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THURSDAY DECEMBER 12, 1872

SCIENTIFIC RESEARCH AND UNIVERSITY ENDOWMENTS

NOTWITHSTANDING the great development of scientific education, and the firm and prominent position which Science holds in public estimation, it must be admitted that a profound dissatisfaction and anxiety are the prevailing feelings with which the conditions and prospects of English science are regarded by the cultivators of knowledge. To the outside observer these sentiments appear simply captious and unreasonable. When so much has been done, why on earth should we complain? The truth, however, unhappily is, that in the midst of our apparent abundance we have still a great deficiency; and those fruits and results of Science, in the way of scientific research and discovery, which afford the true measure of our scientific condition, have by no means proportionably increased. Indeed it may be doubted whether the annual harvest of scientific truth is even as abundant as twenty or thirty years since, when Science had hardly penetrated even the outer crust of English society. The character of our scientific periodicals is essentially altered. The Journal of the Chemical Society, for example, of which the original and proper function was to print the investigations of English chemists, now appears to exist simply to inform us of what is accomplished elsewhere. The volume for the year 1871 is a stout octavo of 1,224 pages; of these, however, not more than 154 are occupied with original communications read before the Society, while the rest of the volume is filled with innumerable abstracts of the investigations of the chemists of Germany and France. Ten years ago the same journal contained on the average at least 400 pages of original matter.

Now, the perfection of science, in all the various aspects in which it appears as an instrument of human progress, is manifested only in scientific inquiry; and to the scientific mind no technical skill, no abundance of information, can be a substitute for this, or compensate for its absence.

This view of the condition of Science is not invalidated by the circumstance that a certain number of distinguished Englishmen are to be found whose scientific work is of the highest order.

In this country there are now, as has been the case in each generation for the last two hundred years, a limited number of individuals of powerful intellect and elevated aspirations, who have made scientific research the main purpose and object of their lives. Of such we have happily sufficient living examples to preserve among us the true type of the scientific investigator, and to dispel the apprehension of intellectual degeneracy. The labours, however, of modern Science are on far too extensive a scale to be carried on simply by the efforts of eminent individuals. Science requires the services of a class devoted to the extension of knowledge, precisely as other classes of society are devoted to commerce, to politics, or to agriculture. Such a class does not exist among us, and its absence is the greatest defect in our social system.

Undoubtedly there are many causes which interfere with the growth of such a class. The unremunerative character of scientific work, the want of intelligent appreciation on the part of the public, of even the value and importance of such work by which the student is deprived of that most powerful stimulus to exertion, the sympathy and support of others, deter many from the career of Science. Moreover, the very spread of scientific knowledge and education is, in its results, by no means in all respects favourable to the pursuit of pure Science. A demand is created for the services of scientific men in a technical direction which it is very difficult to meet, and which induces the student of Science to turn his attention to the practical and remunerative rather than to the theoretical aspect of his vocation. Many a man, too, of genius for research is compelled by the sad necessities of life to labour at the oar for the service of the community, is drafted into the ranks of popular lecturers to amuse the public with ready talk and brilliant experiments, or spends a life which he would willingly devote to scientific investigation as an officer of health, or an analytical and manufacturing chemist.

Such impediments, however, to the indulgence of men's higher tastes and desires, have their root in the very organisation and necessities of modern society, and are not peculiar to English life. But Science has in this country one special difficulty to contend with—the utter apathy in regard to the advancement of knowledge which has so long prevailed at the English Universities, which, without any doubt, is the main cause of our disasters. In Germany the universities are the very centres of intellectual progress; and we might reasonably have hoped that here also amid the distractions of modern life these great institutions would have afforded at least one refuge for science and learning, and have supplied the few who might possess any exceptional capacity for these pursuits with the means of existence and the means of work. Such, indeed, was undoubtedly the main object to which these noble institutions were destined by their founders, who equipped them with all the appliances necessary for the cultivation of the knowledge of their day. But, unfortunately, they fell into wrong hands, and the class to whose protection and care these great interests were confided betrayed in every way the trust committed to them; until at length abuses reached such a point that, after a prolonged agitation, university reformers succeeded in obtaining the interference of the Legislature in the form of the Executive Commission of 1854. The unsatisfactory way in which this commission proceeded to remedy the evils complained of is even now not generally understood.

When we consider the profound importance of learning and scientific discovery, not alone to the material and physical, but also to the intellectual and moral progress of the nation, we might well have anticipated that in any reform of the universities the first object of our statesmen and legislators would have been to provide for these great interests, and to restore the endowments of the university in this respect to their ancient uses. But the commission did nothing of the kind; its efforts were mainly directed to the suppression of pecuniary jobbery. But this having been effected, the further changes which they introduced proceeded upon the lowest possible estimate of the functions of an University, which they appear to have regarded not at all as a national instrument for the

furtherance of knowledge, but simply as a superior kind of Grammar School. Of the University, as thus understood, pecuniary prizes were to be the motive power, and competitive examination the regulating principle. The resources of the colleges were dealt with from this point of view. Numerous scholarships were founded for the support of students, on a scale so extensive, that, as has been computed, one-third of the students of Oxford are thus subsidised during their University career. The remainder and greater part of the endowments was nearly all devoted to fellowships, varying in value from 200*l.* to 300*l.* a year; on these two objects it is estimated that at least 120,000*l.* is annually expended by the colleges of Oxford.

The fellowship which they thus created is indeed a unique and singular institution. It is a life-estate conferred by a corporate body, without exacting in return any services whatever from its possessor, either to the college or to the community at large; and the chief result of the labours of the Executive Commission, whose business it was to reform the University, was the establishment of this gigantic system of sinecure pensions, conferred upon young men in the prime and vigour of life, as the reward of having passed a successful examination. When the ordinances framed by the Commissioners come fully into operation, there will be, in Oxford alone, about 300 sinecure fellowships.

In the arrangements of the Commissioners the most contemptuous disregard was manifested for the interests of science and learning. A few professorships of ancient date founded by men of a very different stamp, which the colleges had suppressed, were revived, but no real or adequate provision was made even for the maintenance of lecturers and professors necessary to carry on the education of the place, and out of these vast funds, not a sixpence was devoted to the advancement of knowledge or the promotion of scientific or literary research, or to the support of museums and laboratories.

These arrangements were not based upon any very high estimate of human motives and desires, and it would have been surprising indeed if an ideal University, devoted to the interests of learning, knowledge, and truth, should have sprung from such ashes. As a matter of fact, complaints are heard on all sides of the futility of this system, and the necessity of a redistribution of the college endowments is widely felt. In this movement the Government have taken the initiative by the appointment of a Royal Commission to inquire into the revenues of the Universities and Colleges of Oxford and Cambridge. These revenues have never as yet been fully disclosed, but we may anticipate that a good deal of surprise and even indignation will be felt when the amplitude of these resources is contrasted with the inadequate results attained by them. Another contingency will then arise, to be deprecated by every lover of knowledge, the possible alienation and dissipation of the noble inheritance of science and learning which has been so inappropriately employed.

It was in connection with these questions and with the view of considering the best application, in the interests of mature study and scientific research, of the endowments of the Universities and Colleges of Oxford and Cambridge that the public meeting was held at the Freemasons' Tavern on November 16, of which the report appeared in this journal on November 28. The spirit and purpose of those present at this meeting will be best understood from the resolutions passed by it. These resolutions were :—

1. That to have a class of men whose lives are devoted to research is a national object.

2. That it is desirable, in the interest of national progress and education, that professorships and special institutions shall be founded in the Universities for the promotion of scientific research.

3. That the present mode of awarding fellowships as prizes has been found unsuccessful as a means of promoting mature study and original research, and that it is desirable that it should be discontinued.

4. That a sufficient and properly organised body of resident teachers of various grades should be provided from the Fellowship Fund.

The Society for the Organisation of Academical Study, founded at this meeting, is constituted by no means in the exclusive interests of the natural sciences, but for the sake of the totality of knowledge. The apprehensions which are felt in regard to the condition of research in the physical sciences, are similarly and equally felt in other departments of knowledge, and the objects of this Society are such as to secure the good-will and adhesion of every genuine student. Much consideration will be necessary to devise really practical arrangements, by which such ideas may be carried out. On this point the evidence of those distinguished persons who have been examined before the Science Commission will be of the greatest value; but it is to be hoped that all those who are familiar with the requirements of the several departments of Science will turn their serious attention to the subject, and give to the Society the benefit of their co-operation and advice, with the view of hereafter laying before the Government an adequate and practical scheme for the re-constitution of the Colleges and Universities, not simply as educational bodies, but as national foundations for the preservation and extension of knowledge.

B. C. BRODIE

THE METEOROLOGY OF THE FUTURE

IT would be a curious inquiry which we commend to those learned in statistics, to determine how many millions of observations have been made in the British Isles on dry and wet bulb thermometers, on barometers, and on other meteorological instruments. It would be a still more curious inquiry, seeing that the infinite industry displayed in these observations shows that the importance of the study of Meteorology is universally conceded, to determine why it is that meteorologists, state-endowed and otherwise, have, as a rule, been content to grope their way in the dark, and not only not seek to find, but persistently refuse the clue, which, if followed, would bring them into the light of day. When some one some centuries hence—thank heavens, we have always that to look to in all branches of research—comes to consider the work done by meteorologists during the present century, he will, unless he be some patient German Dryasdust determined to examine all minutes of Boards of Visitors, all Kew Committee Records, and the like, give up the task in the most utter despair, and on the whole perhaps this is the best thing that could happen.

Surely in Meteorology, as in Astronomy, the thing to hunt down is a cycle, and if that is not to be found in the temperate zone, then go to the frigid zones or the torrid zones to look for it, and if found, then above all things, and in whatever manner, lay hold of, study it, record it, and see what it means. If there is no cycle, then despair for a time if you will, but yet plant firmly your science on a physical basis, as Dr. Balfour Stewart long ago suggested, before, to the infinite detriment of English science, he left the Meteorological Observatory at Kew; and having got such a basis as this, wait for results. In the absence of these methods, statements of what is happening to a blackened bulb in vacuo, or its companion exposed to the sky, is, for research purposes, work of the tenth order of importance.

I said the thing to hunt down is a cycle. Now it may be asked,—Is there anywhere on earth a weather cycle? but anyone who asks this question will at once answer it himself—the question would certainly suggest the trade-winds and monsoons, which are short-period cycles. But is there anything more than this?

When I was preparing to go to India last year to observe the eclipse, Mr. Ferguson, the able editor of the *Ceylon Observer*, who happened to be in London, was good enough (he was good enough to us all afterwards, and the Eclipse Expedition of 1871 have much to thank him for) to give me much valuable local information about the time of the year at which the monsoons broke up in the island. Nor was this all; he added that everybody in Ceylon recognised a cycle of about thirteen years or so in the intensity of the monsoon—that the rainfall and cloudy weather were more intense every thirteen years or so. This of course set one interested in solar matters thinking, and I said to him, "But are you sure the cycle recurs every thirteen years; are you sure it is not every eleven years?" adding as a reason that the sun-spot period was one of eleven years or thereabouts, and that in the regular weather of the tropics, if anywhere, this should come out.

This conversation Mr. Ferguson thought fit to reproduce in the *Ceylon Observer*, and I have now lying before me a cutting from a number of that paper I saw in India, (unfortunately it is cut too much, for both date and writer's name are gone) from which I make the following extract. "The period is not *thirteen* years but eleven (as Lockyer states it). In the tropics, or at least, here in Ceylon, where we enjoy the regular changes of the two monsoons, the basic period runs five or six years dry, and five or six years wet. These make *eleven*, and they form the medium cycle of *three*—the grand cycle of thirty or thirty-three years—being three periods of the eleven cycles. But I must premise here that though I adopt these figures as noting a general run of cycle, it is by no means to be expected that, always, these changes shall run with mathematical correctness in given grooves, for there may be thirteen at one time, and next eleven, giving a grand cycle of thirty or thirty-three years."

It will be seen, then, that those who are not professed meteorologists recognise not only the eleven-year period in the Ceylon rainfall, but possibly also a higher one still—that of thirty-three years. In the press of work that has fallen upon me since my return to England, after my three months' absence, I have been prevented from taking the opinion of my meteorological friends upon this most important matter; but now there comes evidence on the question from an authority whose facts and opinions at once settle the matter.

Mr. Meldrum, of the Mauritius, to whom belongs the honour of having established that the number of cyclones in the Indian Ocean and the West Indies varies with the sun-spot area, has lately attacked the rainfall of the Mauritius, Queensland, and Adelaide from the sun-spot period point of view, with results which are simply startling, although Mr. Meldrum very properly puts them forward to stimulate further inquiry, and not as final.

Mr. Meldrum's step from cyclones to rainfall is a very obvious one, because it is well known that cyclones are generally accompanied with torrential rains. The years, therefore, in which cyclones are most frequent should be more rainy than the years in which they are less frequent. But Mr. Meldrum remarks, in his paper communicated to the Meteorological Society of the Mauritius, "to make the rainfall a fair test of the existence of a periodicity of cyclones in the Indian Ocean it would be necessary to know the annual rainfall over the same area for the same length of time. If such rainfall had no periodicity, we should have reason to doubt a cyclone-periodicity; but if there was a similar rain-periodicity, it would, so far, be a confirmation of a cyclone-periodicity."

Accordingly, as it is impossible to determine the rainfall over the ocean, the law of the cyclones of which has been approximately determined, there remains but one course open, to observe the rainfall on the nearest points of land. This is as follows for the above-named stations:—

BRISBANE.		ADELAIDE.		PORT LOUIS.	
Years.	Rainfall. Inches.	Years.	Rainfall. Inches.	Years.	Rainfall Inches.
		1839	19·840		
		1840	24·107		
		1841	17 956		
		1842	20·318		
		1843	17·192		
		1844	16·878		
		1845	18·830		
		1846	26·885		
		1847	27·613		
		1848	19·735		
		1849	25·444		
		1850	19·274		
		1851	30·633		
		1852	27·340		
		1853	26·995	1853	39·829
		1854	15·346	1854	39·435
		1855	23·145	1855	42·665
		1856	24·921	1856	46·230
		1857	21·156	1857	43·445
		1858	21·522	1858	35·506
		1859	14·842	1859	50·875
1860	54·63	1860	19·670	1860	45·106
1861	69·44			1861	68·733
1862	28·27			1862	28·397
1863	68 82			1863	33·420
1864	47 00			1864	24·147
1865	24·11			1865	44·730
1866	37·24			1866	20·571
1867	61·04			1867	35·970
1868	35 98			1868	64·180
1869	54·36			1869	54·575
1870	79·06			1870	45 575
1871	45·45			1871	41·610

Now, we know, to start with, that the years of minimum and maximum sun-spot frequency were as follows :—

Min. epochs	1833, 1844, 1856, 1867
Max. „	1837, 1848, 1860, 1871 (?)

and Mr. Meldrum has shown that these years were also those of minimum and maximum cyclone frequency. Let us begin by examining the Port Louis Observations, embracing nineteen years (1853-1871).

Taking the rainfall in each minimum and maximum epochal year, and in one year on each side of it, Mr. Meldrum gets—

	Years.	Rainfall.	Total Rainfall.
Min.	1855	42·665	133·340
	1856	46·230	
	1857	43·445	
Max.	1859	56·875	170·774
	1860	45·166	
	1861	68·733	
Min.	1866	20·571	120·721
	1867	35·970	
	1868	64·180	

"These figures show a marked excess of rainfall for the three years comprising the maximum sun-spot year (1860), which was also the year of maximum cyclone frequency.

