rates of consumption both of gas and sperm to the agreed standards. For the consumer of gas it is evident, also, that where it is important to obtain the maximum economical effect from gas, this result is best attained with burners of ample flow. Prof. W. D. Alexander describes, in a letter to the editor, the results of a careful survey of the crater of Haleakala in the island of Maui. F. W. Clarke gives a new method of separating tin from arsenic, antimony and molybdenum, based on the solubility of the sulphides of tin in oxalic acid solution. E. Billings, paleontologist of the Canadian Geological Survey, continues his notes on the *Crinoidea*, *Cystidea* and *Blastoidea*. A paper on a new spectroscope, with contributions to the spectral analysis of the stars, by Dr. Zöllner, is translated from the Proceedings of the Royal Society of Saxony. H. J. Clark has a paper on Polarity and Polycephalism, extracted from a forthcoming memoir on the anatomy and physiology of *Lucernariæ*, in which he treats of the discussion that has of late years prevailed as to whether the lower compound denizens of water are individuals or organs forming only a part of an individual. Dr. Sterry Hunt contributes a paper on Laurentian rocks in Eastern Massachusetts, in which he announces the discovery of Eozoön in the limestone of that district, by Mr. Bicknell. In a paper on the chemistry of common salt, Dr. Goessmann treats of the origin, occurrence and manufacture of salt. J. Lawrence Smith gives an account of the fall of meteoric stones in Alabama, with analyses, and points out the importance of a thorough re-examination of the mineral nature of meteoric stones. A. E. Verrill continues his contributions to zoology, from the Museum of Yale College, by describing Echinoderms and Corals from the Gulf of California and gives also a note on the generic relations and synonymy of the Common Sea-Urchin of New England (*Euryechinus Drobachiensis*) in which he replies to a criticism by M. Agassiz upon the author's classification of the species here referred to. E. S. Morse has a paper on the early stages of Brachiapods, describing the development of *Terebratulina Septentrionalis*, abundant in the waters of Eastport (Maine) and Dr. Jeffries Wyman has a paper on the existence of a Crocodile in Florida, said to have been killed near the mouth of the Miami river and considered by the author, as belonging to the sharp-nosed species (*C. acutus*).

SOCIETIES AND ACADEMIES

London

Royal Society, February 3.—The following papers were read:—"Note on an Extension of the Comparison of Magnetic Disturbances with Magnetic Effects inferred from observed Terrestrial Galvanic Currents—and Discussion of the Magnetic Effects inferred from Galvanic Currents on days of tranquil magnetism." By George Biddell Airy, Astronomer Royal. (Received December 22, 1869.) The author, referring to his paper in the Philosophical Transactions for 1868, stated that he had examined the whole of the galvanic currents recorded during the establishment of the Croydon and Dartford wires (from 1865 April 1, to 1867 October 24). The days of observation were divided into three groups: No. 1 comprising days of considerable magnetic disturbance; No. 2, days of moderate disturbance, of which no further use was made and No. 3, days of tranquil magnetism. The points most worthy of notice are, that the general agreement of the strong irregularities, galvanic and magnetic, is very close; that the galvanic irregularities usually precede the magnetic, in time and that the northerly magnetic force appears to be increased. The author remarks that no records appeared open to doubt as regards instrumental error, except those of western declination; and to remove this he had compared the Greenwich curves with the Kew curves and had found them absolutely identical. In the discussion of the galvanic current-curves, on days of tranquil magnetism, for independent examination of the galvanic laws, the author explained the method of measuring the ordinates and connecting the measures into expressions for magnetic action, at every hour, grouping the measures, at the same nominal hour, by months and taking their monthly means for each hour. As these exhibited sensible discordance, they were smoothed by taking the means of adjacent numbers, taking the means of the adjacent numbers of the new series and so on, repeating the operation six times. The author explained the theory of this process and the way in which it tends to degrade the periodical terms of higher orders. He then explained an easy method of resolving the numbers so smoothed, into periodical terms recurring once or twice, or thrice in the day, &c. and applies the method to the numbers for every month. When these quantities (which from month to month are perfectly independent) are brought together in tables, they present such an agreement, with gradual change accompanying the change of seasons, as to leave no doubt of their representing a real law of the diurnal changes of the galvanic currents. They also show the existence of a constant turn towards the north (explaining the apparent increase of force to the north observed in the results for days of great disturbance), and a still larger force towards the west (also well marked on the days of great disturbance). No light is obtained as to the origin of these turns; but they appear to be probably pure galvanic accidents, depending on the nature of the earth-connections. The author then exhibited, in curves, the diurnal inequalities of magnetism which the galvanic currents must produce. The form generally consists of two parallel lobes, making with the magnetic meridian an angle of nearly 60° from the north towards the west. The greatest east-and-west difference of ordinates, in the month of April, is 0·00044 of total horizontal magnetic force; it corresponds in the hours to which those ordinates relate, nearly with the ordinary diurnal inequality. But it is much smaller than the ordinary diurnal inequality and the daily law of the galvano-magnetic inequality differs greatly from that of diurnal inequality. For the greater part, therefore, of diurnal inequality the cause is yet to be found.

