THURSDAY, FEBRUARY 10, 1887

THE HISTORY OF HOWIETOUN

The History of Howietoun. Part I. By Sir J. Ramsay Gibson Maitland, Bart. (Stirling, N.B.: J. R. Guy, Secretary Howietoun Fishery, 1887.)

PROBABLY every one at all interested in fish-breeding has heard the name of Howietoun, and a great many people, especially in Scotland, have some knowledge of the character of the establishment and the operations there carried on. Occasional paragraphs in scientific periodicals, as well as in daily papers, announce some experiment in the artificial stocking of home waters with some kinds of trout or with salmon fry, or some successful exportation of salmonoid ova to America or to the colonies at the Antipodes. The name of Sir James Maitland or of Howietoun very often occurs in such announcements. Those who have given attention to the subject will find much to interest them in the account of the development of his fish-farm, and in the description of its present condition, which Sir James Maitland is now placing before the public. At present we have only the first part of the work, in which the history is brought down to the spring of 1879. A note on the fly-leaf informs us that the remaining part will be issued shortly. The present volume is of large quarto size, printed in large type, and liberally illustrated with excellent woodcuts.

The author states in the preface that the culture of Salmonidæ is now an achieved success, and he describes the gradual progress of the efforts which have culminated in this result at Howietoun, with the hope that his experience may prove of use to those who are working on the still larger question of our sea-fisheries. The first seven chapters contain a general description of the regular operations which are now carried on after thirteen years of practice and experimental ingenuity at the Howietoun farm. Sir James Maitland asserts emphatically that Great Britain is pre-eminent among all nations in matters pertaining to fisheries. He does not argue at any length in support of this patriotic claim, which he seems to found chiefly on the perfection of the Howietoun establishment, and the success of the system of Government supervision under which the Scottish herring trade is carried on. His eulogy of these two institutions is quite justified by facts, and there can be little doubt that the value of the fisheries of Great Britain, in proportion to the total population and total wealth, is greater than in many other countries. But there are other matters pertaining to fisheries in which the pre-eminence of Great Britain may well be disputed, and has been disputed very frequently of late years. The scientific study of the sea-fisheries, and the application of the results of such study, have undoubtedly been carried out to an enormously greater extent in other countries than with us. The reproduction of the cod was first investigated in Norway; oyster-culture as understood in Holland and in France is still unknown in Britain; and the organised scientific investigation of fishery matters, which has been commenced by the Scottish Fishery Board and is about to be instituted by the Marine Biological Association in England, has been, as it were, forced upon us by the example of the United States. Perhaps no American salmon-hatchery is quite as efficient as the Howietoun farm, but the extent of piscicultural operations applied to Salmonidæ in the United States is certainly greater on the whole than in Britain. This is not the occasion, however, for a complete comparison of Great Britain with other countries with regard to pisciculture. The history of Howietoun shows how greatly Sir James Maitland, by his individual energy and enterprise, has advanced the art of breeding Salmonidæ, and we have to notice shortly some of the most interesting parts of his book.

Before considering particular points, we may remark that the "History of Howietoun" is a book that can not only be referred to with profit, but read with pleasure. The author's genial individuality has an interest of its own, and his pages are full of suggestions of healthy, cheerful, energetic out-door life which make them picturesque and refreshing. The use of the plural "ova" as a singular seems to be common among pisciculturists, and it is a pity that this small blemish was not remedied in the proofs.

The greater number of the ova hatched at Howietoun are from Loch Leven trout kept in ponds at the farm. Ova are collected from wild *Salmo salar* taken from differen Scottish rivers, and small numbers of ova of *S. fario* and *S. fontinalis* are dealt with, but the greatest amount of space and attention seems to be devoted to *S. levenensis*. In the account of the "egg harvest" some interesting discoveries are mentioned which show a constant relation between feeding and breeding. If the fish are highly fed at an early date in the year, they begin to spawn earlier; the food used for this purpose is Pecten, and if this is given early in February, maturity is reached early in November. To obtain the eggs for the hatchery the females are stripped over large earthenware milk-plates, into which the ova fall. About 10,000 ova are stripped into one pan, and these can usually be impregnated by the milt of one male. After the milt has been added, only a tumblerful of water is poured into the pan; the eggs are then left to impregnate for 30 to 45 minutes. The ova, when first shed, are soft to the touch and inclined to adhere together; after impregnation they feel hard, and separate easily. The next process is to pour the ova into large pails full of water, which are held immersed in one of the inlets to the ponds, so that the milt is washed away; the ova are then carried in the pails to the hatching-house.

Collecting ova from fish in the wild state is a much more laborious process than from the fish in the ponds, and Sir James advocates strongly the advisability of Fishery Boards building proper ponds in which to retain the gravid fish until ripe. At Howietoun 20,000,000 trout (presumably *levenensis*) ova can be produced at a cost of little over 1000*l.* a year.

The account of work in the hatching-house would naturally follow that of the egg-harvest, but the chapter on packing has been inserted between them. The work in the hatchery is described in detail. The eggs are poured with a glass measure over the centres of the glass tubes forming the *grilles*, and afterwards dressed into regular rows by "feathering," an operation performed by girls, as the eggs at this stage are easily killed by too

much handling, and a trained girl can give the slight motion which is required to the eggs without actually touching them with the feather at all. Each box is entered by a number in a book, and a record of the number of dead eggs daily taken from it is kept on a printed form, and afterwards entered in the same book. Two girls only are employed in attending to all the hatcheries at Howietoun. The stage in the development of the ova between the formation of the blastoderm and the appearance of the eyes is called the "spectacle" stage, and the health of the embryo can be estimated by certain signs at this period; but the description given of these signs is not easy to follow. Up to the eye stage the ova are very delicate, but as soon as the eyes appear the eggs can be handled, and this is the best age for packing for the Antipodes. Eggs for America or Europe are packed at a later period, when red blood has appeared. When the eggs are ready to hatch, the *grilles* are taken out, the boxes cleaned, and the eggs are emptied off the *grilles* on to the bottom of the box. The depth of water in the boxes containing the alevins is only 3 inches. The alevins congregate in dense masses in the corners and against the sides of the hatching-box, and the motion of the pectoral fins causes a continuous current to descend downwards through the mass. When the yolk-sac is nearly absorbed, the fry are fed with food prepared from fillet of beef or of horse, and yolks of hard-boiled eggs. The food is made into paste in a mortar, and rubbed through "feeding-spoons" of perforated zinc into the hatching-box.

Next follows an account of the method of despatching living fry. These cannot travel for more than twenty-four hours, and they are sent in tanks quite full of water, as motion of the water exhausts the fish at this stage. The greater number of the fry, after a short time in the hatching-house, are placed in ponds constructed of wood, 100 feet in length, where they remain throughout the summer, and where they are fed daily by hand for the whole time. It is stated that 100,000 trout eleven months old would consume between two and three horses a week.

A considerable amount of stocking is effected with yearling trout, which are carried in conical tanks. The fish must be starved some days before being despatched, as, if placed in travelling-tanks when fully fed, they rapidly make the water foul. In the bottom of the lid of the tank is an inverted cone perforated with holes and filled with ice; this keeps a constant temperature, and promotes aëration of the water. Two-year-old, and even larger, trout are also sent out; these are placed in larger tanks, provided with small wheels, but constructed on the same principle.

In Chapter III. an elaborate account is given of the methods of packing ova. The first operation is to transfer the ova which are to be packed from the *grilles* to peach netting stretched on square wooden frames. This step is carried out in a specially constructed sink, through which water is kept running. The ova are emptied from the *grille* into a wooden box, from which they pass into a leaden basin with a narrow bottom. One of the frames is then floated in the sink, and a glass measure containing 1100 eggs is used to measure the eggs from the basin on to the frame. The frames are placed in the packing-room in piles, one pile for each box. Next morning the frames are examined, so that any egg with an ill-developed embryo may be picked out. Then, a square of swan's-down, contained in a special tray, is placed over the eggs on the frame, and, the two being suddenly reversed, the eggs rest on the swan's-down without altering their relative position; thus each egg lies separately on the swan's-down. The frame is removed, and the square of swan's-down with its burden placed in one of the travelling-trays. Above the eggs is next placed a square of felted moss (*Sphagnum*). Above the moss is placed another layer of swan's-down carrying a layer of eggs, and then another layer of moss, and so on, till the travelling-tray is filled. The bottom of the travelling-tray is made of perforated zinc, and before any eggs are placed in it, the bottom is covered with a thin layer of moss. The eggs thus rest on swan's-down, and are covered with felted moss, a layer of which also forms the lowest and uppermost layer of the tray when full. For journeys to the Continent or America, unbleached lino is substituted for the swan's-down, because swan's-down retains so much carbonic acid that advanced embryos are asphyxiated. For the Antipodes, an extra precaution has to be taken: a thin layer of moss is inserted between the layer of unbleached lino and the eggs, so that the latter are in contact with the moss above and below. The travelling-tray is 10 inches square and $2\frac{1}{2}$ inches deep. The trays are packed in an inner box only $\frac{3}{8}$ inch larger than themselves, and this is placed in an outer box 4 inches deeper and 3 inches wider than the inner. Between the two is a layer of sawdust. The outer box or case measures 1 foot 4 inches square, by 1 foot 10 inches deep. This is the method of packing for short journeys within the United Kingdom. The boxes for foreign consignments are larger, and oblong in shape; there is a sawdust space as in the boxes already described, but the trays are separated by means of charred fillets, so that an air-space surrounds each tray: above the pile of trays is a large ice-tray, which occupies the whole of the top of the box. Ova can be safely kept in one of these boxes during a period of sixty days.

In the chapter on "breeders" we have an account of the most unique feature of the Howietoun establishment,—the feature which entitles the place to be called a fish-*farm*, and not merely a hatchery. Salmon and trout eggs have been artificially fertilised and kept in hatching-houses by a great many pisciculturists, but never before the institution of the Howietoun system has a species of Salmo been treated after the same method which is applied by agriculturists to domestic cattle. Sir James Maitland may be said to have domesticated the Loch Leven trout. He keeps them in a system of ponds, where they are placed under more favourable conditions than they meet with in the wild state, where they are supplied with a constant abundance of food, and are protected from enemies. The Howietoun trout have been rescued from the battle of life and subjected to the influences of cultivation and artificial selection. A flow of 5,000,000 gallons of water per diem is made to support a stock which produces 20,000,000 ova annually. The original stock of breeding-fish was raised from eggs taken at Loch Leven in 1874. As the fish grew older the size of their eggs increased, the fry from these ova were bigger and stronger each season, and it became evident that the ova of old trout were much the most valuable.

Time has not yet shown whether the new generation of breeders raised from selected ova of the largest trout, in their turn produce still finer ova and fry, but there can be little doubt that this will be the case.

The history of the gradual improvement of the pisciculturalapparatus given in Chapters VIII. to XVII. is extremely interesting. A detailed account is contained in these chapters of the increasing amount of stock, and of the hatching operations in succeeding seasons. But enough has been said to show the character and value of the first part of the work. The second part will contain descriptions of the experiments which have been made at Howietoun since the establishment reached its present complete and efficient condition. J. T. C.

HARMONY AND COUNTERPOINT

Elements of Harmony and Counterpoint. By F. Davenport, Professor of Harmony, &c., Royal Academy of Music. (London : Longmans, 1887.)

YEARS ago, when the laws of musical sounds, like the laws of Nature before Newton, lay hid in night, it was not unusual for clever and ingenious writers on music to invent what they called "systems of harmony." They found certain combinations and progressions in use by by the best composers, and they conceived it to be their duty to explain, or account for, or justify these by some kind of imaginary natural principles, more or less fanciful, which they conjured up out of their inner consciousness, to fit the case. But, unfortunately, these writers widely disagreed among themselves as to the principles on which their theories should be based, and the result was such a mass of contradiction and confusion that the very name of theoretical harmony became a by-word and a scandal, until the Newton of musical acoustics, Helmholtz, arose, and, by explaining the real nature of musical sensations, swept away these fanciful inventions into deserved oblivion.

Among these systems, however, was one, published in 1845, by a Dr. Alfred Day, which had the great good luck to be admired and patronised by no less a personage than Sir George Macfarren, the Principal of the Royal Academy of Music. So far as we know, this admiration has not been widely shared by musicians in general ; but it would be idle to ignore the great weight that such an opinion must carry, and it is this, no doubt, that has preserved for Dr. Day's work an existence which might otherwise have terminated long ago.

It is natural that Prof. Macfarren should wish this system followed at the famed institution over which he presides, and the little book before us appears to be intended as a cheap manual for the purpose. No one need object to this, for, when it comes to the practical teaching of harmony, it matters little whose system is followed so that the orthodox forms of writing are taught and recommended. That system is the best which renders this knowledge easiest to acquire. It is a feature of Dr. Day's book, that he lays down strict laws, pretty copiously and peremptorily, as to what ought or ought not to be done, and Mr. Davenport has conscientiously carried out this plan. His work bristles throughout with such rules, and we may safely say that if any student can succeed, either with or without the professor's help, in mastering them, he ought to be competent to write very good harmony. If he is of an inquiring mind, and wants to know *why* he is strictly enjoined to do so and so, or strictly forbidden to do so and so, he should postpone his curiosity till he has finished his academical course, and in the meantime be content with the Dicta of Doctor Day.

We must do Mr. Davenport the justice to remark that he has added to the work an original feature of his own which is worthy of all praise, namely, the combination of *counterpoint* with harmony-teaching. It is the general custom to give the harmony examples in the form of pianoforte chords, and this produces the anomaly that when rules have to be stated affecting the motion of certain notes, an idea of part-writing must enter which is somewhat foreign to the general system. Our author has taken the bull by the horns, by requiring the student *ab initio* to write his harmony in separate parts, putting each part on a separate line with its proper clefs. This is an excellent idea. Counterpoint is the highest and most perfect style of musical writing, but it has been much neglected in late days, and Mr. Davenport has hit upon a happy mode of encouraging its cultivation, which cannot fail to benefit his pupils.

PEARLS AND PEARLING LIFE

Pearls and Pearling Life. By Edwin W. Streeter, F.R.G.S. (London : George Bell and Sons, 1886.)

THE book before us, according to the preface, and as far as we are aware, is the only work in the English language which is entirely devoted to the history of pearls. The introductory chapter is immediately followed by one which gives a brief historical account of pearls in connection with India, China, Persia, Palestine, Egypt, Ancient Greece and Italy, and Europe in the Middle Ages. This is succeeded by a *résumé* of the ancient ideas respecting the origin and supposed medicinal qualities of pearls, and by a few words on "breeding" pearls. The next chapter treats of the different kinds of pearl-forming mollusks, both marine and fluviatile. The writer then gives an account of the true mother-of-pearl shell, describing its geographical distribution, the different varieties, its structure, the parasites found within the shells, and their external enemies, their method of getting rid of extraneous substances (stones, small shells, &c.) accidentally introduced within the valves of the shell, and the uses to which the mother-of-pearl is put. The sixth chapter, although headed "The Origin and Formation of Pearls," also refers to the different kinds, such as *bouton* pearls, *baroque* pearls, and *coq de perle*, the mode of life of the oyster, the positions in which pearls are found, &c. It also treats of the qualities which regulate the value of pearls. The next chapter gives a short account of the Sooloo Archipelago, the natives as pearl-divers, and their method of dredging. Then follows a good description of the fisheries of North-West Australia and Torres Strait, and this is succeeded by an interesting chapter entitled "Pearling Life at the Present Day," which is practically descriptive of pearling expeditions made by Mr. Streeter's vessel, the *Sree Pas Sair*, from Singapore

to the North-West Australian coast and the Sooloo Archipelago.

Chapter XI. is devoted to a condensed account of the pearl-fisheries of Ceylon and Southern India, and this is followed by a *résumé* of what is known respecting the fisheries in the Persian Gulf, the Red Sea, on the west coast of North America, and at the West Indies. Pearls produced by shells which inhabit the rivers and lakes of Great Britain and foreign countries are described in Chapter XIV., and the artificial production of pearls by the Chinese is also here referred to. The different kinds of coloured pearls, and the mollusks which produce them, are then treated of. In the succeeding chapter the most famous pearls of both ancient and modern times are recounted, and the immense sums at which some of them were valued are stated. Chapter XVII. gives the history of the remarkable cluster of pearls known as "the great Southern Cross pearl," which was exhibited in the West Australian Court of the Colonial and Indian Exhibition, and valued by the owners at 10,000*l*. The next and concluding chapter is devoted to the value of pearls, and shows how their worth has varied in this country at different periods from 1671 to the present time.

A map is then introduced showing the principal pearling regions. In an appendix, the works bearing on the subject which have been consulted by the author are enumerated, and a full index completes the volume.

Mr. Streeter has brought together a large amount of information which will be of interest to the general reader, for whom especially, and not for the scientific, the work has been written. The most original material is comprised in the part extending from the seventh to the tenth chapter. The chapter devoted to the Sooloo Archipelago contains some details which, although interesting in themselves, are rather foreign to the subject of the work. The same observation applies to the account of the constellation *Crux Australis*, or Southern Cross, introduced in the seventeenth chapter.

