THURSDAY, JANUARY 6, 1887

SCIENCE AND THE JUBILEE

THE year of Jubilee has come, and on all sides we hear of proposals to make it memorable in one way or another. It is right that the completion of fifty years of such a glorious reign as that of the present Queen should be celebrated by all kinds of noble effort, and the more the future greater well-being of the Queen's subjects is considered in those efforts, the more lasting such memorials will prove. But, so far, the word Science has scarcely been mentioned either in summing up the progress of the nation during the last fifty years, or in considering how science should have its place among the memorials by which this year is to be marked out from among its fellows.

This is not encouraging; still less encouraging is it that at the beginning of such a year the progress of science in this country finds itself jeopardised in a serious manner. According to rumour part of Lord Randolph Churchill's famous "plan" was to increase his reputation not only by crippling our national defences but by paralysing all those efforts to spread science broadcast in our land for which the Science and Art Department and other kindred organisations, such as the British Museum, are responsible. To effect any large economy in this direction science schools must have been swept away, science classes crippled, science scholarships abolished, and science museums cast into the limbo of ineffectiveness.

Truly the politician's trade is a curious one; for, supposing the rumour to be well founded, and that all these things had been proposed, what then? In a week the common-sense of the country would have found out that the Government which could sanction such measures was out of touch with all true progress. But suppose, further, that they were permitted to be carried out; we should just be where we were fifty years ago in many things which by common consent lie at the root of all true national progress. It is lamentable, indeed, that even yet the Philistine is so rampant among us, and that those to whom the nation looks for good government and light and leading know so little about our actual needs.

Indeed, it must be frankly conceded that in these matters our nation is fifty years behind others. Nay, more: we must possess our souls in patience for yet another fifty years: for not till then, as things go, it is to be feared, will the average politician know the *rôle* which science plays in modern progress, and the stern necessity there is, if we are to hold our own among the nations, that scientific instruction must be enormously extended.

Turning now to another matter which is engaging much attention in connection with this memorable year, we must confess to a feeling of disappointment in connection with the proposals for an Imperial Institute which we printed last week (p. 210). The Committee who drew up the Report, on which, no doubt, action will soon be taken, have undoubtedly avoided many errors into which they would have fallen had they followed much of the advice which has so freely been tendered to them; but we think that they have missed their mark in great measure, for the reason that the Committee too much resembles the play of "Hamlet," with the Prince of Denmark omitted. It did not please the Prince of Wales to nominate any official representative of science upon it. We do not forget that the Committee had the advantage of numbering Sir Lyon Playfair among its members, but he was not there as an official representative of science, and, had he been, such representation would have been numerically insufficient. As it is, it is not difficult to surmise that many of the best suggestions contained in the scheme are his, and this makes us regret the more that he was there single-handed.

In our view, there is room for an Imperial Institute which might without difficulty be made one of the glories of the land, and which would do more for the federation of England and her colonies than almost any other machinery that it is possible to imagine. But it must be almost exclusively a scientific institution. Its watch-words should be "Knowledge and Welcome." England, through such an institution, should help her colonies in the arts of peace, as she does at present exclusively in the arts of war. In an Imperial Institute we can imagine the topography, the geology, the botany, and the various applications of science and the industries of Greater Britain going hand in hand.

This year is not only the 50th anniversary of the Queen's accession, but it is the 800th anniversary of Domesday Book. Let the Imperial Institute be the head-quarters of a bigger Domesday Book; let all knowledge be there accumulated concerning the growth of England's children during the last 800 years; let the knowledge be complete, and so arranged that what comes from each quarter shall throw light on all. Those who know how matters stand best, will see that in the case of many of our colonies this knowledge does not exist; then let it be the proud duty of the Imperial Institute to get it. We have colonies in which are large stretches of country teeming with mineral and botanical wealth where no surveyor, or botanist, or geologist has ever trod. Let the Imperial Institute bring about the arrangements by which they may be sent; we have men engaged upon all these works at home. We can imagine no greater service rendered to the science of this country than that those engaged upon its various surveys should enlarge their experience by that "travel, travel, travel" upon which Sir Charles Lyell insisted. The presence of such men for a few months in those colonies where surveys have not already been established would be of inestimable advantage on both sides; and if the system were at work for a few years it would be found that there is no more necessity for a colony, unless it prefers to do so, to establish the whole mechanism of a Geological Survey and a Topographical Survey for itself than there is for it to establish an Admiralty or a War Office.

We would by no means limit this scientific outlook to surveys merely. Take the present condition of Barbados as a case in point. Barbados must either start some new industry or she must starve. This new industry must depend upon new knowledge. We take no steps to help Barbados with our brain power, as if it was not our concern; but if Bridgetown were under the guns of a foreign fleet, the whole money and muscle power of the Empire would, if necessary, be at her disposal.

We have said enough to indicate the general direction in which we believe the Imperial Institute can do the noblest

work, and can make itself felt more and more as years roll on, and we believe that if the future governing body of the Institute is a truly representative one, that is, if science is properly represented on it, by such men as the President of the Royal Society, the Directors of the Royal Gardens and of the Geological and Topographical Surveys, that such functions as those we have suggested will be obvious.

To turn now to another part of the scheme, the Report wisely suggests that the new Emigration Office should form part of it. With this we cordially agree. But the return current must be provided for. Those who have lived in England's colonies and dependencies know best the intense home feeling, and in many cases the stern necessity there is of close contact with the mother country. Let the Imperial Institute be England's official home of her returning children, the Hall in which she officially welcomes them back. Let them here find all they need, and let information and welcome be afforded with no stinted hand.

Along the two large lines we have indicated, we believe that there are efforts to be made which could only be effective as connected with such an institution as an Imperial Institute, and we believe that they are more germane to its functions than some of the minor utilities shadowed forth in the Report.

The Committee has certainly made out its case in favour of South Kensington. And it will be generally conceded that, if the Institute has for its chief objects the binding together of the various developments of science and art in the mother country and her colonies into one homogeneous whole, the Commissioners for the Exhibition of 1851 would be perfectly justified in making the valuable gift to the Institute which is referred to in the Report. We shall not follow the *Times* in gibing at South Kensington. To us South Kensington means the Science and Art Department, with its schools, museums, and laboratories, and the Natural History Museum; and we know that these institutions have had no more to do with the various shows there during the last few years than they have with the services of the Oratory, with which they are also geographically associated.

It is with several unpleasant reminiscences connected with these shows still in our minds that we are somewhat doubtful of that part of the Report which refers to the exhibitions of various Imperial products, and we believe the only safeguard possible, if they are really instituted, would be that they should be open free to the public like the National Museums.

HISTORICAL GEOLOGY

The Student's Hand-book of Historical Geology. By A. J. Jukes-Browne. (London: George Bell and Sons, 1886.)

GOOD wine needs no bush, but every prudent vintner will carefully abstain from hanging out a sign calculated in any way to convey to the passer-by the impression that the liquor to be obtained within is of inferior quality. If authors were equally cautious, we should not see, as in the case before us, a good book disfigured by a frontispiece, to say the least, not calculated to produce a favourable impression on the mind of one who opens the work for the first time. The plate in question is a fanciful representation of what some one has imagined may have been the distribution of land and sea during the Carboniferous period. It depicts the present bed of the North Atlantic as then occupied by a broad tract of continental land. Now, when we picture to ourselves a long tongue of land running out, during Carboniferous times, from Scandinavia across the Highlands of Scotland and on to the north and west of Ireland, we are well within the bounds of legitimate speculation. The arguments in favour of such an hypothesis are too well known to need reproduction here. Again, when we look at a geological map of North America, and note how the great central tract of Palæozoic formations is even now hemmed in on the north and east by a belt of Archæan rocks, we are indulging in no improbable supposition if we infer that, during Palæozoic times, the eastern Archæan strip extended further to the east than now, and that from it was derived part of the material for the formation of the rocks of the Palæozoic basin. But it is obviously quite another thing if, on the strength of these two highly probable suppositions, we proceed to fill up the whole of the intervening ocean. It is a puzzle to our mind to imagine on what grounds any one can pretend to know what was the condition of things in mid-Atlantic so far back in the earth's history, and any attempt to lay down such a map as figures in the frontispiece to the present volume seems to be about as striking an instance as can be found of the unscientific use of the imagination.

Luckily a very slight acquaintance with the book itself will dispel the unfavourable impression likely to be created by its frontispiece, but the introduction of this map has permanently impaired the usefulness of the present edition, because the money spent on it would probably have sufficed to furnish a number of illustrations of real value, which are very much wanted. The book contains careful descriptions of the physical geography of the British Islands at different geological periods, but mere verbal accounts of the distribution of land and sea are hard to follow; and if each had been accompanied by a small outline map the value of these really important descriptions would have been more than doubled.

To pass to our author's treatment of the several formations. In the case of each he begins with a general sketch, in which he explains, among other matters, the grounds on which the formation was established and received a distinctive name; then follows a summary of the life of the period, illustrated by woodcuts of rather unequal execution; after this he proceeds to detailed stratigraphy, describing the minor subdivisions and the lithological character of their rocks at the principal localities where the formation has been studied; and he concludes with restorations of the physical geography of each period. Detailed stratigraphy in a work of the present size must necessarily be very condensed; and it is a question whether under this head an attempt has not been made to be too encyclopædic. In his nomenclature the author perhaps shows some weakness for new names; the restorations of old physical geography seem to be accurate and cautious, and as successful as they can be made without illustrative maps.

In the account of the Archæan rocks he displays a caution and a freedom from dogmatism and partisan

feeling which it is much to be wished were more general among the students of this nest of obscurities.

In the oldest Palæozoic rocks (we hardly dare name them, for no nomenclature can be adopted without bringing a storm about one's ears from some quarter), Prof. Lapworth's triple nomenclature is adopted. It would be a comfort if the term "Ordovician" could meet with general acceptance, for there would then be a chance of our knowing what any author meant by Cambrian and what by Silurian, without long and wearisome inquiry as to what camp the said author attached himself to. Our author's weakness for new names, we think, shows itself in the Silurian subdivisions. It is by no means obvious why our old friends "Ludlow" and "Wenlock" are to be displaced by "Clunian" and "Salopian." We had thought, too, that it was generally admitted that the old "Tilestones" and "Downton Sandstone" had no business in the Ludlow group, and that they had better be placed by themselves as "passage beds" between the Silurian and Old Red.

In his treatment of the Devonian the author displays commendable caution. He reproduces on p. 158 a fanciful attempt to correlate the minor subdivisions of the marine Devonian and lacustrine Old Red, but admits that it requires "further examination." There is also a good summary of the recent researches of Prof. A. Geikie and Prof. Hull on the Old Red of Scotland and Ireland. Here, and generally, the book is well up to date.

There are some rather serious objections to be made to the chapter on "The Carboniferous System." The Lower Coal-measures and Millstone Grit are stated to be "partly marine," the Middle and Upper Coal-measures to be "fresh-water." Now, whatever reasons there may be for calling the Lower Coal-measures and Millstone Grit marine in part, apply to the Middle Coal-measures as well. Marine shells occur in the Millstone Grit and Lower Coal-measures; but every one who has looked at the question with a critical eye takes careful note of the fact that they are the exception, not the rule, for they are found only in a few thin bands. Marine shells occur also in the Middle Coal-measures, but here again they are confined to a few thin bands. In short, throughout the bulk of the beds classed as Millstone Grit and Coal-measures, fossils unquestionably marine are strikingly conspicuous by their absence; but from bottom to top, with perhaps the exception of the very uppermost Coal-measures, we every now and then come across a thin band containing, often in great abundance, fossils that are certainly marine, and some of them Carboniferous Limestone species. The inference surely is that the Millstone Grit and Coal-measures are in the main estuarine or fresh-water, but that every now and then the sea broke in and flooded the basin in which they were formed. There are other considerations, too long to be reproduced here, which seem to lead to the same conclusion. They are summarised in "Coal, its History and Uses" (Macmillan, 1878), pp. 50-53. It is hardly fair, however, to blame our author for any shortcomings he may have been guilty of in this matter. He has evidently followed Prof. Hull, and knowing, as he doubtless does, what unrivalled opportunities Prof. Hull has had for studying the Carboniferous rocks, it was only natural that he should look upon him as a trustworthy authority. But when Prof. Hull's statements and tables come to be analysed, they break down sadly. In his general table of the British Carboniferous Series (*Quart. Journ. Geol. Soc.*, xxxiii. 615), we read: "Middle Coal-measures (fresh-water and estuarine). Marine species rare." "Ganister Beds. Essentially marine. Fossils marine." Perfectly true, but only half the truth. Marine species are rare in the Middle Coal-measures, but they are rare in the Ganister Beds also; in both equally they are absent from the bulk of the formation, and are found only in certain bands, always thin, and few in number. This latter fact, which seems to us to be of the utmost significance, is unluckily overlooked by Prof. Hull. Again, in his tabular summary of Carboniferous Mollusca, Prof. Hull has marshalled what looks like a formidable list of marine forms in the column for the Ganister Beds, while only comparatively few occur in the column headed Middle Coal-measures. But against this we have to set off the fact that the marine shells of the Ganister Beds come almost exclusively from beds such as ironstones and the roofs of coals which have been largely worked; while, with I think one exception only, the marine shells of the Middle Coal-measures are not found in beds economically valuable, and therefore largely explored. It is only an additional instance of the truth that there are two ways of looking at statistics, the one arithmetical, and the other rational, and that the purely arithmetical aspect is always full of risk.

Two very interesting borings into the Permian, or, as our author prefers to call them, Dyassic, beds are quoted on p. 239. But it is hardly right to say that the Middlesbrough boring shows beds "not found anywhere along the outcrop." The "Magnesian Limestone, 52 feet, and Grey Limestone, 15 feet," may well be the "Brotherton Limestone" of the Yorkshire section on the opposite page; and the "gypsum, rock-salt, and marl" beneath, fit in exactly with the "Middle Marls" of Yorkshire. In the Scarle bore-hole the great thickness near the base of the Permian of beds largely sedimentary ("shales and dolomites, 193 feet") indicates that we are here approaching the eastern shore of the lake in which the Permians of the north-east of England were accumulated. It seems to us that perhaps rather too much stress is laid on the unconformity between the Permian and Carboniferous. It is marked enough, of course, in the north-east of England, but elsewhere, as in North Staffordshire and Denbighshire, it does not seem to be an easy thing to say exactly where the Coal-measures end and the Permian begins. Now it is, to say the least, worth notice that, in those localities where the unconformity is strong, the Upper Coal-measures are absent or only feebly represented; but that where we find Upper Coal-measures in force, the unconformity is less strongly marked, and perhaps in some places there may be no unconformity at all. Can this be the explanation? In some places, the north-east of England for instance, the absence of the Upper Coal-measures is not due to denudation; there never were any Upper Coal-measures there. What may be called the Upper Coal-measure period was in these localities not a period of deposition, but of upheaval and denudation among the Carboniferous rocks; and so, when, later on, the formation of Permian rocks began, these rested on upturned and largely

denuded Carboniferous beds. Elsewhere, as on the west side of England, there was no break of this kind, but sedimentation went on continuously, or with but very slight interruption, from Carboniferous into Permian times, and there is what practically amounts to a passage from Carboniferous into Permian rocks.

There is one very healthy sentence in the chapter on "The Dyas." "There is no proof that the red rocks" (of the English Permians) "are as a whole older than the limestones, and the notion of their being so is a mere assumption founded on their lithological similarity to the German Rothliegende." If the author had said "fancied similarity," it would have been still more to the point; but it will be most useful to have clearly stated that this correlation, so dear to the pigeon-hole systematists, has nothing to rest upon.

Before concluding, we would call attention to three omissions which it seems desirable to notice. In the account of the Lower Oolites of the Yorkshire coast there is no mention of the marine band discovered by the Geological Survey and named the Ella Beck Bed (*Memoirs* of the Geological Survey, explanation of Quarter Sheet 95, N.W., p. 33). This is a very small matter; but we think it is very much to be regretted that no word has been said, in the account of the Cretaceous rocks, of the southern type of that formation, the Hippurite Limestone, and that in the description of the Tertiary rocks the Nummulitic formation is also passed by in silence. The book is primarily a book on British geology, but in cases, like that of the Triassic rocks, where the British representatives are abnormal or exceptional, the author has not hesitated to take his readers to foreign localities where the normal type is found. Now surely the rocks of the Anglo-Parisian Cretaceous basin are decidedly exceptional in their character, and were formed to a large extent under very special conditions; and the best way to enforce this truth on the reader is to introduce him to the beds of the same age deposited elsewhere in a less special manner. The large range too of the Hippurite Limestone gives it precedence over the deposits laid down in what was after all only a biggish and somewhat land-locked inlet of a western ocean. And the same thing may be said, even with more emphasis, of the Eocene beds. What an imperfect idea any one would have of the physical geography and events of that period who knew only the littoral and estuarine representatives found in the London and Paris basins. If space were an object, it would have been better to have omitted many things which now find a place in the book than to have passed over two such formations as the Hippurite and Nummulitic Limestones. For instance, it seems to be a fixed article of faith that every geological text-book must contain an account of the Permians of the Thüringerwald, a little isolated group with a very special character of their own, and with little or no bearing on British geology, but, as has been said, dear to the pigeon-holers. The omission of the account of this group, and of one or two similar sections of the book besides, would have left ample room for all that need have been said about the two great formations mentioned above.

Such little flaws as have been noted seem to be present in the structure of what, on the whole, will prove a most useful book. If any of the suggestions we have made commend themselves to the author's judgment, we trust he will soon have an opportunity of acting upon them in a second edition. A. H. GREEN

PHOTOGRAPHS AND DESCRIPTIONS OF WILD ANIMALS

Wild Animals, Photographed and Described. Illustrated by Phototype Reproductions of Photographic Negatives taken from Life. By J. Fortuné Nott, Major, Canadian Active Militia. (London: Sampson Low and Co., 1886.)

THE author of this splendidly printed volume, while disclaiming the idea that it is an erudite or scientific work on natural history, assures us that his object in writing and compiling it was to furnish some trustworthy information about some few of the most important varieties of existing wild animals, and to do this in an entertaining and readable manner. The works at present in existence on such a subject may be classified, the author thinks, into the "scientific" and the "educational": the former are, in great measure, incomprehensible to the general reader; the latter have their value to the same class of reader greatly spoiled by the taint of levity that characterises the style in which they are written. When a bear is talked of as "Master Bruin," and a lion as "His Majesty," the dignity of the subject is compromised.

This being so, Mr. Nott thought there was room for a book which "would accurately describe the salient features, distinguishing peculiarities, and specific habits" of wild animals, and that by dropping, as far as possible, all scientific descriptions and the general use of scientific nomenclature, and adding certain historical facts or interesting anecdotes in which they prominently figured, he could make such a volume readable and entertaining.

It is, however, obviously impossible that any one man could personally be familiar with the habits of all of our larger animals, and the author has borrowed a good deal from the works of travellers that "have appeared within the last few years, rather than from similar works of previous dates, wherein fable and truth are so blended that they were practically useless" for his purpose.

Respecting the illustrations of this volume, the author has attempted a new departure. Instead of illustrating his book with portraits of animals taken by artists, which often represent rather the artists' ideas of what an animal ought to be than what the animal really is, he has had photographs of these wild beasts made, and illustrates the volume with phototype reproductions of these. He apologises for the photographs, owing to the difficulties encountered. It is difficult to get human beings to sit properly for their portraits, but wild animals must be taken often in darkish dens, and are not amenable to orders to keep quiet and look their best.