"On the fossil mammals of Australia.—Part III. *Diprotodon australis*, Owen." By Prof. Owen, F.R.S., &c. Received December 10, 1869. In this paper the author communicated his descriptions of *Diprotodon australis*, with figures of the fossil remains at his command, which have been received from various localities in Australia, since the first announcement of this genus founded on a fragment of lower jaw and tusk described and figured in the "Appendix" to Sir Thos. Mitchell's "Three Expeditions into the Interior of Eastern Australia," 8vo, 1838. The fossils in question include the entire cranium and lower jaw, with most of the teeth, showing the dental formula of:—$i\,\frac{3-3}{1-1},\ c\,\frac{0\cdot0}{0\cdot0},\ m\,\frac{5-5}{5-5}=28$; portions of jaws and teeth exemplifying characteristics of age and sex; many bones of the trunk and extremities. The author described the skull and teeth and the result of the comparisons, establishing the marsupial characters of *Diprotodon* and its combination of characters of *Macropus* and *Phascolomys* with special modifications of its own, which are more fully and strongly manifested in the bones of the trunk and limbs, subsequently described. The pelvis and femora present resemblances to those in *Proboscidea*, not hitherto observed in any other remains of large extinct quadrupeds of Australia. But in all the bones described, essentially marsupial characteristics are more or less determinable. A summary of the characters of *Diprotodon* illustrated the conditions of its extinction, its analogies with the *Megatherium*, its affinities to existing forms of *Marsupialia* and the more generalised condition which it manifests of that mammalian type. A table of the localities, in Australia, from which remains of *Diprotodon* have been obtained and a table of the principal admeasurements of the skeleton, are appended to the text.

Royal Astronomical Society, January 16.—Third meeting of the Session.—Mr. De la Rue, vice-president, in the chair. The chairman announced that the president, though he was recovering his health, was not able to take the chair. Thirty-one presents were announced and the thanks of the society voted to their respective donors. The first paper read was a communication from Sir John Herschel, having reference to a supplementary list of eighty-four double stars observed at Slough since the year 1820. Amongst these were many observed by the elder Struve and an interesting portion of the communication referred to the relation between Sir John Herschel's estimate of the magnitudes of stars and Struve's. It appeared from the comparison that Herschel's magnitude 3·0 corresponded to Struve's 2·6 and the difference gradually widened from successive magnitudes until from the lowest orders the two lists were altogether discordant. A similar relation was observed (we believe by Mr. Knott) between the magnitudes in Admiral Smyth's Bedford catalogue and Argelander's estimates.—A communication from Mr. Joynson, having reference to observations made on occultations and on phenomena of Jupiter's satellites, was then read.—In a paper containing a list of occultations, Captain Noble referred to an estimate, by Mr. Penrose, of the latitude of the former's observatory as deduced from an occultation of ζ Ceti.—The next paper, by Commander Davison, on the November meteors as seen at Santa Barbara, California, contained several interesting diagrams.—The annual statement of the observations made on the sun at Kew was then read. It appeared from this that sun-spots have scarcely been so numerous as was to have been expected so near the epoch of maximum spot-frequency. The sun was observed on 96 days during the year 1869; there were no days when the sun was without spots and 224 new groups made their appearance.—Mr. Browning then read an account of a new method of measuring the position of lines in the spectrum. In this arrangement an illuminated cross is made to traverse the spectrum by turning a micrometer screw. Mr. Browning mentioned that he had found it perfectly impossible, by the ordinary mode of measurement, to deal with the faint spectrum of the planet Jupiter. The spectrum itself was nearly obliterated and the lines in it were rendered altogether invisible. He remarked that though Jupiter is so bright, its spectrum is fainter than that of a second magnitude star, even when the latter spectrum is made as wide as that of the planet (a peculiarity obviously depending on the fact that we use but a portion of a planet's light in observing its spectrum, while the linear image of a star includes the whole of the star's light). Mr. Bidder, referring to Mr. Browning's method of bringing the illuminated cross upon the spectrum, said that he had often thought Sir W. Herschel's plan of comparing double stars with movable lights placed at some distance from the observer might, with modifications, be applied to the micrometrical measurement of double stars. He described an arrangement he had tried for this purpose. Messrs. Huggins and Lockyer made some suggestions on the mode of measuring the plan of lines in the spectrum, the former pointing out the necessity of having the cross differently coloured for measuring lines in different parts of the spectrum and showing how this might be done by means of a small prism: the latter remarking that some arrangement was desirable by which the lantern might be so shifted, while the micrometer screw was turned, as not to alter the conditions under which the spectrum was observed. At the chairman's request, Mr. Lockyer then gave an account of Mr. Newall's great telescope, a Cooke refractor, 25 inches in clear aperture, remarking that it was a noteworthy circumstance, that a telescope of this size should have been mounted in the so-called German manner; that is, not on a long polar axis; but on the Fraünhofer stand, familiar to his hearers. He said that Mr. Newall proposed to devote the powers of this instrument in the most generous manner to the interests of science and that when it had been erected in a suitable climate, astronomical workers would be invited to avail themselves of its powers. The chairman then asked if any information could be given respecting Mr. Buckingham's 21-inch refractor, from whose performance so much had been expected. Mr. Buckingham, who was present, said that he had only that evening been observing Jupiter with it; and he had to remark, with reference to the ruddy colours of the equatorial belt which had recently been attracting so much attention, that in his powerful instrument he could clearly discern red masses resembling clouds in shape, on a white background. One band, in the red part of the spectrum, was at present invisible. The chairman invited Mr. Buckingham to make some frequent communications respecting the great telescope's performance. He also confirmed the statements made by Mr. Buckingham respecting the present aspect of the planet. Colonel Strange then gave a most interesting account of a transit instrument constructed by the late Mr. Cooke on the Russian plan (so called) and Mr. Carrington mentioned that the instrument should properly be called the Harris transit, after a countryman of our own who devised the method. The instrument, which is intended to be used by those engaged in the survey of India, was exhibited at the meeting. Instead of the ordinary arrangement, the optical axis of the instrument is divided into two halves at right angles to each other, one corresponding to the object half of an ordinary transit, the other being in the horizontal axis of the instrument; so that the eye-piece is placed at one end of the horizontal axis and the observer stands on one side of the instrument. The advantages of the arrangements are obvious: the eye is always at the same height and the vision always directed horizontally. On the other hand, Colonel Strange remarked that he could not altogether get rid of his dislike to the plan. He thought all who had been engaged in actual observation would agree with him that the less the cone of light forming the object-glass was tampered with the better. But passing over that and minor objections, there remained this important point to be considered. In the ordinary arrangement, any disturbance of the collimation, whether taking place at the object-end or at the eye-end of the instrument, produced effects varying inversely as the distance separating the object-glass from the eye-glass. In the new arrangement, if the prism by which the rays from the object-glass were reflected towards the eye-glass were disturbed, the effects would be increased in precisely the same proportion that the distance between the prism and the object-glass is less than that between the eye-piece and the object-glass in the ordinary arrangement. The answer to this was, that the prism in effect never does get disturbed; but, for his own part, he thought this could hardly be looked upon as established. There was this further objection (first pointed out by Captain Clarke) to be considered, that there was a variation in the collimation—errors according to the position of the instrument. An interesting discussion ensued, during the course of which the possible disturbances resulting from the heat, or from the weight of the observer, were discussed and the performance of the instrument compared with that of such an instrument as Mr. Carrington is about to employ, in which the whole of the telescope's axis is always horizontal. Mr. Stone was then invited to give an account of his researches into the heating powers of the stars, which he did in a most interesting and lucid manner. The substance of his remarks has already appeared in these columns under another heading.