As far as we have noticed, the various opinions and statements set forth in the work are mostly accurate. It may, however, be questioned whether "there is perhaps no instinct implanted in the human breast more powerful than the love of admiration," for is not that of self-preservation supposed to reign supreme? We would point out that the term *Lamellibranchiata* is now superseded by that of *Pelecypoda*, and with good and sufficient reasons is adopted in the latest and best manuals on conchology. The bathymetrical range of bivalves far exceeds the stated limit—200 fathoms—specimens having been obtained by the *Challenger* and other deep-sea exploring expeditions in depths ranging as low down as 2900 fathoms.

The book is printed in good legible type upon toned paper, but the pictorial portion mars the rest. The plates illustrating the *Malleus*, the *Meleagrina*, the *Unio*, the *Pinna*, the *Strombus*, and the *Turbinella* are simply execrable. They are printed upon a fearful black ground (one almost expects to see "Sacred to the memory of," &c.), inclosed by a thin white line with ornamental corners, and seem to us to have a most common appearance. We cannot see one redeeming feature in them, the drawing and colouring of the shells being equally bad. If another edition is called for, fresh and accurate illustrations should be provided. E. A. S.

OUR BOOK SHELF

The Definitions of Euclid, with Explanations and Exercises, and an Appendix of Exercises on the First Book. By R. Webb, M.A. Pp. 48. (London: G. Bell and Sons, 1886.)

THERE are some good points in this little book which will make it a useful help in many cases, especially with backward and dull pupils. The explanations are clear and precise; the exercises are very simple, and aim chiefly at insuring that the pupil really masters the idea involved in the definition illustrated; and good diagrams are supplied. We are sceptical, however, as to the advisability of representing "each of two or more lines which are parallel to one another by two straight lines close together." This is put forward as an assistance to the memory, but the assistance, such as it is, may be very dearly purchased.

The deductions at the end of the volume—three or four on each proposition of Euclid, Book I.—are nearly all very easy; they do not require any knowledge of propositions subsequent to the ones to which they are attached.

Berättelse om en Resa til Grönland. ("Narrative of an Expedition to Greenland.") By Nils O. Holst. (Stockholm: Norstedt und Söner, 1886.)

DR. HOLST'S object in visiting Greenland was to investigate the phenomena of glacial action as they are manifested in the varied geological formations of the Arctic regions, and to secure materials which might help to elucidate many of the questions still needing solution in regard to the Ice Age in Europe.

Having obtained permission from the Swedish King to absent himself from his labours in connection with the Swedish Geological Surveys, and having been allowed by the Royal Danish Greenland Trading Company—generally very chary of granting similar favours—to make the voyage in one of their ships, he embarked at Copenhagen on April 8, 1881, in the *Peru*, which after thirty-nine days sighted the west coast of Greenland. Here he found himself suddenly brought into immediate contact with the ice-formations which he had come so far to study, for the pack-ice, which is annually brought by the Arctic current to the coasts of Greenland between the months of March and September, was so unusually dense in that year that it required ten days' cautious navigation to penetrate the ice—which, with a depth of 10 feet and more, was in many parts from 8 to 10 miles in width—and to reach safe anchoring-ground. This was at length found at Smalle, in 61° 32′ N. lat., far to the north-west of Julianehåb, for which the *Peru* was bound, and there Dr. Holst left the ship and engaged a native boat to carry him to the mouth of Arsukfjord, and to the settlement of Tigssaluk, where he had the opportunity of examining several of the "horse-shoe" moraines described by Hornerup, and comparing the land and water ice-sheets with their respective crevasses, glaciers, packs, and floes, besides making as complete a geological survey of the coast which he visited as time and circumstances permitted. In the course of these expeditions he ascended several of the characteristic so-called "*nunatackor*," or bare fjeld-tops, some of which are between 3000 and 4000 feet in height. On these isolated hill-tops were found, amongst other plants, various Cladonias, Silenes, Cetrarias, and Luzulas, besides *Rhododendron lapponicum*, *Nephroma arcticum*, &c.

Dr. Holst was disappointed in his expectation of examining the kryolite mines of Ivigtut, orders having been received from headquarters in Copenhagen that strangers should not be allowed to see the works, but he was able to determine the geological character of the district, and the conditions under which the mineral is found. According to him, the predominant rock is a grey, finely-

granulated gneiss, in some places impacted together with green sandstone into a tolerably dense granitic breccia. At some points the kryolite is found in direct contact with the granite, at others pegmatite is interposed between the two, while here and there this mineral is embedded in a granitic ivigtite.

Great interest attaches to Dr. Holst's observations on the nature and appearance of the so-called "kryokonite," in regard to whose origin the most opposite views have been maintained. According to the writer, who mainly agrees with the opinions held by Danish geologists, this substance is nothing more nor less than moraine mud ; in support of which view he gives the result of the careful analyses made, independently of one another, by Profs. Lassaulx, Zirkel, and Svedmark, who agree in maintaining that kryokonite contains nothing but the ordinary constituents of the native rocks. The evidence supplied by these and other carefully-conducted microscopical investigations is, it would appear, so conclusive as to the true constituents of all kryokonites, that it has considerably modified the views once held by Baron Nordenskjöld and others, who at one time maintained the cosmic origin of these bodies. In point of fact, Dr. Holst's observations of this substance, of which he collected various specimens between Kipissako, in 61° N. lat., and Illuliakik, 65° 25′ N. lat., seem to show that the kryokonite of Greenland differs in no way in its nature from the loess of Europe, of which it may be considered as the Arctic analogue.

During his four months' stay in Greenland Dr. Holst visited various native settlements, and his descriptions of the numerous difficulties he encountered in securing boats and guides in the face of the Greenlander's habitual slowness and vacillation are not without interest, but the great value of his narrative depends upon the care and clearness with which he has recorded the results of his scientific investigations. In these particulars, indeed, geologists will find that he has ably fulfilled the purposes of his expedition, and there can be no doubt that the results of his diligent study of the various processes by which glacial action is manifested, and the effects which it produces, will prove of the greatest use in contributing new materials towards the interpretation of various problems connected with the Ice Age in Europe.

A chart of South Greenland, drawn by C. J. Kjellström, on which the inland ice-beds are marked in green and the habitable land in white, enables the reader to follow the track of coast explored by the writer between Holstenborg, in 66° 50′, and Kipissako, in 61° N. lat.

The Handy Natural History. By J. G. Wood, Author of "Homes without Hands." With 226 Engravings. (London : Religious Tract Society, 1886.)

MR. Wood is so well and so widely known for his many popular books on natural history, that the present one is sure to be welcomed by a large number of readers. The illustrations as a rule are most excellent, and care has been taken to make the text as simple as possible for even juvenile readers. The chapter on the monkey tribe is one of the longest and most interesting in the book. Mr. Wood is very careful to state in his first page that between the lower animals and man there is a great gulf fixed which neither can pass. Mr. Wood does not seem to see that the question which has been widely ventilated of late years is not whether there is a great gulf now, but whether there was originally any gulf at all. It is not necessary that this question should be discussed in a book intended chiefly for juvenile readers ; but in the absence of a discussion, the statement to which we refer is one which had better not have been made.

There is no index to the book, but at the beginning of it an alphabetical list of animals mentioned is given, which practically serves the purpose of an index. The number of animals mentioned may be gathered from the fact that the list occupies seven pages of closely-printed type in three columns.

Hand-book of the British Flora. By George Bentham, F.R.S. Fifth Edition. Revised by Sir J. D. Hooker, F.R.S. (London : L. Reeve and Co., 1887.)

IN the preface to the first edition of this book the author explained that he had often been asked to recommend a work which should enable persons having no previous knowledge of botany to name the wild flowers they might gather in their country rambles. His object in writing his "Hand-book" was simply to meet this demand, and experience has shown that it is well adapted for its purpose. Sir Joseph Hooker, we need hardly say, has revised his late friend's work with perfect tact and judgment, adding considerably to its value by bringing it into accordance with the latest knowledge, without making any essential changes. Mr. Bentham held that previous writers on our indigenous flora had exaggerated the number of distinct species. His opinions on this subject, Sir Joseph Hooker thinks, should not be dismissed hastily, since they were the views "of a great master of systematic and descriptive botany who had collected and studied a large proportion of the prevalent forms of British plants in a living state, not only in our three kingdoms, but in France, Scandinavia, Russia, Germany, Switzerland, and Turkey."

The Zoological Record for 1885. Being Vol. XXII. of the Record of Zoological Literature. Edited by Jeffrey Bell, M.A., &c. (London : John Van Voorst, 1886.)

BEFORE the close of 1886 the record of zoological literature for the year 1885 was in the hands of those interested in zoology, and the editor is to be warmly congratulated on this result. The difficulties in the way of such a result are very great ; on the present occasion they have been overcome, and we confidently trust the same may be the case for the future. The recorders have accomplished much, but they would be able to do more if the writers of scientific memoirs would assist in so desirable a cause and promptly send to the editor copies of their writings when first issued from the press. All of the recorders seem to have done their share of the work with care and discretion, though to some the lion's share has fallen ; the largest contributor being Dr. Sharp, who records all the Insecta with the exception of the Neuroptera and the Orthoptera, which latter groups are recorded by Mr. McLachlan. The large group for so many years recorded by Dr. von Martens is now divided between Prof. W. A. Herdman and Messrs. W. E. Hoyle and G. R. Vine. Dr. P. Bertkau records the Arachnida, including the new species and genera for 1883 and 1884. Numerous corrections and additions have been made in the list of works consulted, and this list now forms a very useful work of reference to the scientific publications of the world. To the records of the Mammalia and the Birds short introductory paragraphs are added, a practice which we would suggest to the other recorders. It is very expedient that they should follow this example, for, short though these paragraphs are, yet in them the reader gets some hint of what has been done in the group for the year. The Zoological Record Association is again able to record grants of 100*l.* each from the Government Grant Fund and the British Association, and one of 10*l.* from the Royal Irish Academy. Although these money grants are extremely well disposed of, we very much regret that so valuable and essential a publication should be to a large extent dependent upon them, and we would fain hope to see the list of subscribers greatly increased.

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.*]

Lightning-Flashes

THE brief note (NATURE, vol. xxxv. p. 85) giving the results of the observations of Herr Leyst, of the Pawlowsk Observatory, on the anomalous forms of lightning-flashes, suggests several considerations relating to this class of phenomena.

Leaving out of view the exceptional and anomalous phenomena of slow-moving (ball or globular) lightning—which are very difficult to correlate with any purely electrical manifestation—it is questionable whether it is possible for the observer to determine the direction in which the electrical current moves. In ordinary cases the velocity of the electrical discharge is so great, and the duration of the luminous flash is so brief, that it is impossible for the unassisted eye to determine the direction of motion.

According to the experiments of Prof. Rood (*American Journal of Science*, third series, vol. i. p. 15, 1871 ; also *idem*, vol. v. p. 163, 1873), the duration of lightning-flashes varies from 1/1600 to 1/20 of a second. Even the maximum duration of 1/20 of a second is probably too small to be recognised by the unaided human eye. Hence simple observation by means of the eye cannot determine the direction in which the electrical current moves.

It is nevertheless true that the eye seems to perceive the direction of motion of the luminous tract from one point of the cloud-covered sky to another. But this seeming recognition of direction must be an illusion of judgment based upon our interpretation of the phenomena presented to the sight. In these cases, our judgment of direction of motion seems to be dependent upon two considerations :—

(1) When the flash bifurcates or forks, we imagine (probably from the analogy of a ruptured projectile) that the electrical discharge passes in the direction of the diverging branches.

(2) But the more common cause of illusion of judgment in relation to the apparent direction of motion of the electrical discharge arises from the difference of brightness of different portions of the luminous path ; this gives rise to a difference of duration of the lingering visual impression on the retina. Thus, in the case of a flash several kilometres in length, one extremity will probably be much nearer to the observer than the other ; and hence the light emanating from one end will traverse a greater thickness of absorbing atmosphere than that emanating from the other end. This would necessarily render one extremity of the luminous path brighter than the other ; and consequently the duration of the impression on the retina would be greater for one end than for the other : hence the flash would seem to reach the end where the visual effect lingered longer at a later period than the other extremity. In other terms, the light produced in the luminous path is really generated sensibly at the same instant of time along its entire length, and the apparent direction of discharge is an illusion of judgment arising from the varying duration of the visual impression, due to differences of brightness in different portions of the flash. It is evident that the refinements of modern methods of measuring indefinitely small intervals of time might render the actual direction of motion of the electrical discharge appreciable to our senses.

With regard to the zigzag and irregular branching forms of lightning-flashes, these are the natural results of electrical discharges through an interrupted and non-homogeneous medium. The enormous length of some flashes (eight or ten kilometres) indicates that the intervening non-homogeneous dielectric acts as an interrupted conductor. In such a medium the path of electrical discharge is along the line of least resistance, which is the line of best induction, which is likewise the line of best conduction. In the atmosphere these lines are irregular and are perpetually shifting, hence the path of discharge may be nearly rectilinear at one time, branching at another time, and even quadrilateral at another time.

JOHN LE CONTE

Berkeley, California

THE quotation from M. Hirn in your issue of January 27 (p. 303) suggests a few remarks. What may be the greatest length of a flash of lightning? In the year 1843 I attempted to answer this question by the following observations.

My Inarya hut had far-projecting eaves supported by rough posts, some black, others white, and thus easy to distinguish. On the first appearance of a storm in a brick-red cloud I took my seat near the threshold, leaning my head against the door-post, and holding to my ear a pocket-chronometer. Among several flashes I noticed one nearly horizontal. It travelled northwards, and its thunder followed 54·4 seconds later. The thermometer being then at 19° C., I took that degree of heat, from want of better information, as mean heat of the whole trajectory, and got thus 343·7 metres for the velocity of a sound per second. This gave a distance of 18·7 kilometres for the commencement of the flash. It had begun before post A and ended beyond post D. As they were near me, I took care not to move my head before measuring with a small sextant the horizontal angle between A and D. I found it = 20° 30′, and obtained thus 6760 metres for the length of flash, supposing it horizontal and perpendicular to my line of sight. This result was a minimum, because the angle was evidently too small, and because moreover the flash, not quite horizontal, had travelled obliquely towards me. I drew the latter conclusion also from what appeared to me a fact on this and on other occasions, viz. my ear referred the thunder successively to different parts of the preceding flash. If an amanuensis had been at hand, I could have dictated to him at what beats of the watch the sound came from the direction of each post. It would then have been easy to get at least a rough estimate of the azimuth in which the flash travelled, and consequently its real length. In a similar way I measured on another day a flash more than ten times longer. I have not put down its particulars, because such an enormous result made me fear some mistake in time or angle. On my return to Europe, I mentioned these observations to the late F. Petit, then astronomer at Toulouse. He subsequently informed me that he had measured two flashes of lightning, one 13 and another 17 kilometres long. Should you publish the foregoing note you may induce other observers to follow this line of inquiry with improved appliances.

ANTOINE D'ABBADIE

Abbadia, Hendaye, February 2

Dr. Modigliani's Exploration of Nias

YOU have on two occasions given news of Dr. Elio Modigliani's recent exploration of this remarkable and interesting island. I believe it will therefore interest your readers if I endeavour to complete such information. Dr. Modigliani returned to Florence from Nias a short time ago, and at the last meeting of our Anthropological Society gave an able and graphic account of his visit to the island, and especially of his experience of the people ; he illustrated his communication with an exhibition of the rich and very complete ethnological and anthropological collections he has made.

The natives of Pulo Nias are evidently Malesoid, judging from the numerous interesting photographs taken by Dr. Modigliani, and yet they have peculiarities of their own ; and looking at the fine series of crania exhibited, one would say that on a Malayan face a Papuan skull had been fastened. Dr. Modigliani found also some resemblance between the Nias people and some of the hill tribes of Southern India. No traces of stone or shell implements are found in use at Nias. The natives get their iron, brass, and gold from traders, principally Chinese, but work the metals themselves with a primitive forge, making axes (hafted in wooden, club-like handles, as those of some African tribes), lance-heads, and swords : the former, usually barbed, recall the Celebean ones ; the latter are very like the *parangs* of the Bornean Dyaks. Their shields are often heavy and cumbrous, coated with buffalo-hide, very Bornean in shape ; they make besides curious iron helmets of a common Asiatic pattern. The swords are sheathed in wood, and have in front a globular wicker or rotang basket, the size of a big orange, which contains curious and very various amulets, with which they never part willingly ; the handle is often carved so as to represent a grotesque human face. The Nias people are inveterate head-hunters, and Dr. Modigliani showed one of their ghastly trophies procured whilst he was there, and preserved in spirits. The head is buried, and when the flesh has fallen off, the skull is hung up under the council-house. Every young fellow to be considered a man must have cut off at least one head—no distinction is made of sex

or age; after that, he wears as special badge a collar made of a polished section of the cocoa-nut palm stem with ends of brass.

The women go about with a curious staff ornamented with brass; the usual ornaments are armlets of brass wire, bracelets cut out of Tridacna-shell, and ear-rings of the same material or of metal, and beads. The clothes used to be, and in the southern districts are still, entirely made of beaten bark.