"If in place of one year, we take two years on each side of the epochs, we shall get—

	Years.	Rainfall.	Total Rainfall.
Min.	1854	39.435	207·281
	1855	42 665	
	1856	46·230	
	1857	43·445	
	1858	35·506	
Max.	1858	35·506	234 677
	1859	56·875	
	1860	45·166	
	1861	68·733	
	1862	28·397	
Min.	1865	44·730	220·026
	1866	20·571	
	1867	33·970	
	1868	64·180	
	1869	54·575	

Here, again, a similar result is shown. It is not so well-marked as the former one, partly owing, Mr. Meldrum suggests, to the rain-gauge having been removed in 1866 to a temporary Observatory, where the rainfall was probably somewhat greater.

"So far then, as the Port Louis observations enable us to judge, it may be said that during the last twenty years there has been a rainfall-periodicity corresponding with the cyclone-periodicity in the Indian Ocean south of the Equator.

"This may be considered as confirmatory of the correctness of the cyclone period ; for if the rainfall *at one station* shows a corresponding periodicity, much more should *a mean of the rainfall at many stations* within the whole cyclonic area do so."

Mr. Meldrum next passes on to the Australian observations, remarking that, although Adelaide and Brisbane are a long way outside the area for which the cyclone period was determined, there also the rainfall tables seem to point to a similar periodicity.

The *Adelaide* twenty-two years' observations give :—

	Years.	Rainfall.	Total Rainfall.
Min.	1843	17·192	52·900
	1844	16·878	
	1845	18·830	
Max.	1847	27·613	72·792
	1848	19·735	
	1849	25·444	
Min.	1855	23·145	69·222
	1856	24·921	
	1857	21·156	

By taking five-year periods we get :—

Minimum = 100·076 inches.
Maximum = 118·951 „
Minimum = 106·090 „

We next come to twelve years' observations at Brisbane, for which science is indebted to Mr. Edmund McDonnell. Comparing them with the Mauritius observations for the same period, we cannot but be struck with a resemblance, which comes out still more forcibly when we take three-year periods, thus :—

Years.	Port Louis.			Brisbane.
1860	45·166		54·63	
1861	68·733	142·296	69·44	152·34
1862	28·397		28·27	
1863	33·420		68·82	
1864	24·147	102·297	47·00	139·93
1865	44·730		24·11	
1866	20·571		37·24	
1867	35·970	120·721	61·04	134·26
1868	64·180		35·98	
1869	54·575		54·36	
1870	45·575	141·760	79·06	178·87
1871	41·610		45·45	

At both stations the epoch of minimum rainfall is coincident, or nearly so, with the epoch of minimum amount of cyclones, which is itself coincident with the minimum amount of sun-spots ; and that at, or near, the maximum of sun-spots and cyclones, we have also a maximum amount of rainfall.

Mr. Meldrum's important paper concludes as follows :—

"From what has been said it will, I think, be admitted that at least a case of *supposed* periodicity of rainfall has been made out, and that it is highly desirable that the matter should be further investigated. This can be done chiefly by long-continued observation under the same conditions as to locality, size of gauge, &c., and perhaps to some extent by ascertaining, if not the actual rainfall, at least the years remarkable for the comparative absence or abundance of rain in former times.

"It should be remarked that some localities are probably much more favourable than others for showing the operation of a general law of this kind ; for there may be local causes affecting the rainfall so powerfully as to completely mask the effect of a weaker but more general cause ; and therefore it would be no proof of the non-existence of a connection between rainfall and sun-spots to show that the observations taken at such and such places were not in conformity with the supposed periodicity.

"We should be inclined to think that the best mode of testing the matter would be to obtain records of observations carefully made for a long period in some of the islands of the Indian and Pacific Oceans, for example,

far removed from the disturbing influence of Continents, and then to take a mean of all the observations.

"The Adelaide and Brisbane observations would seem to indicate a rainfall-periodicity altogether independent of a cyclone-periodicity, both being apparently the natural consequences of one and the same law. But it would be rash to say more at present, and I should wish it to be understood that the object of this paper is simply to stimulate further inquiry."

Since Mr. Meldrum's results have reached me, I have tested the Cape and Madras rainfall, to see if the same result is to be got from them, and with the following results :—

	Cape.	Inches.	
Max.	1847	22·4	
	1848	23·2	68·6
	1849	23·0	
Min.	1854	20·0	
	1855	24·5	63·9
	1856	19·4	
Max.	1859	36·7	
	1860	29·1	91·2
	1851	25·4	
Min.	1866	19·2	
	1867	22·9	62·0
	1868	19·9	
Max.	1869	32·3	62·3
	1870	28·0	

(For two years only)

From the Madras observations at my disposal only one maximum and one minimum can be given :—

	Cape.	Inches.	
Min.	1843	41·0	
	1844	45·0	125
	1845	39·0	
Max.	1847	81·0	
	1848	40·0	175
	1849	54·0	

Surely here is evidence enough, evidence which should no longer allow us to deceive ourselves as to the present state of meteorology. A most important cycle has been discovered, analogous in most respects to the Saros discovered by the astronomers of old. Indeed, in more respects than one, may the eleven-yearly period be called the Saros of meteorology, and as the astronomers of old were profoundly ignorant of the true cause of the Saros period, so the meteorologists of the present day are profoundly ignorant of the true nature of the connection between the sun and the earth.

What, therefore, is necessary in order to discover the true nature of this nexus? Two things are necessary, and they are these. In the first place, we must obtain an accurate knowledge of the currents of the sun, and secondly, we must obtain an accurate knowledge of the currents of the earth. The former of these demands the united efforts of photography and spectrum analysis, and the second of these demands the pursuit of meteorology as a physical science, and not as a mere collection of weather statistics. When these demands are met—and in spite of the Mrs. Partingtons who are endeavouring to prevent this, they will soon be met—we shall have a Science of Meteorology placed on a firm basis—the Meteorology of the Future.

J. NORMAN LOCKYER

HARTING'S HANDBOOK OF BRITISH BIRDS

A Handbook of British Birds. Showing the distribution of the resident and migratory species in the British Islands, with an Index to the records of the rarer visitants. By J. E. Harting, F.L.S., F.Z.S. 8vo. Pp. 198. (London : Van Voorst.)

MR. HARTING'S "Handbook of British Birds" will be of much use as an easy work of reference to the many students of the feathered tribes of these islands, although it can only be employed as a supplement to one of the standard authorities on the same subject. It consists of two parts—first, a list of the British birds, properly so called, being residents, periodical migrants, and annual visitants; and, secondly, a list of rare and accidental visitants. In the former part a short account of the distribution of the species within the British Islands is given; in the latter a complete list of *all* the recorded occurrences of the species within the same limits. In the latter case the list seems to have been very carefully compiled, and will be of great use to the collector, who, without it, would have to refer to a dozen different journals and periodicals, in order to ascertain how often any "rare visitant" had been previously noticed.

Mr. Harting's estimate of the total number of "British birds," ordinarily so-called, is 395, being 43 more than that of the third edition of Yarrell's History. "Of these, in round numbers, 130 are Residents, 100 Periodical Migrants, and 30 Annual Visitants, the remainder being Rare and Accidental Visitants." The last-named category, it will be observed, forms a large proportion of the total number of species usually included in the British list, being at the present time 135 out of 395, or rather more than one-third of the whole. And this is a proportion which is certain to be considerably increased as time progresses, not a year passing without the arrival of one or more stragglers from distant lands, the occurrence of which has not been previously recorded.

The composition of the "Accidental" list is a matter of considerable interest. Mr. Harting classes 14 as Asiatic, 11 as African, and no less than 43 as American. "It is extremely difficult," our author remarks, "to believe that the non-aquatic species of the last category have actually journeyed across the Atlantic, and performed a journey of 1,700 miles on the shortest route, *viâ* Newfoundland; but that most of them have actually done so seems proved by the fact that they have never been met with in Greenland, Iceland, and the Faroe Isles (the only countries through which they would otherwise have passed by a change of route); and that many which have thus found their way to England or Ireland (as, for example, *Agelaius phœniceus*, *Cuculus americanus*, *Ceryle Alcyon*, *Ægialitis vociferus*, *Totanus solitarius*, *Tringa bonapartii*, *Botaurus lentiginosus*, and others) have never been met with on any part of the European continent. As might be expected, at least half the American species found in this country belong to the orders Grallatores and Natatores, while of the fourteen species of Insessorial birds, none of them, with the exception of *Agelaius phœniceus*, has occurred half-a-dozen times. This plainly shows that their appearance on this side of the Atlantic is the merest accident, and not the result of any continued and successful attempt at migration. In some instances, at

least, it is not unreasonable to suppose that these small birds must have availed themselves, to a great extent, of the rigging of passing vessels, or have been brought to this country in cages, from which they have been allowed, accidentally or designedly, to escape."

As regards the nomenclature and arrangement of the birds contained in his lists, Mr. Harting has not, we think, been quite so successful as in his accounts of their range and of their occurrences in the British Islands. The American Cuckoos are certainly not referable to typical *Cuculus*, and ought to stand as *Coccyzi*. *Erithacus* (not *Erythaca*) is the correct spelling for the generic name of the Red-breast, as any Latin dictionary will show. The Hirundinidæ are typical Passeres, and should not be placed between the Bee-eaters and Swifts, as Mr. Harting proposes (p. 35). The Ibises should not be referred to the family "Tantalidæ." *Tantalus* is nothing more or less than a form of Stork, and should be placed under the Ciconiidæ; whilst the Spoonbills (arranged by Mr. Harting as an independent family, really appertain to the group of Ibises (Ibididæ). The interposition of the Cranes between the Storks and Herons is most unnatural. There can be no question that the nearest relatives of the *Grues* are the Bustards and Rails. What can be the object of inventing such a family as the Petrocinclidæ (p. 99)? The Spine-tailed Swift is by no means a *Cypselus*, as Mr. Harting calls it (p. 127), but belongs to a different sub-division of the Cypselidæ, distinguished by the structure of its feet. Lastly, when such excellent genera as *Coccyzus* and *Chætura* are rejected, it is going a little too far to follow Coues and Bonaparte in adopting such a mere section of *Procellaria* as *Æstrelata*.

It would not be difficult to extend our criticisms in this direction, but it is only fair to say that such minor defects will not seriously interfere with the great usefulness of Mr. Harting's "Handbook of British Birds."

OUR BOOK SHELF

The Clematis as a Garden Flower. By Thomas Moore, F.L.S., and George Jackman, F.R.H.S. (London: Murray.)

A NOTICE of a book of this kind may at first sight seem out of place in a scientific periodical. Those stray threads, however, of biological investigation which have at various times attracted curiosity rather than study, and have, at any rate, been for the first time methodised in Darwin's "Animals and Plants under Domestication," will depend upon works of this kind for their further development. It is hardly generally understood that the production of what are called in popular language, "Florists' flowers" rests on two perfectly different principles and methods of procedure. The one is obvious enough; it may be called an accelerated natural selection, consisting as it does of merely growing on a very large scale the plant which it is desired to improve, and then selecting repeatedly from the sports which are sure to occur those which conform most nearly to some preconceived standard. But the other and far less thoroughly understood method consists in destroying the fixity of ancestral type by persistent and involved hybridising. At first the hybrids are, as might be expected, intermediate between their parents; after a time, however, the seedlings from crosses exhibit variations of habit and characters which could not possibly be expected, and which, consequently, make the business of raising new horticultural varieties almost as speculative as a lottery. Florists' flowers are, consequently, the expression of the action of laws of which we at present know next to nothing, but the investigation of which is of the highest interest. The only possible way of pursuing it is obviously the careful comparison of a hybrid offspring with its various progenitors, somewhere amongst which the latent characters must lurk concealed which reveal themselves often so unexpectedly. A book of this kind is naturally, therefore, turned to in the expectation of its supplying facts of the kind required. A difficulty, however, diminishes, as in other cases, its value in this respect. Horticulturists, as a body, are far from unsympathetic towards scientific inquiry; but business operations cannot always be carried on in a scientific spirit. When crosses are made for the purpose of producing new forms, it is generally done on a large scale, and quite promiscuously, merely avoiding what practical tact points out as undesirable strains. No record is kept, and the seeds are often sown in a single batch; consequently, if a striking variety makes its appearance, it is often all but impossible, as for trade purposes it is not necessary, to assign to it its proper ancestry. Take, for example, a garden *Clematis*, named after its producer, *C. Jackmanni* (botanically, by the way, a hardly legitimate appellation). All that can be certainly said of it is that, amongst others, *C. Viticella* and *C. lanuginosa* hold a prominent place in its ancestry. The first is a European species producing an abundance of moderate-sized, rather dark-coloured flowers. The latter is a native of Japan, producing large pale-coloured flowers rather sparingly; it is the parent, more or less remote, of most of the garden hybrids raised within the past ten years. It is from these sources, therefore, with probability, that *C. Jackmanni* derives its good qualities. In another hybrid, where, it having been raised by an amateur horticulturist, the history is known, the relation of the qualities of parents and offspring is all but inexplicable. Mr. Anderson Henry crossed *C. lanuginosa* already alluded to, which bears pale lilac flowers as much as eight inches across, with *C. Fortunei*, also of Japanese origin, with white flowers rather smaller and of a different character. He obtained, amongst other forms, *C. Lawsoniana*, which possesses flowers as much as *nine and a half* inches across, and of a *rosy purple*; yet it could not possibly owe either its size or colour to its immediate parents. That questions of this kind should be dealt with in what is after all a purely horticultural work, is a striking proof of how little reason there really is to despair about the general interest excited by scientific work. The whole of horticulture is, in a sense, a vast field of biological research, with results all ready to hand. It is due entirely to Mr. Darwin that the attempt has been made to gather them in. Perhaps the authors will hardly care, at least at present, to have their book stigmatised as too scientific. It contains all that can be desiderated of the pure gardening of its subject, and is capitally illustrated with plain and coloured illustrations. W. T. T. D.

Synopses of Subjects taught in the Geological Class, College of Physical Science, Newcastle-on-Tyne, University of Durham. By David Page, LL.D., F.G.S. (Edinburgh and London: Messrs. Blackwood.)

THESE Synopses are most comprehensive, and will, we are sure, be of some value to students and science-teachers. They embrace the subjects taught in the junior and senior divisions of Dr. Page's class. In the former division the subjects follow each other thus:—Physical Geology, Elements of Biology, Physical Geology and Lithology, and Descriptive and Historical Geology. Under the heading of "Senior Division," we find Physical Geology and Mineralogy, Mineralogy, Descriptive Geology and Palæontology, Palæontology, and Economic Geology. The Synopses are characterised by the same clearness and precision for which Dr. Page's text-books are so justly noted. On glancing over the pages, we were surprised to find in the "Tabular Synopsis of European For-

mations" a "Metamorphic System" underlying the Laurentian, and an "Azoic Cycle," preceding the Palæozoic. Now there may be a Metamorphic System of older date than the Laurentian rocks, and strata deposited during "Azoic" times may also exist; but at present we have no knowledge either of the one or the other. Murchison, we thought, had settled once and for ever that the crystalline schists of the Scottish Highlands were of post-cambrian age.

J. G.

LETTERS TO THE EDITOR

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

The National Herbarium

PERMIT me, in your columns, to give shortly the grounds upon which I made the statement that no herbarium of any kind existed at Kew Gardens during the time of the Aitons, but that the Banksian Herbarium was often, and for a long time systematically, used for naming the Kew plants (NATURE, Oct. 3, 1872, p. 450), which statement is thus dealt with by Dr. Hooker (NATURE, Oct. 24, 1872, p. 516):—"Nor was the naming of the Kew plants carried out in London, as is supposed. There was a large herbarium in constant use at the Royal Gardens at the very period alluded to, the breaking up of which, when it was proposed to give up the Gardens, necessitated the formation of another."