To our mind, these photographic illustrations are the more important portion of this volume, which, from its fine type and paper, and wealth of illustration, is likely to become popular. The photograph of the lion is excellent. This beast, as our author would call him, has behaved extremely well under the trying ordeal, and has "come out" first-rate. The group of zebras form a pretty picture. The photographs of the giraffe, hippopotamus, and red kangaroos are characteristic. The text calls for little

comment: we have descriptions of a large number of familiar wild animals, and in these the author has undoubtedly avoided as much as possible being at all scientifically exact. In our opinion the work would have gained in value and interest, and as an "educational" work, if the author had taken care, when he had to use scientific phrases, that he did so with some meaning. Thus it appears odd, to say the least, to read: "The bears, genus Ursidæ, belong in natural history to the sub-order Carnivora"; and that the kangaroos belong to the genus Macropodidæ. It would not have required a large knowledge of logic or science to avoid such mistakes.

Most of the photographs are from animals in the London Zoological Gardens, which will give a special interest to the volume.

OUR BOOK SHELF

First Year of Scientific Knowledge. By Paul Bert. (London: Relfe Brothers, 1886.)

THIS is an English edition of a little book which made M. Paul Bert's name familiar to a vast number of persons in France who knew nothing of his eminence either in science or in politics. As the title indicates, it is intended for children beginning to study science, and we know of no book better adapted for this purpose. It is a book of great merit both in style and selection of subjects. The more experimental sciences are treated as their nature demands—practically; the experiments are simple, and few will find any difficulty in performing them.

The illustrations constitute one of the special features of the book, for a diagram often conveys more meaning than a whole page of print. The language throughout is clear, and everything is simply yet accurately explained. As an example we may refer to p. 333, where the popular fallacy respecting the so-called "respiration of plants" is disposed of:—

. . . "Thus, simultaneously, in the same plant, two opposite phenomena take place: the production of carbonic acid by the parts that are not green, and consumption of carbonic acid by those that are green. Only, the latter activity being much more powerful than the former, the plant not only does not augment the proportion of carbonic acid in the air, but consumes what it finds there. . . . The decomposition of the carbonic acid by the green parts is quite the reverse of respiration, and bears a much closer resemblance to digestion."

The general character of the book leaves little to be desired.

La France en Indo-Chine. Par A. Bouinais et A. Paulus. (Paris: Challamel Ainé, 1886.)

THE important events of the last few years in Annam, Tonquin, and Cambodia have given rise to a quantity of literature in France, relating to this region, which has now reached enormous proportions. French periodicals of all kinds are full of papers relating to it, and new books on the same subject have been issued in many scores during the past three years. Every department of research is represented—historical, scientific, literary, antiquarian, industrial, commercial, &c. If this great flood represents, as it undoubtedly does, the keen interest taken by the French people in the countries with which they have now so close a connection, it is none the less embarrassing to foreign readers who desire to obtain a general and accurate survey of Indo-China. Amid the host of works, good, bad, and indifferent, now issuing from the French press on this region, and on every conceivable topic connected with it, it is difficult to select one which contains all that is wanted by the ordinary cultivated person, who desires to have some knowledge of countries which have been the theatre of events that have moved Europe profoundly. At last MM. Bouinais and Paulus have produced such a book. Capt. Bouinais has served long in Tonquin, and is actually a member of the Frontier Delimitation Commission, and Prof. Paulus, of L'Ecole Turgot, though, we believe, he has never visited the country, has made it a special study, and has laboured to popularise a knowledge of it in France. The two authors have already published a very much larger work on the same subject, of which the present one appears to be an abridgment intended for wider circulation and more general information.

Perhaps the most satisfactory manner of reviewing a work such as this, which covers a large and varied field with brevity, is to describe shortly its arrangement and contents. The first chapter refers to the geography, orography, hydrography, and climate of Indo-China, including in this term French Cochin China, Cambodia, Annam, and Tonquin. The second chapter deals with the history of French intercourse with these regions, commencing, properly speaking, with the cession to France of Tourane Bay and Pulo Condor in 1787, a cession which was due to the management of Pigneau de Béhaine, Bishop of Adran *in partibus*. All the interesting and exciting incidents of the occupation of Saigon, the Garnier and Philastre missions to Tonquin, and the events succeeding the death of Rivière down to the death of Courbet and the peace with China, are recounted with perfect clearness and accuracy. Next, the inhabitants are described, as well as the towns, and forms of religion prevailing in the countries. The aboriginal population is treated under the heads Moïs, Chams, and Muongs, a division which is perhaps sufficient in a book intended for popular reading, but which the authors themselves acknowledge to be wholly inadequate, as they refer also to "savages inhabiting the mountains," the phrase usually employed by the Chinese when speaking of a people about whom they know nothing. The ethnological questions connected with the Moïs, Muongs, Chams, and the unnamed "savages" can scarcely be answered for many years to come; but they are amongst the most interesting ones connected with ethnology in the Far East. The origin and relationship of these and other scattered fragments of once powerful peoples, not in Indo-China alone, but in Upper Burmah, and all over China south of the Yangtsze, did not come within the scope of MM. Bouinais and Paulus's work, although the latter shows how little is known about them when they are all classed indiscriminately as "savages of the mountains." The fourth chapter deals with productions, trade, and communications, and the fifth with the administration in each of the countries mentioned. Finally comes a chapter on the future, a political forecast, to which we need not refer further. The work, it will be seen, goes over the whole field, and, as far as we have been able to check the statements, it is very accurate. As there is no English book on the subject, this may be recommended to readers who desire to know something of the new region which is but now being brought into close contact with Europe. Whether the French are a colonising or only a conquering people, though much debated, is a question with which we are not concerned here: what is beyond all question is that no effort is spared by the Government or the public to acquire that first indispensable requisite of all good and intelligent government, viz. a knowledge of the country and people to be governed. No expense is considered too great, no labour too burdensome, to obtain this knowledge. In this respect they set an example which one more successful colonising nation at least might well follow.

My African Home. By Eliza Whigham Feilden. (London: Sampson Low, 1887.)

IN 1852 Mrs. Feilden and her husband went to Natal, where they remained for five years. On her return to

England her letters were restored to her, and in the present volume she has arranged them in chronological order, with extracts from her journal. The book contains a mass of petty details in which few readers will find much to interest them; but there are also some very good sketches of the scenery of Natal and of the rough, free-and-easy life of the colonists. Mrs. Feilden was much impressed by the fertility of the soil, and by the beauty of the vegetation with which she was surrounded. "As for fruits, vegetables, and flowers," she wrote, "you have only to put the seeds and young plants in the ground and they grow. There is no end of season in Natal." She remarked that there were not many native fruits, but that all that were imported seemed to suit the soil and climate. The native flowers she considered "very exquisite." They "grew in great variety and luxuriance, with the waxy look of hot-house plants." As for birds and insects, the air teemed with them. Of the Caffres Mrs. Feilden formed a very poor opinion. "The Caffre is indolent; he lives only like the beast, to eat and sleep, and pass through life with ease; but to do this he must have his land tilled, and to purchase wives to till his land he must have cows to pay for them. He sells his daughters to be drudges to other Caffres, while the boys and young men go out to work for the white man, till they can in turn buy cows and wives." Even Caffres, however, have one good quality: "they heartily share anything they have with each other, and eat out of the same pot without the least feeling of who shall have most." To Mrs. Feilden they seemed to be rather like Jews, and she asks whether they may not be descendants of Ishmael or an offshoot from the lost tribes—from which it may be inferred that in the list of subjects she has tried to study ethnology has not yet been included.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Coal-Dust Theory

UNDER the title of "A New Mining Danger," the *Yorkshire Post* of the 16th ult. published its final report on the proceedings at the inquest on the bodies of twenty-two men and boys who perished in an explosion at Altofts Colliery, Normanton, on the 2nd of October last.

The inquest was commenced immediately after the explosion, but was adjourned until the workings could be sufficiently re-opened to admit of a careful examination being made into all the circumstances. It was resumed and concluded on the 13th, 14th, and 15th of December. The witnesses, including Mr. F. N. Wardell, Her Majesty's Inspector of Mines for the district, were unanimously of opinion that the explosion was originated by the firing of a shot in the stone or rock constituting the side of one of the main thoroughfares of the colliery, which was also a main intake airway; and they were of opinion that it had expended part of its energy in raising and igniting a cloud of coal-dust, which formed the nucleus whence the explosion was propagated.

The coroner in summing up agreed with this conclusion, and the jury returned the following verdict:—

"That the whole of the workmen killed, except Deakin and Lomax, met their deaths from an explosion of coal-dust, which originated in the west chain road, which explosion was caused by the firing of an unskilfully drilled shot by one of the men engaged in widening the road; and that Deakin and Lomax were suffocated by the stoppage of ventilation consequent on the explosion."

The coal-dust theory, which is discussed at some length in the Final Report of the Royal Commissioners on Accidents in Mines, postulates that coal-dust may not only serve to originate an explosion, under certain given conditions, but may continue to carry it on as far as the same conditions extend. The essential conditions appear to be: that the coal-dust be perfectly dry, in a very fine state of division, and fairly abundant in quantity; that the initial cause be a large flame expanding with sufficient force to propel the air rapidly in front of it, so as to raise a cloud of coal-dust; and, lastly, that the explosion take place in a confined space, such as the workings of a mine.

From the first this theory was intended to account for great explosions in mines, or accomplished facts, which seemed to be otherwise inexplicable. It has nothing to do with mines in which explosions have not taken place, except to point out a possible source of danger; and arguments opposed to it which are based upon the fact that all kinds of coal-dust are not equally inflammable are therefore obviously inapplicable. It was adopted by the Prussian Commissioners as being applicable to certain inflammable dusts in a minute state of subdivision, but not to others of a somewhat different chemical composition. In discussing the Camphausen explosion in NATURE (vol. xxxi. p. 13), I pointed out that the conclusions arrived at from a consideration of the experimental results obtained with Camphausen dust by the Prussian Commissioners, fell far short of the actual occurrence in the colliery, and that the same relation would probably obtain in the case of all the other dusts experimented with, provided all were made equally fine.

MM. Mallard and Le Chatelier, whose conclusions were accepted by the French Commission, of which they were members, rejected the coal-dust theory, and endeavoured to reason away all apparently confirmatory arguments drawn from the consideration of actual explosions in mines.

In this country it has been accepted by some of the Inspectors of Mines, and more particularly by Messrs. W. N. and J. B. Atkinson, who uphold it vigorously in their treatise on "Explosions in Mines," which was recently reviewed in NATURE (Nov. 4, 1886, p. 1) by Prof. Thorpe. It appears also to have found favour with a number of mining-engineers and colliery managers, both here and abroad. There seems, however, to be some doubt as to how far it was accepted by the Royal Commissioners on Accidents in Mines, and I shall therefore quote their own words on the subject:—

"In emphasising this claim (Proc. Roy. Soc., vol. xxxvii. p. 43), Mr. Galloway does not appear to have realised the fact that, *if dust were the principal agent* in coal-mine explosions, *every* blown-out shot occurring in a *very* dusty and dry mine should actually be attended by a more or less disastrous explosion or conflagration, and that, looking therefore to the enormous amount of powder expended in shot-firing in this and other countries, and to the not inconsiderable proportion which blown-out shots must constitute, in many localities, of the total number of shots fired, disastrous coal-mine explosions should be of more than daily occurrence, if his view were correct."

I submit that the conclusion here stated is not deducible from the premiss; and in support of this position I adduce the fact that coal-dust is *admitted* to have been *the principal agent* in two of the most disastrous explosions of the present year, namely, those of Mardy and Altofts collieries, in both of which shots were fired. Altofts Colliery alone is sufficient to prove the case against the Commissioners, for it has been in operation for twenty-one years, and shot-firing has been carried on in it during the whole of that period. If, then, blown-out shots constitute a "not inconsiderable proportion" of the whole, there is a probability amounting to a certainty that such shots must have been fired in Altofts Colliery many times without the results here postulated having been attained until now. The argument as made use of against my own views appears therefore not to be in accordance with ascertained facts.

It may be safely maintained, therefore, that every blown-out shot does not fulfil the whole of the conditions necessary for creating an explosion. For instance, the dust may not be present in sufficient abundance within reach of the flame; it may not be fine enough to ignite at the point where the shot explodes; it may contain too much foreign matter, or be covered with coarse rubbish, or be locally damp; the shot may be too high, or too low, or pointed in an unfavourable direction; the direction and velocity of the passing air-current may exercise some influence on the result; the creation of a nucleus of explosion may in certain cases be facilitated by the previous formation of a cloud of coal-dust to windward, raised by another

shot (as imagined by the late Prof. Marreco and Mr. D. P. Morrison), or by a fall of roof, a train of mine waggons that has just passed, or any other accidental circumstance, and subsequently carried past the mouth of the shot-hole at the instant the flame issues from it."

Immediately after the passage quoted above the Commissioners proceed to say :—

"The following facts relating to the part played by dust in coal-mine explosions may, however, now be regarded as conclusively established :—

"1. The occurrence of a blown-out shot in working-places *where very highly inflammable coal-dust exists in great abundance*, may, even in the total absence of fire-damp, possibly give rise to violent explosions, or may at any rate be followed by the propagation of flame through very considerable areas, and even by the communication of flame to distant parts of the workings where explosive gas-mixtures, or dust-deposits in association with non-explosive gas-mixtures, exist."

"2. The occurrence of a blown-out shot in localities *where only small proportions of fire-damp* exist in the air *in the presence of even comparatively slightly inflammable or actually non-inflammable, but very fine, dry, and porous dusts* may give rise to explosions the flame from which may reach to distant localities, where either gas accumulations or deposits of inflammable coal-dust may be inflamed, and may extend the disastrous results to other regions."

This has the appearance of conceding all that is asked, but when read in the light of the first quotation it leaves the matter in considerable doubt. Indeed, it was stated at the inquest on Altofts explosion that the proprietors of that colliery had not gathered from the Commissioners' Report that they were running any risk of an explosion, such as the one that happened ; and at the inquest on Elemore explosion, which has been adjourned until the 18th inst., Mr. Lishman, the manager, gave utterance to similar sentiments. Be this as it may, it is obvious that legislative measures ought to be adopted without further delay, with the object of rendering the recurrence of coal-dust explosions impossible for the future. In providing against them it must also be recollected that a local explosion of fire-damp, such as the one which originated Mardy explosion, produces exactly the same result as a blown-out shot fired under the most favourable conditions imaginable.

Cardiff, January 5 W. GALLOWAY

The Cambridge Cholera Fungus

IN your issue of December 23 (p. 171) appears a letter from Dr. E. Klein, in which that gentleman attempts to show that the micro-organisms found by Dr. Graham Brown, Mr. Sherrington, and myself in the substance of the mucous membrane of the small intestine in cases of *Cholera asiatica* are nothing more than "common mould (probably aspergillus)," which has grown on and into the tissue during the process of hardening. We were and are, however, perfectly well acquainted with the fact that imperfectly preserved animal tissues are liable to be invaded by various forms of fungi, and took, therefore, precautions which we believe to be ample to prevent such contamination of our material. Moreover, the presence of the micro-organisms in certain parts of the tissues only, their absence in others or on the surface of the specimens, the fact that their presence in the part is accompanied by anatomical changes which could not have taken place during the process of hardening, and, most of all, the characters of the micro-organisms themselves, render such an hypothesis as that brought forward by Dr. Klein absolutely unacceptable.

It is unnecessary for me to answer all the arguments advanced by Dr. Klein in support of his views on this subject. They prove nothing more than that fungi grow on and in animal tissues which are not adequately preserved—a fact which no one will doubt. That, on the other hand, the micro-organisms found by us are of this nature is a matter which neither Dr. Klein nor any other person who is unacquainted with the facts is in a position to decide. Since a short preliminary account only of the work done by Dr. Graham Brown, Mr. Sherrington, and myself, on the pathology of cholera has as yet been published, Dr. Klein has not before him the facts on which alone a decision of any value is possible. CHARLES ROY

Pathological Laboratory, New Museums, Cambridge
December 30, 1886

An Error in Maxwell's "Electricity and Magnetism"

THE criticism of Mr. McConnel upon Maxwell's derivation of the inductive action of currents from the principle of energy is perfectly correct. It is inconsistent with the experimental facts appealed to by Mr. McConnel and Mr. Maxwell's own treatment of the field as the seat of electro-kinetic energy.

In the excellent treatise of Messrs. Mascart and Joubert, a similar misleading appeal is made to Helmholtz's proof, and I have little doubt that Maxwell has correctly stated it. I should be inclined to think that the existence of the energy of the field was not distinctly present to Helmholtz's mind.

Maxwell, as is well known, by an ingenious application of Lagrange's equations of motion, proves that, in the case of two currents, this electro-kinetic energy T_e is given by the equation—

$$T_e = \tfrac{1}{2}(L_1 i_1^2 + M i_1 i_2 + L_2 i_2^2),$$

where $M = \int\int \frac{\cos\epsilon}{r} ds ds'$ taken round both circuits, and L_1 and L_2 are similar expressions for the separate circuits.

I believe, though I dare not trespass upon your space to give the reasoning *in extenso*, that this result may be obtained somewhat more simply and without the use of the Lagrangean equations, a treatment which has the disadvantage of assuming the electric co-ordinates y_1 and y_2, the currents being $\dot{y}_1$ and $\dot{y}_2$. Then the equation of energy becomes

$$A_1 i_1 + A_2 i_2 = \frac{dT_e}{dt} + \frac{dT_m}{dt} + R_1 i_1^2 + R_2 i_2^2,$$

where T_m is material kinetic energy, and $\frac{dT_m}{dt} = i_1 i_2 \frac{dM}{dt}$ supposing the circuits rigid. Therefore

$$A_1 i_1 + A_2 i_2 = i_1 \left\{ \frac{d}{dt}(L_1 i_1 + M i_2) + R_1 i_1 \right\} + i_2 \left\{ \frac{d}{dt}(L_2 i_2 + M i_1) + R_2 i_2 \right\},$$

reducing to Mr. McConnel's equation, when the currents are constant.

In the case of two circuits thus moving in connection with their batteries we may infer that A_1 and A_2 must be such functions of i_1 and i_2, and the coefficients of configuration, that, when the suffixes are interchanged in the expression for A_1, that for A_2 must result, and *vice versâ*. If this be so, then the aforesaid equation necessitates the separate equations—

$$A_1 = \frac{d}{dt}(L_1 i_1 + M i_2) + R_1 i_1 ;$$

$$A_2 = \frac{d}{dt}(L_2 i_2 + M i_1) + R_2 i_2.$$

Or Maxwell's equations are obtained without the use of Lagrange. HENRY W. WATSON

Berkeswell Rectory, near Coventry

The Manipulation of Glass containing Lead

IN a note on this subject in NATURE (Dec. 16, p. 150), Mr. H. G. Madan has made a suggestion which is likely to be very valuable to those who require to manipulate "combustion-tubing" before the blow-pipe. But, in proposing the employment of oxygen in place of air to produce flames for heating glass containing lead, Mr. Madan introduces a refinement which is unnecessary ; for lead-glass may be quite as easily manipulated in flames produced by plain air and gas as soda-glass itself. The pointed flame should be employed for small objects, and the oxidising brush-flame in the case of larger objects. By the oxidising brush-flame, however, I do not mean the brush-flame as ordinarily employed, but one to which the air is supplied liberally through an air-tube without any contraction at its end, and at a steady pressure from a good blower ; care being taken, on the other hand, not to introduce such an excess of air as to reduce the temperature of the flame.