Their idols are roughly carved wooden figures, and both they and the still more primitive carvings representing dead relations vividly recall the idols and the *Karwars* of the Western Papuans. Each village has its chief, and usually war to the knife is waging between one village and the other. This renders a thorough exploration of Nias far from easy.

Dr. Modigliani certainly lost no time, and did his very best; and although quite new to such explorations, in a very short time, with rare energy and perseverance, surmounting many difficulties and not slight dangers, he has succeeded in bringing home most interesting and ample information on the people, extensive ethnological and anthropological collections, important zoological series, and a most interesting sample of the local flora, amongst which are some new species of the singular ant-plants (*Myrmecodiæ*) now being illustrated by Dr. Beccari.

I must say in conclusion that I do not know of any traveller so young and inexperienced who in so short a time (Dr. Modigliani was absent from Florence altogether just eleven months) has succeeded in doing so much and so well.

HENRY H. GIGLIOLI

Royal Museum, Florence, January 22

"Lepidosiren paradoxa"

ZOOLOGISTS will be interested to hear of the capture of a fine specimen of this the rarest of the Dipnoi. Only a few weeks ago I received from my friend Dr. J. Barbosa Rodriguez, the learned and energetic Director of the Museu Botanico do Amazonas, at Manaós, a very fine specimen of the *Lepidosiren*, captured some time last August in that neighbourhood. This specimen is well preserved in alcohol; it measures 85 centimetres in length, with a girth behind the pectorals of 28 centimetres. On opening it I found that it is a female, the ovaries being well laden with well-developed ova; unfortunately the alcohol had not been let into the visceral cavity, and none of the internal organs were in a condition to be successfully investigated. I found the pericardium singularly large and thick. The body is cylindrical, but quite flat along the abdominal surface, where the scales are also bigger, thicker, and of a lighter colour. The short caudal region is much compressed. There are no true median fins except the irregularly rounded caudal, which extends merely as a slightly marked keel to about the middle of the back. The fin-rays on the caudal portion are close together, cartilaginous, and quite hidden by the skin; pectorals and ventrals without traces of membranous edging and rays; the former are slender and compressed, the latter conical and considerably stouter. The entire body, except the head in front of the eyes and the paired fins, is covered with moderate cycloid scales—thicker, as I observed, on the *abdominal cuirasse*, extending from the chin to the anus and composed of about ten longitudinal rows of scales. Except along this ventral stripe, which is of a whitish colour, the animal is generally of a dark brownish purple, with darker indistinct blotches. The double lateral line is dark; it reticulates on the cheeks and around the eyes. These are quite rudimentary, and show under the skin as a whitish spot; they remind me of the eyes of the two *Gymnotus* which I saw alive in the Insect House at the London Zoological Gardens last October. The branchial openings are very narrow, protected by a thick fleshy flap: there are no traces of external branchial appendages, indeed, even the internal branchiæ cannot be seen through the deep, narrow, branchial slit. The mouth is terminal, with well-developed fleshy lips; there are two small conical vomerine teeth; the maxillary and mandibular dental plates are very similar in size and shape; fleshy pads fit into the spaces between the dental ridges. The tongue is thick, smooth, and fleshy, with a rounded point. Four branchial clefts can be made out on each side in the pharynx, the fourth is much reduced; the three free branchial arches are fringed with conical papillæ. The palate and mucous membrane of the mouth is white and quite smooth; the pads along the dental plates are papillous. The anus is exactly 10 millimetres on the left of the mesial line; it is 8 millimetres in diameter, and surrounded with a border in deep folds. I had forgotten to mention the nostrils: both pairs are *inside* the mouth; the anterior ones, just within the upper lip, are ovoid, transverse, without flap or valve; the posterior pair are situated just outside the hinder ridge of the maxillary dental plate, they are ovoid and longitudinal.

I need hardly insist on the importance of the capture of this new specimen of *Lepidosiren*. As far as I am aware, this is the *fourth* known; there are, besides, Natterer's two preserved at Vienna, and Castelnau's one in the Paris Museum. More recent explorers have utterly failed to find any, although an active search was made by several. Only recently I heard from a high authority the expression of a doubt as to the existence of such a creature as the South American *Lepidosiren*!

I may finally state that, evidently prompted by his friendship for me, Dr. Barbosa Rodriguez, seeing, as he believed, distinctions in his specimen, sent a brief description to a Rio scientific periodical, naming it *Lepidosiren gigliolina*; this before forwarding the specimen to me. I have not yet seen his description, nor am I in a position to decide as to any distinction existing between this and the other three existing specimens. I can only say that I consider such a difference very unlikely. I suppose that, like *Ceratodus*, *Lepidosiren* is liable to considerable individual variation. Lastly, I believe it not unlikely that *Lepidosiren* may be on the verge of extinction; that would account for its rarity.

HENRY H. GIGLIOLI

Royal Museum, Florence, January 22

The Coal-Dust Theory

SOME of the facts elicited at the adjourned inquest on the bodies of the twenty-eight persons who lost their lives in an explosion at Elemore pit on December 2 last, appear to have a direct bearing upon the coal-dust theory, and are therefore worthy of being recorded. It will be remembered that the inquest was adjourned until January 18, when it was re-opened; it was concluded on the following day. The verdict of the jury was as follows:—

"That Ralph Fishburn and others met their deaths by an explosion in the George Low Main seam, Elemore Colliery, on the morning of December 2, 1886; that the said explosion occurred between the Daleway end and the greaser; but what caused the ignition there is not sufficient evidence to show."

One of the victims, named Luke, who afterwards died from his injuries, made a statement to the effect that a shot was fired in one of the main intake airways not far from the bottom of the down-cast shaft, at the instant the explosion took place. The person who, according to Luke's statement, ignited the shot, still survives, and denies having done so, although he admits having fired a shot near the same place a short time previously. Some of the experts, including the two inspectors of mines, came to the conclusion that Luke's statement was the more probable; others were unable to concur with them in this. The evidences of violence point to the place indicated by Luke as having been the origin of the explosion. A good deal of discussion took place between some of the examining counsel and solicitors and some of the witnesses, as to whether coal-dust alone in the absence of fire-damp could originate and carry on an explosion, but nothing new was elicited in this respect. All agreed that there could not have been any gas present at the point where the shot was said to have been fired. Mr. G. Baker Foster was "quite of opinion that there had been no gas; . . . he could not imagine that in such an intake, with such ventilation, and such a position, gas could accumulate for a minute." Mr. Bell, the Inspector of Mines for the district, said:—"The ventilation throughout the pit was good. It was a well-managed pit, and the last in which he would have expected an explosion to take place." Mr. W. M. Atkinson, the Assistant-Inspector, said:—"The explosion was confined to those parts of the pit least likely to contain gas, and where there was the most coal-dust. It was highly improbable that there was any fire-damp where the explosion originated. He once examined the place when the barometer was as low as 27·5 inches, and no trace of fire-damp could be detected." (The barometer stood at 29·55 inches at 1 a.m., two hours before the explosion.) "He believed the explosion was entirely due to the combustion of coal-dust in pure air, and that its ignition was caused by a shot fired by Johnson. A blown-out shot would not be necessary. Wherever there had been coal-dust in the mine the explosion had gone; but wherever there was an absence of coal-dust,

there the explosion ceased." The last statement was not called in question by anyone, and stands unimpeached.

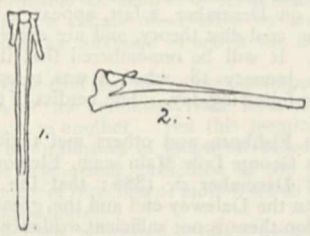
Those witnesses who would not go the length of saying that coal-dust alone in the absence of fire-damp had caused the explosion, had no explanation of their own to offer. The "outburst of gas," the cry which used to be so often adopted in similar cases, was not entertained by anyone in this case. Some of the witnesses were unable to accept the coal-dust theory on account of preconceived notions regarding it; others had read in books and papers certain statements which prevented them from adopting it; and one (Mr. Lishman, the manager of Elemore Colliery) had made experiments, with an apparatus similar to one of mine, which did not lead to conclusive results. With these conflicting opinions before them, the jury arrived at the conclusion that the men had been killed by *an explosion*, but, with the characteristic caution of men of the North, they refrained from stating what it was that had exploded.

Cardiff, February 3 W. GALLOWAY

Abnormality in the Urostyle of the Common Frog

ATTENTION has recently been drawn to abnormalities in the vertebral column of Rana. (See Bourne, *Quarterly Journal of Microscopical Science*, January 1884; Howes, *Anatomischer Anzeiger*, 1 Jahrgang, 1886, Nr. 11; Lloyd Morgan, NATURE, November 1886.) One form of such abnormality is the addition of a supernumerary (tenth) vertebra.

I wish here to record the occurrence, in the skeleton of a large *Rana temporaria*, of an abnormal urostyle, bearing at its anterior end a larger (right) and a smaller (left) transverse process. These are shown in the accompanying figures. Fig. 2 shows a tendency,



in the dorsal moiety, towards a segmentation of the urostyle and and the separation of a supernumerary vertebra. The coccygeal foramina lie just behind the transverse processes.

This case is interesting as showing an incompletely separated tenth vertebra, and as bringing an abnormal Rana into relation with a normal Discoglossus. C. LLOYD MORGAN

University College, Bristol

The Cambridge Cholera Fungus

I HAVE read with much interest the correspondence on the above subject in your issue of January 27 (p. 295). In the new edition of my work on bacteriology, to be issued, I hope, before many days, will be found the following statement:—

"At a meeting of the Physiological Society, held May 15, 1886, at Cambridge, a preliminary communication was made upon the investigations in Spain, referred to in the first edition of this work. The observations made by Roy, Brown, and Sherrington rather tend, in the opinion of the author, to confirm Koch's views. Comma-bacilli were found to be present in some cases in enormous numbers, and the frequency of their occurrence led these observers to believe that they must bear some relation to the disease. At the same time, as they failed to find them in all cases, they regarded the existence of a causal relation as not proven. They failed to find the Naples bacterium or the small straight bacillus noted by Klein, but they drew attention to certain peculiar mycelium-like threads in the mucous membrane of the intestines. These organisms, however, judging from a preparation stained with methylene-blue which was exhibited at the meeting, appeared to the author to much more closely resemble some of the involution-forms of comma-bacilli, *filaments à masses globuleuses*, figured by Van Ermengem, than anything else he had seen. Yet assuming these peculiar structures to belong, as described, to some species of Chytridiaceæ, it is very doubtful whether they can be considered to be of any significance. Methylene-blue has been employed by Koch and others, including the author, for staining sections of the intestine from cholera cases, and had they been constantly present, it is hardly possible that such striking objects could have been overlooked. Again, we must bear in mind that hyphomycetous fungi have been found occasionally to occur saprophytically in the intestinal canal, as well as in the lungs, external auditory meatus, and elsewhere. We must, however, wait before expressing a more definite opinion, until the Report of these observers is published in full."

This, I think, may explain Mr. Gardiner's difficulty. Very probably the same preparation was shown to him, as his second opinion coincides with the conclusion I arrived at last May. I have now before me the Proceedings of the Royal Society, No. 247, and I am greatly puzzled by the illustrations, for they certainly appear to represent a branching mycelium, and do not in the least recall to my mind the preparation which I had an opportunity of examining. EDGAR CROOKSHANK

Eastbourne, January 31

Low Barometric Readings

IN a Note in NATURE of December 16 (p. 157) you observe that the barometric reading of 27·333 inches (reduced to sea-level) recorded at Ochtertyre, Perthshire, on January 26, 1884, is the lowest observed by man anywhere on the land surface of the globe. This, however, is not the case. The cyclone which on the morning of September 22, 1885, swept over False Point, on the coast of Orissa, gave the lower readings 27·135 at the beginning of the central calm, and 27·154 half an hour later (both readings reduced to 32° and sea-level). These readings are perfectly authentic, the instrument being a Casella's observatory standard (on Fortin's principle) that has been verified with the Calcutta standard and is corrected to that standard, which is 0·011″ higher than the Kew standard. Its elevation above the sea, 20·6 feet, has been determined by spirit-level; and the observer, Mr. Workman, is one of the best of those who keep a regular meteorological register for this department. The above are the lowest of a series of readings, taken at intervals throughout the storm, which was then travelling at the rate of thirteen miles an hour.

The storm will be long remembered as that in which the settlement of Hookeytollah, six miles to the north of False Point lighthouse, together with its inhabitants, was swept away by the storm-wave accompanying the cyclone. At False Point station the water rose 22 feet above mean sea-level directly after the passage of the storm centre. The country inundated lay to the north of the lighthouse, and is a low-lying alluvial tract from 4 to 5 feet above mean sea-level, intersected by a network of salt-water tidal creeks.

The destruction that ensued was very great. Including the small settlement of Hookeytollah, some two thousand households were swept away, representing a loss of from six to ten thousand souls. Crops valued at ten lakhs of rupees (100,000*l.*) were irretrievably damaged and lost; the wells and tanks of drinking-water were rendered unfit for use; and about 60,000 acres of land rendered unfit for cultivation for two or three years to come. But even this is very small in comparison with the destructive effects of the Calcutta cyclone of October 5, 1864, and those of the Backerganj cyclone of November 1, 1876.

HENRY F. BLANFORD

Indian Meteorological Office, Calcutta, January 6

Magnetic Theory

MR. WATSON asks, What is the physical evidence in favour of the existence of A, B, C, and α, β, γ? With regard to the former the evidence, derived from the permanence of the magnetisation in a small piece of a hard steel magnet, seems to me almost conclusive; while the following consideration tells very strongly in favour of α, β, γ.

To determine the mechanical force and couple acting on a magnetic element placed in a magnetic field in air, we treat it as consisting of two equal and opposite poles very near together, and find the resultant of the forces on these two poles. It may be proved without difficulty that the same process may be used to find the mechanical force and couple, arising from magnetic causes, acting on an element within the mass of a magnet. In the first case we may, of course, employ either α, β, γ, or a, b, c, as the forces acting on a unit pole. But in the second case we

must employ α, β, γ, as defined in Mr. Watson's letter in your issue of January 27 (p. 296). These mechanical forces cannot, I believe, be expressed in terms of the values of a, b, c, u, v, w, and their differential coefficients at the point. This is a definite physical argument in favour of the existence of α, β, γ, within a magnet.

St. Moritz, Engadine JAMES C. MCCONNEL

"Phantasms of the Living"

NOTHING in your last week's notice of "Phantasms of the Living" gratified me more than the attention paid to our experimental results. The grounds of our own confidence in them are (1) that the conditions were in many cases such as completely to exclude unconscious physical signs, and (2) that, if the success was due to fraud, it was not fraud which the investigators failed to detect, but fraud in which they must actively have shared. But, where the scientific presumption against new phenomena is so strong, it is best to recognise that no line can be drawn at which the evidence for them *ought* to be found convincing, and that, till it actually *is* found convincing, it is incomplete. Meanwhile it *ought* to be sceptically approached—not with the impatient scepticism which denies that such facts can ever be proved, but with the cautious scepticism which perceives that they require a very great deal of proving. The object of this letter, then, is to urge the paramount importance of extending the area of experiment. This cannot be done without an amount of public spirit which it is very hard to evoke. The "percipient" faculty, even though possessed in a high degree, is very unlikely to reveal itself spontaneously: our only hope of discovering it is that trials in thought transference shall be very widely made—which means that a large number of persons shall spend some time and trouble in a manner which will often appear to have been fruitless. It is difficult to press this on anyone as a duty; but it is at any rate worth while to point out how simple and rapid the process of experimentation may be made. Especially anxious am I that a great many pairs of persons should carry out experiments of the very simple type described in "Phantasms," vol. i. pp. 32, 33. If any of your readers are willing to do this, will they kindly, *before beginning*, send me their names and the number of the trials that they propose to make, to guard against any *selection* of results? EDMUND GURNEY

14 Dean's Yard, S.W., February 3

University College, Bristol

MY attention has been called to a paragraph in your issue of the 3rd inst. (p. 326), referring to this College. Will you kindly grant me space to correct the statement made therein, which is inaccurate in some important points, and is calculated, as it stands, to injure our reputation?

No general reduction of the salaries of the Professors has been made, nor is it contemplated. Notice to terminate our engagement with two Professors has been given them, as it was believed that more advantageous arrangements could be made in their departments without affecting the quality of the instruction given. It is too true that the College greatly needs more liberal pecuniary support than it has hitherto received, but efforts are being made to procure it; and as yet the Council have no intention of limiting the subjects hitherto taught, or of requiring a lower standard of attainment than that which has distinguished so many of their Professors. ALBERT FRY,

Chairman of the Council

University College, Bristol, February 7

A Rule for escaping a Danger

SUPPOSE a weir, AB, across a river, and first let it be at right angles to the direction of the current. Suppose a man in the stream above the weir, nearer to B than to A. Let O be his position, and OX a perpendicular on AB. Then he cannot escape if his velocity, v, is $< \frac{BX}{OB} . u$, where u is that of the stream. If his full speed has this critical value, or if there is any uncertainty about his safety, he must swim at right angles to OB.