Instead of my statement being a supposition, it was based on the following data:—1. The lists of the plants sent up from Kew Gardens to be named by Solander when Curator of the Banksian Herbarium, which were duly entered in the "garden book," still preserved in the Botanical Department here. 2. The continuance of this practice to a recent date, as evidenced by the following article in the engagement between Mr. Brown (Solander's successor in the Banksian Herbarium) and the trustees of the British Museum when he became keeper of this department in June 1872, "that Mr. Brown have full liberty to assist the Superintendent of the Royal Botanical Gardens at Kew, in like manner as during the lifetime of Sir Joseph Banks." 3. The specific statements in several official reports of the late Sir W. J. Hooker, such as this from one dated 31st December, 1854:—"Till 1853 our garden was utterly destitute of the two former appendages," viz., an herbarium and library.

I was surprised to read Dr. Hooker's declaration that his evidence is "unequivocally opposed" to the transfer of the collection of dead plants from the British Museum to Kew. In this case I have completely misunderstood his position in the repeated attempts that have been made to destroy the scientific position of the National Herbarium at the British Museum. In 1858, when the trustees of the Museum were induced to inquire into the necessity for the existence of the herbarium in London, they examined Dr. Hooker among other witnesses, and in their finding they say, "Sir W. Hooker, Dr. J. Hooker, and Dr. Lindley have given reasons in favour of the removal of the collections from the British Museum to Kew, with the view of rendering that establishment more complete." Other testimony, however, had more weight, and so they were "unanimously of opinion that it is not desirable to recommend the translation of the botanical collection from the British Museum to Kew." (Return, House of Commons, 1859, No. 126, p. 12.) Ten years after, in the memorial presented through the Board of Works to the trustees, Dr. Hooker proposed that a "Reference Herbarium," consisting of the "British Museum Herbarium, *minus* the specimens required for Kew" should be kept at the Museum for the use of "botanists, geologists, amateurs and others resident in London, or passing through it, who may want information which it would not be worth their while going to Kew to procure." And more recently, in his evidence before the Science Commissioners, Dr. Hooker repeats this proposal with somewhat more of detail. The great scientific working herbarium to which all botanists should come should be at Kew (Q. 6,683). To secure this, "the two herbaria should be arranged under one head" (Q. 6,685). "I could bring the collection under one system" (Q. 6,730). It would be the duty of the first herbarium in the country (*i.e.* Kew) to supply the British Museum (Q. 6,745). The specimens, "on their arrival at the British Museum, could be put into their places by the officers there, the operation being as simple as that of putting books on a shelf;" and in future "a subordinate could intercalate the additions" (Q. 6,732).

No doubt these proposals (excluding that made in 1858, on the death of Mr. Brown, and before the appointment of Mr. Bennett), contemplate the maintenance of a collection of dead plants in London. But a collection from which "all specimens of interest only to the scientific botanist have been removed to Kew" (NATURE, vol. iii. p. 401), and consisting only of the worthless duplicates of the two amalgamated herbaria, would be utterly useless for scientific purposes, and its maintenance would unquestionably be a waste of public money.

I will only add, that there is certainly nothing to prevent Dr. Hooker "recruiting" the British Museum Herbarium from that at Kew to any extent, at once, and without the intervention of a Royal Commission. It is quite certain that the trustees and my predecessors, like myself, would have welcomed sets of the numerous collections, made at the expense of the British Government, which have been distributed from Kew to "America, Paris, Austria, Prussia, Hanover, Holland," &c., but none of which have ever been sent to the National Herbarium at the British Museum!

W. CARRUTHERS

British Museum, Dec. 2

THERE is no inconsistency between Sir W. Hooker's statement, quoted by Mr. Carruthers, that "till 1853 our garden was utterly destitute" of an herbarium and library, and mine that in the Aitons' time there was a large herbarium here, kept up for naming the garden collections. Sir W. Hooker of course referred to the period during which the gardens had been public property. The herbarium in question was broken up when Kew ceased to be a private establishment. The words quoted by Mr. Carruthers ought hardly in fairness to be detached from the context. Sir W. Hooker's meaning was, of course, that the gardens, as a public department, possessed, till 1853, no official herbarium or library. He goes on to speak of his own private ones, by means of which the work of the garden had been carried on ever since he became director, and which, having at his death been purchased by the Government, form, with those presented by Mr. Bentham and others, the foundation of the present collections.

It is necessary to mention this, as otherwise Mr. Carruthers' quotation might lead anyone unacquainted with the facts to suppose that the work of Kew Gardens up to 1853 had been conducted without any herbarium or library whatever.

Mr. Carruthers is mistaken in implying that I ever suggested the supplying the British Museum with "worthless duplicates" from Kew; and equally so in stating that "none" of the collections distributed here have ever been sent to the British Museum. Such an assertion is no encouragement to send more. Nor does the fact that no return of any kind has ever been made by the British Museum for some thousands of specimens that have been sent to it from Kew, offer much inducement to continue such gifts. It is the clear duty of this, as of other similar establishments, to distribute its duplicates to such institutions as exert themselves to make a suitable return. This is the case with the Herbaria of America, Russia, Prussia, Holland, &c., and, in fact, with all kindred establishments with which Kew corresponds. It is the acquisition by this means of authenticated specimens from almost every seat of botanical research, which more especially gives to the National Herbarium of Kew Gardens the incomparable position it now holds.

JOS. D. HOOKER

Royal Gardens, Kew, Dec. 3

The Meteoric Shower

WHILE the observations of the recent meteoric shower continue to attract general attention, the following notes of some descriptions of the display that have reached me, which will contribute useful results for comparison with published accounts of the phenomenon that have already appeared, will, perhaps, be interesting to your readers:—

On the nights immediately preceding that of the star shower the sky was at some places unclouded, and observations of meteors were recorded. The large meteor described in a recent

number of NATURE as having been seen by Mr. Denning at Bristol on the evening of the 23rd ult., as well as a single other shooting star noted during a watch of the sky whenever it was clear by the same observer on that evening, seem, from their apparent courses, to have been both possibly directed from the now well-known radiant point of the meteors of Biela's comet, but only a small number of shooting stars appears to have been visible on that night. During a watch for ten minutes, kept at four different times between half-past 7 and half-past 9 P.M. on the following evening, near Regent's Park, in London, Mr. H. W. Jackson observed, in each watch, a shooting star as bright as a first-magnitude star directed in each case from the recently determined radiant point; while, with an equally uncloudy sky, on the following evening of the 25th, three small meteors from the same radiant point, and two brighter ones from other directions, were seen by Mr. Denning at Bristol between 8 and 11 P.M. in two intervals of a watch for half an hour. A small meteor of the same stream was recorded by Mr. Denning on the 26th, but their numbers on this, as on the previous nights, were evidently inconsiderable, a clear view of the sky on the night of the 26th, between 11h. 20m. and 12h. 40m., affording Mr. Jackson, at Tooting, no observation of a single meteor. The time of first approach and commencement of the bright star-shower seen on the evening of the 27th ult. must therefore have been later than shortly before 1 o'clock on the previous morning. A completely overcast state of the sky after midnight on the night of the shower appears to have prevented observations of its close, and probably of its complete extinction on that night, after the greatly-diminished intensity which it had then attained; but a correspondent in London informs me that, in spite of the densely overcast state of the sky, which prevented any view of the shower from being obtained in the metropolis, an exceedingly bright meteor was seen to flash like lightning through the clouds at about 4 o'clock, A.M., on the 28th. On the evening of the 28th Mr. Greg watched for shooting stars, and for any remnants of the star-shower of the previous evening which might be visible, at Buntingford, in Herts; but although the sky was quite clear he failed to see any meteors. A strict watch for outlying meteors of the shower was also kept by two observers at Hawkhurst, in Kent, on the evening of the 28th, where the sky was quite cloudless between 9h. and 11h. 15m. P.M., but without success, only four shooting stars of ordinary character being visible during more than two hours of their simultaneous watch. An interval of about forty-four hours is thus clearly determined in which the first indications of the star-shower must have arisen, reaching the maximum of its intensity towards the middle of the period, and disappearing so completely before its termination as to leave the whole expanse of the sky almost as perfectly free from shooting stars as it was before its commencement.

In addition to the early appearance of the shower recorded in NATURE of the 5th inst. as having been seen near Dublin, I have received the following communications from observers relating to its early visibility and abundance. At Brancepeth, near Durham, Mr. Joseph Lawson first began to count the meteors at 5 o'clock, and continued to enumerate them until, towards 7 o'clock, their constantly increasing frequency obliged him to desist. During the last half hour of his estimation the rate of their appearance was about ten per minute, while a total number of 1,000 meteors was counted between 5 and 7 o'clock. The rate of their appearance in the first was thus little less than that of their appearance in the latter portion of his watch. Mr. S. J. Miller, at Wisbeach, first noticed the abundance of shooting stars at 5h. 40m., and counted in three minutes twenty meteors, or about six or seven per minute. Soon after this, at about 6 o'clock, their number was ten or twelve per minute. During their appearance before 6 o'clock, Mr. Wood, at Birmingham, considered them to be falling from 5h. 45m. when he first observed them, at a rate of about fifteen per minute, while the result of his enumeration between 6h. and 7h. was at least 600 meteors, and in occasional intervals between 6h. and 7h. 15m., when the sky became gradually overcast, the average rate of appearance was found to be increasing nearly uniformly from 8 to 10 per minute, showing that the intensity of the display before 6 o'clock was little inferior to the maximum which it appears afterwards to have gradually attained. At York the first attempt to estimate their numbers was made by Mr. T. H. Waller, at 5.30 o'clock, when the meteors were found to be appearing at the rate of 12 or 15 per minute. At 6 o'clock their numbers had increased to about 20, and at 7 o'clock to about 30 or 40 per minute for one observer. At 8 o'clock the best determination of their numbers was however obtained by two of Mr. Waller's scholars, who, standing back to back, counted 79 meteors in 1m. 15s. or 31 meteors per minute for each observer. The principal maxima of the shower at about 6h. 30m., and 8h. 15m. P.M., as mostly clearly shown by the continuous observations of Mr. Lowe at Highfield House, and by Prof. Grant, who was assisted in his observations at the Glasgow Observatory by Prof. G. Forbes, are also generally indicated by the observations which I have received, and the gradual diminution of the shower after 9 o'clock was observed at Newcastle-upon-Tyne as well as by some of the observers who combined in their watch for its appearance for the British Association. The frequency of the meteors after 9 o'clock was regarded by Mr. Wood as not more than a quarter of what it was at about 6 o'clock, when they were first seen, yet these numbers continued for some time to be considerable and quite unusual. Near Rothbury, in Northumberland, repeated estimations of their abundance were made by Mr. G. A. Lebour in different parts of the sky, and at different times between the hours of 7 and 10 o'clock, with the following results:—

From $7^h\ 20^m$	to $7^h\ 28^m$	100 meteors falling perpendicularly in the west (the east cloudy).
7 35	7 40	100 meteors falling vertically in the east (the west cloudy).
7 45	7 48	100 ,, ,,
9 0	9 15	Meteors too numerous to count at 9h., falling in showers at 9h. 15m., especially in the north; one bright red with beautiful red streak, which lasted more than 10 seconds.
10 0		Meteors still falling, but in smaller numbers.

In 20 minutes after 10 o'clock 35 meteors were seen by one observer in a clear part of the sky, which scarcely exceeded a quarter of the sky. In 10 minutes after 11 o'clock ten meteors only were counted in the same space, and in 20 minutes after 12 o'clock 9 meteors only could be seen. The rate of decrease of the shower from shortly before 10 o'clock until after midnight was thus apparently more rapid, and the decline of its intensity appears to have been considerably more complete than the first brightness and progress of its gradual increase may be concluded to have been during the earliest hours of its observation.

Newcastle-upon-Tyne, Dec. 7 A. S. HERSCHEL

The De Novo Production of Living Things

WILL you allow me to ask Dr. Bastian to state in your columns, in reply to this note, the specific gravity of the turnip infusion, to which a "fragment" of cheese has been added, and which, he states, has rarely failed to give him positive results in his endeavours to obtain evidence of the *de novo* production of living things from dead matter. If Dr. Bastian should be unable to give the specific gravity of the infusion, perhaps he will be so good as to state accurately the weights of water, turnip, and cheese employed. I am, of course, acquainted with the directions he has already given, but wish to avoid any objection from him or others on the score of improper preparation of the infusion to results which I may obtain and publish.

E. RAY LANKESTER

Exeter College, Oxford, Dec. 7

The Birth of Chemistry

YOUR correspondent, "A. H.," in alluding to my mention of the *Insulæ Cassiterides*, inquires whether the name was derived from a Sanskrit source. The word κασσίτερος is used both by Homer and Hesiod, and it is possible that it may have been borrowed from the Sanskrit *kastira*, and that tin was first procured from India. The Sanskrit word for tin—*kastira*—is clearly related to the verb *kās*, to shine. It is strange that the Arabic word for tin is *kasdir*, closely resembling the Sanskrit, although there is no family relationship between the languages. Possibly the Phœnicians first procured tin from India, and gave it a name resembling its native name *kastira*: then the Greeks converted the Phœnician word into κασσίτερος, the Romans borrowed the word from the Greeks, and the fact of the scarce

metal being found in certain islands north of Spain was sufficient to secure for them the distinctive title of *Insulæ Cassiterides*, or Tin Islands.

G. F. RODWELL

The Greenwich Date

UNDER this heading, in your number for Nov. 28, a letter signed "James Pearson" ends thus:—"The query then is—in what part of the globe and in what meridian does October 20 end and October 21 begin?" As well ask where a circle ends and where it begins. See an article at the end of Bayle's Dictionary, entitled, in the second Rotterdam edition, 1702, "Dissertation sur le jour," vol. iii. p. 3118; in the London edition, 1741, "Dissertation concerning the Space of Time called Day," vol. x. p. 365. The difficulty, as Bayle shows, is in the nature of things. Let an equatorial railroad go round the world in twenty-four hours, with a station at every 45th meridian. At noon of October 20, Mr. West takes "a return ticket" westward; Mr. East takes one eastward. Both reckon by solar time. At every station Mr. West finds it noon, and on his return home reckons noon October 20; but the station-master reckons noon October 21. Mr. East at 45° sees the sun set at 6 o'clock. At 90° he finds midnight; at 135° the sun rises at 6 o'clock on October 21; at 180° it is noon. Here the two passengers pass each other, Mr. West reckoning it to be noon of October 20, Mr. East noon of October 21. At 135° W., Mr. East sees the sun set; at 90° he finds midnight; at 45° the sun rises at 6 o'clock on October 22. On his return home Mr. East reckons it to be noon of October 22. Here then are three different reckonings, and practically the keeping of Sunday, Christmas Day, &c., on different days in different countries exists at this instant and must exist for ever. Practically also those who sail eastward round the world get one more dinner than those who stay at home. Those who sail westward round the world get one dinner less than those who stay at home, and two dinners less than those who sail eastward, when both voyages are completed.

GEORGE GREENWOOD

Brookwood Park, Alresford, Nov. 30

MR. PEARSON'S query, in NATURE of November 28, does not admit of any exact or scientific answer, for there is no natural line of demarcation or change, and the settlement is entirely a matter of usage or convenience. It is not very many years since the dates at Manilla and Macao were different; and till the cession of the Alaska Territory to the Americans, the date there was different from that in the British Territory adjoining. The rule now generally held is, that places in E. long. date as if they were arrived at by the Cape of Good Hope, and places in W. long as if they were reached *via* Cape Horn—a rule that the width of the Pacific renders practically convenient. Afloat, the rule is for a ship making a passage to change her date on crossing the meridian of 180°, or as soon after as the captain may find convenient; repeating or omitting a day, according to the direction in which she is going; but a ship merely cruising across the meridian, with the intention of returning, does not generally change her date, so that ships having different dates may and do occasionally meet—a very marked instance of which occurred during the Russian war, when our squadron from the Pacific joined the China squadron on the coast of Kamschatka.