In his note, Mr. Madan quotes me as saying, in the "Methods of Glass-blowing," that the reduction of lead-glass may be prevented or remedied by holding the glass a little in front of the visible flame, with the comment that there is hardly enough heat in that region to do all that is required in the manipulation

of the glass. I hope he will excuse me if I point out that in this he hardly does me justice; for, although words in the above sense are to be found on p. 18, they occur only towards the end of the preliminary treatment of the subject, attention is at once called to the objections to the method, and they are followed by a full account (with references to diagrams) of the method of adjusting the supplies of air and gas so as to produce flames *within which* lead-glass may be sufficiently heated without reduction.

I have ventured to trespass on your space to this extent, because, for various reasons, I have come to the conclusion that lead-glass is distinctly the best glass for beginners to work with, and therefore I am anxious to correct the widespread and mistaken idea that its manipulation is very difficult, and requires special appliances. W. A. SHENSTONE

Clifton, December 28

Pyrometers and Fusion-Points

I READ with much interest the letter from Naples of Dr. H. J. Johnston-Lavis, and beg to offer a few suggestions in answer to his inquiries. I have done much work with pyrometers, and for my purposes have used Siemens's water pyrometer with satisfaction.

It occurs to me, however, that the pyrometer most suitable for the volcanic lava investigations proposed by Dr. Johnston-Lavis would be either Siemens's electrical pyrometer, or the one recently introduced by Messrs. Murries and Co., 45, West Nile Street, Glasgow. It would seem that, with the latter, observations can be readily taken at a considerable distance from the pyrometer, so that the pyrometer stem might possibly be lowered into the crater, and readings of the internal temperatures taken at various depths, and possibly of the contained lava also.

With regard to the fusing points of various substances, reference may be made to the recent careful researches on this subject of Dr. Thomas Carnelley and Prof. W. C. Williams. THOS. ANDREWS

Wortley Iron Works, near Sheffield, January 4, 1887.

Electricity and Clocks

THE exact combination about which Mr. Wilson inquires is already in existence: it can be seen at 2, Garfield Buildings, Gray's Inn Road, in the Jensen electric bell factory. The arrangement used by Mr. Jensen—and it seems to me preferable to that suggested by Mr. Gardner—is to cause the hammer of the small clock to make electric contact in the circuit of the distant large bell as it rises in preparation for striking the blow upon its own small bell. With a rubbing contact the action is perfectly certain. SILVANUS P. THOMPSON

City and Guilds Technical College, Finsbury

Barnard's Comet

ON December 25, about 6h., with a binocular field-glass, power about 4, I noticed a third tail to this comet between the other two. It was extremely faint, but 6° long, reaching to 11 Aquilæ. The principal tail was reduced to 10° in length, and was far more conspicuous than this shorter, though much broader, tail. The shortest tail, though actually much brighter than this latter, was very indistinct with these field-glasses, being best seen with the telescope, power 20, whereas the middle tail was not distinctly visible therewith, although it showed an evident dark space immediately preceding the principal tail. With the naked eye I could see the long tail only. The head was about as bright as δ Aquilæ. T. W. BACKHOUSE

Sunderland, December 29, 1886

Meteor

I HAVE just seen a very beautiful meteor about the size of Sirius. The local time was within a minute or two of half-past 10. It started out between Pollux and the star-cluster in Cancer, and fell rather slowly in the direction of Regulus, going out before it reached that star. It had a trail, which vanished with it. The sky had just cleared after a thunderstorm.

Sidmouth, December 28 J. M. H.

Red Sunsets and New Zealand Eruptions

NEW ZEALAND eruptions have not the projectile force to cause red sunsets. Singularly, the very same current of ideas expressed by Prof. Newcomb in NATURE, vol. xxxiv. p. 340, occurred to the writer, when in Australian waters the June previous, on the deck of the P. and O. steamer *Ballaarat*, off the Great Bight, on noticing a peculiarly red northerly sunset. The newspapers at King George's Sound were full of accounts of the magnitude of the eruption of Tarawera, and it must be the fine dust from New Zealand that has passed overhead.

The atmosphere of Australia, it may be mentioned, is one of the clearest, "exceptionally free," as Prof. Newcomb puts it, "from vapours or other attenuated matter," and in which volcanic dust would tell immediately.

This suggestion disappeared at once on getting to the actual site of the New Zealand eruption, only six weeks after it had occurred, and on seeing the limited area covered with mud—a mere nothing compared with the vast stretch of country in the North Island passed through. As there was not a trace of its effects till within eight miles of the foot of Tarawera, it was simply ridiculous to suppose that any of the dust had invaded the higher atmosphere.

Besides this, the boundary of the cloud of atmospheric disturbance was distinctly seen, and the altitude placed by none of the spectators to be above 12,000 feet.

The explosion at Tarawera appears to have been merely one of superheated steam. It was different in the case of Krakatão, where the initial force had much more of the character of an explosion of nitroglycerine than of high-pressure steam, as the matter was stated to have been projected at least 40,000 feet into the air.

The magnitude of the New Zealand eruption could only be felt after getting well within the diameter of sixteen miles on which the mud fell, plastering hill and dale, evenly, of a dull gray, eighteen inches thick. Exterior to this it possessed none, and the distant results evidently were infinitesimal.

The writer also saw the "green sun" from the south of India, where it lasted for days, and has no doubt that this phenomenon was due to the dust from Krakatão, such an appearance having never been even faintly approached, before or since, from ordinary natural causes, and more impressive, because unaccounted for, than a total eclipse of the sun.

India, November 26, 1886 A. T. FRASER

THEODOR VON OPPOLZER

THEODOR VON OPPOLZER, one of the most eminent of modern astronomers, died at Vienna on December 26, 1886. He was the only son of Johannes von Oppolzer, the famous pathologist of Vienna, and was born on October 26, 1841. In accordance with the wish of his father, he studied medicine, and took his doctor's degree in 1863. From early youth he had shown great interest in astronomy, and, soon after taking his degree, he caused an observatory to be built at his own expense, and resolved to devote himself wholly to his favourite science. In 1866 he began to lecture at the University of Vienna, on theoretical astronomy, and he was soon promoted to the position of full Professor in his department. In 1870 he was asked by his Government to take charge of the operations for determining the length of a degree in Austria, and to this task he applied himself with so much energy that all the necessary observations were by and by completed, although his results have not yet been published.

Oppolzer distinguished himself in all departments of astronomical science. One of the most important of his writings was his "Lehrbuch zur Bahnbestimmung der Kometen und Planeten," a work which has already become classical. He had hoped to place the theory of the moon on a new basis, but his labours in connection with this subject were not finished at the time of his death. On his death-bed he corrected the last proof-sheets of his "Canon der Finsternisse," in which he calculates all the eclipses of the sun and moon which have taken place, or which have yet to take place, between the years B.C. 1500 and A.D. 2000.

His services to science were recognised by all the great learned Societies, and he was a Foreign Member of the Royal Astronomical Society of London. He was a man of a singularly noble personal character, and his death is deeply regretted by a wide circle of friends.

THE COLONIAL AND INDIAN EXHIBITION

CANADA.—This section of the Exhibition will be remembered chiefly for its agricultural machinery in motion, its fur, and agricultural trophies, and its large collection of furniture. The collection of fruits in the agricultural trophy has probably never before been equalled either in number, variety, or perfection of preservation, the colours of the several fruits being extremely well preserved in various solutions, such as dilute sulphurous acid for the lighter coloured fruits or salicylic acid for the darker ones. Besides these, however, there were numerous exhibits which, though less imposing to the general visitor, were of considerable interest, such, for instance, as the collection of timbers, and manufactures therefrom, photographs of American timber-trees, &c. The enormous sizes of many of the American Coniferæ were well illustrated by magnificent planks of such woods as the Douglas fir (*Pseudotsuga Douglasii*), some sixteen feet high and about ten feet in diameter, large slabs of hemlock spruce (*Tsuga canadensis*), also enormous logs of black walnut (*Juglans nigra*), and many others. Perhaps the most compact and interesting collection of timbers, however, was that from New Brunswick, where the woods were arranged so as to form a kind of design, the lower or basal portion being formed of trunks of trees, with their barks remaining, about three feet high, over this were arranged sections of the wood in frames composed of the young branches with the bark on; and above these, again, panels of the same wood as shown below, cut longitudinally and with a cross section at the base, both polished to show the grain or figure, and on the panel of each wood was painted a very good representation of a spray or branch of the plant itself. Each specimen was properly named, so that the whole thing was very complete. The series of photographs before alluded to are correct representations of the tree flora, each photograph being framed with the wood of the tree illustrated. The general use of the bark and wood of the cedar of British Columbia (*Thuja gigantea*), for useful and ornamental articles, was well shown in the exhibits of mats, native head-dresses, masks cut from the solid wood and grotesquely painted, spoons, whistles.

Fiji.—Though the space occupied by these islands was but small, the exhibits were of an interesting character, including a fine set of native timbers, for the most part scientifically named, and including some large blocks of Fijian sandalwood (*Santalum yasi*), roots of the kava (*Piper methysticum*), which is generally used in the Society and South Sea Islands in the preparation of an intoxicating beverage by chewing the root, ejecting the saliva into large bowls, and then fermenting it; or by pounding the root between two stones, then putting it into a bowl, pouring water upon it, kneading it, and afterwards straining it. The taste is said to be like that of soap-suds, but a liking for it is easily acquired, and it is said to quench the thirst better than any other beverage. A spirit prepared from it in Germany was sold in the Exhibition under the name of yagona or kava schnaps. This spirit, which is something of the nature of a liqueur, is described as having medicinal properties, and is recommended for its remarkable soothing and stimulant effects, restoring faded energies and exhausted nerve-power. Cocoa-nut fibre and oil of course form large staples of produce in Fiji, and were fully represented in the Exhibition, as well as dilo nuts and oil (*Calophyllum inophyllum*). Some excellent samples of sugar, grown and manufactured in the islands, and tea, also grown and prepared in Fiji, as well as many other products, were shown in quantity. Great credit is due to the Executive Commissioner, the Hon. J. E. Mason, for making the resources of his colony known by the distribution of small samples, during the period the Exhibition was open, to any one having a real interest in their development.

Victoria.—Besides the splendid collection of water-colour drawings of Australian plants exhibited on the north side of the Court, the fine series of Victorian woods, the golden arch, and the native encampments, all of which attracted a considerable amount of attention, the products of the genus *Eucalyptus* in the shape of oils and resins, exhibited by Mr. Joseph Bosisto, M.P., and President of the Commission, were amongst the most interesting and important. Samples of the oil of *Eucalyptus amygdalina*, rectified and non-rectified, were shown. This is the best quality of eucalyptus oil, and the oil for the preparation of which Mr. Bosisto's firm has become noted. A sample of the essential oil of eucalyptus of commerce was also shown, and described as being obtained from the allied varieties of *E. amygdalina*, but not from the true species. So many varieties of this species are known that it is difficult for bushmen who collect the leaves to distinguish those of the true species from its congeners, forming, as they often do, a compact jungle or bush growing in close proximity to each other. The oil is rubefacient, antiseptic, disinfectant, and a deodorant of great power. The essential oil of *Eucalyptus globulus*, the blue gum-tree of Victoria, having tonic, stimulant, and antiseptic properties, as well as those of *E. oleosa*, *E. dumosa*, *E. citriodora*, *E. goniocalyx*, *E. obliqua*, &c., were also shown. A sample of eucalyptol from *E. amygdalina* and *E. globulus* is described in the Catalogue as "a homologue of camphor, and appears to be two steps higher in the series. Its vapour, mixed with air, is agreeable when inhaled, and is employed as a therapeutic agent in bronchial and diphtheritic affections." Amongst resins were those of the red gum of Victoria (*E. rostrata*), described as a thoroughly soluble and delicate mucilaginous astringent, and *E. resinifera*, Australian kino. Fine samples of the resin of the Australian grass-tree (*Xanthorrhœa hastilis*) were also shown. This is obtainable in large quantities; it is of a deep amber colour, soluble in spirit, and is used for staining wood to imitate cedar and oak, and is also used in this country in French polish to deepen the colour of light mahogany and other woods.

New South Wales.—Minerals, wools, timber, and furniture made of the timber, were the principal objects exhibited. None of the woods called for any special remark except, perhaps, a small collection either known or considered to be adapted for wood-engraving, and these specimens were of little or no value in themselves, being badly selected, and in many cases much split or cracked. The collection was more valuable as giving a clue to the source of the woods considered suitable for engraving purposes than for any qualities of their own. Among the woods so exhibited were *Backhousia myrtifolia*, *Hymenosporum flavum*, *Xanthoxylum brachyanthum*, *Acacia Cunninghami*, *Duboisia myoporoides*, *Dysoxylon Fraserianum*, *Gmelina Leichhardtii*, *Hemicyclia australasica*, *Weinmannia rubifolia*, *Eugenia myrtifolia*, *Pentaceras australis*, and others. Amongst fibres and fibrous barks was the bark of the small-leaved nettle-tree (*Laportea photiniphylla*), also a fishing-net, cordage, and a dilly bag made from the fibre by the aborigines of the northern coast districts. The collection from New Guinea exhibited in this Court was of considerable interest. The utilisation of the bony seed shells of *Pangium edule* for decorating the skin drums is one not seen by us before. The seeds produce a rattling sound when shaken similar to those of *Thevetia nereifolia*, which are used for like purposes in British Guiana.

South Australia.—The centre of attraction here was undoubtedly the scene on the Murray River wherein the habits of the aborigines were depicted. Wool figured largely, and the applications of emus' eggs for a great variety of purposes were fully illustrated. A good collection of small specimens of the woods of the colony was shown, as well as a collection of fruits and seeds.

Western Australia.—A fine collection of the timbers of the colony was exhibited in this Court, and outside near the basin adjoining. The principal woods shown were jarrah (*Eucalyptus marginata*), and karri (*E. diversicolor*). Of the former, one of the principal attractions in the Court was a log, some seven feet long, over four feet in diameter, and weighing nearly five tons, carefully polished on one end to show the cross section, and in the middle to show the longitudinal structure. The wood has a very fine deep red colour, and "for the durability of its timber," Baron Mueller says, "is unsurpassed by any kind of tree in any portion of the globe." When carefully selected and dried, it is proof against the attack of teredo, termites, or any other wood-borers. It is consequently in great demand for jetties, piles, railway-sleepers, fence posts, and all kinds of underground work, as well as for planking and frames of ships. This fine block of wood, and a fine slab or counter-top of figured jarrah and other West Australian woods, have been presented to the Museum of the Royal Gardens, Kew. Amongst the plants exhibited as being used for tea by the natives were the following:—The leaves and flowers of *Verticordia pennigera*, known, it is stated, to the settlers in the earlier days of the colony, and used medicinally. The taste is said to be similar to Chinese tea. Another kind of native tea proved upon examination to be furnished by *Kunzea Muelleri*.

Queensland.—Of vegetable products exhibited from this colony the collection of woods was the most noteworthy, not only for the number of species, but for the care shown in their selection and preparation. The two enormous trunks of cedar (*Cedrela Toona*), each some fifteen feet high, and one with a girth of twenty feet five inches, will as long be remembered for their majestic size by those interested in tree growth as the number and brilliancy of the opals will be remembered by those interested in gems.

New Zealand.—Next to the collection of birds and minerals, the timbers of New Zealand held a prominent place, and the furniture made from the most important and beautiful woods, such as mottled kauri (*Dammara australis*), and totara (*Podocarpus totara*) was well illustrated. The beauty of these woods is so great that it is remarkable they should still remain comparatively unknown amongst cabinet-makers in this country.

Cape of Good Hope.—The centre of attraction in this Court was undoubtedly the diamonds and diamond-polishing. Of the vegetable products a collection of native medicinal plants was shown, and their uses were well described in the catalogue of Cape exhibits, and for the most part are to be found also in Pappe's *Floræ Capensis Medicæ Prodromus*. There was also a very fine collection of well-seasoned and polished wood slabs, amongst them being Outeniqua yellow-wood (*Podocarpus elongatus*), an extremely valuable, fine-grained wood of a light yellow colour, useful for furniture, planks, flooring-boards, beams, &c. One slab of this fine wood—which was almost entirely hidden during the Exhibition by a counter being built over it, and measures about twenty feet long by five feet in diameter—has been presented to the Kew Museum, together with a fine set of other Cape woods, many of which might become useful in this country were they better known, notably the stinkwood or laurel wood (*Oreodaphne bullata*), a dark-coloured wood much resembling walnut in appearance, but heavier and considerably stronger, so that it has been recommended quite recently for gun-stocks. In the colony it is very highly prized for nearly every kind of work connected with building and cabinet-making, being little inferior if not equal to teak in strength and durability.

Natal.—Raw vegetable products largely predominated in this Court. Sugar, maize, tea, and tobacco were the principal staples. The cultivation and manufacture of tea is a new industry for Natal, and the result is that an article of very good quality has been produced, Natal tea having been on sale during the period of the Exhibition and well spoken of, so that there seems every probability of a future trade in this article with Natal. Amongst tanning materials we noticed the root, both entire and broken, of the Elands Bontjis (*Elephantorhiza Burchellii*), which has attracted some attention of late as a valuable tanning material. Preserved native fruits, such as granadilla (*Passiflora maliformis*), papaw (*Carica Papaya*), amatungulu (*Carissa grandiflora*), and others, were exhibited, as well as a variety of hard woods, many of which were without scientific names.

West African Settlements.—Under this head was included the Gold Coast, Lagos, Gambia, and Sierra Leone. The exhibits consisted largely of raw products of both the vegetable and animal kingdoms, together with some native manufactures, such as textiles from indigenous palm fibre or grasses, carvings in wood, &c. Oil seeds were shown in variety as well as in bulk, and notable amongst them were the kernels of *Elais guineensis*, malukeh seeds (*Polygala rarifolia*), which only occasionally finds its way to this country, physic nuts (*Jatropha Curcas*), benni-seed (*Sesamum indicum*), and others as well known. Some very large balls of rubber were exhibited from Sierra Leone, and some fine masses of a kind of gum copal from the Gold Coast.

Ceylon.—Vegetable products abounded in this Court. On the walls were exhibited no less than 362 specimens of native vegetable drugs, got together by the Director of the Royal Botanic Gardens, Peradeniya. A very fine series of planks of the principal useful or ornamental timbers were exhibited, amongst them being tamarind, satinwood, ebony, calamander, and nedun (*Pericopsis mooniana*). The most attractive of the Ceylon woods is certainly calamander, but this is said to be now extremely scarce, and as it is of slow growth, the supply is very limited. Satinwood trees are common "in the northern, eastern, and north-western forests, but the proportion of these which yield 'flowered satinwood' is very small, and this description of wood is therefore comparatively high in price." Notwithstanding this scarcity of "flowered satinwood," several of the show-cases which contained the exhibits of tea, cardamoms, &c., and some of the barrels containing coffee, were of flowered satinwood. The Ceylon collection on the whole was one of particular interest.

India.—The extent of space occupied by our Indian Empire, and the varied and interesting character of the exhibits, will long be remembered. The contents of the art courts do not come within our notice, but there was sufficient material in the Economic Court for an extended notice. Space, however, will not allow us to say more than a few words on the unrivalled collection of the raw products of India—such a collection, indeed, as in all probability was never brought together at one time before. In such a collection it would be impossible to individualise any of the exhibits—those most striking, such as the bamboo bridge, will remain fresh in the memory—but it is in such details as the individual contents of the several shops that the interest of the economic botanist lies. To obtain any idea of the contents and value of the Indian Economic Court, we must refer our readers to the recently-issued "Special Catalogue of Exhibits," a large portion of which has been compiled by Dr. Watt, who had charge of the Economic Court during the Exhibition. This catalogue is a valuable and interesting record of one of the most important sections of the whole Exhibition.

We cannot close these notes without saying a word in commendation of the excellence of most of the catalogues, especially those of Ceylon and the Cape of Good Hope.