The rule is obviously correct, for to escape he must clear the nearer end of the weir, and must therefore exert his strength in the direction mentioned. Geometry puts it clearly: Reduce the stream to rest so that the weir is advancing on the man with velocity u. Let P be the point at which the man is overtaken, then, if PN be perpendicular to AB,

$$\frac{OP}{v} - \frac{PN}{u},$$

so that P is on a conic for any given velocity. Varying v, he will escape if the conic reaches the bank. The first to do so touches at the end C of the minor axis, and since CB is a tangent, the angle COB is right. Also now

$$v : u = OC : CB = BX : OB.$$

If the weir slants across the river, the direction of safety is still at right angles to the line joining O to A or B. The swimmer must decide, by looking in both directions, to which bank to direct his efforts. The locus of points for which both directions give the same distance is, to axes through the middle of the weir up and at right angles to the current, of the form

$$(y^2x - 2aby + b^2x)(y^2a - 2bxy + ab^2) = by(x^2 - a^2)^2,$$

a quintic having cusps at A, B.

The rule fails if the change of velocity as one approaches the bank be considerable. One would then strike more across.

If one were being charged by any insensate object, the rule would of course apply. FRANK MORLEY

Bath College

Abnormal Cats' Paws

IN reference to the recent articles in NATURE on six-toed cats, allow me to remark that the experiment about to be tried on one of the small islands off the English coast has *apparently* been anticipated at the village of Morriches Centre, on Long Island, where nearly all the cats have at least one supernumerary digit on all feet, and are currently called, in the place, "double-footed." I have a specimen showing the abnormality distinctly. I say "apparently," because there can be little doubt that at some time a single individual was introduced, which has become the ancestor of all the "six-toed" cats in the village.

E. W. CLAYPOLE

ABNORMITIES in cats' paws occur rather frequently in Massachusetts. They are called mitten cats, and are much in demand because they are considered to be good mousers. The first I ever saw was a male yellow tiger, whose four paws had two extra toes strongly developed. A little stray female kitten which was brought up at my house had two abnormal fore-paws with four extra toes on each. As there are no male cats in our neighbourhood with any abnormity I was very anxious to see whether her young ones would inherit the shape of their paws from the father or mother cat, and whether some abnormity would also appear in the hind-paws. She had eight, and only one of them with four normal paws; all the others inherited from the mother the abnormal fore-paws, some even having five to seven extra toes, with perfectly developed claws and pads. I did not pay attention to the sex, but brought one up on account of its strong build, which turned out to be a male, and another for its beautiful stripes, which was a female. The old cat rested nearly a year, and then again had eight three times in succession, in April, June, and October, and every time only one with normal paws. The mother is a pale grey tiger, and each one of the young ones was differently spotted, and, as I believe, had a different father, as I recognised the marked resemblance to the various visitors to our garden. I paid no attention to the sex, but brought up from the last litter the strongest looking, which turned out to be a male, and two others—the one selected by a child, the other because it had seven extra toes. Both these were females.

H. A. HAGEN

Harvard University, Cambridge, Massachusetts, January 5

The Cross as a Sun Symbol

THE use of the cross as a sacred symbol dates from the earliest times, and is almost universal. It occurs upon the monuments and utensils of every primitive people from China to Yucatan. In many, perhaps in a majority of, instances it is used as a symbol of the sun. One of the oldest and most widely occurring forms is the cross with *crampons* turned to the right or left, the *svastika* and *sauvastika* of India, the "Thor's hammer" of Western Europe. Prof. Max Müller thinks that the *svastika* represents the vernal sun, and is hence an emblem of life,

health, and creative energy (Schliemann's "Ilios," p. 348). Mr. Edward Thomas (*ibid.*) believes it to have arisen from the conception of the sun as a rolling wheel. The Chaldean sun symbol was first a circle, then a circle with an inscribed cross. The symbol of the sun-god at Sippara is a small circle with four triangular rays, the four angles between being occupied by radiating lines, and the whole circumscribed by a larger circle. The same symbol occurs repeatedly upon the shell gorgets of the mound-builders (Second Annual Report of the U.S. Bureau of Ethnology, plates liii., lviii., and lix.). The peculiar figure repeated upon the *façade* of the "House of the Nuns" at Uxmal seems to be a conventionalised circle and cross with rays. The Moqui symbol for the sun is a Greek cross with a small circle at the centre, in which are three marks to indicate the eyes and mouth of a face (First Annual Report of the U.S. Bureau of Ethnology, p. 371). It is needless to multiply examples: the important question is, How has the cross come to be a symbol of the sun? If anyone will observe carefully a lamp, or other bright light, with partially closed eyes, the answer will be obvious. The rays which appear to proceed from the luminous point always form a cross of some kind. A little experimenting will show that this appearance is due to reflection from the eyelashes and edges of the eyelids. The same experiment may be tried with the sun itself: if observed when considerably above the horizon, squinting will be unavoidable. If the head is erect, the downward arm of the cross will be much the strongest, and the upward arm may be obsolete; but if the head is thrown back, the arms will be nearly equal. The evolution of the sun symbol seems to have been as follows: He was first represented by a circle or disk as he appears when near the horizon; observations made when he was shining brightly revealed the crossed rays. This led to a combination of the circle and cross. If this hypothesis be correct, the *svastika* was originally neither a rolling wheel, nor, as Burnouf supposes, the crossed sticks from which our ancestors elicited fire; but it is a modification of the circle and inscribed cross.

It is not claimed that the cross has in every case originated in this way; but since sun-worship is known to have been an almost universal form of primitive religion, and since the unscientific observer would be sure to regard the crossed rays as an essential part of the sun, this hypothesis furnishes a reasonable explanation of the universality of the symbol. Anything bearing the cross would be regarded as sacred; hence the Egyptian worship of the scarab, as noticed by Mr. R. G. Haliburton (NATURE, vol. xxxiv. p. 610), and the spider-gorgets of the mound-builders (Second Annual Report of the U.S. Bureau of Ethnology, plate lxi.). Not the least remarkable feature of the subject is the fact that the most ancient and universal symbol of the physical sun should, for entirely independent reasons, continue in use as the sign of "the Sun of righteousness" and "the Light of the world."

CHARLES R. DRYER

Fort Wayne, Ind., U.S.A., January 12

Clausius's Formula

IN the report of our preliminary communication to the Royal Society, reported in your issue of the 13th inst. (p. 262), we give Clausius's formula intended to express the relation between the gaseous and liquid states of matter as

$$p = \frac{RT}{v-\alpha} - \frac{c}{T(v+\beta)^2}.$$

We should have mentioned that this formula has been amended by Clausius to

$$p = \frac{RT}{v-\alpha} - \frac{c}{\Theta(v+\beta)^2},$$

where $\Theta = aT^n b$. As Θ is a function of T, it is evident that this latest form also is not in agreement with the simple relation pointed out by us for ethyl ether,

$$p = bT - a.$$

WILLIAM RAMSAY

January 20 SYDNEY YOUNG

Notes on Certain Traits of Infant Navajos

As we know, the Navajos are an American tribe of Indians, scattered for the most part over the Territories of New Mexico and Arizona. Quite a number of them live with their families, in the curious little habitations they erect, about the frontier military station of Fort Wingate, New Mexico. It is in this latter place that I have had the opportunity, for over two years past, of studying many of their ways and customs. And it was here, too, that, a few days ago, I went out among them with a photographic camera, armed with an English instantaneous shutter, with the view of taking a few pictures of them while they were actively engaged in some of their very interesting games.

After having obtained four or five more or less satisfactory plates, the Indians became quite restive, as they rather object to that sort of a thing; and, as if by common consent, they gradually disappeared, a few at a time making for one of their low, conical-shaped mud huts, where they entered through the single small door at its side. In less than half an hour there were none of them to be seen outside at all, and, knowing full well that they would not appear again so long as I remained upon the ground, I shouldered my instrument and prepared to come away. At the time, I was standing between two of their huts, situated some three hundred yards apart, with a well-beaten, though narrow footpath passing from one to the other. There were no trees within a quarter of a mile, the plain being sparsely covered with sage-brush, the plants being from 2 to 3 feet high. Just then one of their babies toddled out of the doorway of the upper hut; the child could not have been over ten months old, and wore only a very dirty little shirt, which came about half way down to its knees. It looked more like an infant Eskimo than any child, not white, that I know anything about; and it started right down the path with a very unsteady baby-waddle, making for the lower hut, where I imagine its mother had taken refuge from my merciless camera. I had often longed for a good picture of a Navajo baby in its native plains, and here was an opportunity not to be lost. So, stepping a few feet out of the way, in an instant I had my instrument in position, focused on the path, and, with instantaneous snap ready, I stood quietly for my subject to pass. On he toddled, until he came within about 30 feet of me, where he suddenly stopped, and, to my surprise, seemed to fully take in the situation.

At this stage, I feel quite sure that one of our babies, especially at this tender age, would have begun to cry, and more than likely retraced its steps to the hut from whence it had issued. Not so, however, this infant Navajo; and, mark the difference. He steadily watched my every movement, and was evidently determined to reach the lower hut. Very cautiously leaving the path on the side furthest from me, he was, in the next instant, behind one of the sage-brushes, which was something over a foot taller than the baby. From this position he peered through the leafless twigs at me, to see what I would do about it. A little annoyed at this turn in affairs, I threw the focusing-cloth over my head, and turned the instrument on him. Taking advantage of this temporary concealment of my head, he ran, thoroughly baby-fashion, to the next *lower* brush, a distance of some 10 feet, where, hiding as before, he crouched down, and stared at me like a young lynx through the twigs. He now looked, for all the world, the young Indian cub at bay, with all the native instincts of his ancestors on the alert, and making use of all the strategy his baby mind could muster. It was a wonderfully interesting picture to study; but, fearing that I would lose a permanent memento of it, I turned to lift my instrument, with the view of taking a much nearer position, when, again facing the brush where I had last seen the baby, it was, to my great surprise, not there, but had scampered to the next lower one, in the direction of the hut for which it was bound. A full-grown buck of the tribe could not have possibly managed this last movement any better. As it ran to the still next lower brush, I was astonished beyond measure (for, I take it, I am a good stalker myself) how it took advantage of everything that lay in the short intervening distance, and how, after it arrived at the brush, it immediately took a position on the opposite side of it, from where it could make another quick start, and yet not lose sight of my movements. And, mind you, all this from a baby only ten months old at the most. As it was rapidly gaining its point and approaching the lower hut, in sheer desperation I ran up on its last place of concealment, holding my camera in such a way that I could immediately place the tripod in position, which I succeeded in doing, with the lens levelled directly at its head, and not 3 feet from it. It now stood up to the full extent of its baby height, and, giving vent to a genuine infantile bawl, it made a break for the final point of its destination, for there

was nothing else left for it to do. It is almost needless to add that, before I could focus and insert a plate, my Navajo baby was out of range. And, fearing that its angered mother might appear at any point, at the cry of alarm of her child, I immediately forsook the ground.

My object in making a record of such an interesting case as this is to simply draw attention to the fact that the native instincts of these American Indians are exhibited in their young at a wonderfully tender age; and in this particular they differ vastly from our own children at a corresponding time of life, and reared, as they have been for ages, in a civilised environment.

R. W. SHUFELDT

Fort Wingate, New Mexico, January 11

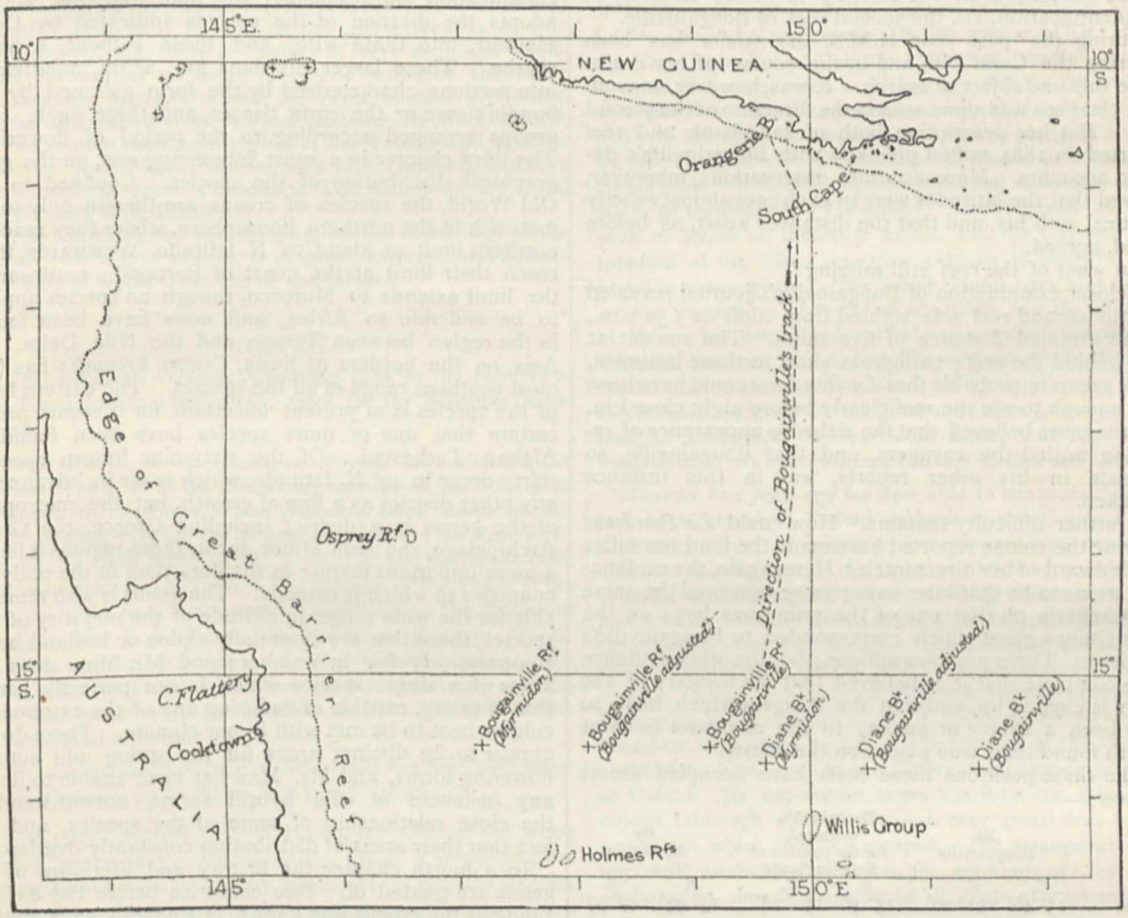
LONG-LOST REEFS

A REMARKABLE instance of the manner in which small reefs in the ocean may elude search has recently been brought to light, and may be of interest to some readers of NATURE.

In June 1768 M. de Bougainville, in the frigate *La Boudeuse*, having left Espiritu Santo, in the New Hebrides, was sailing west over the Coral Sea, south of New Guinea, near the parallel of 15° S. At midnight of the 4th he sighted a sand-bank, and waited till daylight to examine it, when it proved to be a very small patch of sand only just out of water, with apparently no reef around it. This he called Bâture de Diane.

Resuming his course west, he, on the 6th, having run by his reckoning 137 miles from the sand-bank, sighted a reef on which the sea broke heavily, and closing it, at noon obtained its position. After a zig-zag course of five hours, another reef was seen ahead, and as this might be but the prelude to more, the project of exploring further westward was given up, and *La Boudeuse* steered northward, making New Guinea at a bay to which the name of Cul de Sac de l'Orangerie was given. Bougainville thus lost the honour of discovering the eastern coast of Australia, which the celebrated Cook explored two years later. On the last reefs seen no name was bestowed, but they have always been known as the Bougainville Reefs.

Time passed, but these dangers were not again seen.



The subject of their existence was much discussed, and on the longitude of Espiritu Santo being revised, it was recognised that M. de Bougainville's discoveries should be also moved to the westward about sixty miles—the amount of error in longitude of Espiritu Santo in his time. The Diane was therefore placed in longitude 150° 28′ E., and the reefs in 148° 6′. In this position they were searched for by Capt. Denham in H.M.S. *Herald*, who spent fifteen days in traversing in every direction an area of forty miles radius round each danger, but without success. As a result of this search, seeing that Bougainville's description was so circumstantial that the existence of the dangers could scarcely be doubted, they were removed back to their original positions on the charts. These positions, though manifestly too near to Espiritu Santo, agreed better with the land-fall made in New Guinea by *La Boudeuse* after leaving the last reef, as it seemed impossible that the bay generally supposed to be the Cul de Sac de l'Orangerie could have been reached on the course steered by M. de Bougainville from any position westward of longitude 149° 8′ E., Bougainville's own position of the reef.

Many ships passed in fear and trembling over the long line in which it was thought these dangers might yet

exist, and the records are full of remarks as to their non-existence, especially with regard to the Diane, which lay near the main track to Torres Strait from Sydney. They were, however, retained on the charts, with notations as to the doubt in their positions.