And thus, according to established usage, October 21 at Adelaide, and October 21 at the hypothetical place in 9h. 35m. W. long., are different days; in the two places October 21 has a different meaning.

J. K. LAUGHTON

Royal Naval College, Dec. 1

THE Rev. J. Pearson is correct in the method of finding the corresponding Greenwich date, although its numerical performance is incorrectly performed in his letter.

It is absolutely necessary for practical purposes to draw the line somewhere, and it is drawn in England an her colonies as well as in America and Russia, at the meridian 180° E. of Greenwich. The limit, therefore, of the longitude to be added to or subtracted from the Greenwich date will not exceed twelve hours.

It is usual for sailors, when crossing this meridian, to skip a day, or to reckon the same day over again, according as the meridian has been reached from the eastward or westward.

An instance of this apparent anomaly is furnished in the Appendix to the "Nautical Almanac" for 1874. The time of the phenomenon of the transit of Venus over the sun's disc takes place generally about December 8, 16h. Greenwich astronomical time. Its recorded local astronomical time for the middle of the transit at Auckland, New Zealand (long. 174° 42′ E.), is December 9, 3h. 40m.; but for Woahoo (long. 158° W.) the time of the first contact of Venus with the sun's limb takes place at December 8, 3h. 4·7m.

EDWARD ROBERTS

Blackheath Road, Greenwich, Dec. 2

Comets' Tails

CAN any of your readers refer me to a work by a recognised authority in astronomy in which I can find the method by which the direction of a comet's tail, as regards that of the heliocentric radius-vector of the head, has been calculated from observation? Or, more briefly, have we *any proof whatever* that there is other than an occasional chance coincidence of these two directions?

G. H.

REMARKS ON THE ZOOLOGY OF THE FAROE ISLANDS

AS I have already announced in this paper, I started with the Danish expedition in September from Copenhagen, and arrived after a very fortunate voyage of four days in Torshavn, the little capital of Faroe in the isle of Strömö. There I intended to remain while our steamer, with the geologists and engineers, went to the southern island (Suderö), where the miocene coal deposits are to be seen some hundred feet above the level of the sea in the basaltic rocks near the village of Qualbö. As to their researches about the extension of the coal-fields in Suderö, directed by Prof. Johnstrup, and as to the possibility of taking the coals over to Copenhagen at a reasonable price, I cannot say anything now, as the report must first be made to the Minister of the Interior, who will perhaps afterwards publish the results. Some words, however, about my own zoological researches in Torshavn will, I think, have some interest for the readers of NATURE.

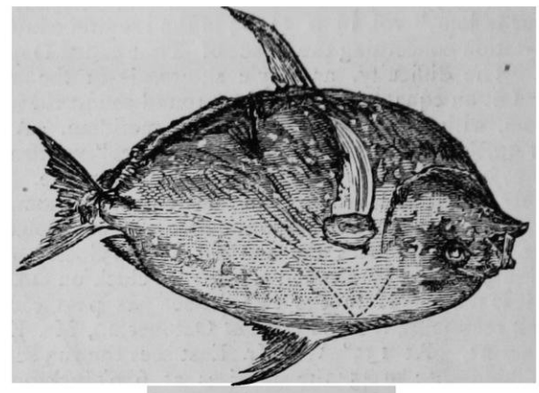
I remarked in my preceding paper that no wild mammals were known to occur in the islands, except some species of the genus Mus. This is, as I now know, not quite correct; for some thirty or forty years ago the northern hare (*Lepus alpinus*) was introduced into the islands, and it seems to have met with very favourable conditions of life, as it is now spread in considerable numbers over Strömö, and has also been brought to Oesterö. The hare finds ample food in the grasses covering the ground; the large rocks spread everywhere protect him, and no mammals or birds of prey endanger his life, with the exception of *Corvus corax*, or the little *Falco aesalon*, which sometimes might take the younger ones. The occurrence of the *Falco islandicus* is too rare to do any serious damage to the hares. Besides these, they have also endeavoured to introduce the "ripers" (*Tetrao lagopus*) so common in Iceland and Norway, but those set free have perished without breeding. These birds require food and protection from trees, which, as it is known, do not occur in these islands.

The rats found in the northern islands of Faroe (although they have not yet come to all the islands) belong to the species *Mus decumanus*, which here, as nearly everywhere in Europe, has nearly destroyed the smaller black rat (*Mus rattus*), still, however, to be found in some houses of Suderö. In the "fields" still another species of rat is said to occur, not heretofore seen by naturalists. Mr. Randrop of Torshavn, who has taken great trouble in order to secure a specimen of the animal, the footsteps of which he has seen, thinks it is the *Lemmus norvegicus*, but he could never get it. Among the large aquatic mammals the "Grindehval" (*Delphinus globiceps*) is known to be of great importance here, as nearly every year large flocks of it are taken, which they drive to the

shore by boats, and the flesh of which is divided after old northern laws still in use in this country. Some hundreds of this whale had just been killed in Westmannshavn (west side of Strömö) some days before we arrived, and I still could examine pieces of the animals brought to Torshavn. I immediately looked after external parasites, but would not have got them if Sysselmand Müller, the well-known magistrate and naturalist of Torshavn, had not had the kindness to give me some specimens. These are two species of Cirripedia, one of them being an *Otion*, which often attaches itself to the teeth of the dolphin, where it easily finds food; as the surface water, coming in, is full of little creatures (infusoria, crustacea, &c.), which the Otion catches by aid of its arms. Another very interesting external parasite of the dolphin is the *Xenobalanus globicipitis* Steenstr., which Sysselmand Müller has discovered in large numbers on the fins of the whale. An allied species, also described by Steenstrup, is found on the fins of *Uranodon rostratus*, a whale met with in small flocks of four and five, especially near the southern island, where one of them was killed during the stay of the expedition. In Torshavn I also sought to get the intestines of the grindehval; but these, of course, had already been thrown into the sea, with the exception of the stomach, in which I have found the rests of Cephalopods, the usual food of this whale, and the common Ascaris.

At the time when we arrived in Faroe the celebrated "Fuglebjergs" (bird-rocks) were unfortunately already deserted by their inhabitants, so that I have seen nothing of their extraordinary life. Of one of them Sysselmand Müller has taken up excellent photographic views (Trollhovedet, near Sandö), which give a very good idea of them, and deserved to be published in an ornithological work. We see in it clearly the different stages which the birds occupy in the rocks, the highest of them being the sea-parrot (*Mormon fratercula*), then a *Larus*, and undermost *Uria*. Only the little *Thalassidroma pelagica* was said to be still breeding (September), and I therefore resolved to see the nests. In the rocks of the north-eastern side of Naalsö these little birds breed in a depth of one or two feet, their nest being simply a hole in the earth. One of the natives lifted the stones for me, then bent his ears to the holes, and, when he heard the birds piping, broke them up. In this manner we took an egg containing an embryo, with the old bird, which did not even endeavour to run or fly away, and three younger ones in different stages of growth. The Thalassidromæ have only one egg, but they seem to breed twice or thrice a year. In the neighbourhood of this place, they told me, the nests of *Procellaria glacialis* were also to be found. Besides these, the birds usually met with were *Anthus campestris*, *Saxicola œnanthe*, *Motacilla alba*, *Troglodytes parvulus*, *Tringa variabilis* and *islandica*, *Numenius phæopus*, and *Hæmatopus ostralegus*, *Carbo*, *Sterna*, *Larus*, &c. We also got some living specimens of *Sula alba*, only occurring in the island of Myggenaes, and of *Lestris cataractes*, now not very common in Faroe, for the Zoological Garden in Copenhagen. Occasionally they have also taken the *Pastor roseus* and once *Syrrhaptes paradoxus*. The former bird is known to appear sometimes in Norway and Heligoland (nearly every summer)—a very remarkable fact, as these birds, which are known to breed in Southern Russia and Asia Minor, have so very seldom been met with in Denmark or in the interior of Germany.

Fishes are caught abundantly on the shores of Faroe; so that, for example, the klippfish trade is very considerable. The *Gadus* are opened, spread out and dried on the rocks (klipps), and are exported to Spain and France, their swim-bladders being used for the fabrication of gelatine, and their ovaries being prepared for the use of the anchovy fishers in the Mediterranean. Of remarkable fishes only the *Lampris guttatus* Brunn was taken during my stay in Faroe, inhabiting the great depths of the Atlantic, and coming only by accident to the shores of these islands. This was the third specimen taken there, an enormous creature, weighing 76 Danish pounds, having a length of 99 centimetres, and a breadth of 52. The colour was a magnificent silver blue with red spots; it had been taken by the fishers in the King's Harbour (Kongshavn), and was admired, when brought to Torshavn, by large crowds of people who had never seen it. Before dissecting it, Sysselmand Müller took a photograph,



Lampris guttatus

which has been reproduced in the accompanying woodcut. We then separated the principal muscles from the bones (the flesh looked like salmon's, but its taste was not quite so good), in order to get the skeleton, and I dissected the intestines. In the stomach I found the same remains of Cephalopods, which also Kröyer mentions (in "Danmarks Fiske") in the specimens he examined. Of the internal parasites I may here only mention an agamic Ascaris in the outer walls of the stomach, and a cestoid in the *intestinum tenue*. External parasites were eagerly sought for, but not found.

Very interesting to me were the lakes in the interior of the islands, as I hoped to get there something like those animals ("relicts") found in the lakes of Sweden and North America. I accordingly dredged in one of them, but did not find anything of importance. I also examined the three species of Salmonidæ of these lakes, one of them being the *Salmo salvelinus*, known to to be found in the lakes of Upper Bavaria and of Scotland. More about these inhabitants of the Faroe lakes may shortly be seen from a paper which I am to publish in v. Siebold and Kölliker's *Zeitschrift*; and the same periodical will also contain the results of my investigations on the Annelids from the shores of Faroe, which formed the principal object of my researches. I may here only remark that, on the whole the invertebrate fauna of the shores of Faroe, as well as of Iceland, is very poor compared with that of Greenland, Norway, or Denmark; so that the place is not to be recommended to those who wish to get in an easy manner favourable objects for anatomical or embryological observations. When I was there the currents were sometimes so strong that, even with the heavy oyster-dredges of Jutland, we did not reach farther down than 15 or 20 fathoms. And as to the surface-fauna, it was, with the exception of some few days, quite impossible to do anything, as the sea was too much agitated. In midsummer, of course, all those obstacles will vanish. Nevertheless, I could every day get fresh materials, as when the sea was rough I was sitting on the rocks of the shore, and selecting the animals from the sand and sea-weeds brought up in the harbour of Torshavn by my fisher, Zacharias Hansen, a very brave man, whom I recommend to every naturalist coming to Faroe in the future. With respect to comfort, my stay in the island was very agreeable, thanks to the care which Mr. and Mrs. Hansen were always good enough to take of me.

RUD. V. WILLEMOES-SUHM

THE SHERMAN ASTRONOMICAL EXPEDITION

BY the courtesy of Prof. Peirce, Superintendent of the U.S. Coast Survey, I am permitted to lay before the readers of NATURE, at the request of its editor, a brief account of the operations and results of the party which was stationed during the months of June, July, and August last at Sherman, the summit of the Union Pacific Railway.

The expedition was organised under the auspices of the Coast Survey; the observations, other than those for determining the mere geographical and topographical constants of the station, being provided for from a special appropriation of 200,000 dols. granted by Congress, at the request of the Superintendent, and placed at his disposal for the purpose of securing a series of astronomical and meteorological observations at some elevated point on or near the Pacific Railway.

The party was under the charge of General R. D. Cutts, one of the most experienced officers of the Survey, and consisted of himself, Assistant Mosman, and Aid Colonna, with myself, my colleague Prof. C. F. Emerson, who was kind enough to act as my personal assistant, and a young friend, Mr. C. K. Wead; we had also a photographer, a mechanician, and a couple of servants. A detail of about a dozen of the most intelligent soldiers from Fort D. A. Russell at Cheyenne served as an escort, and were invaluable in keeping up the hourly series of meteorological observations, and in many other ways, as well as in protecting us from any undesirable attentions of our red brethren; not that the protection was ever actually needed, for we hardly saw half a dozen Indians during the whole summer, except as passengers upon the railway trains.

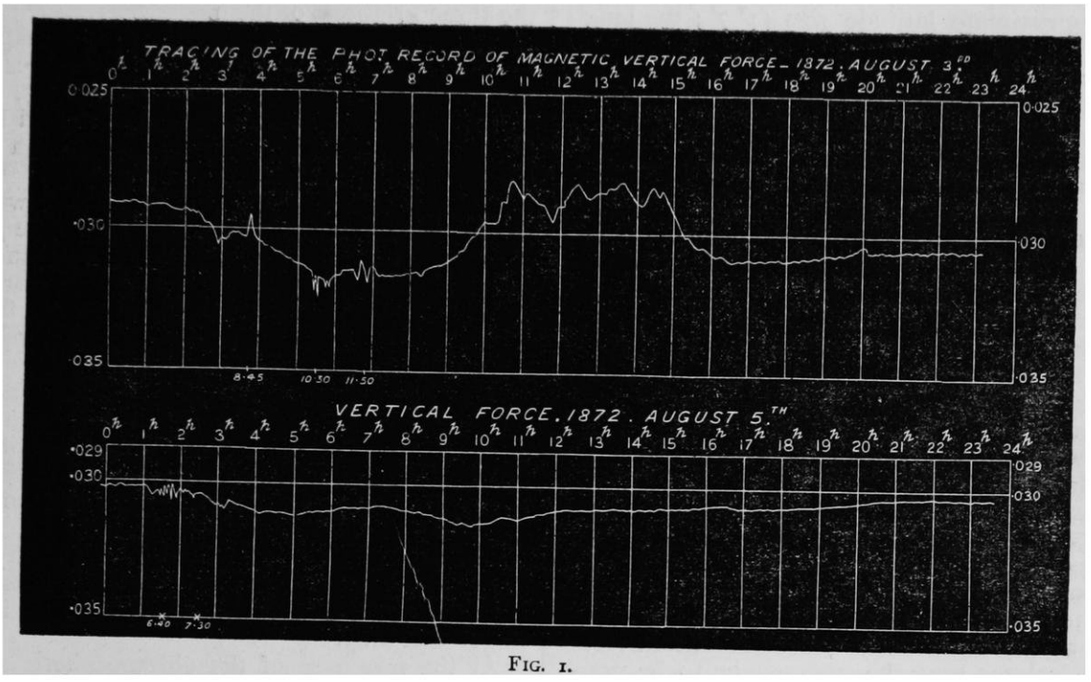


FIG. 1.