Zoological Society, January 27.—Prof. Newton, V. P., in the chair.—A letter was read from Mr. R. B. White, concerning the hairy tapir (*Tapirus roulini*) of the Andes of New Granada, of which he was endeavouring to obtain specimens for the Society's menagerie.—Dr. Cobbold, F.R.S., exhibited specimens of, and made remarks upon, the new entozoön from the Aard-wolf, described at the last meeting of the society, and proposed to be called *Acanthocheilonema dracunculoides*.—Mr. G. D. Rowley, exhibited and made remarks upon a specimen of the Siberian lark (*Alauda sibirica*), recently taken at Brighton, and believed to be the first example of this species that had occurred in the British Islands. He also exhibited some other rare birds from the same locality.—Prof. Newton, in exhibiting a specimen of the North American *Zonotrichia albicollis*, shot near Aberdeen, and sent to him for that purpose by Mr. W. C. Angus, called attention to the injudicious practice of many ornithologists who are prone to give the name of "British Birds" to all such foreign species as occasional stray to this country.—A communication was read from Professor Owen, containing a letter received from Dr. Haast, F.R.S., on the discovery of cooking-pits and kitchen-middens containing remains of various species of *Dinornis*, in the province of Canterbury, New Zealand.—Mr. P. L. Sclater read a paper on some new or little-known birds from the Rio Paranà, collected during the second survey of the river by Captain Page, U.S.N. and submitted to him for examination by the Smithsonian Institution. — Dr. W. Baird communicated a description of a new genus and species of shells from Whydah, on the West Coast of Africa, proposed to be called *Pretoma*, together with some remarks on the genus *Proto* of Defrance.—Mr. R. B. Sharpe read a paper on the genus *Pelargopsis* of the family *Alcedinidæ* and pointed out the geographical distribution of the eight species of this genus in the Indian and Australian regions.—Mr. Sharpe also exhibited and pointed out the characters of a new species of *Campephaga* from Damara-land, which he proposed to call *Campephaga Anderssoni*, after the late Mr. C. J. Andersson, its discoverer.—Dr. J. E. Gray communicated some notes on the skulls of the whales of the genus *Orca* in the British Museum, and a notice of a specimen of the same genus from the Seychelles. —A communication was read from Dr. J. C. Cox, containing descriptions of seventeen new species of land shells from the South Sea Islands. The original specimens were stated to be in the cabinet of Mr. John Brazier, of Sydney.—A communication was read from Lieut.-Col. Playfair, containing an account of a fresh-water fish recently discovered in the vicinity of Aden, which appeared to referable to the widely-distributed Cyprinoid, *Discognathus lamta*.—Dr. J. Murie read a note upon a larval æstrus found in the orbit of the hippopotamus, to which was added a list of the species of mammals in which æstri-larvæ have hitherto been found.—Dr. Murie also read a note on a specimen of the so-called *Aquila Barthelemyi* recently living in the Society's Gardens, which appeared to be nothing more than a variety of the Golden eagle *Aquila fulva*.