At length, in 1884, two reports were made by small trading-vessels from Queensland to New Guinea, one of a small bank in lat. 15° 41′, and long. 149° 43′, the other of a submerged reef in lat. 15° 28′, long. 147° 6′. It was at once observed that the latitudes of these, and their distance apart, agreed with those of Bougainville's discoveries, though they were far to the westward, and it seemed as if the long-lost reefs were at length again found, since it was not at all improbable that the westerly current had caused the reckoning in longitude, uncorrected by chronometers, to be over-run by *La Boudeuse*. Capt. Denham's searches, minute and painstaking, and apparently sufficiently extended as they had been, just fell short of the positions of these new reports, the limit of his examinations passing within ten miles of both of them.

One link, however, was missing to insure certainty in the identification, viz. the second reef of Bougainville.

During the past year H.M.S. *Myrmidon* has been scouring the Coral Sea, and in the course of her cruise made this one object of search. It was, however, unavailing; clear sea was alone seen in the direction of the second reef. But her description both of sand-bank and reef reported in 1884 tallied precisely with Bougainville's detailed accounts. More accurate observations, moreover, showed that the latitudes were in each case almost exactly identical with his, and that the distances apart, as before stated, agreed.

But what of the reef still missing?

A closer examination of Bougainville's journal revealed that the second reef was sighted from aloft at 5.30 p.m., at an estimated distance of five miles. The sun set at 5.35, behind the reef; twilight is short in those latitudes, and it seems improbable that *La Boudeuse* could have been near enough to see the reef clearly before night closed in. It is therefore believed that the delusive appearance of reflection misled the voyagers, and that Bougainville, so accurate in his other reports, was in this instance mistaken.

A further difficulty remains. How could *La Boudeuse* steering the course reported have made the land 100 miles to windward of her direct track? Here, again, the explanation seems to be that later voyagers re-bestowed the name of Orangerie on that one of the numerous bays on the New Guinea coast which corresponded to Bougainville's longitude. These are assumptions; but the other evidence is so complete that it is believed that the mystery of 120 years is cleared up, and that the dangers which have so long been a source of anxiety to the navigator have at length found their true places on the charts.

The three positions these reefs have occupied are as follows:—

	By Bougainville		Bougainville corrected for the position of Espiritu Santo		By *Myrmidon*	
	S.	E.	S.	E.	S.	E.
Diane ...	15° 46′	151° 26′ ...	15° 46′	150° 28′ ...	15° 43′	149° 37′
Bougainville Reefs	15° 35′	149° 8′ ...	15° 35′	148° 6′ ...	15° 33′	147° 12′

W. J. L. WHARTON

THE CROCUS[1]

MANY splendidly printed and illustrated monographs of special genera of flowering plants have been published, but few surpass in merit or interest Mr. Maw's monograph of the species of the genus Crocus. This work, the author tells us, has pleasantly occupied his spare hours for the last eight years. In collecting the material for it, he has travelled far and wide over the crocus region; he has enlisted the services of a whole host of friends, who, on the borders of the Mediterranean, of the great Basin of the Black Sea, and along the shores of the Caspian, have collected the species peculiar to these localities, and forwarded them for culture and description to Mr. Maw. Perhaps never before has a monograph been written so entirely from the study of living plants. At the same time, no information that was to be gleaned from the dried specimens in herbaria has been neglected.

The monograph opens with a chapter on the life-history and physiology of the forms belonging to the genus. As the minute structure of the various parts of the plants has not been made a special study by the author, this portion of the subject leaves a good deal to be done by future workers. The strange phenomenon of dissepiments on the pollen-tube is figured as existing, on the authority of Prof. Martin Duncan. In the chapter on classification and sequence, we find that the author adopts the division of the species indicated by Dean Herbert, into those with, and those without, a basal spathe. These larger divisions are, again, subdivided into sections, characterised by the form assumed by the bundle tissue or the corm tissues, and these, again, into groups arranged according to the period of flowering. The third chapter is a most interesting one, on the geographical distribution of the species. Confined to the Old World, the species of crocus are therein only to be met with in the northern hemisphere, where they reach a northern limit at about 50° N. latitude. Westwards, they reach their limit at the coast of Portugal; southwards, the limit extends to Morocco, though no species appear to be endemic to Africa, and none have been found in the region between Tetuan and the Nile Delta. In Asia, on the borders of Syria, *Crocus hyemalis* has the most southern range of all the species. The eastern limit of the species is at present uncertain, for it seems pretty certain that one or more species have been found in Afghan Turkestan. Of the sixty-nine known species, thirty occur in 40° N. latitude, which is far in advance of any other district as a line of growth, but the metropolis of the genus is a district including Greece, the Greek Archipelago, and Asia Minor, for in these regions it forms a more important feature in the flora than in the outlying countries to which it extends. The genus is also remarkable for the wide range in altitude of the majority of the species, those that are essentially alpine or lowland being comparatively few in number; and Mr. Maw does not know of a single species which is not perfectly hardy, that is to say, capable of enduring any of the extremes of cold or heat to be met with in our climate. There do not appear to be distinct areas for the spring and autumn flowering forms, and Mr. Maw has been unable to detect any instances of wild hybrid forms, notwithstanding the close relationship of some of the species, and the fact that their areas of distribution constantly overlap.

In a fourth chapter the history and literature of the genus are treated of. Two centuries before the days of Linnæus the crocus was known in England as a garden plant, and in Gerarde's "Herball" (1597) eleven forms are figured and described. Most of the famous pre-Linnean writers on plants have added to our knowledge of the species, such as Parkinson in his "Paradisus" (1629), and Ewart in his "Florilegium" (1612); but Linnæus contented himself with making but two species, one *C. vernus*, and the other *C.* (*Bulbocodium*) *bulbocodium*. The first important attempt to classify the genus was made by A. H. Haworth in 1809, followed by Goldbach's monograph in 1817, Gay's in 1827, and Sabine's in 1830. Dean Herbert in 1847 and Baker in 1873 added much to our scientific knowledge of the group, and now in this beautiful monograph

[1] "A Monograph of the Genus Crocus." By George Maw, F.L.S., &c. With an Appendix on the etymology of the words "Crocus" and "Saffron," by C. C. Lacaita, M.A., M.P., F.L.S. (London: Dulau and Co., 1886.)

we have the history of the genus, written in a manner that, except for the anatomical student, will not for very long indeed be surpassed.

Hints on cultivation and on species not yet introduced to cultivation, and remarks on saffron, its cultivation and uses, form Chapters V. and VI. Saffron would appear to have been cultivated in England prior to 1582, and from its importance as an article of commerce gave its name to Saffron Walden. It is very strange that after having been grown as an economic plant in England for three or four centuries its production has died out, and that it is an extremely difficult thing to get the saffron crocus to flower in this country. The author says that saffron was used as a royal dye in the olden time in Ireland, but this is a very doubtful statement.

Into the descriptive portion of this work it is needless that we should enter in detail. All the species and their chief varieties are most carefully described, full synonymic lists are given, and ample details as to the geographical distribution of each and its period of flowering. The description of each species is accompanied by a plate illustrating the corm, flower, leaves, fruit, and structural details; and, as if to add to the attractiveness of this splendid volume, there is a series of very exquisite woodcuts, introduced as head-pieces, of some of the more remarkable districts where the rarer species are found. Some of these are from original sketches, by Mr. Danford, of the remote mountain region of the Taurus and of other parts of Asia Minor, where, with Mrs. Danford, journeys were made in quest of crocuses. The volume is dedicated to Mr. and Mrs. Danford.

The appendix, by Mr. Lacaita, on the etymology of the words crocus and saffron, is of great interest, and tells of the almost world-wide use of the terms.

NOTES

LAST week, Sir William Armstrong paid to the bankers of the Royal Society a cheque for 7800*l.* for the Scientific Relief Fund.

THE Council of the Geological Society have awarded the medals to be given at the anniversary meeting of the Society on February 18, as follows:—The Wollaston Gold Medal to Mr J. W. Hulke, F.R.S., the Murchison Medal to the Rev. P. B. Brodie, the Lyell Medal to Mr. S. Allport, and the Bigsby Gold Medal to Prof. C. Lapworth. The balances of the Funds at the disposal of the Society are awarded as follows:—The Wollaston Fund to Mr. B. N. Peach, the Murchison Fund to Mr. R. Kidston, and the Lyell Fund to the Rev. Osmond Fisher. We believe that the President's address at the anniversary meeting will deal mainly with the relations between geology and the mineralogical sciences.

THE Geographical Society of Australasia has been authorised by the Queen to prefix the word "Royal" to its title.

THE recent death of General Hazen, the chief of the Army Signal Service in the United States, which is responsible for the meteorology of that country, has raised the question whether or not meteorology should be dealt with by a civil rather than a military bureau. It will be remembered that when the present meteorological system was established in the United States it was connected with the Signal Service, in order to utilise the time of the officers and men during peace. There is no doubt that the work done by the American Signal Service has been done with a thoroughness and vigour which have not been equalled elsewhere; and the eminent men of science who have been associated with the Chief Signal Officer have taken care that the mere forwarding of weather information should not be the whole of their duties. A Committee of the National Academy of Science has already been appointed to consider the matter, and has recommended separation of the work from the War Office. Whatever decision is arrived at, it is to be hoped that the service in its new form (if it is to have one) may not be less efficient than it has been in the past. This question is of course part of the general question now being seriously discussed in the United States, as to whether a purely scientific service should be controlled and directed by scientific men. In the abstract there can be of course but one answer to this question, but it must at the same time be pointed out that to make a man of science responsible for large administrative and executive work is to destroy him utterly as a man of science. This is a good reason for having some one other than a man of science for the carrying out of such work. It is, however, no argument for placing the man of science in a subordinate position to any mere administrator, and it would perhaps be best to intrust such inquiries on a very large scale to a small Committee, one of whom should be the man responsible for the science and the other the man responsible for the administration.

VERY enlightened ideas prevail among the influential classes of India with regard to the manner in which the Queen's Jubilee should be celebrated. On the motion of Dr. Hunter, the Vice-Chancellor of Calcutta University, the Jubilee Committee at Calcutta decided some days ago that the fund which is to be raised in India for a permanent memorial, shall be devoted partly to the Imperial Institute in London, partly to a scheme for the placing of technical education in India on a sound and lasting basis. It is said that the provincial cities are resolved not to be outstripped by the capital. The people of Patna propose to found an industrial school, and the Calcutta Correspondent of the *Times* says their example is likely to be followed in many places. The native princes have also begun to see the importance of technical education, and the Maharajah of Mysore has determined not only to contribute largely to the Imperial Institute in London, but to form an Institute of a similar kind in his own dominions. All this promises well for the material progress of our great dependency, and it should tend to strengthen the movement among ourselves for the establishment of closer relations between science and industry.

NEARLY four years ago we were able to announce that a vote had been passed at Oxford authorising the Curators of the University Chest to spend a sum of 7500*l.* in building an annex to the east side of the University Museum, to contain the splendid anthropological collection which General Pitt-Rivers had most munificently offered to the University, and in providing the requisite cases and fittings. The collection has now been partially arranged in the hall built for it, and is thrown open to visitors. It has been enriched by objects transferred from other University Museums, such as the Ashmolean, and by numerous donations from other sources. The opening of the collection ought to mark an epoch in the history of anthropological study at Oxford. Its importance arises less from the value of the objects (although that, of course, is very great) than from the manner in which they are grouped. The arrangement brings out with astonishing clearness the working of the law of evolution in the development of all kinds of implements and weapons.

IT is proposed that a Medical School shall be formed in connection with University College, Dundee. There can be little doubt that the scheme will be successful, for not only has Dundee an important hospital, but medical students at the new school would have the advantage of being able to take the degrees of the University of St. Andrews. Some time ago Mr. T. H. Cox offered 12,000*l.* as an endowment for a Chair of Anatomy, and now the sons and daughters of the late Mr. J. F. White, of Balruddery, have given 6000*l.* to found a Lectureship or Chair to be associated with their father's name.

About 2000 delegates, including about 300 from Europe, are expected to be present at the ninth triennial meeting of the International Medical Congress at Washington in September next. An effort is being made to secure the hall of the House of Representatives for the opening meeting. After this meeting the Congress will be divided into seventeen sections, assembling in the different halls of the city.

Mr. G. T. Ryves, F.R.Met.Soc., wrote the other day to the *Times*, from Stoke-on-Trent, presenting the results of an independent comparison of the daily forecast issued by the Meteorological Office for the Midland District with the actual weather experienced in 1886. The number of forecasts sent out by the Office during the year was 310. Of these, 309 were tested, and Mr. Ryves found that there were 247 absolute successes, 26 absolute failures, and 36 partial or doubtful successes. That is to say, omitting small fractions, there were 80 per cent. of successes, 8½ per cent. of failures, and 11½ per cent. of doubtful cases. Mr. Ryves understands that a similar result has been arrived at in other places where the forecasts have been submitted to an examination extending over a period of sufficient length to make it possible to strike a fair average.

The French Minister for Public Instruction has nominated a Commission, under the presidency of M. Bertrand, the Secretary of the Académie des Sciences, which will award a prize of 50,000 francs (2000*l.*) to the inventor of a cheap method for the application of electricity to the purposes either of heating and lighting, chemical or mechanical force, telegraphy, or the treatment of the sick.

The Royal Scientific Society of Göttingen offers a prize of 500 marks (25*l.*), in 1889, for a complete review of the literature of the Arabs and the Arabian-speaking tribes of the Islam and Christian kingdoms up to the time of the conquest of Egypt by Turkey. Further particulars can be obtained of the Society.

Mr. Maclean, the official assistant to the Professor of Natural Philosophy in the University of Glasgow, has just published a little book containing examples of exercises given in the natural philosophy class during recent years, with indications how to answer them. The exercises deal largely with dynamics and properties of matter, and include sound, light, magnetism, electricity, and heat. The exercises, especially those on dynamics, are very interesting, and indicate distinctly the thoroughness of the instruction given. Several of the hints for solution will be found also of great value to students.

We have frequently had to refer to the scientific *renaissance* now going on in Italy. Another indication of this has just reached us, in the shape of a volume of some 500 pages, on "Geological Evolution: Inorganic, Animal, and Human," by Signor Enrico del Pozzo di Mombello. The book is published by Sgariglia, of Foligno. It exhibits a wide philosophical grasp of the subject. The first chapter is almost confined to an analysis of Herbert Spencer's "Principles of Evolution." The writer then discusses the nebular hypothesis, and the new views as to the inorganic evolution now going on in the sun. Geological climates, with full references to the works of Lyell and Croll, follow; and after a chapter on vulcanism are chapters on practical geology. The rest of the work deals with life, including a full statement of Darwinism and human evolution, while the last chapters are devoted to prehistoric man. Such a book as this will be of the greatest service to science in Italy.

We have received the fifth edition of "Celestial Motions," a handy book of astronomy, by Mr. W. T. Lynn, formerly of the Royal Observatory, Greenwich. In this last edition a chapter has been added on the refraction, propagation, and aberration of light. The treatment, however, is necessarily so limited, that the chapter is practically useless for educational purposes.

We have received also the fifth edition of Prof. Bentley's "Manual of Botany." The physiological part of the subject has been largely revised, with the assistance of Mr. J. D. Groves, Demonstrator of Practical Biology at King's College, London. Many alterations have been made in the part treating of the properties and uses of plants; but the most marked change is in those chapters relating to the classification of plants. The book is now adapted in all essentials to the arrangement adopted in the "Genera Plantarum."

A strong shock of earthquake was felt in Venice on the night of January 24. No damage seems to have been done. At Aquila, in Lower Italy, seven shocks of earthquake were noticed on January 26, three of which were rather strong. They occurred between 2.30 p.m. and 7.45 a.m. of the next day.

On the night of January 31 a shock of earthquake was felt in Zurich and the neighbourhood, and in the cantons of Zug and Schwyz. The district affected was about 80 kilometres in diameter.

Under the auspices of the Geological and Natural History Survey of Canada, Prof. J. Macoun, of Ottawa, has now completed the first volume of his "Catalogue of Canadian Plants." The third part, just published, comprises the Apetalæ, Coniferæ, and a long list of additions and corrections to parts 1 and 2, carrying the work down to the end of Exogens.

A consignment of German carp has been forwarded to Portugal by the National Fish-Culture Association, for the purpose of acclimatisation in the waters of that country. The experiment is being made by Messrs. Broughton and Frietas, who have also made arrangements to import a quantity of salmon and trout ova, and hatch them out for a similar purpose. The National Fish-Culture Association have intimated their intention of supplying Salmonidæ fry this year gratuitously to public bodies desirous of repopulating depleted waters. One million and a half of whitefish ova (*Coregonus albus*) arrived from the American Government at the hatchery of the Association on January 31.

The National Fish-Culture Association have just issued the first number of their quarterly Journal, edited by Mr. J. W. Willis-Bund. The objects of this publication are not only to chronicle the operations of the Association, but to collect information concerning the fish, fish-culture, and fisheries both of the United Kingdom and abroad. The present number includes articles by Dr. Francis Day, Mr. J. W. Willis-Bund, Mr. W. Oldham Chambers, and Mr. Anderson Smith.