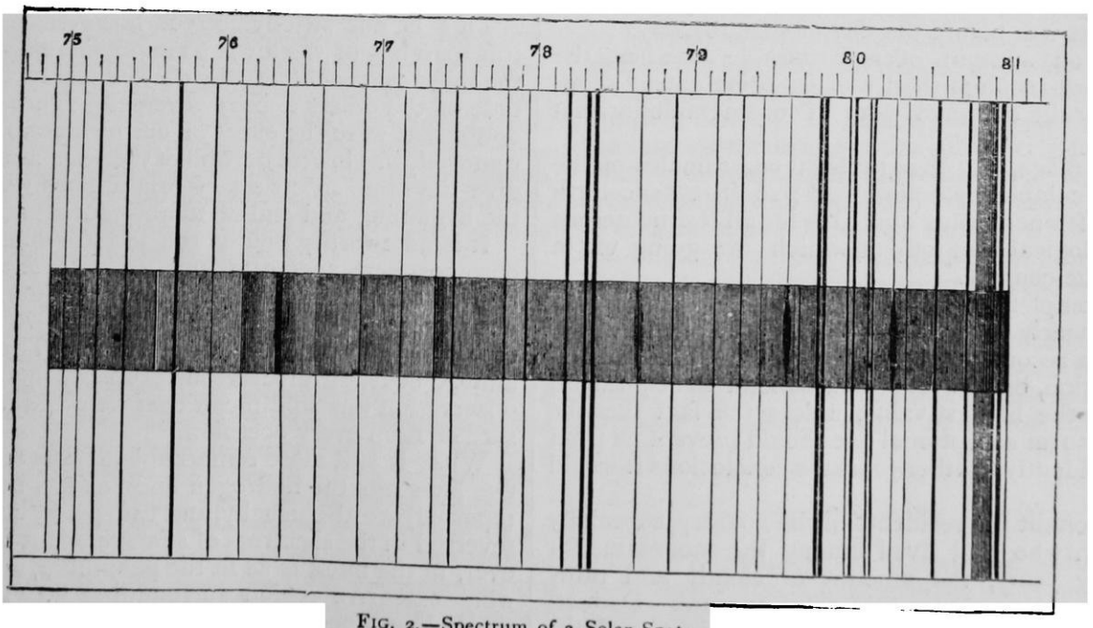


FIG. 2.—Spectrum of a Solar Spot.

The station was established in June, but it was not until July that I was able to join the party with Prof. Emerson and Mr. Wead. Our instrument had been forwarded by express, and was already on the ground. It was the Dartmouth College equatorial, having an aperture of $9\frac{4}{10}$ in., with a focal length of 12 ft., provided with clock-work and all the usual accessories, and fitted with an

automatic spectroscope having the dispersive power of 13 prisms. The instrument was loaned for the occasion by the trustees of the College, who, for the good of science, have never hesitated to send their most valuable apparatus to any portion of the earth; and thus far, I am happy to say, have met with no loss in so doing.

Our observatories, one for the transit instrument, one for the meteorological apparatus, and one for the equatorial, were "shanties" of rough boards, placed upon the summit of a slight elevation, some 150 yards S.E. of the railway station, and some 40 or 50 ft. above the track. The altitude of the observatory was about 8,300 ft. above the sea; the approximate latitude was 44° 7′; the longitude about 1h. 53·2m. west of Washington, or 7h. 1·4m. west of Greenwich. I give only approximations, the accurate reduction of the observations being not yet completed.

To the east the horizon was bounded by hills of no great apparent elevation, nor was there anything in the general aspect of the nearer landscape to remind the careless observer of his altitude. To the north, at a distance of about three miles, but seeming not more than half a mile away, rose some picturesque piles of granite several hundreds of feet in height; to the north-west lay the so-called Laramie hills; and from the north-west to the south, across the broad green Laramie plains, toward the mountains, many of them capped with perpetual snow. In the south were Long's and Gray's peaks, some 60 miles away; nearly west lay somewhat nearer the great mass of Medicine Bow; and between them, over the lower ridges, rose some of the high mountains of the Colorado parks. None of these snow-capped peaks have an elevation of less than 13,000 ft., and several exceed 14,000.

Our principal object was to ascertain what advantage would accrue to astronomical, and especially to spectroscopic, work, by placing the instrument at a great elevation. Theory declares that the gain ought to be great, since it is certain that our atmosphere, by its continual currents, its impurities, and its reflective power, is a most serious hindrance to telescopic work, and at the height of 8,000 ft.—more than a fourth of the whole is left below. The experiment of Prof. Piazzi Smyth, in 1856, on the Peak of Teneriffe, had already given a practical demonstration of the fact, so far as relates to ordinary telescopic work; but that was before the day of spectroscopy.

Although, on account of unfavourable weather, the amount of work accomplished was to some extent diminished, the results obtained were of considerable interest and value.

In the first place, the geographical co-ordinates of the station were completely determined; so that henceforth it will be a reference point and base for all the numerous surveys, geological and others, which are going on in that part of the country.

Then a complete hourly meteorological record was obtained for nearly the whole of the months of June, July, and August, a record which, from the exceptional character of the station, on the very back-bone of the continent, must possess the highest value, unless the fact that the season was also an exceptional one should prevent us from applying confidently to other years the conclusions it would indicate.

If we may credit the residents of the country, especially an old trapper who had lived among the mountains for nearly twenty years, the amount of cloudy and rainy weather during the summer was most unusual. Deducting a single week, during which every night and the greater part of every day was fine, clear nights were very rare, and clear days only a little less so. Indeed during our whole stay there were but two afternoons during which work upon the sun could be kept up uninterruptedly from noon to sunset, though during the same time there were more than twenty mornings.

Undoubtedly the explanation of this state of things is to be found in the enormous quantity of snow which fell last winter, and was still, in the middle of July, lying 8 ft. deep on the plateau at the base of the Medicine Bow mount.

Whenever the sky was unclouded the air was usually of most exquisite transparency. At night multitudes of stars, invisible at lower elevations, were easily seen; so that it was estimated that nearly all the stars of the seventh magnitude were fairly within reach of the naked eye. For instance, in the quadrilateral which forms the bowl of the "Dipper" I could see distinctly nine stars, with glimpses of one or two more, while at home I can only perceive the three brightest of them.

The power of the telescope was correspondingly increased. Without being able to devote a great deal of time to stellar observation, I ascertained that, with my 9¼ inches of aperture, nearly everything could be fairly seen which, at the sea-level, is within the reach of a 12-inch object-glass.

Some most exquisite views of Saturn will always be remembered, in which, notwithstanding the planet's nearness to the horizon, the inner satellites, and the details and markings of the rings, especially a dark stripe upon the outer ring, about a third of its width from the outer edge, were clearly shown under powers ranging from 500 to 1,200.

But in the use of the spectroscope the advantage was even greater. At Hanover I had been able to make out a list of 103 bright lines in the spectrum of the chromosphere; at Sherman the number was extended to 273; and at moments of unusual solar disturbance there were glimpses of at least as many more.

Sulphur, strontium, and cerium are pretty conclusively shown to be constituents of the solar atmosphere. Zinc, erbium, didymium, and iridium are also indicated, but not so certainly.

At the very base of the chromosphere, and to a distance of perhaps 1″ or 15″ from the edge of the photosphere, it was found that those dark lines which are not actually reversed lose their intensity, and vanish more or less completely. This is substantially a confirmation of an old and somewhat disputed observation of Secchi's, who reports at the edge of the sun a layer giving a continuous spectrum.

This is not strictly correct, however, since when the transparency of the air is so much increased as to cause the most persistent of the dark lines to vanish, a multitude of the others appear reversed. There can be little doubt that were the effect of our own atmosphere entirely removed, this lowest portion of the solar atmosphere would give the same spectrum of bright lines which is seen at the beginning and end of totality during an eclipse.

It is noteworthy that of the 170 new lines found in the chromosphere spectrum, not a single one lies below C, and that for no want of careful examination. The only new lines of much importance are the two Hs at the extreme violet end of the spectrum. These were found almost constantly reversed, probably quite so, but the observation was so difficult that we could not be perfectly sure of it on every occasion.

What is still more remarkable, it was found that these two lines (not the hydrogen lines, as has been erroneously reported) are also usually, and I am pretty confident always, reversed in the spectrum of sun-spots, not so clearly, moreover, in the nucleus as in the penumbra, and over a somewhat extensive region surrounding it. This reversal of the H lines does not involve at all the disappearance of the dark shade, but a bright streak rather than a line makes its appearance in the centre of the shade, which itself is, if anything, a little intensified.

The spectra of several different spots were carefully studied, and a catalogue was drawn up of 155 lines which are more or less affected, usually by being greatly widened, but in some cases by a weakening or reversal. Several

bright lines were also found in the spot spectrum, and between C and D some very peculiar shadings terminated sharply at the less refrangible limit by a hard dark line, but fading out gradually in the other direction at a distance of three or four of Kirchhoff's scale divisions. The interpretation of such markings is not quite clear, but would rather seem to point to such a reduction of temperature over the spot-nucleus as permits the formation of gaseous compounds by elements elsewhere dissociated, since these shaded spectra are quite probably characteristic of non-elementary substances, a view fortified by Schuster's recent beautiful investigations upon the spectrum of nitrogen.

Many more or less remarkable solar eruptions were observed, though none on quite so magnificent a scale as some before recorded. On several occasions velocities of from 150 to 200 miles per second in the ejected matter were observed by means of the displacement and distortion of the hydrogen lines, and on one occasion a velocity of nearly 250 miles was attained. One of the finest eruptions was visible on the surface of the sun itself in the immediate neighbourhood of a large spot.

A careful comparison of some of these observations with the corresponding magnetic records at Greenwich and Stonyhurst, for copies of which records I am indebted to the courtesy of Sir G. B. Airy and Rev. S. J. Perry, goes far to show that, although probably the *greatest* magnetic disturbances are due to terrestrial causes, or at least are only indirectly results of solar or cosmical influences, yet, on the other hand, every solar paroxysm does have a distinct, direct, and immediate effect upon the magnetic elements. Thus on August 3 such solar paroxysms were noted at 8.45, 10.30, and 11.55, also on August 5 from 6.20 to 7.30 A.M. (Sherman time), and the last was the only outburst during the day.

Now the annexed figure (Fig. 1), from a photographic copy of the vertical force curve for these days at Greenwich, shows marked and characteristic disturbances at the points indicated, which, allowing for the longitude, correspond to the very instants when the solar disturbances were noted. Further comparisons of such phenomena will be necessary to establish the conclusion with absolute certainty; but in the meantime it seems altogether probable that every solar disturbance receives an immediate response from the earth, and that the magnetic impulse travels with, sensibly, the velocity of light.

I must not close without alluding to certain observations that enable us to distinguish, to some extent, between the substances ejected from the sun, and those constituting the atmosphere into which the irruption takes place. Certain lines during these outbursts were distorted and displaced, while others near them, equally conspicuous, were wholly unaffected.

Thus on August 3 and 5, the former class included the lines of hydrogen, D_3, the lines of sodium, magnesium, and many of those of iron; in the latter were K534, 1474, 1505, 1515, 1528, 1867, 2007 (1870 and 200 were intensely disturbed), 2581, and probably the two Hs; I say probably, because the observation of these lines was too difficult to permit absolute certainty, still I feel very confident that they were unaffected. The barium lines also seldom seemed to participate in any disturbance.

The obvious moral of our summer's work seems to me this, that no time ought to be lost in occupying points of such advantage with the most powerful instruments: the great telescopes now building should be put in a position to profit by such atmospheric conditions as will secure their utmost efficiency, for while it is of little consequence to science whether ordinary glasses are placed where their power will be increased by 25 per cent., it may make a difference of years and decades in her advance if the new artillery opens its attack upon the heavens from the mountain-tops instead of from the plains.

Dartmouth College, Nov. 25 C. A. YOUNG

THE TRANSIT OF VENUS

AT the meeting of the Astronomical Society on November 8, a sketch was given of Lord Lindsay's preparations for the forthcoming transit of Venus. Lord Lindsay has selected the island of Mauritius as his station, on account of its highly favourable meteorological conditions. He intends, if possible, to combine the following methods of observation:—1. Observations of the internal contacts to be worked out on the plans of Halley and Delisle. 2. Observations of the first external contact at the chromosphere, to be made with the spectroscope. 3. Photographic pictures. 4. Heliometric measures. For the longitude it is at present intended to use the transits of the moon with an altazimuth made by Simms. As it is expected that the Germans will also have a station on the Mauritius, Lord Lindsay will connect his station with theirs by triangulation. The transit instrument is by Cooke, and has four inches aperture. The chronograph, which can be kept in motion for four hours, has four barrels, each of which can be worked separately, thus avoiding all confusion. The photographic method to be used is that of Prof. Winlock, who suggests a telescope of 40 feet focal length, placed horizontally, and a heliostat to reflect the sun's image along it. The lens is to be an achromatic one. It is intended to have two planes to the heliostat, one mounted on a polar axis, and another to send the rays down the tube. Lord Lindsay has ordered a Foucault siderostat with 16-inch mirrors, and has obtained a 13-inch unsilvered mirror to fit the telescope to be taken out. He intends to use a heliometer, though it is not much in favour in this country, Messrs. Respald, of Hamburgh, having undertaken to make one for him with all the improvements used in the Oxford instrument, as well as in some others. The Germans intend to send one to Kerguelen Land, and the Russians will use it at Lake Baikal and the mouth of the Amoor. Lord Lindsay's will include the motion of the halves of the object-glass in curved slides, so that the images will remain in focus; unlimited rotation of the tube in the cradle; the measurement of the position angle at the eye end, and measures of the micrometer read there also. Some new points are;—the graduation of the slides of the object-glass side by side, so as to be read by the same microscope; an arrangement to shut off light from half the object-glass, so as to equalise the light of the images; and the introduction of a thermometer at the end of the tube. Lord Lindsay proposes to eliminate errors of division as affected by temperature, by placing the instrument on one of the collimating piles of his transit circle at home, and heating the room by gas to different temperatures. It is hoped that, by taking a large number of measures, and by taking the most careful precautions, the original error of observation may be reduced to less than $0''.5$, and thus make the result one of extreme accuracy.

Lord Lindsay will be glad to receive the advice and assistance of astronomers accustomed to use the heliometer. Mr. D. Gill will accompany Lord Lindsay, the two dividing the work of observing between them.

THE "CHALLENGER"

ON Friday last, Dec. 6, several members of the council and "the Circumnavigating Committee" of the Royal Society, by invitation of the Lords of the Admiralty, inspected at Sheerness H.M. ship *Challenger* which sailed on Saturday on her three or four years' scientific circumnavigating expedition. The Government have all along consulted the Royal Society as to the fitting out of this expedition, and have liberally carried out every suggestion made by the Circumnavigation Committee. The visitors to Sheerness on Friday included many distinguished men of science, among them being Sir William

Thomson, Sir Charles Wheatstone, Prof. Huxley, Dr. Carpenter, Sir Henry Holland, Prof. Stokes, Prof. Allman, Dr. Hooker, Mr. Siemens, and others. Under the guidance of Captain Nares, the commander of the *Challenger*, Prof. Wyville Thomson, the scientific leader of the expedition, and other members of the staff, the visitors inspected with keen interest all the fittings and appliances with which the handsome ship has been furnished for carrying out the purposes of the expedition. Everything appeared complete, and the perfection and abundance of the preparations excited the universal admiration of the visitors. Government, in this instance, have acted with the most praiseworthy liberality. The ship itself has a greater tonnage than the three ships together which formed the expedition of Cook in 1772. After the visitors had completed their inspection, they were entertained to an ample luncheon in the ward-room, under the presidency of Captain Nares. A few toasts were drunk and a few very brief speeches made, in which some well-deserved compliments were paid to those most intimately connected with the expedition. Dr. Carpenter felt sure that under Prof. Thomson's superintendence "no fact would be let go, and that every fact would find its place and its value when results came to be worked out;" while Prof. Thomson said that if the vessel were not thoroughly equipped, it was the fault of the scientific staff; they had met with every encouragement from Government to ask for what is necessary.

We are sorry to hear that the *Challenger* has already met with a little rough treatment from some of the elements she is bound to explore. In the fierce gales which prevailed on Sunday, she lost her cutter, and was compelled to put into Deal. We believe no serious delay will result from this accident, which, we hope, may be the only one of the kind the party may meet with. According to present arrangements she leaves Portsmouth on Monday next.