JOHN R. JACKSON

Museum, Royal Gardens, Kew

IPECACUANHA CULTIVATION IN INDIA

THE following note is from a letter which I have received from Mr. Gammie, who has charge of the cinchona plantations of the Bengal Government at Darjeeling. The facts are of considerable biological interest, as showing that amongst closely connected forms, which can scarcely be distinguished by palpable morphological differences, there may yet be unobvious constitutional distinctions which in the struggle for existence may determine the survival and ultimate dominance of some one form in particular.

The facts are also perhaps interesting in another way. To any one who will be at the pains to turn up vol. vii. of NATURE, p. 6, it will be amusing to see the sequel which the chance of circumstance has brought to one branch of a long-burnt-out controversy.

W. T. THISELTON DYER

Royal Gardens, Kew, December 13

"I don't think I ever told you the final results from our ipecacuanha-growing experiments, but do so now.

"Our original stock of plants came from Kew and Edinburgh—the great majority from Edinburgh. The few plants from Kew differed a good deal in appearance from the Edinburgh lot, which, again, differed greatly from each other. All the Kew plants were of one sort, which we named, from the start, the Kew variety. It was rougher in the leaf than the Edinburgh sorts, and not so strong-growing while under glass.

"After we had satisfied ourselves that we could make nothing of ipecacuanha, from a commercial point of view, we put all the plants out in the open, under shade, and let them take their chance. By this time we had all the sorts mixed up together; and as we had originally at least ten Edinburgh plants for each one of the Kew sort, and the Edinburgh lot had, besides, been much the stronger growers under glass, the Kew plants formed less than 5 per cent. of the whole. But very soon the Edinburgh sorts began to disappear, until, in the course of a year or two, there was not a single plant of one of the Edinburgh varieties alive, whilst almost every plant of the Kew variety lived. Of it, at the present moment, we have a good stock, and in one place, at 1400 feet elevation, under the shade of living trees, we have plants, which were put out many years ago, in the most perfect health, but unfortunately their growth has been so slow as to render the prospect of any profitable return from them almost hopeless. Still it strikes me that, in places geographically better situated for ipecacuanha-growing than Sikkim, this particular variety may succeed, although other sorts may have failed. Probably our ipecacuanha experiments may prove another instance of the folly of giving up the cultivation of new crops as hopeless until the most exhaustive experiments have been carried out. It may be that there are even hardier varieties of ipecacuanha than the 'Kew variety' to be found."

SUNSPOT OBSERVATIONS IN HUNGARY[1]

THE Observatory, of which the first volume of Publications is now before us, was founded by Cardinal Haynald in 1878 in connection with the archiepiscopal gymnasium at Kalocsa in Hungary. Preliminary geodetic operations, of special importance as supplying an independently determined point of reference for the Hungarian survey, with the examination and adaptation of instruments, cost much time and labour; so that only a fragmentary part of the energy of the establishment has hitherto been available for purely astronomical work. The Director, however, Dr. C. Braun, has wisely embraced the rule of concentration which governs most successful campaigns, and is hence enabled to present, in lieu of a multitude of scattered and perhaps useless observations, the connected results of four years' solar study, unpretending in aim, but thoroughly well executed, and developed with much clearness and not a little originality. The time, it is true, has somewhat gone by for visual solar work of the kind here described; and Dr. Braun, like all other astronomers, is getting ready his camera. Still, it is well worth while to consider what has been learned—even at a somewhat disproportionate cost of labour—by graphical delineation pursued through fifty consecutive solar rotations.

The instrument employed was the smaller of two excellent Merz refractors possessed by the Kalocsa Observatory. It is of four Paris inches aperture, is equatorially mounted, and appears to possess uncommonly fine definition. To its eye-end was fitted an apparatus invented and constructed by Dr. Braun himself, by means of which an image of the sun 22 centimetres in diameter was projected, after total reflection from a right-angled prism, upon a sheet of drawing-paper. In this way nearly 5000 drawings of spots were executed during the years 1880 to 1884. For their reduction two expeditious methods—one graphical, the other computative—were devised; and the resulting heliographical latitudes are rendered strictly comparable with those derived by English observers, through the application of a small correction due to a difference in the adopted elements of the solar rotation. Now that sunspot observations have become cosmopolitan, it seems indeed a pity that there should not be unanimity on this point among astronomers. Dr. Braun conforms, however, to the solar prime-meridian chosen at Greenwich, so that the longitudes given in his maps practically coincide with Greenwich longitudes.

The highest grade of accuracy was not aimed at in these observations. Their object was the collection of materials for studying the processes of spot-formation and the relation of spots to prominences, with side-glances towards a possible, but every year less and less probable, transit of "Vulcan." The determination of the solar rotational elements, or of the minute changes of latitude of spots, was left to observers provided with the means of executing refined micrometrical measurements. Nor was the estimation of maculated area attempted. Yet with all these limitations, much of interest remains to be gathered from the paper before us.

The results are portrayed in fifty maps, each representing the aspect of the sun's surface between the parallels of 40° north and south, during one synodical rotation. The indication of the solar meridians which on successive days were central at mean mid-day (Kalocsa time) renders it easy to trace the fluctuating appearance of the actual visible disk throughout each period. The maps further contain two long sinusoid curves—one denoting the heliographical latitude of that point on each meridian of which the position-angle on the east limb was 90°, the other showing the latitude of the points similarly situated on the west limb. Hence the position-angle of any given spot as it traversed either edge of the sun can at once be deduced—a datum obviously much facilitating inquiries into the connection of spots with prominences.

To each map corresponds a table, in which, besides the heliographical position of each spot, something of its history and peculiarities is set forth—the number of times it was observed, the epochs of its appearance and disappearance, with a general description of its size and shape. Especial interest attaches to a table in which Dr. Braun

[1] "Berichte von dem Erzbischöflich-Haynaldschen Observatorium zu Kalocsa in Ungarn." Von Carl Braun, S. J. (Münster i. W.: Aschendorff, 1886.)

has separately collected particulars of sixty-one spots, held, with more or less of probability, to have presented themselves afresh after making the circuit of the sun, and hence to be available as guides to the period and law of its rotation. From these data he constructed a curve (Plate XVI. Fig. 2) showing the variations in the rate of spot-displacement with varying latitude, the perfect symmetry of which on either side of the sun's equator testifies to the absence of any systematic difference in this respect between the hemispheres. From the curve were derived three distinct formulæ of the solar rotation, all fitting perfectly with the observations within the parallels of 30°, but diverging widely in their results for high latitudes. For example, No. I. gives for the region close to either pole a period of just 33 days; No. III. of a little over 40; No. II. of 55·8 days. From Carrington's formula, Dr. Braun deduces a polar period of 30·86 days; Faye's implies one of 32; Spörer's actually reverses the direction of change beyond the spot-zones, indicating a recovery of velocity towards the far north and south, and a period, in latitude 90°, of no more than 25·1 days—about the same which prevails in parallels of 10°. It may be worth remarking, as at least a coincidence, that almost precisely this rate of motion was inferred by Father Secchi (very doubtfully, it is true) from observations of relatively stable prominences near the pole. Nevertheless, a survey of the discrepancies tabulated by our author can hardly fail to inspire a profound distrust of empirical formulæ, and still more of the risky process termed "extrapolation."

The swiftest-moving spot noted by the Kalocsa observers was situated 1° 20′ north of the equator; its estimated daily displacement of 868′ bringing about the completion of its circuit in 24·88 days. The most sluggish was in south latitude 29° 38′, and gave a period of 26·5 days. As might have been expected, considerable irregularities are apparent; yet not more than might reasonably be set down to uncertainties of observation. A much higher degree of accuracy must, however, be reached before the mean rate of motion proper to each parallel can be at all satisfactorily ascertained. This mean rate is itself, in Spörer's view, subject to cyclical change; and his observations during the years 1861-1871, as compared with Carrington's during seven preceding years, disclosed persistent differences not easily accounted for. Dr. Braun's results, on the other hand, agree quite as well as could be expected with those of the English observer. A further complication is introduced by what may be called the individual caprices of spots. Each spot has probably a velocity of transport peculiar to itself, depending upon the circumstances of its origin; this velocity is certainly subject to accelerations connected with the processes of its development. These accelerations (for the change of motion is always in a *forward* direction) are shown, in Prof. Spörer's recent communication to the Physical Society of Berlin, to be very considerable; they are beyond question highly significant; yet they emphasise our disadvantage in being compelled to rely upon such unstable phenomena for all our knowledge regarding that most important datum—the rate of the sun's revolution on its axis.

The Kalocsa solar observations were made at a critical period. They cover the whole of the prolonged maximum which culminated near the close of 1883, and disclose or confirm very satisfactorily some of its characteristics. Dr. Braun has depicted in a remarkable curve the progressive changes in the mean latitude of the spot-zones during the years 1880-84. Their continuous approach to the equator at once strikes the eye; but superposed upon the line of uniform descent is a series of minor oscillations with a period of about a year, and an amplitude of fully 2°, which seem too regular and strongly-marked to be the mere effect of accident. This feature is quite novel and deserves attention.

The general rule that the long series of spots comprised within each cycle break out first in high latitudes, and become extinct close to the equator, was first observed by Carrington, and may now be regarded as fully established. Ordinarily, the maximum occurs when the mean latitude of the zones is 16° or 18°, the energy of the disturbance diminishing as they close further in. But the retarded character of the recent crisis was significantly attested by the fact that it did not reach its height until the closing in had proceeded much further than usual. In 1882, when the maximum was due, the average latitude of spots was (from Dr. Braun's curve) about 16°; whereas, at the close of 1883, when the maximum actually occurred, it was no more than 11°. It would seem as if the punctual and duly prepared completion of the outburst had been frustrated, and its stored-up energy spent upon an abnormal protraction of the maximum.

It might even be said that the perturbation thus indicated affected chiefly, or solely, the southern hemisphere of the sun. Although the respective sum-totals of spots observed at Kalocsa north and south of the equator eventually almost exactly balanced each other, large temporary discrepancies were manifest. The northern hemisphere displayed in 1880 an excess of activity, still more conspicuous in the ensuing year. Southern spots, on the contrary, outnumbered northern in 1882 to the extent of 8 per cent., and in 1883 in the proportion of nine to five. Dr. Braun adds the remark that each hemisphere would almost seem to have completed its cycle of change independently of the other, the northern maximum having occurred late in 1881, while the southern was postponed for two further years. The cause of perturbation should, in this view, be localised in the southern hemisphere.

A. M. CLERKE

NOTES

ON November 10 last, an important meeting of intercolonial delegates was held at the rooms of the Royal Society, Sydney, for the purpose of forming an Australasian Association for the Advancement of Science. There were delegates from all the principal scientific Societies of Australia, and they seem to have had no difficulty in arriving at a decision on the questions they had met to discuss. On the motion of the chairman, Mr. Russell, it was agreed that an association of the scientific Societies of Australasia should be formed under the name of "The Australasian Association for the Advancement of Science." It was also resolved that the rules of the British Association should be adopted, and that the first meeting of the Australasian Association should be held in Sydney in the first week of September 1888. This date was fixed because it will be the hundredth anniversary of the foundation of the colony of New South Wales.

Mr. H. N. RIDLEY, of the British Museum, intends to make an expedition to the island of Fernando Noronha for the purpose of investigating its natural history. The funds for the expedition have been supplied by the Royal Society, and Mr. Ridley hopes to be able to start at the end of February. The marine flora and fauna were collected by the *Challenger* Expedition, but owing to the fact that the island is a Brazilian penal settlement, no naturalists have hitherto been permitted to make collections therein. The Trustees of the British Museum have obtained from the Emperor of Brazil the necessary permission for Mr. Ridley's exploration of the island, which, from what little is known of it, and from its geographical position, promises to be of exceptional interest from a natural history point of view.

THE death is announced, at Victoria, British Columbia, of Dr. W. F. Tolmie. Dr. Tolmie's name has been favourably known to ethnologists for many years in connection with his researches respecting the Indian tribes of British Columbia and

neighbouring parts of the Pacific coast, where he has been almost continuously resident since 1833. Dr. Tolmie was a native of Inverness, but in 1832 accepted an appointment as medical officer to the Hudson's Bay Company at Fort Vancouver on the Columbia River, and subsequently became a chief factor in the Company's service. Information supplied by him to Mr. George Gibbs and other ethnologists has appeared in various publications. In 1884 he published, in conjunction with Dr. G. M. Dawson, a nearly complete series of short vocabularies of the principal languages spoken in British Columbia. He has had for many years a larger work in contemplation on the traditions and folk-lore of the same tribes, but the materials for it were not complete at the time of his death.

CHARLES SHALER SMITH, the distinguished engineer, died at his home in St. Louis, Mo., on December 19, 1886. He had been suffering from the effects of a fall, which resulted in serious injuries. From the first his case was considered very grave, but his great vital powers enabled him to keep up for two years.

MR. CLEMENT WRAGGE, late of Ben Nevis Observatory, and now of Adelaide, is to be appointed Meteorologist to the Government of Queensland.

YESTERDAY Prof. A. W. Reinold, F.R.S., delivered at John Street, Adelphi (the Society of Arts), the first of the usual short course of lectures adapted for a juvenile audience. The subject was "Soap Bubbles." The second lecture will be given on January 12.

THE lectures founded by Sir Thomas Gresham will be read to the public gratuitously on the following days, at Gresham College, Basinghall Street, in the subjoined order, beginning each evening at 6 o'clock:—Rhetoric (Mr. J. E. Nixon), January 18, 19, 20, and 21; law (Dr. Abdy), January 25, 26, 27, and 28; geometry (Dean Cowie), February 1, 2, 3, and 4; physic (Dr. Symes-Thompson), February 8, 9, 10, and 11; divinity (Dean Burgon), February 15, 16, 17, and 18; astronomy (the Rev. E. Ledger), February 21, 22, 24, and 25; and music (Dr. H. Wylde), March 1, 2, 3, and 4.

THE complaint is frequently heard that natural science does not get adequately encouraged in Oxford. Six weeks ago a notice was issued by Queen's College that an examination would be held on March 1, 1887, for the purpose of filling up various Scholarships and Exhibitions, including one Scholarship for mathematics and another for natural science. This notice was inserted in various newspapers, of which copies were sent to upwards of a hundred schools in England. The result is that *one* candidate has signified his intention of offering himself for examination in natural science. No doubt there will be at least ten candidates for the vacancy in mathematics, and twenty for each vacancy in classics. This certainly does not show a demand for natural science scholarships in excess of the supply.

ON December 9 the Council of the College of Surgeons adopted, and ordered to be entered on the minutes, a report from the Committee, recommending that the Committee's powers should be enlarged, with a view to the extension of the museum and the library, and the addition of work-rooms. It was also recommended that the Committee should receive power to take other improvements into consideration, and to inquire to what extent an increase of the staff would be rendered necessary by the proposed changes. The improvements, it is believed, would be paid for out of the Erasmus Wilson legacy. The scheme is likely to meet with some opposition, and before finally deciding on a matter of so much importance the Council would do well, as the *British Medical Journal* suggests, to submit its plans to the Fellows.

WE regret to notice that objection is being made in Hong Kong to the expense of publishing in the official gazette the Monthly Weather Reports of the Observatory there. These tables, which have frequently been noticed in these columns, contain the usual statistics of evaporation, radiation, the relative humidity and tension of aqueous vapour, the classification of clouds, and other meteorological details. The local critics say that these are of no practical value; but they surely forget that similar tables are published by every Observatory in the world. The Tokio and Siccawei establishments, to select two which are nearest to Hong Kong, publish periodically the same meteorological statistics, and it is therefore sincerely to be hoped that Dr. Doberck will be permitted to pursue his arduous and useful labours. The colony handsomely voted a sufficient sum for an Observatory a few years ago without question, and the work which it has since done is appreciated in Europe. Only a few weeks since we printed a paper by Dr. Doberck on the typhoons of the China seas, which was essentially and directly practical, for it told the mariner of the various classes of these storms, their direction, and course, and the time at which they are most prevalent. It further explained how vessels caught in these typhoons may best minimise or escape altogether from their evil effects. All this information, the value of which for the protection of life and property, can be appreciated nowhere better than in Hong Kong, with its enormous shipping trade, is obtained only by the careful and sedulous collection and collation of statistics. The physical position of Hong Kong renders its Observatory one of considerable importance in meteorological science, and it is the duty of the colonial Government to see that the institution is not allowed to decline from the high standard which it has already attained.

THE ideas of some Americans as to the education of women seem to be very far ahead of those which still prevail in this country. At Northampton, near Amherst, an observatory is being built by the Trustees of Smith College for young women. Mr. David P. Todd, Director of the Amherst College Observatory, has lately devoted much time to the plans for the construction and equipment of this building, taking care that it shall be thoroughly fitted for the purposes of collegiate instruction, and that it shall contain ample facilities for research.

A SOCIETY for the promotion of the higher education of women has been founded in Japan, under the presidentship of the Prime Minister, and with the support of various influential foreign and Japanese gentlemen. Besides regular courses of instruction which will be provided, special courses of afternoon lectures will be delivered by the professors of the University. The whole institution will be under the control of a foreign lady principal, assisted by two or more foreign lady teachers. Although female education in Japan has already reached an advanced stage, this appears to be the first attempt to provide for the higher education of women, as understood in European countries.

THE late Mr. Greenleaf, the Boston hermit, left the whole of his fortune—probably amounting to five hundred thousand dollars—to Harvard College. The conditions imposed by him are said to be not unreasonable, but it would have been better, as *Science* urges, if he had imposed no conditions whatever. Wealthy men who think of bequeathing money to learned institutions apparently find it hard to realise that the authorities of those institutions are likely to be the most competent judges of the way in which the money should be spent. The needs of Harvard College were certainly not so well known to Mr. Greenleaf as to its President and Faculty.

THE other day *Science* commented on the fact that advertisements calling for applications for vacant Chairs in leading educa-

tional institutions are often inserted in educational and literary journals in England. This is never done in the United States. There were no fewer than forty applications for a recent vacancy in a prominent American college, and if the appointment had been advertised, the number would no doubt have been very much larger. *Science* is of opinion that American colleges lose nothing by declining to follow the English example in this matter, since in the case of every important college "the president and trustees keep their eyes continually open, and when a vacancy occurs they are pretty sure to know who is the best man for the place, or, in any event, they have made up unconsciously a short list from which the selection is to be made." A distinct advantage of the American plan is that governing bodies are not troubled with the importunities of persons who wish to be appointed to positions for which they are wholly unsuited.

THE Wagner Free Institute of Science, Philadelphia, has issued a valuable report, by Mr. Angelo Heilprin, on his explorations on the west coast of Florida and in the Okeechobee Wilderness. Mr. Heilprin is of opinion that the whole State of Florida belongs exclusively to the Tertiary and post-Tertiary periods of geological time, and consequently, as a defined geographical area, represents the youngest portion of the United States. There is not, he thinks, a particle of evidence supporting the coral theory of the growth of the peninsula. Sedimentation and deposition along this portion of the American coast appear to have been practically unbroken or continuous, as is indicated by the gradational union of the different formations, and the absence of broad or distinct lines of faunal separation. The elevation of the peninsula, especially in its more southern parts, seems to have been effected very gradually, judging from the perfect preservation of most of the later fossils, and the normal positions—*i.e.*, the positions they occupied when living—which many of the species still maintain. There is evidence that before its final elevation a large part of the peninsula was for a considerable period in the condition of a submerged flat or plain, the shallows covering which were most favourably situated for the development of a profuse animal life, and permitted of the accumulation of reef-structures and of vast oyster and scallop banks. The present submerged plain or plateau to the west of the peninsula may be taken to represent this condition. Fresh-water streams, and consequently dry land, existed in the more southern part of the peninsula during the Pliocene period, as is proved by the inter-association of marine and fluviatile mollusks in the deposits of the Caloosahatchie. Mr. Heilprin holds that the doctrine of evolution receives positive and most striking confirmation in Florida, because the modern fauna of the coast is indisputably a derivative, through successive evolutionary changes, of the pre-existing faunas of the Pliocene and Miocene periods of the same region; and the immediate ancestors of many of the living forms, but slightly differing in specific characters, can be determined among the Pliocene fossils of the Caloosahatchie. He is also convinced that man's great antiquity on the peninsula is established beyond a doubt, and he suggests that the fossilised remains found on Sarasota Bay, now wholly converted into limonite, may represent the most ancient belongings of man that have ever been discovered.