Chemical Society, February 3.—Prof. Williamson, F.R.S., President, in the chair. Mr. Chapman read a note on the organic matters contained in the air. Some time ago the author in connection with Mr. Wanklyn and Mr. Smith, found that the smallest traces of nitrogenous organic matter in water could be detected by converting the nitrogen of the organic matter into ammonia and estimating the latter with the Nessler test. It occurred to the experimentors that the process might be extended to the investigation of the air by washing it with water. But Mr. Chapman found the operation of washing the air more difficult than he had expected. It seemed the most obvious method to draw air through water, or through some other medium which would have afterwards to be washed with water. The absorption by water alone proved insufficient. Filters of cotton wool and gun cotton acted very well; but neither of the two materials could be obtained free from traces of nitrogenous substances. Asbestos seemed to be sufficiently good; but the preparatory treatment it has to undergo before its use in the experiment, is too troublesome. Lastly, finely powdered pumice-stone was tried as a filtering medium and was found satisfactory in all respects. It has to be heated to redness before it is employed and is then moistened with some water spread over coarser pieces of pumice, which rest on wire gauze fitted into a funnel. The funnel is connected with one neck of a Wolfe's bottle, whilst the other neck is joined to an aspirator. When a sufficient quantity of air—say 100 litres—has been drawn through the apparatus, then a pumice is transferred to a retort which contains water freed from ammonia and organic matters and the operation is now proceeded with exactly as if it were an estimation of nitrogenous organic matter in a sample of water. By this method Mr. Chapman found that the air of crowded rooms contains suspended fixed organic particles, as well as volatile bases. The first can be removed by filtration through cotton wool, the latter pass through the filter and when conducted into water can be detected therein. Air collected from the neighbourhood of a sewer contained notable quantities of those volatile bases. The author thinks it would be of interest to investigate by the above-described method the air in hospitals, fever wards and the like places. With respect to the examination of the volatile bases occurring in the air, Dr. Mills suggested that the charcoal out of the "Stenhouse air filter" might furnish a good means for collecting those bases.—In another paper Mr. Chapman communicated some new reactions of alcohols. Amylic alcohol, as commonly obtained, consists of two liquids, one rotating the polarised ray, the other not. The two may be separated by distilling the mixture from soda, calcic chloride, &c. The non-rotating alcohol is retained, the rotating distills over. But by repeated distillations it was found that the rotating alcohol is converted into the non-rotating by the very treatment employed to separate the two. No difference in the physical properties of the two alcohols is perceptible. The compounds of the non-rotating liquid do not turn the ray of polarised light; those of the rotating do and that in an opposite direction to the original alcohol. These facts seem to indicate that the internal structure of organic compounds is not so permanent as the habit is of thinking them. Another observation Mr. Chapman made whilst pursuing these experiments was, that caustic soda is not merely unable to dry alcohol, as is well known, but that it actually moistens it. On proper investigation, it turned out that the sodium replaces the hydrogen of the alcohol, whilst the displaced hydrogen takes the place of the sodium in the caustic soda and thus produces water. Referring to this latter observation, the president remarked that it confirmed the idea of a double decomposition taking place when potassic hydrate is dissolved in alcohol, an idea derived from the well-known reaction of carbonic action on a solution of potassic hydrate in alcohol, whereby ethylo-potassic carbonate as well as potassic carbonate is formed.—Mr. Perkin exhibited a modification of Berthelot's method for the synthesis of hydric cyanide (prussic acid) by direct union of acetylene and nitrogen under the influence of the electric spark. Mr. Perkin takes advantage of the fact that nearly all the hydro-carbons, when submitted in the state of vapour to the action of the spark, yield more or less acetylene. Nitrogen was caused to bubble through benzole, then to pass through a globe in which the spark was discharged and thence into a solution of silver. Even after a few seconds, abundant evidence of the formation of hydric cyanide was obtained. Hydric cyanide is further produced when the spark is discharged in a mixture of ammonia-gas and ether vapour. If, however, nitrogen instead of ammonia is employed, no prussic acid is formed. Mr. Perkin's modification of Berthelot's method is well adapted for purposes of lecture demonstration.