We cannot, however, but express our regret that the party were allowed to set off on an absence from England which may be prolonged for four years, animated, in their voluntary exile, by no motive but a desire to promote the interests of science, without some more official and more extended acknowledgment from their scientific brethren throughout the country than a few after-lunch speeches on board the corvette. Our contemporary *Punch* has, however, given his accolade to the expedition in some spirited lines:—

"Broadside guns have made room to ship batteries magnetic,
Apparatus turns out ammunition,
From main-deck to ground-tier I'm a peripatetic.
Polytechnic marine exhibition."

PROCEEDINGS OF ZOOLOGICAL COLLECTORS

MR. T. K. SALMON has lately transmitted to his agent, Mr. E. Gerrard, jun., of Camden Town, a fine collection of birds from the province of Antioquia, United States of Columbia. Amongst them are specimens of a new Humming Bird, which Mr. Gould has described as *Adelomyia cervina*. Mr. Salmon has now pushed forward into the upper valley of the Cauca, where he will enter upon untrodden ground.

Mr. Henry M. Whitely has also been very active lately in the district he is now exploring, in the Andes of Caravaya, east of Cuzco, Peru. His last collection contains some very fine species of Tanagers, previously only known from d'Orbigny's specimens in the Paris Museum. There are also several remarkable humming birds in Mr. Whitely's collection, one of which, being new to science, Mr. Gould has named *Iolæma Whitelyana*, after its discoverer.

Letters have been received from Mr. Charles R. Thatcher, who is *en route* for the Philippines, announcing his arrival at Yokohama, *viâ* San Francisco, and immediate departure for his destination. Mr. Thatcher will attend principally to the land-shells and birds of the Philippine Archipelago. P. L. S.

NOTES

THE Italian Government has ordered a massive gold medal, with a suitable inscription, to be prepared for presentation to Dr. Livingstone. The medal was to be ready by the 3rd inst. and was to be consigned—with an official letter addressed in the king's name to the great traveller—to Sir Bartle Frere, in the hope that he may either present it in person, or forward it to him by some safe hand. The Commendatore Negri Cristofero, President of the Italian Geographical Society, has been the prime mover in bringing about the gratifying recognition of Livingstone's labours in behalf of Science and humanity; and the Italians generally appear to be delighted with the idea of being the first to tender him this national proof of the high estimation in which they hold him. On one side the medal bears the bust of the king, with the legend "Vittorio Emmanuele II. Rè d'Italia," and on the obverse "A Davide Livingstone, Vittorio Emmanuele II. 1872."

AT a meeting of the Geographical Society on Monday night, Mr. Francis Galton, who occupied the chair, stated that he believed Sir Bartle Frere would probably be in Alexandria that night, and that Lieut. Grandy, leader of the "Livingstone Congo Expedition," would land in Sierra Leone about the 15th of this month. Mr. Galton also announced that a long list of astronomical observations had been received from Livingstone by Sir Thomas Maclear, at the Cape, who says they will take three or four months to reduce.

WE greatly regret to have to record the death, on Monday last, of John Keast Lord, the manager of the Brighton Aquarium. We learn from the *Brighton Daily News* that Mr. Lord was laid up with a severe attack of paralysis some months since, but though it was known that he was not in the enjoyment of robust health, it was far from being generally thought that his indisposition would so soon be brought to a fatal termination. Originally a captain in the Royal Artillery, in which capacity he served in the Crimean war, and took part in the battle of Balaclava, Mr. Lord seems to have always entertained an intense love for the study of natural history; and at the close of the Russian campaign he quitted the army for a field in every way more congenial to his tastes. He now devoted himself to the study of nature in good earnest, and spent some time in Vancouver Island, which he appears to have thoroughly investigated. The results of his labours were afterwards given to the world in "The Naturalist in Vancouver Island." Mr. Lord afterwards served on the North American Boundary Commission, and later on was engaged by the Viceroy of Egypt to report upon certain characteristics of that country. It was from Egypt, we believe, that he was called by the directors of the Aquarium to take the appointment for which he was so peculiarly fitted.

THE University of Cambridge has passed a resolution by which in future successful candidates in Moral Science can present themselves for the next Natural Science Tripos, and *vice versâ*.

AN examination for minor scholarships for students intending to commence residence at Cambridge next October will be held at Clare College on Wednesday, March 26, 1873. One of these of the value of 50*l.* tenable for 3½ years, will be awarded for Natural Sciences. The subjects are Chemistry, Chemical Physics (including Light, Heat, and Electricity), Comparative Anatomy and Physiology, and Geology. Excellence in any two

of these subjects will be preferred to a less perfect acquaintance with a greater number.

THE Janssen-Lockyer medal was presented by the French Government to the Academy at its sitting on Monday last week. May we hope that some time our Government may have attained to that degree of civilisation at which it will be possible for it to take official cognizance of additions to our scientific knowledge?

ON Saturday last, Prof. Huxley and the Marquis of Huntly were formally nominated for the Lord Rectorship of Aberdeen University. The election takes place on Saturday next.

AT a meeting of the faculty of the College of William and Mary, Williamsburg, Virginia, held on the 4th November last, it was unanimously resolved that the degree of Doctor of Laws be conferred upon Robert Potts, M.A. of Trinity College, Cambridge, England, in recognition of his successful labours as an educator and his valuable contributions to geometrical science.

THE Ricardo Scholarship in Political Economy has been awarded by Professors Cairnes and Courtney to Mr. Sereill. They also report that Miss Eliza Orme obtained a sufficient number of marks to qualify her for the scholarship had she not had so powerful a competitor.

DR. C. MEYMOTT TIDY, Professor of Chemistry at the London Hospital, has been elected Medical Officer of Health for Islington.

WE have received the Prospectus of the Royal Institution, and are glad to see that, in its new form, it places first among the chief objects for which it is established the promotion of scientific and literary research, and the teaching of the principles of inductive and experimental science. It informs the public of some of the great results which have followed from the experiments and original investigations which have been made in its laboratories by such men as Davy, Faraday, Tyndall, and Frankland. The chemical and physical laboratories have been this year rebuilt, and the liberal and permanent endowment of the professorships is now the chief thing wanting to ensure the promotion of scientific research. We hope this want may be short-lived.

THE Christmas lectures at the Royal Institution, intended especially for a juvenile auditory, will be by Prof. Odling, on Air and Gas. They will be six in number, and will be delivered on Dec 28 and 31, and Jan. 2, 4, 7, and 9, 1873.

AT the meeting of the National Academy of Science held at Cambridge, Mass., Nov. 22, Prof. Agassiz gave a very interesting account of his researches in the *Hassler* expedition, and especially of his discovery of the great South American glacier. He defended his rejection of the Darwinian theory of evolution on the ground that "his opponents are presenting views on scientific principles which are not even based on real observation; that they have not shown evolution, or the power of evolution, in the present day, and hence are not entitled to assume it in the past." He further characterised the theory as "a mire of mere assertion."

AN interesting event in the history of American science took place on Oct. 30, in Philadelphia, on the occasion of laying the corner-stone of the new building of the Philadelphia Academy of Natural Sciences. This institution was founded in 1812, and has for many years occupied the foremost rank among natural history establishments in America. The Academy since its establishment has been the recipient of many benefactions. Among those who have been most conspicuous in this connection may be mentioned William M'Clure and Thomas B. Wilson. To the latter gentleman is due very much of the present extent of its library and museum. The expense of the new building, it is pexected, will amount to $500,000, and it is hoped that sufficient funds will be contributed by the liberal-minded citizens of Philadelphia to complete the entire structure in a comparatively short space of time. The present building has long been inadequate to the accommodation of the collections of the Academy. According to statements made on the occasion referred to, the Academy now possesses more than 6,000 minerals, 700 rocks, 65,000 fossils, 70,000 species of plants, 1,000 species of zoophytes, 2,000 species of crustaceans, 500 species of myriapods and arachnidians, 25,000 species of insects, 20,000 species of shell-bearing molluscs, 2,000 species of fishes, 800 species of reptiles, 21,000 birds, with the nests of 200 and the eggs of 1,500 species, 1,000 mammals, and nearly 900 skeletons and pieces of osteology. Most of the species are are presented by four or five specimens, so that, including the archæological and ethnological cabinets, space is required now for the arrangement of not less than 400,000 objects, as well as for the accommodation of a library of more than 22,500 volumes.

WE are glad to see that the French Government, in its present trying circumstances, is not neglecting the interests of Science. By a decree of Nov. 25 last an Astronomical Commission has been charged with the preparation of a scheme for the organisation of the French observatories. The members of the commission are MM. Belgrand, Faye, Fizeau, Guillot, Janssen, Lespiaut, Le Verrier, Löwy, Puiseux, Rayet, Roche, Charles Sainte-Claire Deville, Stéphan, Wolf, Yvon-Villarceau.

MR. G. DEVYLDER writes from Ghent to the *Photographic News* in reference to the appointment by the Prussian Government of Dr. Vogel as Professor of Photography at Berlin, which we noticed last week, that Dr. Vogel's appointment is not the first in this department. Mr. Devylder has been Professor "official" of Photography at "L'Ecole Industrielle" of Ghent for more than ten years.

THE session of the Royal Society of Edinburgh was opened on December 2, by an address from the President, Sir Robert Christison, consisting mainly of the sketches of the lives of members of the Society who have died during the year. The Brisbane prize has been awarded by the council to Prof. Allman.

WE learn from the *British Medical Journal* that the chair of Practice of Medicine, in the Royal College of Surgeons, Ireland, vacant by the resignation of Dr. Benson, has just been filled by the election of Dr. James Little, the editor of the *Dublin Journal of Medical Science*. The election for the Professorship of Surgery, in the room of Dr. William Hargrave, will take place on the 24th of this month; Mr. Croly and Mr. Stokes are the only candidates at present in the field. It is no yet known who will be likely to be Mr. Hargrave's successor as representative of the College of Surgeons on the General Medical Council.

THE Paris correspondent of the same journal writes that the medical courses there are now open, and that three or four ladies are attending the *cliniques*:—"they are modest, well-informed, and intelligent ladies, and are much respected and kindly received by the professors; and our students, turbulent as they are, know how to respect those who come among them as strangers appealing to their gentlemanly souls, and show a better example than your riotous students of Edinburgh."

A MEDICAL Society for the West Riding of Yorkshire has been organised at Leeds, with Dr. Chadwick as president. Its object is to promote the study of Medicine and Surgery among Practitioners by the communication of clinical and therapeutical facts, and by the application of pathological specimens, and discussions thereon.

NUMEROUSLY attended meetings have been held at Totnes, Newton, Dartmouth, and Yeovil, for the purpose of establishing cience and art classes for the instruction of young men.

THE *Gardener's Chronicle* states that the Jardin d'Acclimatation has sprung into new life since the war, and has become the most fashionable resort in Paris. An additional feature of attraction is now being added to the rest—a large collection of rare shrubs recently brought from Algeria by M. Geoffroy, being in the course of arrangement in the great conservatory. In addition to this, it may be mentioned that two reading rooms are being arranged for the use of the members of the society and the public. One of these rooms is to be supplied with newspapers and literary and scientific publications, while the other is to be devoted to study, and to contain a complete scientific library.

MR. H. C. WATSON has printed, for private distribution, a Supplement to the Compendium of "Cybele Britannica," comprising an extremely useful epitome, accompanied by a map, of the distribution of all British species and sub-species of plants through the thirty-eight sub-provinces into which Great Britain is divided. We doubt the wisdom or the advantage to science of the introduction into a book, even if only printed for private distribution, of the personal matters which disfigure the Appendix to the volume.

WE have received the 8th, 9th, and 10th parts of the new edition of Griffith and Henfrey's Micrographic Dictionary, bringing down the issue of this useful publication as far as Equisetaceæ.

DR. WILLIAM ULRICH publishes an International Dictionary of Plants in Latin, German, English, and French. Notwithstanding a few defects or inaccuracies in the English department, not to be wondered at in a work published in Germany, it appears to be, on the whole, extremely well done, and to be a very useful compilation. What we do not so often find in German books, there is an admirable and copious index.

MR. JAMES F. ROBINSON, of Frodsham, Cheshire, is about to publish "A Flora of the Isle of Man," in memory of Prof. E. Forbes, who was a native of the island. It will be illustrated with engravings of the principal island scenery (waterfalls, &c.). and accompanied with a specimen of the Manx fern (*Adiantum capillus veneris*) mounted as a vignette.

MR. BULLER, to meet the wishes of many of the most influential subscribers to his "Birds of New Zealand," intends to publish a series of supplementary plates, so as to include figures of all the species of birds inhabiting that interesting country. This will be a great gain to students of ornithology, who would otherwise have been left to search for representations of many of the most remarkable forms in works which are especially difficult of access—for instance the "Atlas" to the voyage of the *Astrolabe*, the bird-volume of the "Voyage of the *Erebus* and *Terror*," or Mr. Gould's magnificent but somewhat expensive "Birds of Australia."

A GERMAN correspondent inquires the name and price of the best and most complete work in English on the histology of hair and wool.

Ocean Highways, a journal excellently conducted, has an article in the December number on the Congo, by Lieut. Grandy, the leader of the "Livingstone Congo Expedition." He traces the history of discovery from 400 A.D., and says that no serious attempt has been made to explore the river since Capt. Tuckey's expedition of 1816.

ON Friday, December 6, there was held, in the Corporation Galleries of Glasgow, under the auspices of the energetic Geological Society of that city, the finest geological exhibition that has ever been held in Scotland; indeed, according to the *Scotsman*'s report, it has probably never been equalled elsewhere in Britain. In connection with the exhibition, there was also held a very successful *conversazione*. This Society, which is one of the most efficient in the country, was formed in May 1858. The unusually rich and varied collections exhibited all belonged to private individuals, but would have done credit to any high-class public museum. Glasgow, the commercial capital of Scotland, if it hold out as it has been doing recently, may ere long vie with "the grey metropolis of the north" as a centre of the highest culture.

IN the *Arnhemsche Courant* of December 4, H. van de Stadt has an article on the intimate connection between the recent meteoric shower and Biela's comet.

THE Continental scientific journals have the same brilliant tale to tell of the meteoric display of the night of Nov. 27-28 last as we had. From all parts of France and from various parts of Italy observers speak of "the rain of falling stars" which was kept up for several hours, and all agree that the radiant point was in the constellation Perseus, near to Cassiopeia. Father Secchi says that at Rome, between 7.30 P.M. and 1.30 A.M., 13,892 were counted; while *L'Institut* says that the average in most places was two meteors per second, while in some places the number registered amounts to upwards of 40,000. M. F. Raillard, writing to *Les Mondes*, says that so long ago as January 1839, he communicated in a note to the Academy the idea that shooting stars, the aurora borealis, and comets, had a common origin.

IN reference to the extraordinary whirlwind in Ireland, of which we lately printed an account, the following note has been communicated to us from Mr. C. J. Webb, of Knockvarre, Randalstown:—"I have received no further definite information respecting the course taken by the whirlwind except that contained in my letter. I think it probable, however, that it crossed to Scotland, forming itself into a waterspout while passing over the sea, as, a few days afterwards, I saw an account in the daily paper of a most destructive waterspout, which broke some time on the night of the same Sunday that the whirlwind visited us above the coach road near Lough Katrine, rendering it impassable for several days, owing to the trees, *débris*, &c., which were swept down by the flood."