AN interesting paper on the sub-genus Cylinder (Montfort) of Conus, contributed by Mr. J. Cosmo Melvill, M.A., F.L.S., to the tenth volume of the third series of Memoirs of the Manchester Literary and Philosophical Society, has been reprinted. Mr. Melvill has much to say about the *Conus gloria maris*. This exquisite shell is "prominent among all its kindred for beauty of shape and excellence of pattern;" and "the reticulations are so fine as to defy the skill of the lithographer." The land of its nativity is Jacna, island of Bohol, Philippines, where the late Mr. Hugh Cuming found two examples, one very juvenile, scarcely more than an inch in length. Mr. Cuming tried hard to find other specimens, employing all the available natives in dredging expeditions; but his efforts were unsuccessful. It is said that the original very circumscribed locality has been annihilated by an earthquake, and Mr. Melvill thinks that this is not improbable. Only twelve specimens are known to exist. Five are in this country, and one of them is in Mr. Melvill's collection at Prestwich. Another—perhaps the finest specimen known—is in the collection which belonged to the late Mrs. De Burgh, and three are in the British Museum collection at South Kensington. A good example was bought by Mr. Lovell Reeve in 1865 for the Melbourne Museum.

WE have received a "List of the Macro-Lepidoptera of East Sussex," compiled by Mr. J. H. A. Jenner, F.E.S., Lewes. It is reprinted from the Proceedings of the Eastbourne Natural History Society. East Sussex, according to Mr. Jenner, is probably one of the richest, in number of species, in the country. This he attributes to the southern latitude of the district and its varied characteristics—its downs, marshes, extensive woods and forests, and its sea-coast. Some parts of East Sussex have been well worked by entomologists, especially near the larger towns, but little is known of some of the outlying districts.

AMONG the numerous forms of fungus which live upon higher plants (many of which are so detrimental to their hosts) are some, it is now believed, which live with these on terms of mutual assistance. Frank found that the young root points of some of our forest trees, as the beech and the oak, are covered with a coating of fungus (probably belonging to the truffle or allied family), which seems to help in the nutrition of those trees. Another interesting case is that of fungi which live with orchids, and whose mode of propagation has lately been established by Herr Wahrlich (*Botanische Zeitung*). The fungus appears in the outer cells of the root tissue in the form of yellow bladder-like balls (of the nature of *haustoria* or suckers) surrounded by numerous filaments. It works no perceptible harm to the plant, but on the contrary it is thought that, especially in the case of orchids which live on the humus of woods, the fungus probably transforms the humus matters into such as are more easily utilised by the orchid, thus doing it a physiological service. The fungi observed by Herr Wahrlich belong to the family of *Pyrenomycetes*, and the genus *Nectria*.

THE amount of free carbonic acid in the ground has been lately shown by Prof. Wollny (we learn from *Naturforscher*) to depend, on the one hand, on the factors of decomposition of organic substances (heat, moisture, porosity), as affected by the physical nature of the ground and its covering; on the other hand, on the resistance which the ground presents, according to its mechanical state, to the escape of the gas. Ground-air seems to have most carbonic acid when the ground is at a slope of about 20°. Slopes facing south have most carbonic acid; those facing north, least, though the difference is not great, as the two principal factors, heat and moisture, largely counteract each other. In drought, ground facing north has more carbonic acid. With equal quantities of organic matter there is more carbonic acid, the more finely granular the ground; and such ground hinders movement of the gas downwards as well as into the atmosphere. The air in ground shaded by living plants has considerably less carbonic acid than that in bare ground, and in the latter it has less (in dry years, not in wet) than in ground covered by dead parts of plants.

IN lecturing upon the "Denizens of the Aqueous Kingdom" on Friday last at the Royal Aquarium, Mr. August Carter referred to deformities that exist among fish. In 1885 and 1886 he had examined many thousands of trout and salmon fry at South Kensington on their emerging from the ova, and found

one case of deformity in every thousand, and one case of monstrosity, such as twin and dual-headed fish, in every four thousand. From observations he had made at the South Kensington Aquarium and elsewhere, the lecturer concluded that certain fish, such as the carp and perch, have the power of communicating with one another.

WHILST collecting fish ova from the River Colne for the hatchery at the Delaford Fish Culture Establishment, the water-bailiffs found an "egg-bound" trout, that is, one that had died through being unable to extrude its eggs. It was brought to Mr. W. Oldham Chambers, who on examination found the ova to be thoroughly healthy, although the fish, judging from its decomposed state, must have been dead about three weeks. He at once obtained a milter, and succeeded in impregnating the ova, which appear to be quite healthy and capable of incubation. The spawning season has been greatly retarded by the extreme severity of the weather.

WE have received the first number of the *Cycling Budget*, the editors of which undertake to keep cyclists "thoroughly well posted in every imaginable topic which may be of service to them." There are to be careful analytical descriptions of every new or modified type of machine as it comes into the market. The *Budget* advocates the building of a club-house for cyclists in London. In America, it appears, there are magnificent club-houses for "the votaries of the pastime."

DURING the year ended October 31, 1886, the total quantity of steel and ingot iron made from phosphoric pig was 1,313,631 tons, of which 927,284 tons were ingot iron containing under ·17 per cent. of carbon. As compared with the make of the previous twelve months, there was an increase of about 368,314 tons. The total quantity produced represents about 394,000 tons of slag, containing from 30 to 35 per cent. of phosphate of lime. Most of the basic slag made in Germany is finely ground, and used in place of superphosphates.

M. ALFRED MARCHE, who has already been despatched on more than one scientific mission to distant regions on behalf of the French Ministry of Public Instruction, left Marseilles on the 19th ult., on a similar errand, for the Marianne Islands.

M. THOUAR'S expedition to solve the question of the navigability of the Pilcomayo, and its suitability as a trade route between Bolivia and the eastern parts of South America, has had to be postponed so far as the upper waters are concerned, owing to the refusal of the Bolivian Government at present to supply its share of the funds for the undertaking. Writing, however, from Suere on Octo'er 22, M. Thouar reports that the Bolivians have confided to him a mission of exploration in the same regions. He is to cross the Bolivian Chaco and survey it, with a view to discovering a land route for trade, and also to make a scientific investigation of the territory on the right bank of the Paraguay, directing especial attention to its capacity for cultivation and to the methods by which immigration should be encouraged. M. Thouar was to start on this mission about November 18.

THE *Annuaire pour l'An* 1887, issued by the Bureau des Longitudes, Paris, contains mu:h astronomical and other scientific information, arranged in a convenient form. The work is carefully edited, and has been considerably enlarged, by M. Loewy, one of the members of the Bureau.

THE current number of the *Memorie della Società degli Spettroscopisti Italiani* contains a good portrait of the late Alessandro Dorno, with a brief sketch of his career. Dorno was born at Asli on February 13, 1825. He had scarcely taken his degree at the University of Turin in 1848 when he was appointed Professor of Mechanics at the Military Academy there. In 1865 he was made Professor of Astronomy at the University of Turin and Director of the Observatory. Many papers by him appeared in the Transactions of the Turin Academy of Sciences, and he was a frequent contributor to the various scientific journals. In 1874 he took part in the scientific expedition to India for the observation of the transit of Venus. He died at the Villa di Borgo, San Pietro, near Turin, on August 19, 1886.

WE have received Parts 16-20 of the "Länderkunde des Erdteils Europa," which is being issued at Leipzig and Prague. This admirable work is edited by Dr. A. Kirchhoff, who has secured the co-operation of many eminent geographers. There are numerous illustrations, all of which are carefully executed.

WE print to-day an abstract of an excellent paper on "The Use and Equipment of Engineering Laboratories," by Prof. A. B. W. Kennedy, M.Inst.C.E., read at the ordinary meeting of the Institution of Civil Engineers on Tuesday, December 21, 1886.

WITH regard to the postscript to his letter on "Electricity and Clocks," in our last number (December 30, 1886, p. 198), Mr. Henry Dent Gardner writes to us that it is the weak spring, not the hammer, which should be kept away from a banking.

THE additions to the Zoological Society's Gardens during the past week include two Green Lizards (*Lacerta viridis*), a Slow-worm (*Anguis fragilis*), European, presented by Mr. R. M. J. Teil; a Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE ANDROMEDES, NOVEMBER 27, 1886.—P. F. Denza, writing in *Cosmos* under date December 2, gives the results of the watch maintained on the night of November 27 last at seven observatories distributed over the Italian peninsula. All the reports alike agree in showing that there was no repetition of the shower of 1885, the number of meteors observed being no greater than on an ordinary night, and of these the majority radiated from Perseus and Taurus, only very few from the radiant of the Andromedes. It follows, therefore, from these observations and those of 1873 and 1885, that the meteoric cloud giving rise to the shower is of comparatively small extent, but very dense. This fact tends to confirm the theory of the recent formation of the stream and of its origination in the disintegration of Biela's comet. The interval, thirteen years, between 1872 and 1885, corresponds to two revolutions of the comet; but the earth was in quite a different part of its orbit at the date of the intermediate return, and therefore no shower was witnessed.

THE REDUCTION OF THE POSITIONS OF CLOSE POLAR STARS FROM ONE EPOCH TO ANOTHER.—A paper containing a catalogue of 130 Polar stars for the epoch 1875·0, resulting from all the available observations made between 1860 and 1885, and reduced to the system of the Catalogue of Publication xiv. of the Astronomische Gesellschaft, has been communicated to the American Academy of Arts and Sciences by Prof. W. A. Rogers and Miss Anna Winlock. The first section of this work, giving an investigation of the methods of reducing the positions of close Polar stars from one epoch to another, has been published in the Memoirs of the Academy, vol. xi. part 4, No. 5. And Prof. Rogers chivalrously appends a note to the effect that his connection with the work is limited to the methods of discussion adopted, and to an examination of the numerical results obtained; and that beyond this all the work in the preparation of the paper has been done by Miss Winlock, who is entitled to all the credit therefor. By the laborious process of actual computation, taking the instance of Groombridge 1119—a star situated within 1° of the Pole, it is shown that it is impossible to obtain an exact agreement between the values of the precessional motion computed by Taylor's theorem and the corresponding values computed from the rigorous trigonometrical formulæ, in the case of such a star, when the time exceeds forty years. But it is also shown that the time at which the values derived from the development by Taylor's theorem begin to deviate from those derived from the rigorous formulæ may be extended many years by means of a secondary series, which represents the residuals

between the exact co-ordinates and those obtained with any assumed limit to the terms of the series. The application of this principle to the case of Groombridge 1119 is explained, and the formulæ formed for reducing the stellar co-ordinates to any date between 1875 and 1955, and also between 1875 and 1755. The results obtained by Miss Winlock will doubtless be very useful to astronomers discussing the positions of close Polar stars.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 *JANUARY* 9-15

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on January 9

Sun rises, 8h. 6m.; souths, 12h. 7m. 20·2s.; sets, 16h. 9m.; decl. on meridian, 22° 6′ S.: Sidereal Time at Sunset, 23h. 24m.

Moon (Full) rises, 4h. 11m.; souths, oh. 9m.*; sets, 8h. 3m.*; decl. on meridian, 18° 44′ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	7 4 ...	10 55 ...	14 46 ...	23 45 S.
Venus	8 42 ...	12 46 ...	16 50 ...	21 45 S.
Mars	9 19 ...	13 47 ...	18 15 ...	18 4 S.
Jupiter... ...	1 47 ...	6 52 ...	11 57 ...	11 28 S.
Saturn... ...	16 5* ...	0 10 ...	8 15 ...	21 55 N.

* Indicates that the rising is that of the preceding evening and the southing and setting each that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich)

Jan.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
9 ...	B.A.C. 2432 ...	6½ ...	19 6 ...	19 40 ...	106 175
10 ...	*f* Geminorum ...	6 ...	3 5 ...	4 9 ...	111 303
11 ...	54 Cancri	6½ ...	8 6	near approach	205 —
12 ...	18 Leonis... ...	6 ...	6 21 ...	6 55 ...	54 346
12 ...	45 Leonis... ...	6 ...	21 11 ...	21 50 ...	83 171
12 ...	ρ Leonis	4 ...	23 29 ...	0 30† ...	61 199
13 ...	49 Leonis... ...	6 ...	1 29	near approach	320 —

† Occurs on the following morning.

Jan.	h.	
9 ...	5 ...	Venus at greatest distance from the Sun.
9 ...	14 ...	Saturn in opposition to the Sun.

Variable Stars

Star	R.A. h. m.	Decl. ° ′			h. m.	
U Cephei	0 52·3 ...	81 16 N. ...	Jan.	11, 23	22	*m*
Algol	3 0·8 ...	40 31 N. ...	,,	13, 5	52	*m*
R Persei	3 22·8 ...	35 17 N. ...	,,	13,		*M*
λ Tauri	3 54·4 ...	12 10 N. ...	,,	9, 1	4	*m*
			,,	12, 23	56	*m*
U Monocerotis ...	7 25·4 ...	9 33 S. ...	,,	13,		*m*
V Cancri	8 15·3 ...	17 39 N. ...	,,	9,		*M*
W Virginis	13 20·2 ...	2 48 S. ...	,,	11, 5	0	*m*
Z Virginis	14 4·3 ...	12 46 S. ...	,,	14,		*M*
δ Libræ	14 54·9 ...	8 4 S. ...	,,	10, 19	15	*m*
U Coronæ	15 13·6 ...	32 4 N. ...	,,	13, 23	56	*m*
R Draconis	16 32·4 ...	67 0 N. ...	,,	10,		*m*
U Ophiuchi... ...	17 10·8 ...	1 20 N. ...	,,	9, 5	4	*m*
		and at intervals of		20	8	
β Lyræ...	18 45·9 ...	33 14 N. ...	Jan.	9, 23	0	m_2
			,,	13, 4	0	*M*
R Lyræ	18 51·9 ...	43 48 N. ...	,,	13,		*M*
S Delphini	20 37·9 ...	16 41 N. ...	,,	14,		*m*
R Vulpeculæ ...	20 59·4 ...	23 22 N. ...	,,	12,		*m*
δ Cephei	22 25·0 ...	57 50 N. ...	,,	11, 23	0	*m*

M signifies maximum; *m* minimum; m_2 secondary minimum.

GEOGRAPHICAL NOTES

THE latest news from Dr. Oscar Lenz is of much interest. Three letters have been received from him, the latest dated June last from Kasonge, a large Arab town, three days south-east from Nyangwe, on the Upper Congo. Dr. Lenz, it will be remembered, went out for the purpose of reaching Dr. Junker and Emin Bey. The latest rumours state that he has been compelled to abandon this object, and may therefore be soon heard of at Zanzibar. Dr. Lenz, in canoes furnished by the famous Tippoo Tip, journeyed up the Congo from Stanley Falls, taking fifty days by the way. This, however, included frequent stoppages. He found great changes had taken place since Mr. Stanley made his memorable voyage down the river ten years ago. Then there were few Arabs to be seen beyond Nyangwe, and the river over a great part of its length was peopled by natives, between whose villages the expedition had to run the gauntlet. Now Dr. Lenz finds the whole country practically in the hands of Arab and Zanzibari slavers and traders. The natives in many places have retired into the recesses of the forest, and large Arab settlements have taken their place at several points along the river. There is a constant traffic up and down the river between Nyangwe, or rather Kasonge, and Stanley Falls. Immense rice-fields occupy the swampy and unhealthy areas round these Arab settlements, and all round Nyangwe and Kasonge the country is covered with rice, and plantations of bananas and other fruits. Nyangwe is no longer the important centre it was in the days of Livingstone. It is an irregular collection of Arab settlements, covering a considerable area. Kasonge, three days' journey off further up the river, is, on the other hand, a large town, with broad streets and many well-built houses. This is the head-quarters of Tippoo Tip and other Arab traders, who have their agents for their ivory in Muscat and India. It is evident that we have here a great and increasing intrusion of a foreign element among the native population. In some cases the natives are on friendly terms with the Arabs, and in other cases hostile. At any rate the result will in the end be a very serious modification of the population over a great area of Central Africa, and a marked change in the face of the country by the introduction of rice and other exotic cultures.

MM. BONVALOT AND CAPUS, the French travellers in Central Asia, lately turned back by the Emir of Afghanistan, write to the French Geographical Society, giving some account of their recent journeys. They refer especially to the country between Teheran and Meshed, which they traversed in April last, and which, as they say, is so much frequented that no one thinks it worth while to observe its special features. They found it much cut up by broad rivers with pebbly beds, and irrigation canals which nourish the rare oases along the base of the Elburz Range. The travellers found themselves almost always in the steppe region, on the edge of an immense basin, the bottom of which is the "Khevir" or great salt desert. It is incrusted on the surface with a great quantity of saline crystals, especially soda and magnesia, which often spoil the water and render cultivation impossible. The flora, the fauna, and the geology are those of the steppe, and MM. Bonvalot and Capus make out that the region forms a geographical unit with Central Asia. Not a tree, not a bush even, unless a few garden fruit-trees, with willows and poplars along the canals, relieve the monotony of the country. From the bridge of Saugil to the Thian-Shan, going from west to east, such a thing as a forest is unknown.

HERR QUEDENFELDT, in a paper in the last number of the *Verhandlungen* of the Berlin Geographical Society, on a recent journey in Morocco, mentions a fact of some geographical interest. For more than two years a commission of three or four Spanish staff officers, with a colonel as chief, has been stationed at Tetuan, and have quite publicly been carrying out a topographical survey. They have in this way already surveyed a considerable part of the Garb region, as far as Tangier, Arsila, Laraish, Alkasar, and even Fez.

IN the December *Petermann*, Count Pfeil describes his journeys of exploration last year in the Ulanga and Ussagora regions, with a map. But the article which will attract most interest now—a melancholy interest in some respects—is the preliminary report of the late Dr. Fischer, on the expedition for discovering Dr. Junker; this, too, is accompanied by a map. Dr. Emil Jung continues his essay on the effect of the last Indian famine on the movements of the population, basing the discussion on the official census. A special part of the *Mittheilungen* has been issued, containing an elaborate and systematic index of the contents of the periodical for the ten years 1875-84, including ten annual volumes and eight supplementary volumes. By an ingenious system of colouring, a glance at the maps of the various continents shows

that special maps have been published with the magazine during that period, what the scale of each is, at what part of the publication it is to be found, and whether the map is topographical, physical, geological, or statistical. These maps, with their variously-coloured lines, show, too, in a moment, what are the regions of the earth which have most engaged attention during the last ten years. In Europe the Balkan peninsula is covered with lines, in Asia the khanates, the Pamir, Tibet, and South-Western China, while the number of lines in Central Africa north and south of the equator form a veritable labyrinth. A rough idea of the work of every traveller in the last ten years could be formed from this outline map alone, as the name and occasionally the date are added in each case. The index and the maps give a bird's-eye view of the work of this famous geographical publication better than anything else can do, and we are glad to know that it begins a new decade full of youthful life and vigour, and with the prospect of a career of as much usefulness in the future as in the past.