Royal Geographical Society, January 24.—Sir R. Murchison, president, in the chair. A letter from Mr. Hayward detailing his plans of reaching the Pamir Steppe, by way of Ghilghit, was read. He expected to winter in Ghilghit and hoped to be at Lake Karakol next May; he proposed to thoroughly lay down the positions of the Pamir Steppe and the basin of the Jaxartes. An account of Easter Island, or Rapa Nui, by Mr. Palmer, R.N., was then read. The island lies in 27° 8′ 46″ S., long. 109° 24′ 36″ W., about 1,000 miles from Pitcairn. It is volcanic and contains several extinct craters, the highest point being 1,100 to 1,200 feet high. The principal craters are Te Rana Kau, the depth of which is 700 feet; Te Rano Hau, whence came the tufa of which the hats or crowns of the images are made; and Te Rana Otu Iti, where the images were sculptured of grey lava. There is no water, save in pools, which are 26 feet deep and one spring, mineral, but potable. The coast is ironbound, without harbours. The character of the natives has been much improved by the teaching of the Jesuit Fathers and they now are scrupulously honest. They are perfectly idle, content to starve rather than work; number about 900—600 women to 300 men and will probably, ere long, die out. They make and sell well-carved wooden figures, with eyeballs of obsidian, ornamented with double-headed "aronies," or birds—and other figures. They are described by all visitors as a tall, almost white, race; the women handsomer than those of the Marquesas. They are not idolatrous, but believe in a Great Spirit. The dead, swathed in grass, are laid on platforms, heads to seaward. They have a tradition that they came from Oparo. The platform for the images faced the sea, supported by a stone wall seven or eight yards high, built of dry stones six feet in length; the platform was 100 paces long and thirty feet deep, terminating landwards in a step three feet high. It was strewn with bones; all the images had been thrown down. Near that, on an area paved with large stones, stood a pillar of red tufa, six feet high, on which were two skulls, apparently twelve or fourteen years old. A place of cremation was near this. The images amount to several hundreds, some unfinished. In the crater of Otu Iti they vary in size from thirty feet (of which the head measures two-thirds) to five feet. They are marked by excessive shortness of the upper lip; the eyeballs, of obsidian, are lost; the ears display very long pendant lobes; each image has its own name; some have "hats" or crowns, some have the heads cut flat to receive them; the tools seem to have been long boulders ground down with obsidian—only one specimen was found. The paper was illustrated by numerous drawings made on the spot and enlarged pictures taken from them. Mr. Markham pointed out the resemblance between these remains and the Imarra works in the vicinity of Lake Titicaca, in Peru and advocated the theory that this island had been a stepping-stone for the successive arrivals of immigrants into Peru and perhaps revered as a holy isle whither the Incas sent ships. The Peruvian images were dispersed like those of Easter Island, as though walking through the country; the present islanders were simply Polynesians and probably not descendants of the sculptor-race. Mr. Franks pointed out the resemblance of some peculiarities in the wooden figures now made and the stone images; at the same time the wooden figures brought home by Cook and now in the Museum, differed materially from those brought in 1840—the change of style, therefore, would not imply a change of race. The want of forest timber might have occasioned the employment of the soft volcanic tufa and a long lapse of time would account for the numbers of images found. Sir G. Grey stated that all Polynesians were addicted to carving—if the wooden figures carved in New Zealand had not decayed there would be now thousands of them; there were in these islands traditions of stone figures brought from other islands. Mr. Palmer said, in reply, that he had not formed any theories on the subject; but only recorded what he saw; the people had all been withdrawn to the settlement in consequence of the Peruvians having kidnapped some hundreds to work the guano deposits.

Anthropological Society of London, February 1.—Captain Bedford Pim, R.N., V.P., in the chair, "On the negro slaves in Turkey," by Major Frederick Millengen, F.R.G.S. The author exposed first the particulars connected with the sale of negro slaves in Mussulman countries, then described the condition of negroes in Turkey and concluded by some general observations. The negroes imported into the Sultan's dominions come from the countries situated on the higher basin of the Nile; and though that valley is the route followed by the cargoes of slaves on their way to the markets, numbers of secondary channels exist, through which slave-dealers convey their merchandise. The causes of the supply are the feuds of the negro races, the causes of demand are that slavery is inherent in the religious system of Mussulman nations, inherent in their social system and congenial to their ideas and manners. The author considered that Sir Samuel Baker's expedition to put a stop to the slave trade must end in failure; and he quoted the speech of Lord Houghton plainly avowing the disappointment felt by his friend Sir Samuel Baker on seeing the Mussulmans hostile to his scheme. In conclusion, the author said that, if the Sultan and Khédive really intend doing away with slavery, they have nothing else to do but to open wide the gates of their harems.