ANOTHER phenomenon of a similar kind is recorded as follows by a correspondent of the *Birmingham Morning News*. The people living near King's Sutton, Banbury, say that about one o'clock on Saturday they saw something like a hayeock revolving through the air, accompanied by fire and dense smoke. It made a noise resembling that of a railway train, but very much louder, and travelled with greater rapidity. It was sometimes high in the air, and sometimes near the ground. It passed over the estate of Colonel North, M.P., Sir W. R. Brown, Bart., and Mr. Leslie Melville-Cartwright, whose park wall it threw down to the foundation in several places, and at one place for upwards of sixty yards. A man named Adams was breaking stones, and a minute before he was standing under a tree that was torn up by the roots and the branches scattered in every direction. Two or three trees near him were torn up, and one of them, the largest beech on Sir William Brown's estate, which tore up with it twelve or fifteen tons of earth. For a distance of nearly two miles, hedges, rails, trees, hovels, and ricks have been knocked down or injured. A whirlwind followed the fire-meteor, and carried everything before it. Stones from the walls knocked down were carried forty yards away, and the water in a pond disappeared on the passage of the phenomenon. After travelling about two miles the meteor seemed to expend itself, and disappeared all at once. There was a heavy fall of rain at the time, and a vivid flash of lightning just before. The direction taken by the meteor was from south to north, and it travelled almost in a straight line.

MIMICRY IN THE COLOURS OF INSECTS*

HAVING observed that in treating of the interesting phenomena of mimicry, writers have used indiscriminately very different factors, I shall try to give some preliminary ideas which I do not find published, and which I believe will be useful in explaining this interesting subject.

It will be best to consider the colour and pattern separately. There are three different kinds of colours: viz., colours produced by interference of light, colours of the epidermis, and colours of the hypodermis. All three may either be wanting, or all three or two of them may occur together in the same place.

Colours produced by interference are produced in two different ways: first by thin superposed lamellæ, as in the wings of Diptera, Neuroptera, &c., without any other colour, as in hyaline wings, or connected with other colours as in the scales of Entimus and others.

There must be at least two superposed lamellæ to bring out colours by interference, and there cannot be more than four, as both wings and scales consist only of four layers, two internal belonging to the hypodermis, two external belonging to the epidermis. In fact, if scales taken from dry specimens of Entimus are observed under the microscope, many partly injured can be found, which give different colours according to the layers of the lamellæ which remain.

Secondly, colours by interference are produced by many very fine lines or striæ in very near juxtaposition, as in Apatura and other colour-changing insects. Colours by interference may perhaps be sometimes also produced in the same way as in the feathers of the dove's neck by very small impressions situated near together.

The colours produced by the interference of light are only optical phenomena, differing in this respect from the other colours of the body, the epidermal and hypodermal colours.

The epidermal colours belong to the pigment deposited in the cells of the chitinised external skin, the epidermis. These colours are mostly metallic blue, green, bronze, golden, silver, black, brown, and perhaps more rarely red. The epidermal colours are very easily recognised, because they are persistent, never becoming obliterated or changed after death.

The hypodermal colours are situated in the non-chitinised and soft layer, called hypodermis by Weismann. They are mostly brighter and lighter, light blue or green, yellow, milk white, orange, and all the shades between. The hypodermal colours *in the body* of the insect fade or change, or are obliterated after the death of the insect. A fresh or living insect when opened may easily be deprived of the hypodermal colours simply by the action of a little brush. I said hypodermal colours in the body, because there are hypodermal colours which are better protected, being encased nearly air-tight, and therefore are more easily preserved even after the death of the insect. I refer to the colours in the elytra and wings, and in their appendages, the scales. The elytra and the wings are, as is well known, at first open sacs in communication with the body, of which they are only the extension; of course they are formed of the epidermis and hypodermis, which become so strongly glued together after the transformation into the imago state that a maceration of years tried by me showed no effect at all on such wings. This fact is very interesting, as it explains how wings, and even coloured wings, can be found in palæontological layers in good preservation. The destruction of insects, which is so peculiar to the secondary strata in England, proves, as I believe, that the bodies of the insects must have floated a very long time before they were deposited. It is quite a rarity to find well-preserved insects there, although many well-preserved wings, even of lace-winged flies, have been described.

There is an interval after the transformation, before the membranes of the wings become inseparably glued together; it is at this time that the finishing of the colours takes place. For instance in an Æschna, a *Libellula depressa* or *trimaculata*, if the wing is cut off at the base, the two layers can be easily separated by manipulation under water, and the wing can be inflated with a little tube by separating the borders with a knife. I can show specimens so prepared. But this is only possible as long as the wings possess the appearance of having been dipped into mucilage, an appearance which is well known in young Odonata.

The scales have just the same development as the wings. At first they are little open sacs, communicating with the hollow of the wing and the whole body, and at a later period are glued together like the wings themselves.

In the wings and in the scales the hypodermal colours are formed and finished before the wings stick together, and by this means they are well preserved and safely encased. They have no more communication in the glued parts with the interior of the animal, and are preserved in the same way, as if hermetically inclosed in a glass tube. There are even here in the wings and scales many epidermal colours, chiefly the metallic ones; but all the brighter colours (for instance the somewhat transparent spots in the elytra of the Lampyridæ, Cicindelidæ, &c., and in the greater number of Lepidoptera) are, as I believe, hypodermal colours.

Finally there sometimes occurs outside of the animal, that is, on the epidermis, a kind of colour which I consider as hypodermal colour, such as the pale blue on the abdomen of many Odonata, the white on the outside of many Hemiptera, the pale grey on elytra and thorax of the Goliathus beetle, the powder on Lixus and others. Some of these colours are very easily resolved in ether, and are apparently a kind of wax. I believe that these colours are produced by the hypodermis, and are exuded through the little channels of the pores.

The hypodermal colours are very often different in males and females of the same species, the epidermal colours rarely differ so far as I know; but there are genera with prominent epidermal colours which are nearly always different in different sexes, viz., Calopteryx, Lestes, some Hymenoptera, &c.

It would be interesting to know the different colours of the epidermis in such cases. So far as I know, the change seems to be between related, and not between complementary colours. But my observations are far from having any conclusive importance. The same investigation would be necessary for the hypodermal colours.

The hypodermal colours may change or be altered in some male or female during its lifetime, by sexual or other influences. The epidermal colours never change. By sexual influences yellow is changed into orange, brown into red, and even sometimes more changed. By other influences, for instance by cold in hibernation, pale yellow is changed into red (Chrysopa). The hypodermal colours may be changed even by a voluntary act of the animal, and the new colours disappear again (Cassida). The hypodermal colours are the only ones on which the animal has any influence, either involuntarily by the action of the nutritive fluid, or voluntarily. The epidermal cells are placed entirely outside of any influences of the animal, when once established. It will perhaps be possible to prove that the so-called mimetic colours are all hypodermal colours.

The hypodermal colours seem to be produced by a photographic process (I know no better expression), the epidermal colours by a chemical process of combustion or oxidation. Would it be possible to prove that by a photographic process even the colours of the surrounding world could be transmitted, a great step towards an understanding of the phenomena would be gained. The fact, of course, is very probable, at least, in some instances.

In observing the mimicry, the pattern of an insect must be clearly separated from the colour. In fact, the pattern is not the product of an accidental circumstance, but apparently the product of a certain law, or rather the consequence of certain actions or events in the interior of the animal and in its development. The proof is very easily afforded by the regularity of the pattern in a genus or a family of insects. If studied carefully and comparatively, the pattern in a genus is the same, or is only more or less elaborated. The number of such families is so exceeding great that some example will readily occur to every one.

Moreover a certain and constant pattern can be found for the head, a different pattern for the segments of the thorax, and a different pattern for the segments of the abdomen. This pattern is in the different segments of the abdomen (Hymenoptera, Diptera, Neuroptera, Orthoptera) always the same, only more or less elaborated, and less finished in the first and last segments. In some way the same is true for the thoracic segments.

In some few instances I was able to observe how the pattern is produced. In the Odonata (Dragon-flies) at the moment of transformation the thorax is transparent, and shows no colours at all. At this time the muscles are without importance, and in process of formation. The thoracic muscles, as is well known, are, in the Odonata, very powerful, and also very extraordinary

* Reprinted from the *American Naturalist* for July 1872.

as regards the shape of their tendons. Just along outside the muscles are dark lines more or less well finished, and resulting from the action of the muscles. *Ubi irritatio ibi afflluxus.* I believe that it would not be unphilosophical to conclude that a powerful action in the development of the muscles is, in such a case, the cause of a greater combustion or oxidation in the neighbouring parts. In fact, on the head of a Cicada and on the abdomen of an Æschna we find similar patterns, in some way mostly representing the underlying muscles. In the Gomphina the fact is striking, and far more as the stronger species mostly possess a large dark pattern. There are some very small species which are almost entirely yellow; there are no small species entirely black.

Should the fact, with the explanation, be admitted, a step farther in the explanation of the different patterns would be made. I know very well that in the Odonata there are patterns which do not agree with my explanations, even some contrary to it; but if some certain facts be explained, there are perhaps more factors still unknown or unobserved. The explanation for certain facts would still be admissible, or at least not entirely objectionable.*

The patterns on the wings and elytra could not be the product of the action of muscles, but I believe it to be probable that the sudden rush of blood, or even air, by the accelerated circulation and respiration in the act of transformation may have the same effect. In this way some patterns, otherwise not explicable, could be understood. The eyespots in the caterpillars of some Papilionidæ have been ascertained by Leydig to be epidermal colours, and I believe that the various kinds of eyespots in the wings of the imago are also epidermal colours. If a stream of blood meets a small obstacle just in the centre, a funnel is formed; if this obstacle is a ring, and behind it another obstacle, we have two or more funnels, one in the other, and the section of them will be circular or elliptical according to the angle at which they reach the surfaces. Such patterns in the elytra and wings are formed or preformed at the time when the wing is a sac; sometimes before the transformation, and here is another circumstance which explains some patterns. The walls of the sac are suddenly augmented and strongly dilated in the transformation. Small patterns performed in the sac will also be altered and enlarged by the same process, and I know that many patterns of Lepidopterous wings are in such a way very easily explained All the waved lines of the wings and other marks belong here, and as the ribs or nervures seem to grow faster in transformation, the waved appearance would be explained In fact the greater part of the patterns seem to be produced by expansions or distraction of the pattern performed in the wing at some period before the transformation. H. HAGEN

SCIENTIFIC SERIALS

THE *Monthly Microscopical Journal* for October 1872, contains a continuation of Dr. Robert Braithwaite's papers on bog mosses, the present communication being confined to *Sphagnum neglectum* Angstr. Dr. J. J. Woodward contributes a reply to further remarks on Tolles' $\frac{1}{7}$th and Powell and Lealand's $\frac{1}{10}$th. This is succeeded by a communication "On the History, Histological Structure, and Affinities of *Nematophycus Logani* Curr. (*Prototaxites Logani* Dawson), an Alga of Devonian Age," by Wm. Carruthers, F.R.S., in which the author combats the theory advanced by Dr. Dawson, that the fossil in question is coniferous, and contends that it is cryptogamous, belonging to a gigantic alga, of the class *Chlorospermeæ*. Two plates accompany this very interesting and important communication.—"On the active part of the Nerve Fibre, and on the probable nature of the Nerve Current," by Lionel S. Beale, F.R.S., is a further contribution to the researches for which Dr. Lionel Beale has earned a reputation.—"On the Regeneration Hypothesis," by Dr. Louis Elsberg, of New York. The fundamental proposition of this hypothesis is thus stated by its author: "The germ of every derivative living being contains plastitudes of its whole ancestry."—Dr. J. J. Woodward contributes some observations on the use of monochromatic sunlight, as an aid to high-power definition.—A short paper by Prof. Albert H. Tuttle, on one of our common monads is from a communication made to the microscopical section of the Boston Society of Natural History.

Bulletin de l'Académie Royale de Belgique, No. 8. This number contains a mathematical paper of some length, by M. P. Mansion, on singular solutions of differential equations of the first order; also a note by M. Dubois describing some researches on the camphors. He studied the action of pentasulphuret of phosphorus at a high temperature on monobromated camphor, and found that it gave cymol, accompanied with small quantities of hydrocarbons of the same homologous series, and an organic sulphhydrate soluble in alkalies. M. Alphonse Waters gives a sketch of some efforts that were made in Belgium in the middle of the 17th century towards the establishment of free trade.—A note by M. Schuermanns treats of the discovery of objects of amber in Belgium, the writer advising a special study of the circumstances which may have connected Belgium with the commercial route from Etruria to the country of amber, on the Baltic.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 5.—"Colouring-matters derived from Aromatic Azodiamines." II. Safranine. By Drs. A. W. Hofmann, F.R.S., and A. Geyger.

Whilst we were engaged with the study of the blue colouring-matters produced by the action of aromatic monamines on azodiphenyldiamine, our attention became directed to a beautiful red tar-pigment, which has been known for some time by the commercial name of Safranine, being extensively used as a substitute for safflower in dyeing silk and cotton. Safranine has not as yet been minutely examined; but, as far as can be judged from the scanty information we possess regarding its production, it is scarcely doubtful whether this important dye must be looked upon as being the derivative of an azodiamine. The analyses of safranine thus promised to throw considerable light upon the nature of the compounds under examination.

Saframine occurs in commerce either as a solid body or *en pâte*. In the solid state it forms a yellowish-red powder, in which, together with considerable quantities of chalk and common salt, the chlorhydrate of a tinctorial base has been recognised. The pure dye may be easily separated from the crude safranine. It is only necessary to exhaust the commercial product with boiling water; on cooling, the filtrate deposits a slightly crystalline substance, which, after several recrystallisations from boiling water, leaves no residue on ignition. During these operations, however, the salt undergoes perceptible alteration; with every recrystallisation it becomes more soluble and less crystalline. These alterations depend upon the separation of chlorhydric acid from the salt. In fact the percentage of chlorine is found to diminish in the product of succesive crystallisations; thus the product of the third contained 8·48 per cent. that of the fourth crystallisation only 7·46 per cent. Addition of chlorhydric acid to the mother-liquors at once reproduces a crystalline precipitate. This instability of the chlorhydrate, and, in fact, as may even now be stated, of the salts of safranine in general, has very considerably impeded the study of this body, and often materially affected the accuracy of the analytical results. In order to obtain the normal salt, the boiling liquid during the last crystallisation had always to be acidified with chlorhydric acid.

"Synthesis of Aromatic Monamines by Intramolecular Atomic Interchange." By Dr. A. W. Hofmann, F.R.S.

In a paper submitted to the German Chemical Society about a year ago, we proved (Dr. Martius and myself) that the action

* So far as I know the literature relating to the phenomena of mimicry, all these related differences are often confused, and I believe that in separating them and following the views above given, many facts would be better understood, and this interesting subject more easily advanced.

Besides all the difficulties which oppose a clear and correct view, there is one more which I do not find mentioned, *i.e.* the so-called colour-blindness, and the different degrees of it. Prof. B. A. Gould in his excellent work, "Investigations on Anthropological Statistics of American Soldiers," has given attention to it in a very remarkable chapter. Persons who cannot distinguish ripe cherries upon the tree, or strawberries on the vine by their colour, are far more numerous than would be suspected. Serious misunderstandings, and even calamities, have been reported in the army, resulting from mistakes in the colour of green and red light by officers of the signal corps. He gives the statement that usually one in twenty, and in the soldiers examined one in fifty, was subjected to colour blindness. But these numbers show only the extremes; and it is easy to believe that a much greater number are more or less affected with it. In fact, we have no means of measuring this physiological difference; if two persons call something green, and even compare the colour with certain known objects, there is no proof at all that they see just the same colour. I think that it would be prudent in describing cases of mimicry, especially when they are extraordinary, not to forget that even the best observer may be unaware of this infirmity, and in fact the best authorities on colour-blindness always state that the greater number of persons have no idea of their infirmity.

of methylic alcohol on aniline chlorhydrate at a high temperature and under pressure, far from yielding exclusively methyl- and dimethylamiline, as has been formerly believed, is capable of causing methylation of the phenyl group, and thus producing quite a series of higher homologues of dimethylaniline.