HERR NIEDERLEIN, of Buenos Ayres, has been appointed Naturalist and Geographer to the Argentine-Brazilian Boundary Commission, on behalf of the Argentine Government, and he left in October last for the *rendezvous* of the Commission at Misiones. He has been engaged for sixteen months in the Ministry of Foreign Affairs of the Republic, working out the results of a previous journey, especially his surveys on the Uruguay and Parana Rivers and their main tributaries; these, however, did not rest on any astronomical observations, a defect which he hopes to remedy in the present journey. A careful geodetic survey of the frontier districts will be made, and a map of these and of the province of Corrientes will be published next year.

TASMANIAN FISHERIES

THE Report for 1885 of Mr. Saville Kent, Superintendent and Inspector of Fisheries to the Tasmanian Government, contains a good deal that is of scientific as well as economic interest, as will be seen from the following extracts:—

(1) *The Oyster Fisheries.*—It affords me much gratification to inform you that considerable success has attended the experiments made in the direction of breeding oysters on the Government reserves and in private fisheries, upon the system advocated and explained in my last year's Report. This system consisted chiefly of laying "collectors," constructed of thin planks or split palings coated with cement, over the breeding oysters placed upon the beds. At the Government reserve at Little Oyster Cove, on a private bed at Great Oyster Cove, and on one at the Prosser's River on the East Coast, a considerable quantity of brood or spat has adhered to the collectors laid down, giving the greatest encouragement for a yet more substantial and commercially remunerative return resulting from the following out of the system upon a sufficiently extensive scale. The operations so far conducted have been furthermore productive of much valuable information concerning the breeding habits of the oysters of this colony that may be hereafter utilised in their artificial culture. Thus, last summer none of the collectors were placed on the beds until November, which is generally accepted, as is May in England, as representing the earliest month in which the spat or brood is liberated. From the size of the brood deposited on the collectors, as also by an examination from time to time of the parent oysters, it was, however, made evident that the greater portion of the spat had been already emitted before the collectors were placed over them. This circumstance indicates the desirability, in future years, of having at least a considerable portion of the collectors in position by the commencement of September. It is of interest to observe that the larger portion of the spat deposited, at both the Government reserve at Little Oyster Cove and on the private bed in the adjacent bay, was derived from the New Zealand oysters, thus demonstrating that that variety is suitable for acclimatisation in Tasmanian waters. Another important circumstance to be recorded of the Oyster Cove reserve is the fact that the spat thus obtained was attached exclusively to the cemented collectors, and in no case to the shells of the parent oysters or to the rocks, cultch, or other natural objects to which they customarily adhere; this fact of itself affords practical evidence of the efficacy of these collectors for the purpose for which they have been devised.

At the Government reserve at Spring Bay the collectors ordered were not supplied sufficiently early to intercept the fall of spat. At the same time the fall which took place, both in the reserve and also upon the public and private oyster-beds throughout the Spring Bay district, has been a very abundant one, the young brood adhering plentifully to the parent shells, mussels, cultch, stakes, and any other objects that afforded them a suitable fulcrum for attachment. With a continuance of this past season's rate of increase, and provided a sufficient amount of breeding stock is maintained on the reserves and private beds, it should not take many years for this locality to regain its original prominent position with relation to the oyster trade. At the present time the recovery of this district has advanced to such an extent that there has been no difficulty experienced in obtaining from it during the present season a stock of about 50,000 breeding oysters for laying down upon various private beds and the Government reserves. From the third Government reserve, established at the West Arm on the Tamar estuary, no substantial results have as yet been obtained, it having been found impossible to complete it and stock it with oysters in time to obtain last summer's fall of spat. A fourth oyster reserve is in process of formation at Little Swanport; and it is proposed, with the funds available for the purpose during the current year, to establish similar Government reserves in the following neighbourhoods, *i.e.* the Carlton River, Taranna, and Southport in the southern district; and at George's Bay, Port Sorell, and other favourable localities to be yet selected, on the north-eastern and northern coast-lines.

I am gratified to be able to report to you that there are already substantial prospects of accomplishing one of the most important objects of the establishment of the Government oyster reserves. At the time of their inauguration it was anticipated and intended that these reserves, in addition to fulfilling the part of nurseries for the propagation of oysters and the replenishment of the surrounding waters, should likewise constitute central stations for the assistance and encouragement of private enterprise in a similar direction, and by whose aid, if developed upon an extensive scale, the restoration of the oyster fisheries of this colony on a thoroughly substantial commercial basis would be greatly accelerated. One private bed with breeding oysters is already established in the vicinity of the Government reserve at Little Oyster Cove, one at Spring Bay, and another at the Prosser's River. Encouraged by the success of these undertakings, applications have been or are about to be made for the leasing of three more suitable areas for the same purpose at Spring Bay, for the same number at Great and Little Oyster Cove, and for others in the neighbourhood of Little Swanport, and at Port Sorell on the north coast.

The important operations connected with oyster-culture in course of progress at the newly inaugurated Fisheries Establishment at Battery Point are recorded under the following heading.

(2) *Fisheries Establishment, Battery Point.*—Since the date of my last Report, and in accordance with the recommendations therein made, suitable premises, including a residence, have been selected and are now rented by the Government at Battery Point for the development and maintenance of a Fishery Establishment. To this site the marine hatchery originally erected at Gore Street has been transported, and re-erected with various additions. The premises occupied include a sea frontage of about three hundred feet, allowing the location of the hatchery so close to the water's edge that the salt water necessary for the maintenance of a constant circulation through the tanks is pumped direct from the sea. The mechanical arrangements are at the same time so disposed that in the event of a storm or flood rendering the outside water temporarily unfit for circulation, the intake pipe can be disconnected, and the water circulated independently from a small reservoir beneath the building. The great advantages derived from the transport of the marine hatchery to its present site, next to the means now afforded for obtaining an unlimited supply of pure sea-water, are the facilities it has provided for constructing in connection therewith tidal ponds for the culture of oysters and marine fish generally upon the adjacent shore. For this purpose an area of about one acre has been inclosed with stakes wired together after the manner adopted for the fencing off of the Government oyster reserves, and within this inclosure two such ponds have been already constructed. In consequence of the circumstance that at ordinary ebb tide the water recedes from a large portion, and at spring tides from almost the entire extent of this inclosed area, the plan has been adopted of excavating these ponds for a foot or two below lowest tide-level, so that under any circumstances they contain an abundant supply of water. The nature of the ground upon the

foreshore inclosed has proved to be well adapted for the construction of these ponds, as immediately beneath a thin superficial covering of sand it is composed of pebbles and tenacious clay so firmly amalgamated as to almost resemble concrete ; any excavations made in this bed are consequently thoroughly water-tight. In the preparation of this site for the required purpose, it was found desirable to divert the course of that portion of the Sandy Bay Rivulet which formerly at low tide flowed over the area now occupied by the ponds. This has been accomplished by further excavating the main channel of the stream straight out to sea, and away from the area inclosed, and by interposing between the two a barrier or groin of rocks and tree-trunks, which has had the desired effect of accumulating along its course a natural sand-bank which effectually shuts off the water of the creek. One of the ponds constructed in the inclosure, measuring sixty feet long by thirty wide, is situated immediately beneath the hatchery, and serves as a reservoir for the constant supply of the tanks. This pond, being fenced round with wire netting, is further utilised for the storage and culture of a variety of edible fish in addition to oysters. With each ebb and flow of the tide the water in this pond is more or less completely renewed, and the fish under these conditions are found to thrive remarkably. A list of the edible species of fish that have been cultivated in the pond and tanks since the establishment of the fishery at Battery Point—that is, between the months of February and July 1886—is herewith annexed.

1. Native Salmon (*Arripis salar*).
2. Sea Carp (*Chilodactylus allporti*).
3. Black and Silver Perch (*Chilodactylus macropterus*).
4. Magpie Perch (*Chilodactylus gibbosus*).
5. Real Trumpeter (*Latris hecateia*).
6. Silver Bastard Trumpeter (*Latris forsteri*).
7. Rock Gurnet (*Sebastes percoides*).
8. Flathead (*Platycephalus bassensis*).
9. Tasmanian Whiting (*Sillago ciliata*).
10. Snotgall Trevally (*Neptonemus brama*).
11. Sea Mullet (*Agonostoma forsteri*).
12. Rock Cod (*Pseudophycis barbatus*).
13. Tasmanian Ling (*Genypterus blacodes*).
14. Flounder (*Rhombsolea monopus*).

In both the ponds and tanks of the Fisheries Establishment the chief attention is at present being given to the culture of oysters. There is already upon the premises a stock of some eight or ten thousand oysters of different varieties, and in all stages of growth, which stock it is proposed to yet further increase in anticipation of the approaching spatting-season. The varieties include the irregular-shaped Rock Oyster (*Ostrea angulata*) from New South Wales; the smooth variety of *O. edulis* from New Zealand, and many modifications of the indigenous type of the same species. The majority of these oysters have now been acclimatised in the tanks and ponds for the last three or four months, in which space of time it is gratifying to have to record that all of them have thriven and considerably increased the size of their shells. This is particularly noticeable of the New South Wales species, which it is anticipated from this experience it will be found possible to establish and propagate in these waters. The experiment now in course of trial, as to whether they will be able to withstand the severity of the Tasmanian winter months, will be an important factor in this question. The series under cultivation includes, in addition to the stock of adult oysters for breeding purposes, samples of brood raised last summer at Little Oyster Cove and other Government reserves. Among the useful functions accomplished by the Oyster-Culture Department of the Fisheries Establishment at Battery Point may be mentioned the *rôle* it fulfils of an accessible model for the advantage of those who, in increasing numbers, are taking up oyster-culture as a private enterprise, and who can there obtain information and instructions as to the best methods upon which to conduct their operations. It is also of much value as a central station, at which practical experiments can be made with the view of solving the many vexed problems that present themselves to the pioneers of this industry, and of discovering newer and more profitable methods of cultivating and breeding this mollusk. Already among eminent American and European oyster-culturists it is maintained that the secret of obtaining a far larger percentage of the brood produced by the parent oyster than has hitherto been accomplished is to be solved through the medium of tidal ponds and tanks, wherein the oysters will be supplied with all the equirements necessary for their healthy growth and development, and wherein at the same time suitable provision is made for the retention of the produced spat. Tentative experiments having this object in view are now in course of progress under scientific direction in all of the more important oyster-growing communities, and it is hopefully anticipated that some material assistance towards the solution of this important question may be forthcoming from this newly-established practical branch of the Fisheries Department of this colony.

Among the more important points to which my attention has been recently directed and advice solicited is the widely recognised desirability of discovering some method for cultivating oysters in localities in all respects suitable for their growth, with the exception that the labour involved in keeping them constantly clear from sedimentary deposits, or from sinking beneath a too yielding bottom, is too costly for their profitable culture. Experiments made with the view of surmounting this difficulty have resulted in the invention of a species of frame or cradle composed of wood and strong galvanised wire netting, measuring 6 feet long and 3 feet wide, upon which the oysters are placed, and raised to a height of from 9 to 10 inches off the ground. This description of frame so completely answers the purpose for which it was devised that they are being supplied to all of the Government reserves, and are recommended for the use of private growers. Each frame of the dimensions above quoted, which are found to be most portable, conveniently carries as many as 500 adult oysters, so that for a well-stocked bed of, say, 10,000 oysters, a score of them will be sufficient. Having the stock placed on frames of this description, a vast amount of labour usually bestowed in keeping the beds clean and the oysters free from sediment can be dispensed with. In place of the tedious process of dredging the bed through and raising the oysters a few at a time, to be cleaned and re-deposited on the cleared ground, each frame, with its contents, can be raised to the surface, a few shakes suffice to get rid of the sediment that may have accumulated upon them, and they may again be lowered to their place. This object may indeed be accomplished in many instances without raising the frames to the surface, it being sufficient merely to tilt the frame to and fro a few times, as it lies on the bottom, with the aid of a boat-hook, such agitations effectually getting rid of all the sedimentary matter. Wire handles for raising the frames to the surface of the water, with the aid of a boat-hook, should be attached.[1] Further advantages are attached to this frame-system of oyster-culture, since not only can the frames and their contents be raised to the surface at all times to be cleaned and manipulated, but it affords facilities, hitherto unprovided, of keeping an accurate estimate of the amount of stock placed upon the beds, and of watching, from time to time, the progress it is making in development. The form of spat collector that can be most advantageously utilised in conjunction with these oyster-frames is the one figured and described in my last Report under the title of the "single pale" collector, consisting, as its name implies, of a single split paling 4 feet long by 8 or 9 inches wide, having its under surface coated with cement and a brick attached at either end to retain it in the desired position. The experience gained by the past season has demonstrated this to be the most economic and productive form of collector, no alteration in its construction being suggested, with the exception that, by placing a single wire loop or handle in the centre instead of one at each end, as hitherto, their portability, both in and out of the water, is greatly increased. The adaptability of these paling collectors for use in conjunction with the newly-invented frames is very obvious, and their size is such as to allow of their being placed over the oysters in either a single or in two or more transverse rows. It is anticipated that the oysters placed upon the frames will of themselves constitute very efficient spat-collectors, their under surfaces, exposed through the meshes of the wire netting, being kept free from slime and sediment, and raised to a height above the ground favourable for the adherence of the spat. Empty shells or cultch similarly placed on frames in the vicinity of the breeding stock are also likely to prove favourable fulcra for the brood to adhere to. A remaining direction in which the oyster culture department of the Fisheries Establishment at Battery Point is found to be of great assistance in the operations now in course of progress relates to its value as a central depot for the reception and temporary storing of the stock brought from a distance for distribution among other reserves.

[1] The frames are raised to the surface of the water by blocks and cord attached to a tripod ; where the boat is sufficiently large to carry a mast, the same apparatus may be more conveniently worked from a small derrick affixed to the mast.

THE FORMS OF SEEDLINGS: THE CAUSES TO WHICH THEY ARE DUE [1]

SIR JOHN LUBBOCK commenced the lecture with some general remarks on the innumerable types of foliage among mature plants and the causes to which we might refer their various forms, the breadth of some and narrowness of others, the differences of position, the differences of length in conifers, &c. He said that these considerations had led him to study the cotyledons or first leaves of seedlings. Cotyledons do not present such extreme differences as leaves; nevertheless, they afford a very wide range. Some are broad, some narrow, some are long, some short, some are stalked, some sessile, some lobed, some even bifid or trifid. At first sight these differences seem interminable, and it might appear hopeless to attempt to explain them. Sir John Lubbock, however, pointed out, as regards many species, taking especially the commonest plants, such as the familiar mustard and cress, the beech, sycamore, pink, chickweed, &c., the conditions of their formation and growth, and it is beautiful to see the various reasons to which the differences are due, gradually unfolding themselves; the same result being sometimes brought about by very different circumstances—emargination of the cotyledons, for instance, being due to at least six different causes. He mentioned one curious peculiarity in the seedling of a species allied to our common mistletoe. It is a parasitic species, and its fruit, like that of the mistletoe, is somewhat viscid, so that it adheres to any plant on which it falls. But, even if it reaches the plant on which it grows, it may light on an unsuitable position—say, for instance, a leaf. What then happens? The radicle elongates for about an inch, and then develops on its tip a flattened disk, which applies itself to the plant. If the situation be suitable, there it grows; if not, the radicle straightens itself, tears the berry from the spot where it is lying, curves itself, and then brings the berry down on to a new spot. The radicle then detaches itself, curves in its turn, and thus finds a new point of attachment. We are assured that this has been seen to happen several times in succession, and that the young plant thus seems enabled to select a suitable situation.

The form of the cotyledons, or seed-leaves, depends greatly on that of the seeds, long narrow seeds naturally, in most instances, producing embryos with narrow cotyledons. The cases, however, which can be so simply accounted for are comparatively few. Many plants with narrow cotyledons have flattened and orbicular seeds. In such species, however, the cotyledons lie transversely to the seed. An interesting case is afforded by the pink family, where the pink itself has broad cotyledons, while the chickweed has narrow ones. In both cases the seeds are flattened and orbicular, but in the pink the seed is dorsally compressed, and the cotyledons lie in the broad axis of the seed; while in the chickweed the seed is laterally flattened, and the cotyledons lie transversely to the seed.

Another very interesting case which he gave is that of the genus Galium, to which the common "cleavers" of our hedges belongs. Here also we find some species with narrow, some with broad, cotyledons; but the contrast seems to be due to a very different cause. *Galium aparine* has broad, *Galium saccharatum* narrow, cotyledons. So far as the form of the seed is concerned, there is no reason why the cotyledons should not be much broader than they are. The explanation may perhaps be found in the structure of the pericarp, which is thick, tough, and corky. It is very impervious to water, and may be advantageous to the embryo by resisting the attacks of drought and of insects, and perhaps even, if the seed be swallowed by a bird, by protecting it from being digested. It does not split open, and is too tough to be torn by the embryo. The cotyledons, therefore, if they had widened as they might otherwise have done, would have found it impossible to emerge from the seed. They evade the difficulty, however, by remaining narrow. On the other hand, in *Galium aparine* the pericarp is much thinner, and the embryo is able to tear it open. In this case, therefore, the cotyledons can safely widen without endangering their exit from the seed. The thick corky covering of *Galium saccharatum* is, doubtless, much more impervious to water than the comparatively thin test of *Galium aparine*. The latter species is a native of our own isles, while *Galium saccharatum* inhabits Algiers, the hotter parts of France, &c. May not then, perhaps, he suggested, the thick corky envelope be adapted to enable it to withstand the heat and drought. In this genus, as in many other plants, the embryo occupies only a part of the seed, being surrounded by a store of food or "perisperm." In many cases the embryo occupies the whole seed, and the cotyledons must, therefore, in large seeds, either be thrown into various folds, as in the beech, or be thick and fleshy, as in the bean or oak. The reasons for their numerous differences open up an inexhaustible variety of interesting questions. Sir John gave a great number of examples, which were rendered clearer by means of numerous diagrams of seeds and seedlings.

In conclusion, he said it might be asked whether the embryo conformed to the seed, or the seed to the embryo, and showed that, at least as regards certain species, the former was the case; while the shape of the seed, again, might be shown to be influenced by considerations connected with the construction of the fruit. In reply to this he compared the seedlings of the sycamore and of the oak. In the sycamore, the seed is more or less an oblate spheroid, and the cotyledons, which are long and ribbon-like, being rolled up into a ball, fit it closely, the inner cotyledon being generally somewhat shorter than the others. On the other hand, the nuts of the beech are triangular. An arrangement like that of the sycamore would therefore be utterly unsuitable, as it would necessarily leave great gaps. The cotyledons, however, are folded up somewhat like a fan, but with more complication, and in such a manner that they fit beautifully into the triangular nut. Can we, however, he said, carry the argument one stage further? Why should the seed of the sycamore be globular, and that of the beech triangular? Is it clear that the cotyledons are constituted so as to suit the seed? May it not be that it is the seed which is adapted to the cotyledons? In answer to this, we must examine the fruit, and we shall find that in both cases the cavity of the fruit is approximately spherical. That of the sycamore, however, is comparatively small, and contains one seed, which more or less exactly conforms to the cavity in which it lies. In the beech, on the contrary, the fruit is at least twice the diameter, and contains from two to four nuts, which consequently, in order to occupy the space, are compelled (to give a familiar illustration, like the pips of an orange) to take a more or less triangular form. Thus then, he said in conclusion, in these cases, starting with the form of the fruit, we see that it governs that of the seed, and that the seed again determines that of the cotyledons. But, though the cotyledons often follow the form of the seed, this is not invariably the case. Other circumstances, as I have attempted to show, must also be taken into consideration, and we can throw much light on the varied forms which seedlings assume.