DUBLIN

Natural History Society, February 2.—Mr. R. P. Williams in the chair. Dr. A. W. Foot exhibited a young bitch terrier suffering from goitre and made a few remarks on the subject of goitre in animals. The list of animals affected with this complaint includes the lion, hyæna, racoon, monkey, cat, dog, horse, mule, pig, cow, sheep and mouse. The geological conditions which appear to be connected with the occurrence of this disorder in animals were discussed and commented upon.—Prof. Macalister read a paper "On some points in the anatomy of the sartorius muscle."—Dr. A. W. Foot exhibited thirteen species of dragon flies, collected during the past summer in the county of Wicklow: *Agrion elegans, minium, puella, cyathigerum; Lestes nympha, Calypteryx virgo, splendens, Æschna pratensis, juncea, grandis, Libellula quadrimaculata, striolata* and *cœrulescens*.

MANCHESTER

Literary and Philosophical Society, January 25—J. P. Joule, LL.D., F.R.S., &c., president, in the chair.

"On organic matter in the air." By Dr. R. Angus Smith, F.R.S., &c. In referring to the new experiments by Prof. Tyndall on this subject, the author mentioned that he had long ago proved the existence not only of inorganic and organic material; but also of organised bodies in the atmosphere. He did not claim to have originated the idea that this is the case; but rather to have furnished proof and quantitative demonstration of the fact, as far back as 1846, when he brought a notice of the subject before the Chemical Society and, in 1848, in a report to the British Association; having also followed up the inquiry since then, in conjunction with Mr. Dancer and published his results at various times. In conclusion he says we must not be panic-stricken because of the presence of organised germs in the air. Some are hurtful; but it may be that others are required for the maintenance of healthy animal life exactly as in vegetable fermentation.

Prof. Williamson exhibited some specimens affording additional information as to the organisation of calamites. Through Mr. Butterworth he had succeeded in obtaining examples whose structure was intermediate between calamodendron and calamopitus. In the general arrangement of separate parts the new specimens corresponded closely with the type figured by Mr. Binney; but they differ in two important particulars. All the fibro-vascular tissues are of the reticulate type seen in calamopitus and dictyoxylon, with a few scalariform vessels here and there. The cellular laminæ separating the vascular wedges exhibit remarkable variations even in the same specimen; the cells being sometimes elongated into vertical forms of prodenchyma—sometimes extended transversely and still more frequently they consist of ordinary parenchyma. In some the fibro-vascular tissues of the wedges are separated by masses of cellular tissue, both at the nodes and internodes. These tissues, or modified medullary rays, are so numerous in one example, that more than two vertical vessels can scarcely be found in contact without the intervention of one of these vertical rows of mural cellular tissue. In other specimens these medullary rays are much more scanty, as if connecting the type under consideration with that figured by Mr. Binney. In these new examples, the verticillate medullary radii of calamopitus are wholly wanting. Additional proof is thus afforded that all three of the types may be only variations of the common calamodendron and it thus becomes more demonstrable that in the Lancashire coal-field, at least, we have no evidence of the existence of an equisetiform type of calamite distinct from the calamodendroid one. The author further announced the discovery by Mr. Butterworth of a young calamite in which the vertical layer is well preserved, presenting a parenchyma of somewhat remarkable structure and of a thickness equal to the ligneous zone which it invests. Its further description will be given after investigation.

"On the so-called molecular movements of microscopic particles." By Professor Stanley Jevons, M.A. In studying the phenomenon first pointed out by Robert Brown in 1827, the author found that silicates appeared to be generally the most active substances in this respect, pure quartz crystal in fine powder maintaining rapid oscillation: but charcoal, red phosphorus, antimony and sulphur were also very active. Metallic oxides and earthy salts, such as carbonate of lime, appeared to be less active; but it cannot be said any substance is free from such motion. On varying the liquid, however, by dissolving salts in it, the fact became apparent that pure distilled water gave rise to the greatest activity. The motion appeared to be closely connected with the suspension of fine powder in water, a fact already noticed by Dujardin.* All acids, alkalis, or salts which checked the motion were found to facilitate the subsidence of suspended material. Gum arabic, on the contrary, prevents subsidence and it has a remarkable power of exciting the molecular motion. The author was soon convinced that the motion was due to electrical action, by the close analogy with the circumstances under which electricity is produced by the hydro-electric machine, pure water alone producing much electricity, while almost any salt, acid, or alkali prevented the action by rendering the water a conductor. Ammonia, however, is a remarkable exception in this respect and it does not stop the molecular motion or facilitate subsidence of suspended material. Boracic acid, likewise, is a non-conductor and does not cause subsidence.

However, acetic acid, which Faraday stated did not render water a conductor, does, in common with other vegetable acids, occasion subsidence. It is probable that silicic acid does not render water a conductor, since silicate of soda tends to increase the molecular motion rather than otherwise and this is another exception to the general influence of soluble substances in causing subsidence.