If we endeavour to gain an insight into the mechanism of this reaction, we are led to assume that in the first instance the chlorhydric acid of the aniline salt gives rise to the formation of methylic chloride, which in its turn induces substitution, first in the ammonia fragment, and ultimately in the phenyl group itself. If, on the other hand, we remember that a tertiary monamine, such as must be formed by the final methylation of the ammonia fragment in aniline, when submitted to the action of an alcohol chloride, is invariably converted into an ammonium compound, it must appear rather strange that in the process above alluded to only tertiary, and never any quaternary bases are observed.

Under these circumstances the idea very naturally suggested itself of submitting the behaviour of quaternary compounds at a high temperature under pressure to an experimental investigation.

The simplest compound that could be detected for such an inquiry appeared to be trimethylphenylammonium iodide.

$$C_6H_5\ CH_3\ CH_3\ CH_2NI.$$

Reserving for a future communication the experimental details of this inquiry, I will limit myself for the present to a brief statement of the principal result obtained.

Leaving secondary reactions out of consideration, the transformation of the trimethylated phenylammonium iodide is represented by the following equations :—

Transformation of quaternary into tertiary compound.

$$C_6H_5.CH_3.CH_3.CH_3\ NI=(C_6H_4.CH_3)CH_3.CH_3\ N.HI.$$

Transformation of tertiary into secondary compound.

$$(C_6H_4.CH_3).CH_3.CH_2.N.HI=[C_6H_3(CH_3(CH_3)_2]CH_3.HN.HI$$

Transformation of secondary into primary compound.

$$[C_6H_3(CH_3)_2]CH_3.HN=[C_6H_2(CH_3)_3]HHN\ HI.$$

Accordingly trimethylated phenylammonium iodide, when submitted to the action of heat, is transformed in the first place into iodhydrate of dimethylated methylophenylamine or dimethyl toluidine; this, in a second phase of the reaction, becomes iodyhdrate of monomethylated dimethylophenylamine, or xylidine, which in its turn is ultimately converted into iodhydrate of trimethylophenylamine, *i.e.* of cumidine. The essential character of the reaction is thus seen to be an intramolecular change in the position of the methyl groups. According to the duration of the process, there are incorporated in the benzol nucleus, first the methyl group of the alcohol iodide, and then successively the two methylic groups which are stationed in the ammonia fragments. The action of heat on the quaternary ammonium compound thus places at our disposal a simple means of rising from the benzol series itself to the toluol-, xylol-, and cumol series, or, generally (for the reaction may probably be utilised in many other cases), of passing from a less carbonated to a more carbonated series of compounds.

"New Method for producing Amides and Nitriles." By E. A. Letts, Berlin University Laboratory.

"Investigation of the Attraction of a Galvanic Coil on a small Magnetic Mass." By James Stuart.

Geological Society, Nov. 20.—Prof. P. Martin Duncan, F.R.S. vice-president, in the chair.—"On the Geology of the Thunder Bay and Shabendowan Mining Districts on the North Shore of Lake Superior." By H. Alleyne Nicholson, M.D. The author described the general characters of Thunder Bay, which is almost landlocked on the south-east by the bold promontory of Thunder Cape and a series of islands which form a continuation of this. The rocks immediately surrounding Thunder Bay belong to the "Lower and Upper Copper-bearing series" of Canadian geologists. The author described the general characters of Lake Shabendowan, and stated that from the foot of the lake for about 15 miles westward there is a succession of trappean rocks, beyond which, to the head of the lake, distant 13 miles, the country is occupied by Huronian slates like those between the lake and Thunder Bay. These slates extend for an unknown distance north-west of the head of the lake, and contain numerous veins, having an E.N.E. and W.S.W. direction, conformable with the strike of the beds, and some of them are auriferous. The vein-stuff is quartz containing copper pyrites; the gold is contained in the copper pyrites, or disseminated in very minute grains through the quartz. Several of these veins are being worked, and their peculiarities were noticed by the author.—"Note on the Relations of the supposed Carboniferous Plantants of Bear Island with the Palæozoic Flora of North America," by J. W. Dawson, LL.D., F.R.S. The author referred to Dr Heer's paper on the carboniferous flora of Bear Island (see Q. J. G. S. vol. xxviii. p. 161), and stated that the plants cited by Dr. Heer as characteristic of his "Ursa Stage," are in part representatives of the American flora belonging to what the author has called the "Lower Carboniferous Coal-measures" (subcarboniferous of Dana). He considered that the presence of Devonian forms was due either to the mixture of fossils from two distinct but contiguous beds, or to the fact that in these high northern latitudes there was an actual intermixture of the two floras. He dissented altogether from Dr. Heer's identification of these plants with those of the Chemung group, or with those of the Middle Devonian of New Brunswick. Mr. Carruthers stated that the list of the eleven Lower carboniferous plants published in Principal Dawson's "Acadian Geology" did not contain a single species found in Bear Island; but, on the other hand, some species and several well-marked forms were common to the Bear Island deposits and the Devonians of North America, and he had no doubt that Prof. Heer had in his paper rightly correlated these floras. As to the age of these plant-bearing beds, found alike in Bear Island, Ireland, the Vosges Mountains, Canada, and Australia, Mr. Carruthers said that it was difficult to draw any lines which would separate the Palæozoic plants into clearly-marked and distinct floras; but if the Devonian is to be retained as a system, all these plant-bearing beds belonged rather to that system than to the carboniferous.—"Further Notes on Eocene Crustacea from Portsmouth." By Henry Woodward. In this paper, after referring to his former communication on Crustacea from the Lower Eocene deposits at Portsmouth (Q.J.G.S., vol. xxviii. p. 90), the author gave a full description of *Rhachiosoma bispinosa*, one of the new species described in it, the materials being furnished by several fresh specimens, which show the whole structure of the animal. The new points include the description of the limbs, the anterior border of the carapace, the lower surface of the body in both sexes, and the maxillipeds. The author also characterised, under the name of *Litoricola*, a new genus of shore-crabs allied to *Grapsus*, from the same deposits. Of this genus he described two new species, *L. glabra* and *L. dentata*.—"On a new Trilobite from the Cape of Good Hope." By Henry Woodward. The Trilobite described in this paper is from the Cock's Comb Mountains at the Cape of Good Hope, and was preserved in a nodule, the impression retained in which, when broken, furnished the most instructive details as to its structure. Each of the eleven thoracic segments was furnished with a long median dorsal spine, giving to the profile of the animal a crested appearance; on each side of this the axis of the segment bears two or three tubercles, and the ridge of the pleura four or five tubercles. The tail is terminated by a spine more than half an inch in length, and all the spines are annulated. For this Trilobite the author proposed the name of *Encrinurus crista-galli*, although with some doubt as to the genus, the head being only imperfectly preserved.

PARIS

Academy of Sciences, Dec. 2.—M. Faye, president, in the chair.—The first paper was by M. de Saint-Venant on the division of the force due to a vibratory movement into those due to simple and isochronous oscillations, &c., and of the work due to the same composite movements, at any two moments, between the constituent movements.—M. Claude Bernard read a note in answer to M. Bouillaud's paper on animal heat. He states that the latter author, in asserting that the arterial blood in the heart is warmer than the venous, has disregarded numberless experiments which prove the direct contrary to be the case. To this M Bouillaud replied, defending the theory of the heat of the body actually being formed in the lungs by the combustion in them of carbon compounds in the blood, this being Lavoisier's original theory, which he defends.—A letter from Father Secchi on the meteors of Nov. 27 was then read; from 7 30 P.M. to 1 A.M. 13,892 meteors were observed. MM. Is. Pierre and Ed. Puchot read a paper on certain observations on the laws deduced from the boiling points of the members of homologous series. The authors find that the rise in boiling point for each addition of $C H_2$ is not so regular as is supposed.—M. A. Caligny read a paper on the "Theory of the Sluice of L'Aubois," a paper

relating to canal works, and M. Thém Lestiboudois one on the structure of heterogenic vegetables. The section of the paper read related to heterogeneous monopetalæ. After this M. Dupuy de Lôme read a note on the preservation of the material of a "screw balloon."—A report on M. Felix Lucas's memoir on the general theorems of the equilibrium and movements of material systems was then read, and followed by a note by M. Marès on the utility of a permanent scientific institution in Algeria. M. H. Resal read a note on the relation between the pressure and the volume of steam which expands in producing work without the addition or subtraction of heat.—MM. E. Mathieu and D. Urbain read a paper on the part played by gases in the coagulation of milk and in producing muscular rigidity. The authors believe these effects to be due to oxidation.—Anatomical researches on limules, a note by M. Alph. Milne-Edwards, was next read, and followed by a description of a new method of treating intermittent fevers, by M. Déclat. A feature in this treatment is the administration of small doses of carbolic acid.—Communications on the *Phylloxera* from M. A. Laliman and M. A. Vidal were sent to the commission on *Phylloxera;* a note on the tertiary formations of Lormandieres, by M. Delage, was referred to a special committee; and notes on aerostation from MM. Billet, Braconnier, Deppe, and Chamard were sent to that commission.—A copy of the Janssen-Lockyer Medal was sent by the Minister of Public Instruction.—M. A. Laussedat then read a note on the prolongation of the French meridian into Spain and Algeria.—M. Mannheim described a model of a vernier to a vernier, and M. Gramme read a note on the application of his magneto-electric machines to electrotype and the production of light. He asserts that his machine produces greater effects than Wilde's well-known instrument, though driven at one-eighth of the speed.—M. Becquerel presented a note by M. E. Jannettaz, continuing his observations on the connection between cleavage planes, cohesion axes, and axes of thermic conduction in crystals.—M. Th. du Moncel presented the continuation of his paper on the currents produced in a telegraphic wire, one end of which rests insulated in the air.—M. A. Treve read a note on Magnetism, in which he describes some experiments on magnetic induction.—M. Balard presented a note on a new brominated ether, by M. P. Schützenberger. The formula of the new body is stated to be $(C_4 H_{10} O Br._3) 2$. It is crystalline, very deliquescent, and heated to 70° to 80° disengages hydrobromic acid in large quantities and decomposes. M. Malhe described the manufacture of a neutral soap by exposing ordinary soap to carbonic anhydride.—MM. Rabuteau and Papillon read a note on the Therapeutic effects of Sodic Silicate. They believe that it is likely to be of great use in certain skin diseases. M. Picot's second note on the "Antifermentescible" properties of the same salt followed; he has used it with great success in cases of blenorrhagia.—M. A. Bechamp then read a note on certain of M. Pasteur's recent communications on ferments, a long contribution to the controversy, which has now nearly worn itself out, and followed it up with a joint communication of his own and M. Estor on M. Pasteur's paper of the 7th of October. M. P. Champion read a note on a substance extracted from a Chinese Champignon. The fungus is that known to the Chinese as Fouh-ling (*Pachyma pinctorum*). The author proposes to call the extract pachymose. It somewhat resembles starch, and its formula is $C_{20} H_{24} O_{28}$.—M. Claude Bernard presented a paper on the number of the Blood Corpuscles in Mammalia, Birds, and Fish, by M. Malassez. The author calculates that in the mammalia the number varies from 3,500,000 per cubic millimeter to 18,000,000; in man it is about 4,000,000. In birds the number is much less, from 1,600,000 to 4,000,000. In fish the osseous fishes have 700,000 to 2,000,000; the cartillaginous, 140,000 to 230,000. M. Larrey presented M. G. Le Bon's paper on some experimental researches on the Treatment of Asphyxia; which was followed by a note by M. L. Vaillant on the value of certain characters used in the Classification of Fish; and by a note on the larval form of the dragon-flies, by M. A. Villot.—A note by M. F. Pisani on a new vanadiferous-silicoaluminate of manganese from Salm Chateau, Belgium, was then read. The mineral contains 1·8 per cent. of vanadic acid, and in composition resembles masonite.—M. Daubree presented a paper on the superior Jurassic formations of the department of L'Herault, by M. Bleicher. M. Stan. Meunier read a paper on the lithological analysis of the meteorite of the Sierra de Chaco, Chili; and on the mode of formation of logronite.—M. Le Verrier communicated a long list of observations of the meteoric shower of the 27th November from various observers.—A note on the same subject was received from M. Malinowski.—M. Champouillon communicated some experiments on the effects of borax and sodic silicate on malt; his results confirm those of M. Dumas. M. Sacc communicated a note on the colouring matter of the red carrot the colouring substance is insoluble in water, slightly so in alcohol, more so in ether. In the carrot it exists to the extent of not more than one part in 1,000.—M. Roenler described a method for reversing drawings for the engraver.—M. Prunières sent a note relative to the researches in lake Saint-Andéol (Lozère); he believes that the rest of the structures ascribed to man there found are those of beavers.—Mdlle. Chenu sent two notes on the "Functions of the Great Sympathetic" and on a method for the observation of the ganglionic nervous system, after the reception of which the session was adjourned.

BOOKS RECEIVED.

ENGLISH.—A Manual of Palæontology: H. A. Nicholson (Blackwood and Sons).—The Ocean, Section I. and II.: E. Reclus (Chapman and Hall).—Elements of Chemistry, Part I., 5th edition: W. A. Miller (Longmans).—Zoological Mythology, vols. I. and II.: A. de Gubernatis (Trübner).

DIARY

THURSDAY, DECEMBER 12.

ROYAL SOCIETY, at 8.30.—A Contribution to the Knowledge of Hæmoglobin: E. Ray Lankester—On the Structural Elements of Urinary Calcule: Dr. H. V. Carter.—Researches in Spectrum Analysis in connection with the Spectrum of the Sun. No. I.: J. N. Lockyer, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—On a Celtic Tumulus in Kent: C. Knight Watson, M.A.

LONDON MATHEMATICAL SOCIETY, at 8.—On Geodesic Lines, especially those of a Quadric Surface; and on the Mechanical Description of certain Quartic Curves by a modified Oval Chuck: Prof. Cayley.—Note on the breaking up of the Inharmonic-ratio Sextic: J. J. Walker.—On a Deduction from Standt's Property of Bernoulli's Numbers: J. W. L. Glaisher.

FRIDAY, DECEMBER 13.

ASTRONOMICAL SOCIETY, at 8.

SUNDAY, DECEMBER 15.

SUNDAY LECTURE SOCIETY, at 4.—On the Ear, and how we hear: John S. Bristowe, M.D.

TUESDAY, DECEMBER 17.

LONDON INSTITUTION, at 4.—On Elementary Physiology: Prof. Rutherford.

ANTHROPOLOGICAL INSTITUTE, at 8.—Origin of Serpent Worship: C Staniland Wake.—The Garo Hill Tribes: Major Godwin-Austen.—The Kojahs of Southern India: Major Godwin-Austen.—Primosdial Inhabitants of Brazil: Capt. Burton and M. H. Gerber.

WEDNESDAY, DECEMBER 18.

SOCIETY OF ARTS, at 8.—On Russia, her Industries, Commerce, and Means of Communication: Prof. Leone Levi.

GEOLOGICAL SOCIETY at 8.—Further Notes on the Punfield Section: C. J. A. Meyer.—On the Origin of Clay-Ironstone: J. Lucas.—On the Coprolites of the Upper Greensand Formation, and on Flints: W. Johnson Sollas, St. John's Coll. Camb.

ROYAL SOCIETY OF LITERATURE, at 8.30.

THURSDAY, DECEMBER 19.

ROYAL SOCIETY, at 8.30.

LINNEAN SOCIETY, at 8.—On the General Principles of Plant-construction: Dr. M. T. Masters, F.R.S.

CHEMICAL SOCIETY, at 8.

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