I fear you may consider that I have occupied your time by a multiplicity of details, and I wish I could hope to have made those little plants half as interesting to you as they have made themselves to me; but, at any rate, I may plead that without minute, careful, and loving study, we cannot hope in science to arrive at a safe and satisfactory generalisation.

The lecture was accompanied not only by numerous diagrams, but by specimens, kindly lent by the authorities of Kew, and by some practical illustrations.

[1] Lecture at the Royal Institution, May 21, 1886, by Sir John Lubbock, Bart., M.P., D.C.L., LL.D., F.R.S., M.R.I.

ON THE USE AND EQUIPMENT OF ENGINEERING LABORATORIES

AT the ordinary meeting of the Institution of Civil Engineers, on Tuesday, December 21, 1886, Mr. Edward Woods, President, in the chair, the paper read was on "The Use and Equipment of Engineering Laboratories," by Prof. Alex. B. W. Kennedy, M.Inst.C.E. The author believed that it was essential for a young engineer to obtain his practical training, in the ordinary sense of the expression, in a workshop. But the practical training of a workshop was incomplete even on its own ground, and there appeared to be plenty of room for practical teaching such as might fairly fall within the scope of a scientific institution, and which should at the same time supplement and complete workshop experience without overlapping it. In an ordinary pupilage a young engineer did not have much opportunity of studying such things as the physical properties of the iron and steel with which he had to deal, nor the strength of those materials, nor the efficiency of the machines he used, nor the relative economy of the different types of engines, nor the evaporative power of boilers. He required such experience as might help him to determine for himself, or at least to see for himself how other people had

determined, all the principal engineering constants, from the tenacity of wrought-iron to the calorific value of coal, or the efficiency of a steam-engine, or the accuracy of an indicator-spring, or the discharge-coefficient of an orifice. He thought that this kind of practical experience could be gained best in an Engineering Laboratory, in connection with some institution where technical instruction was given. He claimed that, in the matter of engineering laboratories, as a branch of technical education, England had really taken the lead, instead of being, as was too often the case in such matters, in the rear.

After distinguishing between laboratories whose chief function was original investigation or research, and those whose main object was the practical education of young engineers, and after giving an outline of the method of work which he had adopted, he went on to enumerate the principal subjects upon which experiments in an engineering laboratory might be carried out, summarising them thus:—(1) Elasticity and the strength of materials; (2) the economy, efficiency, and general working of prime movers, and especially of the steam-engine and boiler; (3) friction; (4) the accuracy of the apparatus commonly used for experimentation, such as springs, indicators, dynamometers, gauges of various kinds, &c.; (5) the discharge over weirs and through orifices, and hydraulic experiments in general; (6) the theory of structures; (7) the form and efficiency of cutting-tools; (8) the efficiency of machines, especially of machine-tools and of transmission-gearing; (9) the action and efficiency of pumps and valves; (10) the resistance of vessels and of propellers, and experiments in general connected with both. The paper dealt mainly with the three first subjects, the others receiving brief mention only.

In discussing the best form of testing-machine for laboratory purposes the author described specially the Werder machine, used by Bauschinger and largely elsewhere in engineering laboratories on the Continent, the vertical machine of Mr. J. H. Wicksteed, and the horizontal machine of Messrs. Greenwood and Batley, on Mr. Kirkaldy's principle, used by himself. Incidentally he described a number of other testing-machines, including the Emery machine at the United States Arsenal at Watertown, Fairbanks' machine, and others. The three machines first named were compared in some detail in respect to their accuracy, mode of applying load, methods of making observations, adaptability for varied experiments, simplicity, and accessibility, and the comparative advantages and disadvantages of each were discussed, the author preferring, on the whole, the Greenwood type. The method of testing employed by the author, with pump, accumulator, and Davy motor, was then described and illustrated,

Different apparatus for the measurement of minute extensions, compressions, &c., occurring below the limit of elasticity, were next discussed, the instruments specially mentioned being those of Prof. Unwin, Prof. Bauschinger, Mr. Stromeyer, and the author, as representing micrometric, optical, and mechanical exaggeration of strains. Automatic test-recording apparatus was next dealt with, Prof. Unwin's, Mr. Wicksteed's, Mr. Ashcroft's, and the author's diagramming machines being mentioned and illustrated. Automatic diagramming apparatus for elastic strains was next discussed. The paper contained *facsimiles* of various diagrams, both ordinary and elastic. In concluding this section of the paper, brief references were made to machines for transverse tests, torsional tests, shearing tests, cement and wire tests, secular experiments, experiments on repeated loads, &c.

In discussing the design of an experimental engine for laboratory purposes, the author first enumerated the principal conditions under which such an engine should be capable of working, summarising them thus:—(1) Condensing or non-condensing; (2) simple or compound; (3) compound, with cranks at various angles; (4) with the greatest possible variation of steam-pressure; (5) with the greatest possible variation of cut-off and other points in the steam distribution; (6) with the greatest possible variation of brake-power; (7) with considerable variation in speed; (8) with or without throttling; (9) with or without jackets, and with varying conditions as to their use; (10) with variation of clearance-spaces; (11) with variation of receiver-volume; (12) with or without arrangements for intermediate heating; (13) with variation in the reciprocating masses. He then enumerated the principal quantities which had to be measured during an engine-test, making remarks upon each important point in passing. A list was given of the principal experimental engines in existence, including those in London, Birmingham, Leeds, Munich, and Liége. This section was concluded by a description of the arrangement of an experimental boiler.

Under the head of friction-experiments, the principal points were summarised upon which experiments were required, in order that anything like a complete theory of friction in machines might be worked out. These included the variations of velocity, intensity of pressure, extent of contact, temperature, lubricant, method of lubrication, and nature of rubbing material. Friction-measuring machines, used or proposed by Prof. Thurston, Prof. R. H. Smith, Mr. Tower, and himself, were briefly described. The paper concluded with a few remarks on laboratory experiments connected with hydraulic work, the theory of structures, the form and efficiency of cutting-tools, the efficiency of machines and of transmissions, the action and efficiency of pumps and valves, and the resistance of vessels and propellers.

In an appendix there were added:—(*a*) Forms used by the author for conducting engine-trials. (*b*) Notes on the principal engineering laboratories in Europe and in America, with brief accounts of the chief apparatus used in each.

BIRDS' NESTS AND EGGS[1]

THE philosophy of birds' nests and eggs involves questions far too profound to be settled in an hour's lecture. The extreme partisans of one school regard birds as *organic automata*. They take a Calvinistic view of bird-life: they assume that the hedge-sparrow lays a blue egg because, under the stern law of protective selection, every hedge-sparrow's egg that was not blue was tried in the high court of Evolution, under the clause relative to the survival of the fittest, and condemned, a hungry magpie or crow being the executioner. The extreme partisans of the other school take an entirely opposite view. They regard the little hedge-sparrow, not only as a free agent, but as a highly intelligent one, who lays blue eggs because the inherited experience of many generations has convinced her that, everything considered, blue is the most suitable colour for eggs.

Perhaps the first generalisation that the egg-collector is likely to make is the fact that birds that breed in holes lay white eggs. The sand-martin and the kingfisher, which lay their eggs at the end of a long burrow in a bank, as well as the owl and the woodpecker, which breed in holes in trees, all lay white eggs. The fact of the eggs being white, and consequently very conspicuous, may have been the cause, the effect being that only those kingfishers which bred in holes survived in the struggle for existence against the marauding magpie. But the converse argument is equally intelligible. The fact that kingfishers breed in holes may have been the cause, and the whiteness of the eggs the effect; for why should Nature, who is generally so economical, waste her colouring-matter on an egg which, being incubated in the dark, can never be seen? The fact that many petrels and most puffins, which breed in holes, have traces of spots on their eggs, whilst their relations the auks and the gulls, who lay their eggs in open nests, nearly all lay highly-coloured eggs, suggests the theory that the former birds have comparatively recently adopted the habit of breeding in holes, and that consequently the colour being no longer of use is gradually fading away. Hence, we assume that the colour of the egg is probably the effect of the nature of the locality in which it is laid.

The second generalisation which the egg-collector is likely to make is the fact that so many of these birds which breed in holes are gorgeously coloured, such as kingfishers, parrots, bee-eaters, &c. The question naturally arises, Why is it so? The advocates of protective selection reply, Because their gay plumage made them so conspicuous as they sat upon their nests, that those that did not breed in holes became the victims of the devouring hawk, exactly as the conspicuous white eggs were eaten by the marauding magpie. But the advocates of sexual selection say that all birds are equally vain, and wear as fine clothes as Nature will let them, and that the kingfisher is able to dress as gorgeously as he does because he is prudent enough to breed in a hole safe from the prying eyes of the devouring hawk. The fact that many birds, such as the sand-martin and

[1] Abstract of a lecture delivered by Mr. H. Seebohm at the London Institution on December 20, 1886.

the dipper, which breed in holes, are not gorgeously coloured, while others, such as the pheasants and the humming-birds, are gorgeously coloured, but do not breed in holes, is evidence, as far as it goes, that the gorgeous colour of the bird is not the effect of its breeding in a hole, though the white colour of the egg probably is. It must be admitted, however, that the latter cases are not parallel. Whilst the hen kingfishers and bee-eaters are as gorgeous as their mates, the hen pheasants and the hen humming-birds are plainly, not to say shabbily, dressed. If birds be as vain as the advocates of sexual selection deem them, it must be a source of deep mortification to a hen humming-bird to have to pass through life as a foil to her rainbow-hued mate. Whilst the kingfisher relies for the safety of its eggs upon the concealed situation of its nest, the humming-bird depends upon the unobtrusiveness of the plumage of the sitting hen.

A very large number of birds, such as the grouse, the merlin, most gulls and terns, and all sandpipers and plovers rely for the safety of their eggs upon the similarity of their colour to the ground on which they are placed. It may be an open question whether these birds select a site for their breeding-ground to match the colour of the eggs, or whether they have gradually changed the colour of their eggs to match the ground on which they breed; but, in the absence of any evidence to the contrary, it is perhaps fair to assume, as in the previously mentioned cases, that the position of the nest is the cause, and the colour of the egg the effect.

Many birds make their nests in lofty trees, or on the ledges of precipitous cliffs. Of these, the eagles, vultures, and crows are conspicuous examples. They are, for the most part, too powerful to be afraid of the marauding magpie, and only fear the attacks of beasts of prey, amongst which they doubtless classify the human race. They rely for the safety of their eggs on the inaccessible positions of the nest. Many of them also belong to a still larger group of birds who rely for the safety of their eggs upon their own ability, either singly, in pairs, or in colonies, to defend them against all aggressors. Few colonies of birds are more interesting than those of herons, cormorants, and their respective allies. These birds lay white or nearly white eggs. Nature, with her customary thrift, has lavished no colour upon them because, apparently, it would have been wasted effort to do so; but the eggs of the guillemot are a remarkable exception to this rule. Few eggs are more gorgeously coloured, and no eggs exhibit such a variety of colour. It is impossible to suppose that protective selection can have produced colours so conspicuous on the white ledges of the chalk cliffs; and sexual selection must have been equally powerless. It would be too ludicrous a suggestion to suppose that a cock guillemot fell in love with a plain-coloured hen because he remembered that last season she laid a gay-coloured egg. It cannot be accident that causes the guillemot's eggs to be so handsome and so varied. In the case of birds breeding in holes secure from the prying eyes of the marauding magpie, no colour is wasted where it is not wanted.

The more deeply Nature is studied, the more certain seems to be the conclusion that all her endless variety is the result of evolution. It seems also to be more and more certain that natural selection is not the cause of evolution, but only its guide. Variation is the cause of evolution, but the cause of variation is *unknown*. It seems to be a mistake to call variation spontaneous, fortuitous, or accidental, than which expressions no adjectives less accurate or more misleading could be found. The Athenian philosophers displayed a less unscientific attitude of mind towards the Unknown when they built an altar in its honour.

SCIENTIFIC SERIALS

American Journal of Science, December 1886.—On the crystallisation of native copper, by Edward S. Dana. This elaborate memoir, which is illustrated with four plates figuring fifty-four varieties of native copper crystalline forms, is based chiefly on the fine collection of over sixty specimens from Lake Superior, belonging to Mr. Clarence S. Bement, of Philadelphia, supplemented by reference to the cabinets of Yale College Museum and Prof. G. J. Brush. The planes here determined are disposed in the three groups of tetrahexahedrons, trisoctahedrons, and hexoctahedrons, and include several new to the species. The paper also comprises an historical summary from the studies of Haüy and Mohs (1822) to the recent contributions of W. G. Brown.—On the trap and sandstone in the gorge of the Farmington River at Tariffville, Connecticut, by W. North Rice. The trap and sandstone of this locality are here specially studied with a view to the general elucidation of the history of these formations in the Connecticut Valley. The author's researches confirm the conclusion already arrived at by Prof. W. M. Davis, that some of the sheets of trap intercalated among the sandstones and associated rocks are contemporaneous, and others intrusive.—Comparative studies upon the glaciation of North America, Great Britain, and Ireland, by Prof. H. Carvill Lewis. This is an abstract of a paper by the author, read at the Birmingham meeting of the British Association last September. Its object is to show that the glacial deposits of the British Isles, like those of America, may be best interpreted by considering them with reference to a series of great *terminal moraines*, which both define confluent lobes of ice, and often mark the line separating the glaciated from the non-glaciated areas.—On certain fossiliferous limestones of Columbia County, New York, and their relation to the Hudson River shales and the Taconic system, by J. P. Bishop. The author describes some new fossils recently discovered in a metamorphic limestone occurring in the Chatham and Ghent districts on the western border of the Taconic slates of Columbia county, and tending to throw further light on the age of the Taconic formation. His investigations are still in progress, but from the facts so far determined, he considers that the fossils are of Trenton age, suggesting a synclinal having the Trenton limestone outcropping on both sides, and with the eastern edge pushed over westward.—Crystallised vanadinite from Arizona and New Mexico, by S. L. Penfield. The specimens here described and figured belong partly to the collection of the late Prof. B. Silliman, partly to that of Prof. Geo. J. Brush. Those from Pinal County, Arizona, are specially interesting, being of a deep red colour, and usually showing the very simple combinations already described by L. H. Blake.—The viscosity of steel and its relations to temper, by C. Barus and V. Strouhal. Having during the course of their former researches expressed the belief that the qualities of retaining magnetism exhibited by steel would probably stand in relation to the viscous properties of the metals, the authors here make a first search for such a relation. For several reasons their investigations are limited to torsional viscosity, and a new and very sensitive differential method is partially developed for the study of this property, with incidental reference to the viscosity of iron and glass. The results of the method as applied to steel are further compared with the known behaviour of permanent linear magnets tempered under like conditions.—Some remarks upon the journey of André Michaux to the high mountains of Carolina in December 1788, in a letter addressed to Prof. Asa Gray, by C. S. Sargent. Michaux's chief object was to secure living specimens of *Magnolia cordata*, and the locality explored by him appears to have been the highland region of North and South Carolina about the head waters of the Savannah River. The author has recently visited the same district for the purpose of re-discovering the same plant where Michaux was thought to have found it, but he searched for it in vain, and he concludes that Michaux's *Magnolia cordata*, as known in gardens, must be regarded as a rare and local variety of *M. acuminata*.—Note on the age of the Swedish Paradoxides beds, by S. W. Ford. It is argued on several grounds that these beds, or at any rate those above the division characterised by *Paradoxides kjerulfi*, are of the age of the Menevian group. Even this species should probably be referred to the same group, so that the strata containin it may be regarded as constituting a legitimate portion of the Swedish Paradoxides measures.

Rivista Scientifico-Industriale, November 1886.—On the development of atmospheric electricity which accompanies the condensation of aqueous vapour to rain or snow caused by a lowering of the temperature, by Prof. Luigi Palmieri. Those physicists who still doubt the reality of this phenomenon are recommended to conduct their researches with the Bohnenberger electroscope, as perfected by the author.—On the electric conductibility of vapours and gases, by Prof. Constantino Rovelli. Some experiments are described, fully confirming the important conclusions recently announced by Prof. Luvini regarding the non-conducting property of aqueous vapour.—On the pairing-season of frogs and toads in the Venetian district, by Dr. Alessandro P. Ninni. This period is shown to be determined by the atmospheric conditions, being advanced or retarded according to the mildness or severity of the weather in spring.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, November 18.—"On the Specific Heats of Minerals." By J. Joly, B.E., Trinity College, Dublin. Communicated by Prof. Fitzgerald, F.R.S.

A number of experiments—carried out by the method of condensation—are tabulated in this paper, on minerals whose specific heats have not previously been determined as well as on some mineral substances previously dealt with by Kopp, Regnault, &c.

The observation of specific heat is suggested as of value in determinative mineralogy. It is, with some exceptions, nearly constant for the same chemical composition, and calculable from an assumed chemical constitution, not alone in the case of simple compounds, but in the case, often, of the more complicated silicates, &c. No difficulty is introduced into its determination by conditions of aggregation such as looseness, &c. The method by weighing in air and steam admits of its value being very simply determined, and, if great accuracy be not required, very rapidly.

The experiments made by the writer show that there is a small variation in the specific heats of minerals of the same species, accompanying slight differences in translucency, lustre, perfection of crystalline form, the tendency being for the specific heat to be a minimum in the most perfect crystals. There is, further, in some cases, a variation of quite different order accompanying pronounced differences in physical appearance, as from the transparent aquamarine to the clouded beryl, sapphire to corundum, &c.; so that a distinct and definite value exists for each variety, unaccounted for by any probable variation in chemical composition.

It appears, also, that this kind of variation obtains in the case of the isometric sulphides, pyrite, galenite, sphalerite, and in such degrees as admit of the several values being stated in numerical proportion from one substance to another. Thus, using the initial letters for the observed values, it is found that—

$$p_1 : p_2 :: g_1 : g_2;$$

and, if the orthorhombic disulphide of iron, marcasite, be included, the proportion

$$s_1 : s_2 :: p_1 : m :: g_1 : g_3$$

obtains very closely. The observations of other observers are included in these ratios, the existence of which, if further borne out, suggest as an explanation the existence of variations of structure of definite character affecting, in a definite way, the freedom of the atom. From this point of view, the case of marcasite would be that in which such variation proved adequate to determine a special symmetry for the aggregate.

December 9.—"Note to a Paper on the Geometrical Construction of the Cell of the Honey-Bee" (*Proc. R.S.*, No. 240, p. 253, 1886). By Prof. H. Hennessy.

The author found in the foregoing paper that a side of one of the lozenges terminating the cell was three times the difference between two parallel edges of the hexagonal prism, and from this result he constructed one of the lozenges by erecting a perpendicular at one-third of its length from one end, and from this end, with radius equal to the side, he inflected a second side of the lozenge, which gave the whole figure and also the six trapeziums forming the prism. With a compass and ruler the whole figure can be thus easily constructed.

The author further proves that the triangular pyramid which terminates the bee's cell may be inscribed in a sphere whose diameter is three times one of the edges of the pyramid. Moreover, this sphere contains within it as much of the hexagonal prism as may be measured by twice the side of a lozenge on the prism's shorter edge. These results, together with the extremely simple mode given by the author for constructing the figure, divest the problem of the complex character which it was sometimes supposed to have, and they may also assist in explaining the action of the bees in moulding the cells of the honeycomb to their observed shapes.

"The Intra-ovarian Egg of some Osseous Fishes." By Robert Scharff, Ph.D., B.Sc. Communicated by Prof. McIntosh, F.R.S.