The author is of opinion that this motion of suspended particles is closely connected with the phenomena of osmose as a case of action and reaction; for, if a liquid be capable of impelling a particle in a given direction, the particle, if fixed, would be capable of impelling the liquid in an opposite direction with an equal force. The earthenware jars used by Graham were composed of a substance highly active under the microscope, and the fact that osmose is chiefly an affair of very dilute solutions, certainly accords with the electric origin of the molecular motion, which the author considered to be established experimentally, pointing to the experiments of Wiedemann on electric osmose as suggesting a speculative explanation. Solid particles of organic substances also exhibit the motion; albumen, distrin, sugar, starch-solution, alcohol, &c., have little power to arrest the motion. The author thinks it not unlikely that, when these phenomena are fully investigated, they will give strong support to the theory lately put forward by Becquerel, that the movements of liquids in animals and plants are really due to electric action. Mr. Dancer stated that particles approaching to a spherical form showed the greatest activity with some few exceptions, as in the case of sublimed mercury and sulphur. He did not regard electric action as a satisfactory explanation of the phenomenon, and thought the results of many experiments pointed to heat as a probable cause.—"On a general system of numerically definite reasoning," by Prof. W. Stanley Jevons, M.A. The substance of this paper was given in the report of the Royal Society's proceedings for January 20.

LIVERPOOL

Naturalists' Field Club, January 14.—The Rev. H. H. Higgins, president, in the chair. The President informed the members that Mr. H. S. Fisher was in communication with some botanists in the south of England, with the view of obtaining exchanges of specially local plants and that he had been successful in supplying a gentleman in Cornwall with fifty or sixty specimens of plants, placed in a list of desiderata forwarded by him—among them *Centaurea latifolia*—a plant peculiar to Crosby in this neighbourhood. He also mentioned that he had witnessed the phenomenon known as the Zodiacal Light at Rainhill on the 19th of December last, at 4.25 P.M. In substance, but not in form, it resembled the tail of a comet.—Mr. Gibson then read a

* Manuel Complet de l'Observateur au Microscope. Paris: 1843, p. 60.

short paper on the Parasitic character of *Pyrola rotundifolia*—Wintergreen—and stated his belief, founded on minute personal investigation, that it *is* Parasitic on the root of the dwarf willow, *Salix repens*. He never found Pyrola where the willow was absent and in some cases he detected the fibrous roots of the Pyrola apparently growing on those of the willow.

BRIGHTON

Brighton and Sussex Natural History Society, January 13.—The president, Mr. T. H. Hennah, in the chair. The receipt of a copy of a paper by Mr. C. Roper, on the Decapod Crustacea found at Eastbourne, was announced.—Mr. J. E. Mayall communicated a note on what he believed to be a new fact in connection with coal gas. While engaged in the spectrum analysis of organic bodies, he had found his results interfered with by the presence of copper. Examining the solutions and no trace of copper being found, it occurred to him that it might be present in the common coal gas used in the Bunsen lamp, in which the incandescence of the organic matter was produced. Having candles with wicks dipped in the chlorides of various metals always at hand as standard spectra, on comparing the flame of a copper candle with that of the gas under examination, their spectra were found to be identical. From this he inferred the copper was generated from pyrites contained in the coal. Mr. J. E. Mayall then read a paper on Volcanic Theories.

PARIS

Academy of Sciences, January 24.—M. Lecoq de Boisbandeau communicated a note on the continuity of luminous spectra, in which he developed his theory of the production of spectra by inequalities in the luminous molecules, and referred especially to the phenomena presented by rubidium, cæsium, and potassium.—At this meeting there were no other papers on subjects of any special importance.

January 31.—M. Vérard de Sainte-Anne read a Memoir on a project for establishing a communication between France and England. The author proposes the establishment of a railway bridge, either open or tubular, across the Straits of Dover. A continuation of M. J. Boussineq's memoir on the theory of the flow of a liquid through an orifice in a thin partition was presented by M. de Saint-Venant.—M. Gaiffe communicated a letter containing remarks on the process employed by Mr. Adams to produce deposits of nickel by electrolytic action, in which he maintained that the neutral chloride and sulphide of nickel and ammonia with no trace of free fixed alkali can alone furnish workable baths.—M M. Becquerel maintained that the presence of soda and potash does not hinder the deposition of the nickel.—M. A. Lallemand stated that when a solution of sulphur in sulphide of carbon is exposed to solar light concentrated by a lens, insoluble sulphur is produced: the spectrum of the emergent light is deficient in all the rays between G and H and the ultra-violet spectrum has entirely disappeared. A solution of phosphorus in sulphide of carbon is similarly acted upon.—M. Cahours presented a note by M. L. Daniel, giving an account of some interesting experiments with vacuum-tubes under the influence of magnetism.—A note on the heat of combination of boron with chlorine and with oxygen, by MM. L. Troost and P. Hauteville, was presented by Mr. H. Sainte-Claire Deville, who also communicated a paper by Mr. Landrin on the division of a limited quantity of acid between two bases employed in excess. From his experiments it appears that the oxides are dissolved in simple equivalent proportions, *i.e.*, 1 to 2, 3, 4, 5, &c.—A note by M. E. Bourgoin on the cause of the unequal loss of oxalic acid at the positive and negative poles and on the nature of oxalic acid when dissolved in water, was presented by M. Bussy. The loss by decomposition is three times as great at the positive as at the negative pole; the gas disengaged at the former is pure carbonic acid, at the latter hydrogen. The author concludes that the composition of oxalic acid in solution in water, is $C^4 H^2 O^8$, 2 H^2, O^2.—M. C. Dareste read a paper on the convolutions of the brain.—M. P. Gervais presented a reply to the observations of M. Balbiani on the ova of the *Sacculinæ*, by M. E. Van Beneden and M. A. L. Donnadieu noticed a case of monstrosity (hemiterism) in a carp.—M. A. Chatin communicated a note on the cause of the dehiscence of the anthers of plants, in which he denies that this phenomenon is due exclusively to the fibrous cells of the endothecium as supposed by Purkinje and shows that in some cases certainly and in many others probably, the exothecium or epidermic layer plays an important part in it.