Herr Richard Andree, of Leipzig, who has for some years past made a special study of cannibalism and its prevalence in ancient and modern times, has recently published (Beit: Leipzig) a pamphlet on the subject, which is full of interest to others besides the ethnologists for whom it is, of course, mainly intended. He treats first of the practice of anthropophagy in prehistoric times, discussing traces of it in popular tales, legends, and superstitions. To this section also belong the investigations into the remains found in caves and ancient burial-places in Europe, which Herr Andree thinks prove beyond doubt that cannibalism existed at this remote epoch in countries which are now the most highly civilised on the globe. The next part deals with the geographical distribution of the practice at the present day. The mass of information brought together is drawn from the literature of many countries, ancient and modern, and is enormous in amount. The writer attributes the origin of cannibalism to hunger and want in the first instance, until it developed into a settled practice, from which the step to human sacrifice, whether of single individuals, such as prisoners, or of holocausts of victims, as in ancient Mexico, is not a long one.

The death is announced of Dr. Philip Fischer, the well-known mathematician and Professor at the Polytechnic Institution at Darmstadt. He died on January 22.

In a recent issue, *Science* comments on the fact that the number of lectures delivered by professors at Oxford and Cambridge falls considerably below that which it is usual for a professor to give in the United States. *Science* is by no means of opinion that the American plan is best. American professors are, it says, compelled to teach and lecture so much that few of them have an opportunity of doing justice to their abilities as investigators and writers. Our American contemporary counsels governing Boards in the United States to take this fact into serious consideration. "They value a professor according to the number of lectures he delivers and the number of students he attracts. They fail to perceive that scientific research is the peculiar duty, and should be the peculiar privilege, of the University professor. Oxford and Cambridge professors do more original work than our professors, simply because they are given the time for it."

Capt. Dutton, of the U.S. Geological Survey, is making rapid progress with the preparations for his Report on the Charleston earthquake. With regard to the velocity of the propagation of the earth-wave, the final computations have not yet been made, but the evidence is said to indicate with certainty a velocity somewhat in excess of three miles per second.

We have received the new number of the *Annuaire* of the Royal Observatory of Brussels, by M. Folie, Director of the Observatory. This periodical has appeared every year without interruption since 1834. The present number, like its predecessors, contains much useful astronomical information. The section on physical units and constants has been enlarged, and there are valuable notes on the geography and statistics of Belgium.

Messrs. Rivington will shortly have ready a "Text-book on Animal Biology," by Prof. C. Lloyd Morgan, of University College, Bristol. The first part of the volume deals with the anatomy and physiology of vertebrates, as exemplified by the frog, the pigeon and fowl, and the rabbit. In this part there are special chapters on histology, embryology, the genesis of tissues and organs, and animal metabolism. The second part is occupied with the structure and life-history of some invertebrate types, viz. the crayfish, cockroach, earthworm, liver-fluke and tapeworm, snail, freshwater mussel, hydra, vorticella, and amœba. Numerous outline woodcuts have been drawn specially for this work. It aims at satisfying the requirements of those who are preparing for the immediate science and preliminary scientific examinations of the London University, and for the Oxford and Cambridge Local Examinations.

In a report on the working of his department during the past six years, which has just been laid before Parliament (C—4943), the Controller of the Stationery Office refers to the publication of the Report of the scientific results of the exploring voyage of the *Challenger*. This was much delayed, Mr. Pigott observes, by the long illness and death of Sir Wyville Thomson in 1882, but it now approaches completion. The original estimate of the bulk of the work has already been very largely exceeded, "owing," writes Mr. Murray, the present editor, "to the enormous wealth of the observations and collections made during the expedition not having been at first realised." Twenty-seven quarto volumes, illustrated by about 2000 full-sized lithographic plates (many of them exquisitely finished in colours), by some eighty charts and diagrams, and by many hundred photographs and woodcuts, either already have been, or in the course of a few weeks will be, published. The editor (continues Mr. Pigott) estimates that another seven volumes at least will be required to complete the work, but hopes that with perhaps the exception of the last, in which it is intended to show the bearing of facts stated in the previous volumes on theories hitherto accepted, all will be before the public before the end of the coming financial year (March 31, 1888). The Controller thinks that perhaps it is fortunate for science that the Lords of the Treasury, when considering whether the publication of the results of the voyage should be undertaken at the public expense, were necessarily imperfectly informed of the cost. The amount paid from Stationery Office votes alone has already reached nearly 25,000*l.*, of which about 12,000*l.* only has been recovered by sales. To the balance of this account in calculating the actual cost of the book must be added the sums granted annually by Parliament for the expenses of the commission since the return of the ship —something over 40,000*l.*, making the net cost of the publication up to the present time, roughly, 53,000*l.*—a larger sum perhaps than has ever been spent by any Government on a single work. On the other side, however, Mr. Controller Pigott is good enough to add that the value of the Report can scarcely be exaggerated, and in a few lines he gives his estimate of the work of the expedition.

Lieutenant W. H. Emory, of the U.S. Navy, who commanded the *Bear* in the Greely Relief Expedition, has been ordered to the *Thetis*, and will shortly sail for Alaska. He is to investigate the seal-fisheries, and has received special instructions regarding the boundary-line between Alaska and British territory.

There seems to be some need for a scientific examination of medals granted in America for distinguished services. The "fine, large, gold medal," given to General Grant for the part he played in the Mexican war, is now in the National Museum, Washington, and, according to *Science*, it is "bogus," having a specific gravity of only 7 instead of 16.

In a recent Report, Mr. J. R. Dodge, Statistician of the U.S. Agricultural Department, shows that the amount of beetroot-sugar produced last season exceeded the cane-sugar by 162,000 metric tons. The manufacture of beet-sugar is wholly a European industry, and Mr. Dodge says its success in Europe is largely due to the fact that each shareholder in the stock of a beet-sugar factory is required to furnish so many beets per share. The farmers are in reality the manufacturers, and, since they obtain the profits of the manufacture, it is their interest to raise good beets at a nominal price. Mr. Dodge states that the sugar consumed in the United States amounts to about one-fourth of all the sugar reported from the places of principal production, and that within twenty-five years the country will require as much as the whole of the present supply of the cane-sugar of commerce, and nearly as much as the present production of beet-sugar. Mr. Dodge expresses surprise that Americans "scour the world for food-products costing more than 200,000,000 dollars per annum, the larger portion of which should be produced in the United States." What is needed, he thinks, is "a more skilful, scientific, and inventive agriculture."

The introduction of the electric light is not always, apparently, an unmixed benefit. Some time ago electric lights were placed in front of the Treasury and other public buildings in Washington, and a fine and striking effect is said to have been produced. Unfortunately, however, spiders discovered that game is plentiful in the vicinity of the new lights, and that they may there ply their craft successfully both day and night. In consequence, as Mr. G. Thompson writes to *Science*, their webs are so thick and numerous that portions of the architectural ornamentation are no longer visible, and when the webs are torn down by the wind, or fall from decay, the refuse gives a dingy and dirty appearance to everything it comes in contact with.

WE notice in one of the morning papers that considerable progress is being made at the great Lambeth factory of Messrs. Maudslay, Sons, and Field, with the large compound engines which are being prepared for the new Italian armour-clad *Il Re Umberto*. According to the contract, these engines are to be of 19,500 horse-power, which is about 7500 horse-power more than that of any vessel yet designed for the British Navy. It is stated that they will actually indicate 21,000 horse-power, or 9000 more than any vessel in the British Navy. These engines, completely made of steel, are expected to drive the *Il Re Umberto*, fully equipped, about 20 knots per hour.

MR. C. C. LACAITA is taking charge of the Sanitary Registration of Buildings Bill in the House of Commons. The Bill as introduced in 1886 consisted of ten sections, and, it will be remembered, made the sanitary registration of all buildings compulsory in towns of 50,000 inhabitants and upwards. The new Bill consists of seventeen sections, and is to apply to all towns or districts of 2000 inhabitants, but it is only to be compulsory in the case of schools, colleges, hospitals, asylums, hotels, and lodging-houses. An important feature of the new Bill is that the local authorities will have to keep a Sanitary Register, in which any building certified in accordance with the proposed Act may be registered, so that a stranger visiting any district would be able to ascertain at the office of the local authority whether any particular house was or was not certified as in a satisfactory sanitary condition. The new Bill will, no doubt, be more acceptable to sanitary experts, seeing that all persons entitled to certify must first obtain a license from the Local Government Board, and provision is made for the appointment of examining Boards. Persons entitled to sign certificates are designated Licentiates in Sanitary Practice.

THE town of Baku was recently threatened with destruction by the sudden outburst of a natural naphtha fountain. This was soon followed by a volcanic eruption from Lok Botan, close to the Ponta railway station, and about ten miles from Baku. The eruption began on the night of January 15, when the inhabitants of Baku were alarmed by a shock like that of an explosion, which made all their window-panes tremble violently, while towards the south-west the sky was illuminated by an intense light, as of some terrific conflagration. The following information, furnished by the railway officials of the Ponta station, appeared in a telegram from the St. Petersburg Correspondent of the *Times* on Monday last :—"Quite suddenly, at eleven o'clock at night, the noise of an explosion was heard, and the summit of Lok Botan shot up an enormous column of fire some 350 feet high. The whole country was instantly lit up brighter than day, and the heat could be felt at nearly a mile from the crater. There was scarcely any wind, so that the column continued to ascend quite vertically, carrying with it, as could be seen, large dark substances which appeared to fall again into the volcano. This lasted with short intervals of subsidence all through the night and the following twenty-four hours, but luckily the matters ejected did not reach the railway station." The *Times* Correspondent says that the volume of muddy liquid thrown out is estimated at half a million cubic *sojenes*—the Russian *sojene* equalling 7 feet—and has spread itself over more than a square mile to a depth of from 7 to 14 feet.

ON the night of January 26 a brilliant meteor was observed at Holmestrand, on the south-east coast of Norway. It went from south-west to north-east, at a rapid pace, and disappeared below the horizon. The light was an intense white, illuminating for a few seconds the whole town as in broad daylight.

A STATUE is to be erected at Christiania in honour of the celebrated mathematician Abel, subscriptions being raised towards it from all parts of Europe.

THE Council of the Royal Meteorological Society have arranged to hold, at 25 Great George Street, S.W. (by permission of the Council of the Institution of Civil Engineers), on March 15 to 18 next, an Exhibition of Marine Meteorological Instruments and Apparatus. The Exhibition Committee are anxious to obtain as large a collection as possible of such instruments; and they will be glad to show any *new* meteorological instruments or apparatus invented or first constructed since last March, as well as photographs and drawings possessing meteorological interest.

MR. JOHN MURRAY, of the *Challenger* Expedition Office, Edinburgh, writes to us that the passage placed within inverted commas in one of our Notes on Jan. 27 was not a quotation from his address to the Royal Society of Edinburgh. We may explain that the passage was quoted from what professes to be "a condensed report of the address" in the January number of the *Scottish Geographical Magazine*. In this "condensed report" Mr. Murray is represented as having said that "money grants of considerable annual value are devoted to the maintenance of learned Societies in London and Dublin." Our only object was to point out that so far as London is concerned this statement is misleading.

THE additions to the Zoological Society's Gardens during the past week include a Black-winged Peafowl (*Pavo nigripennis* ♀) from Cochin China, presented by Mr. John Marshall; a Cayenne Lapwing (*Vanellus cayennensis*) from South America, purchased; six Long-fronted Gerbilles (*Gerbillus longifrons*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

COMET BROOKS (1887 *b*).—This object was observed at Paris on January 27 as a circular nebulosity of about 1′·5 in diameter, with a small but fairly bright nucleus, almost stellar in appearance, and situated not quite in the centre of the coma. The comet was estimated as of the 12th magnitude.

Dr. Rud. Spitaler, Vienna Observatory, has computed the following elements and ephemeris :—

T = 1887 March 23·01985 Berlin M.T.

$\pi = 89^\circ\ 26'\ 17''$
$\Omega = 283\ 0\ 15$ } Mean Eq. 1887·0
$\iota = 102\ 25\ 29$
$\log q = 0{\cdot}19021$

Error of middle place ($O - C$).

$d\lambda \cos\beta = +9''$, $d\beta = -5''$.

Ephemeris for Berlin Midnight

1887	R.A. h. m. s.	Decl. ° ′	log Δ	log r	Brightness
Feb. 12	1 59 34	+ 73 5·6	0·07734	0·21040	1·39
16	2 35 23	68 19·5	0·08193	0·20660	1·39
20	2 59 23	63 27·4	0·09016	0·20314	1·36
24	3 16 58	58 41·5	0·10154	0·20007	1·31
28	3 30 42	+ 54 9·1	0·11553	0·19744	1·25

The brightness on January 25 is taken as unity.

COMET BARNARD (1887 *c*).—Barnard's comet was observed at Paris on January 26, and seemed to be of much the same brightness and dimensions as Brooks's comet appeared on the following night, but it differed somewhat as to its nucleus, there being a central condensation forming a diffused nucleus about 4″ or 5″ in diameter. The comet is steadily diminishing in brightness. The following elements and ephemeris are by Prof. E. Weiss :—

T = 1886 November 23·6302 Berlin M.T.

$\pi = 284^\circ\ 27'\ 58''$
$\Omega = 257\ 14\ 17$ } Mean Eq. 1887·0.
$\iota = 85\ 22\ 5$
$\log q = 0{\cdot}15454$

Error of middle places ($O - C$).

$\Delta\lambda \cos\beta + 4'' - 3''$, $\Delta\beta - 1'' - 9'$.

Ephemeris for Berlin Midnight

1887	R.A. h m s	Decl. ° ′	log Δ	log *r*	Brightness
Feb. 12	20 4 1	+ 37 25·2	0·33827	0·26127	0·83
16	20 16 44	39 50·3	0·34157	0·26929	
20	20 29 54	42 12·3	0·34566	0·27733	0·74
24	20 43 32	44 30·2	0·35051	0·28538	
28	20 57 38	+ 46 43·4	0·35638	0·29341	0·66

The brightness on January 24 is taken as unity.

THE ROUSDON OBSERVATORY.—We have received Mr. Peek's report on the astronomical work done at the Rousdon Observatory, Lyme Regis, in 1886. During the year, 146 nights were available for observation, the most cloudy month having been February, and the clearest December. Selected lists of long-period variable stars are under systematic observation with the 6·4-inch equatorial. The following comets have also been observed: 1885 *d* and *e*, 1886 *a*, *b*, *c*, *e*, and *f*. The great nebula in Andromeda is under regular observation. We would suggest to Mr. Peek the propriety of publishing the observations of cometary positions at as early a date as is possible; their value is much increased by speedy publication.

MINOR PLANET No. 264.—This asteroid has been named Libussa by Prof. Peters, of Clinton, U.S.A., the discoverer.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 *FEBRUARY* 13-19

(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 February 13

Sun rises, 7h. 20m.; souths, 12h. 14m. 25·5s.; sets, 17h. 8m.; decl. on meridian, 13° 21′ S.: Sidereal Time at Sunset, 2h. 42m.

Moon (at Last Quarter February 15) rises, 22h. 48m.*; souths, 4h. 27m.; sets, 9h. 55m.; decl. on meridian, 7° 5′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	7 43 ...	12 38 ..	17 33 ...	13 7 S.
Venus	8 1 ...	13 22 ..	18 43 ...	8 28 S.
Mars	7 56 ...	13 16 ...	18 36 ...	8 33 S.
Jupiter... ...	23 43* ...	4 44 ...	9 45 ...	12 11 S.
Saturn... ...	13 29 ...	21 37 ...	5 45* ...	22 19 N.

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

Occultations of Stars by the Moon (visible at Greenwich)

Feb.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
13 ...	94 Virginis ...	... 6 ...	5 26 ...	6 22 ...	38 305
14 ...	ξ′ Libræ ...	... 6 ...	1 4 ...	2 6 ...	52 202

Feb. h.
13 ... 12 ... Jupiter in conjunction with and 3° 43′ south of the Moon.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h m	
U Cephei	0 52·3	81 16 N.	Feb. 15,	20 58	*m*
S Piscium	1 11·7	8 20 N.	,, 18,		*M*
R Arietis	2 9·7	24 32 N.	,, 15,		*M*
Algol	3 0·8	40 31 N.	,, 13,	18 50	*m*
ζ Geminorum ...	6 57·4	20 44 N.	,, 13,	4 0	*M*
R Boötis	14 32·2	27 14 N.	,, 17,		*M*
δ Libræ	14 54·9	8 4 S.	,, 17,	0 57	*m*
U Coronæ	15 13·6	32 4 N.	,, 14,	1 37	*m*
V Coronæ	15 45·5	39 55 N.	,, 14,		*M*
U Ophiuchi... ...	17 10·8	1 20 N.	,, 15,	2 41	*m*
		and at intervals of		20 8	
T Herculis	18 4·8	31 0 N.	Feb. 18,		*M*
β Lyræ...	18 45·9	33 14 N.	,, 20,	22 0	*M*
R Lyræ	18 51·9	43 48 N.	,, 13,		*m*
δ Cephei	22 25·0	57 50 N.	,, 13,	4 0	*m*
R Cassiopeiæ ...	23 52·7	50 46 N.	,, 15,		*M*

M signifies maximum; *m* minimum.