December 16.—"On the Changes in the Proteids in the Seed which accompany Germination." By J. R. Green.

The author described experiments proving the existence in germinating seeds of a ferment resembling the proteolytic ferment of the pancreas. This exists in the resting seeds in the condition of a mesostate or zymogen, and is, on the starting of the germinative process, transformed into the active ferment. He traced the changes which it brings about in the reserve proteids of the seed, and showed that, while they passed through the stage of peptone, the nitrogen was carried to the growing points in the condition of a crystalline amide, such as leucin, asparagin, &c.

Zoological Society, December 21, 1886.—Prof. W. H. Flower, LL.D., F.R.S., President, in the chair.—Mr. Howard Saunders, F.Z.S., exhibited and made remarks on a specimen of a hybrid between the Tufted Duck and the Pochard, bred in Lancashire in 1886.—Mr. J. Bland Sutton, F.Z.S., read a paper on atavism, being a critical and analytical study on this subject.—Dr. von Lendenfeld read a paper on the classification and systematic position of the Sponges. This was based on the recent researches on the Hexactinellida, Tetractinellida, and Monaxonida of the *Challenger* Expedition, and on his own investigations on the rich Australian Sponge-fauna, particularly of the groups Calcarea, Chalinidæ, and Horny Sponges. A complete system of Sponges was proposed, and worked out down to the families and sub-families, and all the principal genera were mentioned. An approximately complete list of the literature of Sponges (comprising the titles of 1446 papers), a "key" to the determination of the 46 families, and a discussion of the systematic position of the Sponges were also contained in the paper.—Prof. Ray Lankester communicated a paper by Dr. A. Gibbs Bourne, of the Presidency College, Madras, on Indian earthworms, containing an account of the earthworms collected and observed by the author during excursions to the Nilgiris and Shevaroy Hills. Upwards of twenty new species were described.

Geological Society, December 15, 1886.—Prof. J. W. Judd, F.R.S., President, in the chair.—John Usher and Joseph Tertius Wood were elected Fellows of the Society.—The following communications were read:—Notes on *Nummulites elegans*, Sow., and other English Nummulites, by Prof. T. Rupert Jones, F.R.S. The author finds, in the "Sowerby Collection," now in the British Museum, the original specimens on which Sowerby founded his *Nummularia elegans* (1826, "Min. Conch." vol. vi. p. 76). These are partly specimens from that part of the bed "No. 29" of Prof. Prestwich's section of Alum Bay (Quart. Journ. Geol. Soc., vol. ii. (1846), p. 257, pl. ix. fig. 1), which is known to be the lowest of the Barton series; and partly some in a stone said to be from Emsworth, in Hampshire. The former are the same as those named *Nummulites planulata*, var. *Prestwichiana*, by Rupert Jones in 1852; and the latter are *N. planulata*, Lamarck (1804), and probably foreign. Thus *N. elegans* has priority over *Prestwichiana*; and as this last was determined by De la Harpe to be a variety of *N. wemmelensis*, Van den Broeck and De la Harpe, this variety should be var. *elegans*. The author thinks that, on broad zoological principles, *N. planulata* might still be regarded as the species; but, in view of the careful differentiation worked out by De la Harpe, he accepts the "specific" standing of "*wemmelensis*" as useful among *Nummulites*; but "*Prestwichiana*" has to give way to "*elegans*" for the peculiar "Barton" variety. A bibliographical history of the long-misunderstood *N. elegans*, Sowerby, descriptions of this form and of *N. variolaria* (Lam.), notes on *N. lævigata* (Brug.), and an acccount of their range in England, complete the paper.—On the dentition and affinities of the Selachian genus *Ptychodus*, Agassiz, by A. Smith Woodward, F.G.S. The genus *Ptychodus*, owing to the detached condition in which the teeth are usually found, has hitherto been imperfectly understood. Agassiz referred it to the Cestraciontidæ, on account of a supposed resemblance in the arrangement of the teeth, and Owen's researches on their microscopic structure served to confirm this view. On the other hand, several writers have pointed out characters tending to show affinity between *Ptychodus* and *Rhynchobatus*. More recently, however, Prof. Cope and the author had shown that the supposed affinities between *Ptychodus* and the Cestraciontidæ were only apparent, and in the present paper additional evidence was brought forward. The author proceeded to describe several specimens of *P. decurrens* in the British Museum, and in the collection of Mr. H. Willett, of Brighton, one of the latter, especially, containing, what had been previously entirely unknown, the dentition in part of both jaws. These specimens showed that each jaw contained six or seven longitudinal rows of teeth on each side of the median row, and that the genus must

be referred to the true Rays, and not to the Cestracionf sharks, though the precise family to which *Ptychodus* belongs was more difficult to determine. On the whole the writer was disposed to assign it a place either amongst the Myliobatidæ or in their neighbourhood. The microscopic structure of the teeth was shown to be insufficient, by itself, to show their affinities.—On a molar of a Pliocene type of *Equus*, from Nubia, by R. Lydekker, B.A., F.G.S. A small collection of Mammalian remains from near Wadi Halfa had recently been placed in the author's hands; some of the bones were mineralised similarly to those of the Upper Pliocene of the Val d'Arno, or the Lower Pleistocene of the Narbadda valley. Amongst others, the most interesting is a right upper cheek-tooth of *Equus* but little worn. It evidently does not belong to any of the late Pleistocene or recent species of the genus, but to the more generalised group comprising *E. sivalensis*, &c.; though, bearing in mind the impossibility of distinguishing many of the existing species of the genus by their teeth alone, its absolute specific identity is not asserted. We may infer, then, that the ossiferous beds of Wadi Halfa are not improbably of Pliocene age, since this group of horses, both in Europe, Algeria, and India, had totally disappeared after the period of the forest-bed. Moreover, it is of interest, in view of previously expressed opinion, to find in the Tertiary of Nubia a species of this primitive group of *Equus*, which is apparently more nearly allied to the Siwalik than to the European species.

Royal Microscopical Society, December 8, 1886.—Rev. Dr. Dallinger, F.R.S., President, in the chair.—Mr. J. Mayall, Jun., called attention to a microscope, exhibited and made by Mr. Hilger after the designs of Sir A. Campbell, for measuring with great accuracy the divisions ruled upon a diffraction-plate. A special feature was the application of electricity, so that, by means of a weak battery and a galvanometer, it could be arranged that a contact should be made when passing every line, such contact being shown instantly by a deflection of the galvanometer-needle. In this way, end-measurements could be made with great accuracy.—Mr. Mayall also exhibited and described a new form of heliostat (made by Mr. Hilger) for use in solar photomicrography. The pencil of sunlight reflected from the first mirror could, by means of the second, be directed in any desired direction, affording to the worker the very great advantage of being able to place his microscope and camera in any position he pleased.—Mr. F. R. Cheshire exhibited and described an improved form of inoculating needle for use in connection with Bacterium culture-tubes. It was mounted in a wooden handle having a square ferrule which prevented it from rolling when placed upon an unlevel surface; in this was inserted a piece of silver tube, at the end of which was the platinum wire. A circular disk of silver was fixed on the tube, which, when placed in the flame of a lamp, rapidly became hot, and communicated the heat to the needle, while the small size of the tube enabled it to be introduced into the culture-tube more easily than the glass rod usually employed.—Prof. Bell called attention to some specimens exhibited of *Tænia nana*, the smallest of the human tape-worms, originally found by Bilharz in Egypt in 1850. Though extremely rare, it had the great advantage, to the physiologist at least (though not perhaps to the patient), of being found in considerable numbers. In the present instance the worms had been found in quantities in the duodenum of a girl aged seven years, at Bellegarde. The largest specimen met with was only 15 millimetres long.—Mr. J. D. Hardy called attention to a paper, by Dr. O. Zacharias, in which it was stated that Rotifers could never be revived after desiccation. He thought a protest should be entered against this, as it was within his knowledge that revivification had taken place over and over again. He had frequently tried the experiment, and had found that, when the dried mud was moistened, the Rotifers constantly revived. Prof. Stewart pointed out that a good deal must turn on what was meant by "desiccation." It was exceedingly difficult, under ordinary circumstances, to produce a condition of complete desiccation, and it was therefore very probable that in all cases of revivification there was sufficient moisture retained to preserve life. Prof. Bell said this explanation had usually been accepted as the real one when this subject perennially came to the front. The most curious part of Dr. Zacharias's paper, however, was that he did not in any way attempt to criticise the observations of his predecessors on the facts, but simply declared them to be fables, not inquiring at all into the conditions under which the revivals took place, so as to ascertain whether or not they were desiccated in the same sense in which his objects were when dried up in a granite basin. A discussion ensued, in which the President, Mr. Crisp, Mr. Michael, and Mr. Lewis joined.—Colonel O'Hara's note on the dissimilarity of appearances of crystals of blood as examined by him, and the illustrations in text-books, was read.—Mr. P. H. Gosse's paper, on twenty-four new species of Rotifera, was read, and two plates, drawn by Mr. Gosse in illustration, were handed round for inspection.

Anthropological Institute, December 14.—Francis Galton, F.R.S., President, in the chair.—The election of Mr. J. A. Otonba Payne, of Lagos, as an Ordinary Member, and of Dr. W. J. Hoffmann as a Corresponding Member, was announced.—Dr. E. B. Tylor read a paper by the Rev. G. Brown on Papuans and Polynesians, in which Mr. Brown contended that, notwithstanding physical differences, the similarity of their languages and customs prove the Papuans and the inhabitants of all the Pacific Islands have a common origin.—The following papers were also read:—Notes on songs and song-makers of some Australian tribes, by A. W. Howitt, F.G.S.—Music of the Australian aborigines, by G. W. Torrance, Mus.D.—On the aborigines of Western Australia, by R. H. Bland.

PARIS

Academy of Sciences, December 27, 1886.—M. Jurien de la Gravière, President, in the chair.—The proceedings were opened with an eloquent allocution by the President on the progress and triumphs of science during the past year, with a touching allusion to the loss sustained by the Academy in the death of its distinguished members, MM. Tulasne, de Saint-Venant, Laguerre, and Paul Bert.—The allocution was followed by the announcement of the prizes awarded during the year to the successful competitors in the various branches of the physical and natural sciences:—Prix du Budget (Mathematics), Edouard Goursat; Prix Francœur (Geometry), Emile Barbier; Extraordinary Prize of 6000 francs (Navigation), Capt. G. Fleuriais 4000 francs, Capt. de Bernardières 2000 francs; Prix Montyon, 2500 francs (Mechanics), M. Rozé; Prix Plumey (Naval Engineering), M. de Bussy; Prix Poncelet (Mathematics), Emile Picard; Prix Lalande (Astronomy), M. O. Backlund; Prix Damoiseau (Astronomy), M. Souillart, and to M. Obrecht 1000 francs; Prix Valz (Astronomy), M. Bigourdan; Prix Bordin (Optics), M. R. Radau; Prix Montyon (Vital and Social Statistics), M. Victor Turquan, with honourable mention of Dr. Mireur, Cazin, and Socquet; Prix Jecker (Chemistry), divided equally between MM. Colson and Oechsner de Coninck; Prix Vaillant (Geology), the members of the French Mission to Andalusia, MM. Michel Lévy, Bertrand, Barrois, Offret, Kilian, and Bergeron, and 1000 francs to M. de Montesson; Prix Barbier (Botany), M. Eugène Collin; Prix Desmazières (Botany), MM. H. van Heurck and A. Grunow; Prix de la Fons Mélicocq (Botany), divided equally between MM. Gaston Bonnier, G. de Layens, and E. G. Camus; Prix Montagne (Botany), Dr. Quélet; Prix Thore (Entomology), M. Peragallo; Prix Montyon (Medicine), Drs. Léon Colin, Dejerine and Landouzy, and Oré, 2500 francs each, besides honourable mention with 1500 francs to MM. Cadéac and Malet, Masse, and Ollivier; Prix Bréant (Medicine), Dr. Duflocq 2000 francs, M. Ad. Guérard 1500 francs, and M. Thoinot 1500 francs; Prix Godard (Surgery), M. Bazy; Prix Lallemand (Surgery), M. W. Vignal; Prix Montyon (Experimental Physiology), M. Gréhant, with honourable mention of M. Assaky; Prix Gay (Physical Geography), M. Ph. Hatt; Prix Montyon (Unhealthy Industries), MM. Appert Brothers, and M. Kolb 2500 francs; Prix Trémont (Magnetism), M. Moureaux; Prix Gegner, M. Valson; Prix Delalande-Guérineau (Terrestrial Physics), M. Hyades; Prix Jean Reynaud (Therapeutics), M. Pasteur; Prix Ponti (Aërial Navigation), MM. Renard and Krebs; Prix Marquise de Laplace, M. E. A. Brisse.—Prizes proposed for the year 1887:—Francœur, 1000 francs, discoveries or works useful to the progress of pure and applied mathematics; Extraordinary Prize of 6000 francs, works tending to increase the efficiency of the French naval forces; Poncelet, 2000 francs, for the most useful work for the advancement of the pure and applied mathematical sciences; Montyon, 700 francs, mechanics; Plumey, 2500 francs, improvement of steam-engines, or any other invention contributing most to the progress of steam navigation; Fourneyron, 500 francs, theoretical and practical study of the progress made in aërial navigation since 1880; Lalande, 540 francs, Valz, 460 francs, and Damoiseau and Janssen, gold medals, works contributing to the advancement of astronomy; Grand Prize of the

Mathematical Sciences, 3000 francs, researches on the elasticity of one or more crystallised bodies from the experimental and theoretical standpoints; L. Lacaze, 10,000 francs each, to the authors of the best work on physics, chemistry, and physiology; Montyon, 500 francs, vital statistics; Jecker, 10,000 francs, organic chemistry; Delesse, 1400 francs, to the author of a treatise on the geological or mineralogical sciences; Barbier, 2000 francs, for any valuable discovery in surgery, medicine, pharmaceutics, or botany, in connection with therapeutics; Desmazières, 1600 francs, for the most useful work on the whole or any section of cryptogamy; Thore, 200 francs, awarded alternately for works on the cellular cryptogams of Europe, and for researches on the habits and anatomy of any European entomological species; Montagne, 1000 and 500 francs, to the authors of important works on anatomy, physiology, the development or description of the lower cryptogams; Grand Prize of the Physical Sciences, 3000 francs, researches on the phenomena of phosphorescence in animals; Bordin, 3000 francs, for a comparative study of the African, South Asiatic, and Australasian freshwater fauna; Bordin, 3000 francs, for a comparative study of the auditory apparatus in the warm-blooded vertebrates, mammals, and birds; Savigny, 975 francs, for young zoological travellers; Montyon, 750 francs, medicine and surgery; Bréant, 100,000 francs, to the discoverer of an efficacious remedy against Asiatic cholera; Godard, 1000 francs, anatomy, physiology, and pathology of the genito-urinary organs; Serres, 7500 francs, general embryology, especially as applied to physiology and medicine; Chaussier, 2500 francs, for important works on forensic and practical medicine; Lallemand, 1800 francs, for works relating to the nervous system in the widest sense of the term; Montyon, 750 francs, experimental physiology; Gay, 2500 francs, distribution of heat on the surface of the globe; Montyon, unhealthy industries; Trémont, 1100 francs, for any naturalist, physicist, artist, or mechanician needing assistance in the accomplishment of any undertaking useful to France; Gegner, 4000 francs, in aid of any *savant* distinguished by serious pursuits undertaken for the purpose of advancing the positive sciences; Petit D'Ormoy, 10,000 francs, pure and applied mathematics, and the natural sciences; Laplace, a complete edition of the works of Laplace, for the first student leaving the Ecole Polytechnique. General conditions: the Academy retains all memoirs, the authors being at liberty to obtain copies from the Secretary. Competitors must send in their papers by June 1, accompanied by a brief summary of the part containing the discovery on which they desire the judgment of the Academy. No one can claim the title of Laureate of the Academy unless awarded a prize. Honourable mention or any other formal recognition of merit does not justify the assumption of this title.

STOCKHOLM

Society of Natural Science, September 18.—Prof. Wittrock gave an account of the gypsies, chiefly in relation to Hungary, which country he had recently visited with a view to studying its various nationalities.—Dr. Skåuberg exhibited abnormal specimens of various plants he had found in Sweden last summer, viz. *Phleum pratense*, *Listera ovata*, *Linaria cymbalaria*, *Typha angustifolia*, and *T. latifolia*.—Herr Berggren exhibited a specimen, in spirits, of *Nyctalis parasitica*, which had grown on another fungus, *Russula adusta*, whilst the latter was still quite fresh. The former fungus, he said, was also at times attacked by a smaller parasitic one, imparting to it a kind of coating.—Herr Meves exhibited a specimen of *Oriolus gulbula*, shot last May, a bird very rarely found in Sweden.

Entomological Society, September 25.—Prof. Chr. Aurivillius gave an interesting account of his studies, last summer, of the habits of various species of Hymenoptera. He specially referred to one, *Odynerus muralis*, which he had found when boring holes in red-painted wooden walls, at the bottom of which it deposited its larvæ, protecting the latter against attack by making partitions of clay at intervals, and by putting a prop at the end, which it carefully covered with tiny bits of red paint, whereby these holes were almost impossible to detect.—Dr. Lampa described his observations of the remarkable keenness of the olfactory organs of the males of *Bombyx quercus*, L., whereby they were enabled to discern the females, even when far off. In one instance a female had been discovered by a male, although access to the former, which was in a cage, could only be gained through a balcony and room beyond.—Dr. Adlerz referred to an unusual case of hermaphroditism in an ant, whose left half was formed like a male, and the right like a female.

CHRISTIANIA

Society of Sciences, October 1.—The following papers were presented:—Der Ursprung der Etrusker durch zwei lemnische Inschriften erläutert, by Prof. Sophus Bugge.—Fresh contributions to our knowledge of the extension of the tube plants in Norway, by Prof. A. Blytt.—On variations in climate in the course of time (see NATURE, vol. xxxiv. pp. 220 and 239), by the same.—Ueber die Entwickelungsgeschichte der Pollenkörner des Angiospermen, by Dr. N. Wille.—Fresh contributions to our knowledge of the extension of lichen in Norway, by Herr B. Kaalaas.—Dr. G. Storm read a paper on voyages to countries north and north-west of Iceland, maintaining that the priests who, in 1285, discovered "Nya Land" (New Land) did not reach Newfoundland, but the south-eastern part of Greenland, and that the island discovered in 1194, "Svalbarde," was Jan Mayen. He further believed that the old Norsemen knew of other Arctic countries north of Russia and Norway.

BOOKS AND PAMPHLETS RECEIVED

Annual Report of the Geological and Natural History Survey of Canada, new series, vol. i.: A. R. C. Selwyn (Dawson Bros., Montreal).—Negretti and Zambra's Encyclopædic Catalogue.—Proceedings of the Royal Physical Society, Session 1885-86 (M'Farlane and Erskine, Edinburgh).—Den Norske Nordhaus-Expedition, 1876-78, XVI. Zoologi, Mollusca, II.: H. Friele (Grondahl, Christiania).—Transactions of the Sanitary Institute of Great Britain, vol. vii. 1885-86 (Stanford).—Zeitschrift für Wissenschaftliche Zoologie, xliv. Band, 4 Heft (Engelman, Leipzig).—Geological Survey of Alabama—On the Warrior Coal-Field: H. McCalley (Montgomery).—Year-book of Photography, 1887 (Piper and Carter).—Anuario de la Oficina Central Meteorolojica de Chile, 3er Cuaderno, Mayo i Junio.—Fourth Annual Report of the Metropolitan Public Gardens Association.

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