DIARY

THURSDAY, FEBRUARY 10.

ROYAL SOCIETY, at 8.30.—On some remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium: H. C. Sorby, F.R.S.—On the Mathematical Theory of Stream Lines, especially those with four foci and upwards: Professor Rankine.—On Linear Differential Equations: W. H. L. Russell, F.R.S.

MATHEMATICAL SOCIETY, at 8.—Quartic Surfaces: Prof. Cayley.

ZOOLOGICAL SOCIETY, at 8.30.—On a new Cervine Animal from the Yang-tze-Kiang: R. Swinhoe.—On the Size of the Red Corpuscles of the Blood of *Moschus, Tragulus, Orycteropus, Ailurus* and some other mammalia, with historical notices: G. Gulliver.

ANTIQUARIES, at 8.30.

LONDON INSTITUTION, at 7 30.

FRIDAY, FEBRUARY 11.

QUEKETT MICROSCOPICAL CLUB, at 8.—For exhibition of objects and microscopic gossip.

ROYAL INSTITUTION, at 9.—The Deep Sea: Dr. Carpenter.

ASTRONOMICAL SOCIETY, at 3.—Anniversary Meeting.

SATURDAY, FEBRUARY 12.

ROYAL BOTANIC, at 3.30.

MONDAY, FEBRUARY 14.

MEDICAL SOCIETY, at 8.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.

TUESDAY, FEBRUARY 15.

ANTHROPOLOGICAL SOCIETY, at 8.—On the Aborigines of the Chatham Islands: Dr. Barnard Davis and A. Welch.—Polygamy: Dr. John Campbell.—Inscribed Stone from Venezuela: R. Tate.

PATHOLOGICAL SOCIETY, at 8.

STATISTICAL SOCIETY, at 8.—On International Coinage and the Variations of Foreign Exchanges during recent years: E. Seyd.

INSTITUTION OF CIVIL ENGINEERS, at 8.

ROYAL INSTITUTION, at 3.—On the Architecture of the Human Body: Prof. Humphry.

WEDNESDAY, FEBRUARY 16.

SOCIETY OF ARTS, at 8.—On Emigration: T. Plummer.

METEOROLOGICAL SOCIETY, at 7.

THURSDAY, FEBRUARY 17.

ROYAL INSTITUTION, at 3—Chemistry: Prof. Odling.

LINNEAN SOCIETY, at 8.—On the Tree Ferns of British Sikkim: Mr. Scott.

CHEMICAL SOCIETY, at 8.

ZOOLOGICAL SOCIETY, at 4.

ANTIQUARIES, at 8.30.

ROYAL SOCIETY, at 8.30.

BOOKS RECEIVED

ENGLISH.—Transactions and Proceedings of the New Zealand Institute, 1868: Edited by J. Hector, M.D. (Trübner).—The Year Book of Facts: J. Timbs (Lockwood and Co.).

FOREIGN.—Bericht über die Fortschritte der Eisenhütten-Technik im Jahre, 1867, nebst einem Anhange enthaltend die Fortschritte der anderen Metallurgischen Gewerbe: A. K. Kerpely.—Studien aus dem Institute für experimentelle Pathologie in Wien aus dem Jahre, 1869: S. Stricker.—Zeitschrift für Parasitenkunde: Dr. E. Hallier and Dr. F. Zürn.—Handbuch der theoretischen und clinischen Percussion und Auscultation vom historischer und critschen Standpuncte bearbeitet: Dr. P. Niemeyer.—Beiträge zur Naturkunde Preussens herausgegeben von der königlichen physikalisch-ökonomischen Gesellschaft zur Könisberg: miocene baltische Flora: O. Heer.—Landwirthschafliche Zoologie: Dr. C. E. Giebel (Williams and Norgate).

CONTENTS

JANUARY 1870] [PART III

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

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

CONTENTS

No. 10

No. 11

No. 12

No. 13

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