Meteor-Showers

On February 17, a radiant near υ Herculis, R.A. 238°, Decl. 48° N. On February 20, from Coma Berenices, R.A. 180°, Decl. 33° N.; and another from near ρ Herculis, R.A. 263°, Decl. 36° N. Other radiants of the week:—Near λ Draconis, R.A. 165°, Decl. 73° N., and near β Ophiuchi, R.A. 260°, Decl. 0°.

GEOGRAPHICAL NOTES

IN a private letter from Mr. H. M. Stanley, published yesterday, he says that when he reached Cairo he found that all the political authorities and experts there were opposed to the idea of his taking the Congo route. They thought that as the Expedition was to be armed with several hundred Remingtons and a machine-gun of the latest invention it was to be an offensive force, conducted after strict military rules, and that Mr. Stanley would therefore meet with no insuperable difficulties either by the Karagwé or by the Masai route. On this point he undeceived them, and he also showed that if serious fighting were necessary his men would be wholly unable to meet great masses of native warriors. Besides, the probable result of a struggle with Uganda would be that Mr. Mackay, the missionary, and the French Bishop and Père, now in Mwanga's power, would be murdered. The total length of each land journey is given by Mr. Stanley as follows:—Congo route: Mataddi to Stanley Pool, 235 English miles; Stanley Falls to Lake Albert, 360 English miles—total 595 English miles. Karagwé route: Zanzibar to Lake Albert, 950 English miles. Masai route: *viâ* Taveta, Kenia, and Turkan, 925 English miles. Mr. Stanley also calculates the length of the various routes by days, assuming that only an average of six miles could be made daily. Congo route: land journeys, 99 days; Zanzibar to Congo, by steamer, 20 days; Lower Congo, by steamer, 3 days; Upper Congo, by steamer, 35 days. Total, 157 days. Karagwé route: land journey, 156 days. Masai route: land journey, 154 days.

THE most important contribution to the new number of the *Bulletin* of the Paris Geographical Society is the series of maps of the River Ogové in West Africa, by Lieut. Mizon. These maps, which are on the scale of about 1 kilometre to an inch, and refer to the whole course of the river as surveyed by Lieut. Mizon, are executed with much care. In the brief text which accompanies the maps, the author describes his method of observation, and gives the positions of some of the more important points. M. Jamkowski contributes an article on Fernando Po, in which he gives some welcome information on the curious people known as Bubis, who inhabit the mountainous districts of the island. Other papers in this number are on the "Ksour" of Bouda (West Sahara), by M. Chatelier; two papers on Tonquin, by Lieut. Gouin; and a paper on the expedition of General de Bussy in the Deccan in the eighteenth century.

IN the Bulletin of the American Geographical Society, No. 2, 1886, Commander H. C. Taylor, U.S.N., describes the various projects which from time to time have been advanced for the construction of a canal across Nicaragua, and attempts to show that this is the most favourable route for a canal between the Atlantic and Pacific. Dr. G. E. Ellis gives an interesting *résumé* of the history of the Hudson's Bay Company, 1670-1870.

LAKE TAHOE, long regarded as the deepest fresh-water lake in the United States, must now take the second place. Capt. C. E. Dutton, of the U.S. Geological Survey, made, in July 1886, a series of soundings at Crater Lake, Oregon, with unexpected results. The mountain wall that surrounds the lake is 900 feet high; the average depth is 1500 feet, and the maximum 1996.

To the January number of *Petermann's Mitteilungen*, Dr. Theobald Fischer contributes the first part of a study of the coasts of North Africa, in which he attempts to account with precision, on geological and meteorological bases, as well as by the action of the sea, for the various features of the North African coast. The present instalment deals mainly with the Algerian and Tunisian coast, and the investigation forms part of a detailed study which Dr. Fischer is making of the whole Mediterranean coasts. The paper is accompanied by maps, while another map illustrates the distribution of languages in Germany and Austria, the accompanying text being by Prof. F. Held. Dr. Possewitz contributes a paper on the laterite outcrops in the Island of Banka.

THE new number of *Appalachia* contains, among other things, a series of useful data, by Prof. E. C. Pickering, on "The Heights of the White Mountains," and a valuable paper by Prof. W. Morris Davis, on "Mountain Meteorology."

IT may interest both geographers and ethnologists to know that in the current numbers of *Les Missions Catholiques* the Rev. Jules Brunetti describes his recent journey up the River Maroni, in French Guiana, giving many details concerning the Negro population which is settled on its banks.

THE Austro-Hungarian Expedition for the investigation of Central Africa, which was organised last year by Count Samuel Teleki, and reached Zanzibar last June, has left for the interior.

A GERMAN Expedition to Brazil sailed from Bremerhafen on January 25. The gentlemen are: Dr. Karl von den Steinen and his cousin Wilhelm, Dr. P. Vogel (Uelfeldt), and Dr. Ehrenreich (Berlin). Both Dr. K. von den Steinen and Dr. Vogel took part in the German Polar Expedition to South Georgia, and the former gentleman and Dr. Clauss were with the celebrated Expedition for the investigation of the Xingu River in Central Brazil, while Dr. Ehrenreich was on a journey in the Amazon district.

THE new number of the *Mittheilungen* of the Vienna Geographical Society contains Dr. Lenz's map of the Congo between Stanley Falls and Kasonge, to the journey up which we referred in a recent number of NATURE. The map gives much information as to the character of the country along the banks of the river, and the people who inhabit them. As it is only six months since Dr. Lenz arrived at Kasonge, one cannot but remark the rapidity with which the journey between the coast and the centre of Africa can now be made. As a matter of fact, the London Missionary Society has a monthly mail between Zanzibar and Lake Tanganyika, and letters from their missionaries on the west shore of that lake reach London in three months.

THE same number contains the conclusion of Herr Baumann's very valuable description of the country and people on the Middle and Lower Congo; a paper on the high lakes of the Eastern Alps, by Dr. August Böhm; and a collection of recent statistics on the population of Bosnia and Herzegovina.

HERR P. LANGHAUS has been endeavouring to form an estimate of the native population in the Cameroons territory recently acquired by Germany. He confines himself to the coast region between the Rio del Rey and the Rio Campo, and gives 480,500 as the population on 26,000 square kilometres, or only 18 per square kilometre. The people mostly belong to the north-west branch of the Bantu stock, and Herr Langhaus gives some useful details as to their distribution and subdivision in the *Deutsche Rundschau* for January.

A NEW exploration of the districts on the Upper Meikong, inhabited by the Laos tribes subject to Siam, has attracted considerable attention in Paris. Towards the end of 1885, the Siamese Government found it necessary to undertake an expedition against these tribes (the principal of them being the Ho). An Italian officer, Capt. Pinson, who was a military instructor in the Siamese service, accompanied the expedition, which ultimately arrived at Muen-Son, fourteen days' march to the north-east of Luang-Prabang, in the centre of a region wholly unknown to Europeans, for these Hos had prevented Dr. Neis from completing his famous exploration of the whole of the Laos States. The expedition, owing to frontier complications with Tonquin, was not a success, and now M. Pinson has determined to explore the country for himself, partly with the object of discovering commercial routes along the Meikong into Yunnan and into Tonquin, both starting from Luang-Prabang, and also for geographical purposes. He has arrived in Paris to lay the project before the President of the Council and the various mercantile bodies. To the former he has presented a memorial asking to be despatched on the mission by the French Government. In this document he describes briefly the divisions of the Siamese Laos, the nature of the soil, the commercial situation of Great Britain in Burmah in regard to the Laos States, the alternative trade routes for Upper Laos—which he describes as by the Meinam to Bangkok (which appears the natural route), by the Ho country into Tonquin, or by the Meikong—and other details. He expresses the determination to return without delay to Luang-Prabang, and, if aided by the French Government, (1) to penetrate into Yunnan in order to study the peoples on the route and their commercial wants, and (2) to explore and study in like manner the two routes from the same town into Tonquin and Annam. The projected exploration, it will be observed, is mainly through unknown territory, Dr. Neis not having been able to penetrate a large part of this region.

IN the last number of *La Gazette Géographique* M. Kaltbrunner publishes an interesting article entitled "L'Indicateur Géographique." He first gives statistics of the various Societies for geography and the allied sciences in the world. According to continents, the number of these is as follows:—Europe 91, Africa 5, America 9, Asia 9, Australia 2, giving a total of 115. France heads the list with 28, then comes Germany with 23, then Italy with 8, Switzerland with 7, Austria with 6, and Great Britain with 4. The total number of periodicals treating of geography as a principal or accessory subject is 263, of which 214 are published in Europe, 14 in Africa, 19 in America, 15 in Asia, and 1 in Australia. France again heads the list with 79, Germany has 42, Great Britain 18, Italy 13, Austria and the United States 11 each. Many other interesting details respecting membership, amount of subscriptions, of Government assistance, &c., are given. In Great Britain, Germany, and France the average subscriptions per member are 70, 35, and 15 francs respectively. The writer complains that, notwithstanding the great number of French Societies and publications, no one publication similar to *Petermann* in Germany and the Proceedings of the Royal Geographical Society in England exists. He proposes, therefore, that a geographical indicator should be published containing the title, place of publication, summary of contents, price, and, where desirable, a critical review of all the geographical journals, as well as of new books, maps, &c. The editor of *La Gazette Géographique* promises to carry out the idea as far as possible by giving these details respecting such of the publications as have reached his hands since the beginning of the New Year.

DR. VON KLÖDEN recently published a list of 374 rivers, with their lengths, and other data, in which he gave the Nile as the longest river, with a length of 6470 kilometres, the Missouri-Mississippi coming second with 5882 kilometres. General von Tillo revises these estimates, and from more exact measurements concludes that the Missouri-Mississippi is the longest river in the world, with 6750 kilometres, the Nile coming next, with 6470 kilometres as in Von Klöden's list. Other rivers given both by Von Klöden and Tillo with the same measurements are the Ta-Kiang, 5083 kilometres; the Amazons, 4929; the Yenisei-Selenga, 4750; the Amur, 4700; the Congo, 4640; and the Mackenzie, 4615. In connection with this subject *Petermann's Mitteilungen* states that a new curvimeter is being practically tested in Perthes's geographical establishment; if the results are satisfactory it will be of great service to those who have much to do with maps.

THE Geographical Society of Mexico is about to resume the publication of its proceedings, which has been interrupted since 1882.

Cosmos announces the forthcoming publication of an important work on the geography of the interior of Madagascar, by a French Jesuit, Père Roblet, who has explored the greater part of the island. It will be accompanied by various topographical maps, especially of the provinces of Imerina and Betsileo.

AT a recent meeting of the Geographical Society of Paris, a note was read from M. Cervera, who is charged by the Madrid Geographical Society with a journey in Eastern Africa, on his itinerary. M. Raffray, the Consul of France at Zanzibar, sent a report on the results of Dr. Junker's last journey. M. Chaffanjon, writing from San Fernando, announced his approaching departure for the exploration of the Orinoco; and Dr. Chervin read an interesting paper on the increase of the populations of France and the principal States of Europe during the present century. In France the urban population was only 24 per cent. of the total in 1843, while now it is 35 per cent. The writer referred to the very slow increase of the population in France, although the average mortality is less than in other European countries. In some of the departments the population is even less now than it was in 1801. He thought colonial extension was one of the most efficacious remedies for a state of things which threatened to place France in a position of numerical inferiority towards other States. New colonies, he says, open new fields to future generations. The process suggested, however, appears like that of putting the cart before the horse.

THE INSTITUTION OF MECHANICAL ENGINEERS

THE Institution of Mechanical Engineers held its meeting in the Theatre of the Institution of Civil Engineers on Thursday and Friday of last week. The paper on "Triple Expansion Engines," read at the last meeting, of which we then gave an abstract, was discussed. The remainder of the papers on the programme were read and discussed.

Mr. E. P. Rathbone's paper on "Copper-Mining in the Lake Superior District" comprised a general description of the district, the method pursued in mining, and the system of ore-dressing and machinery employed. The ore employed is what is known mineralogically as "native copper." It does not occur in true fissure veins, but rather in beds, or, as they are not inaptly termed in the district, "belts," dipping at the same inclination as the "country" or rock inclosing them.

From exhaustive scientific investigations into the origin and derivation of the copper in these deposits, it appears probable that it was infiltrated into them in the form of an aqueous solution of copper, which also appears to have had a strong chemical affinity for special constituents of the rocks, thereby giving rise to a series of chemical reactions, whence resulted the precipitation of native copper in a more or less concentrated state, according to the proportion and the even distribution or otherwise of the precipitating or displacing agent present in the original rocks. In the amygdaloidal trap-rocks the displacing agent appears generally to have been less evenly distributed than in the conglomerates; in certain places the concentration of the displacing agent has been so excessive as to give rise to the formation of large masses of copper. Whether or not the precipitating action was connected with some natural process of lixiviation, influenced by terrestrial electrical currents, it is impossible to decide. In the amygdaloidal trap-rocks the veinstone is frequently composed largely of epidote, a mineral whose presence is regarded as favourable or "kindly" to copper. Other minerals found in association with the hornblendic and augitic porphyries that constitute the veinstone proper, are quartz, calc-spar, and many varieties of the zeolite group. The commercial copper smelted from these ores being entirely free from deleterious matters, such as arsenic, bismuth, antimony, &c., is especially valuable for electrical purposes, as the conductivity of copper is reduced by the presence of foreign matter even in the minutest proportions, a trace of arsenic reducing the conductivity 20 per cent. In the manufacture of brass, again, the presence of antimony is most deleterious: one-tenth of 1 per cent. converts first-rate "best selected" into the worst possible; one-fortieth of 1 per cent. renders it unfit for anything but inferior brass; one-eightieth of 1 per cent. changes "best selected" into "tough ingot"; one-tenth of 1 per cent. of either bismuth, arsenic, phosphorus, nickel, or cobalt, is sufficient to turn "best selected" into tough metal.

There are two methods pursued: "mass mining," where copper is found concentrated into masses varying in weight from a few hundred pounds up to many tons; and "stamp-rock mining," where the copper occurs in a more or less divided state, and usually pretty evenly disseminated throughout the whole veinstone, so that its separation from the matrix or gangue can be economically effected only by stamping and by the subsequent processes ordinarily employed in mechanical ore-dressing. The more evenly the copper is distributed throughout the veinstone, the more valuable is the latter, and hence it is that veinstone producing only 0·75 per cent. can be worked profitably at the present low price of copper.

The object of ore-dressing is to separate as far as possible the small percentage of valuable metal occurring in the ore from the worthless matrix or gangue, and concentrating it to the highest degree of purity practicable. The main feature of the process may be said to consist in applying to copper ore the principles and the machinery already employed elsewhere in the dressing of tin and lead ores.

In the Lake Superior copper-mining the features which appear to the author most worthy of special attention are:—(1) The care with which the exploratory workings are kept in advance of the stoping. (2) The general use of machine drills, which admits of opening up the mines at a rate otherwise impracticable. This is one of the few localities where drills are employed for stoping, and it has been found that two or three times as much rock can be stoped in the same time by drill as by hand. (3) The care bestowed upon the separation of the copper from the gangue by dressing.

M. Marc Berrier-Fontaine's paper was descriptive of his portable hydraulic drilling-machine, by means of which holes are drilled in a single operation through all the superposed thicknesses of metal without stopping the drill, which insures that all the holes are quite true. By its use 25 per cent. more holes are drilled than can be drilled by stationary machines in the shops.

Mr. H. Teague's notes on the pumping-engines at the Lincoln Water-works, which the Institution visited at its summer meeting last year, are mainly of a technical character. It is interesting to learn that when in 1884 still further pumping power was required, the author, from experience gained at Grantham, Maidstone, and other places, decided to revert to the Cornish pumping-engine, as he had been convinced that the cost of coals and repairs had been reduced in some instances to as low as only one-sixth of the annual expenditure pertaining to rotatory pumping-engines previously in use there.

THE SCOTTISH METEOROLOGICAL SOCIETY[1]

THE Journal of the Scottish Meteorological Society, which has recently been published, contains, in addition to copious tables of the meteorology of 1885, several papers of more than usual interest. Prof. Piazzi Smyth leads with a suggestive paper on hygrometric observation, based chiefly on observations made by him in the neighbourhood of Malvern in the summer of 1885, on fifteen successive days, at 9 a.m., in June, at a height of 125 feet; and subsequently for twenty successive days at the same hour but at a height of 350 feet. Scrupulous care was taken to have the dry-bulb surrounded with air as nearly as possible of the same quality as that of the free atmosphere outside, by placing a large and tall black iron chimney on the top of the Stevenson screen, according to Mr. Aitken's idea of promoting a current inside the screen; and to have the wet-bulb as perfect as possible by enveloping it in thin muslin, tightly drawn over its surface, and by securing that it was always thoroughly wet for each observation. The results gave for the lower station a mean depression of 3°·4 of the wet- below the dry-bulb; and 6°·4 for the upper station. It is probable that these results would be found to be higher than what obtained at the three or four stations in Central England nearest to Prof. Smyth's at the same dates; and without a doubt the value of the inquiry would have been enhanced if such comparisons had been made and recorded in the paper.

An important point would be gained if such inquiries led meteorologists more earnestly to consider the necessity of improving the means and methods of observing and reducing the observations of this most important element of the atmosphere, it being by its aqueous vapour that the disturbing influences at work are called into play, giving rise to winds, storms, rain, snow, hail, electric displays, and other atmospheric phenomena.

Mr. Omond, in an interesting paper on the wind and rainfall of Ben Nevis in 1885, based on the hourly observations at the Observatory, shows that the direction of wind with which most rain fell was a little to the north of west, and that the quantity diminishes round the compass in both directions from this until the driest point is reached a little to the south of east: east winds having a very low value. As regards the rate of fall with each wind during the time it lasts, north-westerly winds are the wettest and easterly and south-easterly winds the driest. Since south-easterly winds mostly occur when an anticyclone is moving off and a cyclone approaching, the fact of their dryness at the Observatory, 4406 feet high, is a valuable contribution to our knowledge of storms, since the same winds under the same conditions at lower levels are notoriously wet.

A hopeful inquiry is being carried on at the Ben Nevis Observatory by Mr. Rankin, first assistant, on rainband observations; and from the results already obtained there can be little doubt that when a complete low-level observatory, with hourly observations, has been established at Fort William, much light will be thrown on the vertical distribution of vapour in this part of Great Britain, and its important bearing on forecasting the weather. The observations for seven months are discussed, and the means show that a heavier rainband indicates with steady regularity a larger rainfall as determined by the hourly observations.

But the most important contribution of new facts in the Journal are thirty-nine pages of temperature observations made on the Firth and Lochs of the Clyde from March to November 1886, by

[1] Journal of the Scottish Meteorological Society, Third Series, No. iii. (Edinburgh and London: William Blackwood and Sons.)

the staff of the Scottish Marine Station on board the *Medusa;* the trips having been made in April, June, August, September, and November. The observations were made at all depths of the sea, from the surface to 107 fathoms. The novelty and, in not a few cases, the unexpectedness of the results render it advisable to delay a full discussion till more observations have been made and the densities worked out. In the meantime a provisional report on the results of the April and June trips, by Dr. H. R. Mill, will be read with interest. Among the unexpected results was the discovery in June in Loch Fyne of a lenticular mass of water with temperature below 43° floating between two warmer strata, the cold area being most definite at its upper surface and more diffused below. The greatest thickness of the mass of water colder than 43° was 180 feet, off Inveraray. Its lower bounding plane ran along the bottom from the head of the loch to Dunderave; then where the water deepens it dipped down again at the same angle until off Inveraray, where it bent up again and met the upper bounding surface at Furnace, 120 feet under the surface of the loch.

In a paper by the secretary on the meteorology of Ben Nevis, it is shown from the three years' observations at the low-level station and the high-level observatory that the mean decrease of temperature with height is at the rate of 1° F. for every 270 feet of ascent, the lowest monthly rate being 1° for every 284 feet in winter and the most rapid rate 247 feet in spring. A table of the barometric corrections for height for the different sea-level pressures and air temperatures that occur has also been prepared directly from the observations themselves. The importance of the results of these two inquiries rests on the fact that the Ben Nevis pair of stations alone supply, owing to their great difference in height, close proximity horizontally, and the positions of their thermometers, the physical data of observation which satisfy with sufficient closeness the requirements of these fundamental problems of meteorology. The science has now passed that stage when Great St. Bernard with Geneva, Mount Washington with Portland and Burlington, Hochobir with a station in one of the neighbouring deep valleys, or brief continued observations with balloons or at different heights on the slopes of the Faulhorn, can be accepted as affording the data required for dealing seriously with these questions.

REPORT ON THE BOTANICAL GARDEN, SAHARUNPUR

MR. DUTHIE'S "Report on the Progress and Condition of the Government Botanical Gardens at Saharunpur and Mussoorie for the Year ending March 31, 1886," which has recently reached us, contains, besides the usual routine matter, inseparable from such Reports, on the state of the Garden itself, much that has a wider range of interest. As usual, the cultivation of new plants of economic value appears to have occupied a considerable amount of attention during the year. Where so many useful plants have been introduced and reported upon, it is not an easy matter to select one or two for an example of the work in which Mr. Duthie is engaged. The character of this work is now, however, pretty well known, though the following extracts will show that plants of very varied character and uses are yearly being experimented with in our Indian and colonial botanic gardens.

Under the head of New Zealand spinach, a quantity of the seed of this vegetable is reported to have been received and planted, germinating freely and yielding a continuous crop of leaves, which, when cooked, is said to much resemble in flavour that of English spinach. The plants, Mr. Duthie says, seed freely, and he has no doubt that it will readily acclimatise; though, as he says, the introduction is not one of much importance, except for variety, as it comes into season at the same time as English kinds, and it can hardly compete with them in popular estimation. This so-called New Zealand spinach many of our readers will remember as *Tetragonia expansa*.

The Oca-quina (*Ullucus tuberosus*) is another food-plant upon which experiments in cultivation have been made. It is a native of South America, and the tubers, which are about the size of a walnut, and similar in appearance to a potato, are eaten, when cooked, by the people. Its cultivation in this country as a substitute for the potato was at one time proposed and attempted. Mr. Duthie says that twenty-eight tubers were received by him from the Royal Gardens, Kew, four of which were sent to the Arnigardh Garden, and the remainder were planted at Saharunpur. Up to within a few weeks of the date of the Report, these latter plants had made good growth, but after the commencement of the hot weather they became sickly, so that it is evident it will not suit the plains of India, but may succeed very well in the climate of Arnigardh, where it was intended that the majority of the plants should be sent.

Of the Japanese varnish-tree (*Rhus vernicifera*) the seedlings are stated to be making rapid progress. The growth for the two years after germination did not average more than a foot, which, however, has been doubled since the commencement of the hot season, and there is now no reason to doubt that this useful tree will thrive in the climate of Saharunpur. Mr. Duthie further says a small plantation will be made next rainy season, and it will then be a question of time as to when the plants will be ready for tapping.

Mr. Duthie makes the following interesting report on the subject of spider silk, which had previously attracted some attention. He says:—"I arrived from British Garwhal just in time to superintend operations at the commencement. The men employed on this work were provided with small sticks about a foot long, and they were told to collect as many clean webs as possible during the day. There was not much to show at the end of the day, as the silk takes up very little space when wound round these sticks, and the weight is inappreciable. The total weight of webs collected during the season did not exceed 10 lbs., the bulk of which was despatched to Mr. Wardle, of Leek. The cost of collecting the above, and the carriage from Bhim Teel to Saharunpur, and from Saharunpur to Bombay, amounted to Rupees 33 - 7 - 0. At this rate the export of spider silk to England would, of course, never pay, but expenses might be reduced very considerably: for instance, this first consignment included the weight of the sticks round which the silk was wound. The silk is removable after immersion in hot water. During my stay at Indalpur, in the Sháhjahánpur district, I saw some fine clean webs of the same kind in a forest about eight miles to the north of Indalpur."

Judging from the remarks of Mr. Duthie, there seems but little chance of spider silk ever becoming an article of commercial value.

The Report includes some interesting notes on some official tours made by Mr. Duthie during the year, and a valuable list of plants collected, the names of which have been verified at the Royal Gardens, Kew.

SCIENTIFIC SERIALS

Bulletin de l'Académie des Sciences de St. Pétersbourg, tome xxxi. No. 3.—Corrections and additions to the Syrian-German and Votyak-German dictionaries, published in 1880, by F. J. Wiedemann. These emendations are based on the following recent works: "The Land and Language of the Syrians," by Lytkin; the publications on the Votyak language issued by the Kazan Mission; "Votyak Tales and Proverbs," collected by Dr. Aminoff, and published in the works of the recently instituted Finnish-Ugrian Society; Dr. Max Buch's ethnographical sketch of the Votyaks in the "Actæ Societatis Scient. Fennicæ," vol. xii.; and MM. Koshurnikoff and Miropolsky's monographs on the Votyaks.—On the Ornis of the western spurs of the Pamir and Alai, by V. Bianchi—On "Claudii Galeni Pergameni Scripta minora," by L. Nauck.

Nyt Magazin for Naturvidenskaberne, vol. xxx. Nos. 3 and 4, Christiania, 1886.—This number of the Norwegian *New Journal of Sciences* contains:—Continuation of Herr Brögger's paper on the geological history of the Christiania Fjord. According to the writer, it may be assumed that the bed of the fjord has been raised by eruption to the surface of an older bed, which consists of depressed strata of the earth's crust, whose depression had been connected with active processes of dislocation, crumpling, and folding in the post-Silurian period. The evidences of erosion and eruption are considered at length, with special reference to the action of glaciers in the formation of the fjord.—Dr. Lang concludes in an exhaustive paper his contributions to the study of the eruptive rocks of the Silurian beds of Christiania, and thus completes an important chapter in the geological history of South Scandinavia.—Notice of *Regalecus glesne ascanius*, by Herr J. Grieg. This specimen, a female, with well-developed ovarium, is the fourteenth that has been taken off the Norwegian coasts since 1740.—Report of the various attempts made within the last four years to introduce new plants into Iceland, by Dr. Schierbeck. The results of these efforts to

enlarge the meagre flora of the island are scarcely encouraging. Thus, although hopes are entertained that some kinds of maples may thrive in sheltered spots, conifers, from whose introduction great expectations were entertained, have not given promise of success, while poplars, oaks, apple and pear trees have without exception died. Common red- and black-currant bushes thrive so far as to set fruit, but this does not ripen except in the warmer summers. Potatoes, which would be invaluable to the islanders, have not yet been successfully cultivated, but turnips, rhubarb plants, and several of the hardier cabbages, together with lettuce and chamomile, do well. The great question, whether cereals can be cultivated, as would appear to have been the case in the times of the Sagas, does not seem to admit of a satisfactory solution, and, according to the writer, the present regular supply of corn from the mother-country by means of rapid steamers, no longer makes the attempt necessary or desirable from an economic point of view. An interesting list of the various plants introduced, with the times of sprouting, budding, &c., adds to the value of Herr Schierbeck's paper.

Revue d'Anthropologie, troisième série, tome ii., Paris.—Recapitulation, by M. Topinard, of the Society's instructions for noting the colour of the eyes and hair in France, with *facsimiles* of the printed papers distributed to intending observers, and directions how they should be filled up.—On a quinary nomenclature for the nasal index in the living subject, by Dr. Collignon. The writer, who considers a correct and systematically determined nasal index as the most important anthropometric determination, not excepting even the cephalic index, proposes to divide the ordinarily accepted nasal groups into hyper-leptorhinian, leptorhinian, mesorhinian, platyrhinian, and hyper-platyrhinian, including under the platyrhinian section all the black races, under the mesorhinian the yellow races generally, and under the leptorhinian most of the white races. The paper gives a clear and concise description of the instruments in general use, and of those best adapted for making the required measurements, which he regards as of paramount value in determining racial characteristics.—Contributions to the sociology of the Australian races, by Elie Reclus. This paper, which is principally concerned with the system of clanships and cousinships existing among these peoples, has comparatively little interest for English readers, who have long been familiar with the curious questions involved in the principles of inter-tribal relationship. Indeed, M. Reclus has drawn so largely from the writings of Brough-Smyth, Eyre, Howitt, Taplin, Morgan, McLennan, and other British writers, that this first part of his paper is a mere *résumé* of some of the more sensational details of information contained in their several works.—Anthropological observations in Guiana and Venezuela, by Dr. Ten Kate. These observations chiefly refer to the differences between the native Caribs, the so called "wood Negroes," and half-castes. The first of these present two distinct types, reminding the anthropologist of the Red Indians in some respects, and of the Mongolian races in others; the second are a specially vigorous black tribe, the descendants of runaway slaves domiciled in the forests of Surinam. Most of these men are of herculean strength and stature. Numerous anthropometric and other tables illustrate the paper.—On the depopulation of France, by M. de Lapouge. This subject, which has lately been attracting renewed attention through the appearance of the second edition of M. de Nadaillac's interesting pamphlet "On the Decline of the Birth-Rate in France," is considered by the author from an anthropological as well as a social and moral point of view. After drawing attention to the fact that while between 1770 and 1780 there were 380 births for every 10,000 of the population, this number has gradually fallen to 235 for the present decade, and is thus lower than that of Switzerland, which had been assumed to have the lowest birth-rate in Europe, and less than half that of Russia. According to the writer, the population of France has reached a stationary point, its annual increase of 80,000 admitting of no comparison with the hundreds of thousands, and even millions, annually added to the populations of Germany, Russia, the United States, and the British Empire, while, moreover, this slight increase is solely to be referred to the constantly increased immigration into France of foreigners, who now constitute one million of the population, and who predominate so largely at some points as to have reduced the French language to a secondary place in such districts. The writer discusses the various causes, such as the adoption of Malthusian principles, alcoholism, Catholicism, immorality, want of patriotism, self-interest, &c., to which the present low birth-rate has been referred. And rejecting these as inadequate, he insists that the main source of the increasing depopulation in France is the gradual obliteration since the great revolution of the blond dolichocephalic type, to which he considers most of the distinguished Frenchmen of earlier times belonged, while the representatives of the brachycephalic races, who have never distinguished themselves in science, art, or letters, have been able to take the lead through superiority of numbers. By their cupidity, narrow range of interests, and indifference to the traditions of family and national glory, he holds them responsible for the anomalous condition of the country, in which an unprecedented accumulation of wealth and great prosperity are associated with physical degeneration and diminished births. In the re-introduction of the dolichocephalic element through immigration the author sees the surest means of effecting a substitution of national type and the best prospects of securing renewed vitality to the French race.

Rendiconti del Reale Istituto Lombardo, December 1886.—Obituary notice of the late honorary member of the Institute, Signor Marco Minghetti, by the Editor. Reference is made more especially to the illustrious statesman's great merits as a political economist and art critic.—On the liquors employed in the artificial cultivation of Bacteria and other minute organisms, by E. L. Maggi. The various gelatinous, albuminous, and other solutions now in general use are described, with remarks on the best means of preparing and rendering them sterile.—On the geometry of linear spaces in a space of n dimensions, by Prof. E. Bertini. The author's theorem for ordinary space of three dimensions—"A necessary and sufficient condition for three straight lines to exist in a plane is that all straight lines meeting two of them at arbitrary points shall also meet the third"—is here generalised for a linear space S of any number n dimensions.—Meteorological observations made at the Brera Observatory, Milan, during the months of October, November, and December, 1886.

Rivista Scientifico-Industriale, December 1886.—Determination of the weight of the mercury contained in a thermometer, by Dr. G. Gerosa. Clayden having recently determined the volume of the mercury contained in a thermometer (Proceedings of the Physical Society of London, vol. vii. p. 367, 1886), Dr. Gerosa here gives a determination of its weight, which he had already worked out in the Rendiconti of the R. Academia dei Lincei, vol. x., 1881.—On the electric transmission of force, by Dr. Gerosa. The paper gives a critical appreciation of the work done by M. Marcel Deprez at Creil and by M. Fontaine in the Atelier Gramme. He considers the latter experiments the more successful of the two, M. Fontaine showing that with more economic means the same results may be realised as were obtained in the experiments at Creil.—On the development of electricity in the condensation of aqueous vapour, by Dr. Franco Magrini. In reply to Prof. Costantino Rovelli the author again shows that there is no perceptible development of electricity during the condensation of the vapour of water. A description follows of M. A. Nodon's hygrometer, already reported in the *Journal de Physique* for October 1886.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 13.—"Supplementary Note on Remains of Polacanthus foxii." By J. W. Hulke, F.R.S.

In a paper published in the Phil. Trans. 1881 the author described some remains of a large Dinosaur, remarkable chiefly for its dermal armour, discovered some fifteen years previously in Brixton Bay by the late Rev. W. Fox, and then in his collection. These have since become national property; and the large shield, which, for facility of transport, had been broken up by its discoverer into innumerable small pieces, having been recently reconstructed in the workshop of the British Museum, the author now describes this singular armature, and also some parts of the pelvis formerly obscured by rock. The pieces, which, in their very fragmentary condition, had been thought scutes, are now seen to be parts of a continuous osseous shield which protected the rump and loins, having its anterior surface ornamented with closely-set tubercles, and in each lateral half four longitudinal rows of keeled eminences. The ischium has its long axis directed transversely to that of the trunk, and not roughly parallel to it as in the Iguanodonts.

January 20.—"A Study of the Thermal Properties of Methyl Alcohol." By William Ramsay, Ph.D., and Sydney Young, D.Sc.

The writers have investigated the properties of the above substance, and obtained numerical values for the expansion of the liquid, the vapour-pressure, and the compressibility of the vapour; and from these results the densities of the saturated vapour and the heats of vaporisation have been deduced. The range of temperature is from − 15° to 240° C., and of pressure from 11 mm. to 60,000 mm. The apparent critical temperature is 240°, and the pressure 59,660 mm. The pressures were corrected by means of Amagat's results, and the temperatures are those of an air thermometer.

January 27.—"On a Perspective Microscope." By G. J. Burch.

In 1874, the author, while trying to devise means whereby the different planes of an object should be visible under the microscope without the adjustment of the focus to each, discovered that, when two lenses are separated by a distance equal to the sum of their focal lengths, the optical conditions are such that the magnitude of the image bears a constant ratio to that of the object, no matter where upon the optic axis it is situated—the ratio being that of the focal lengths of the two lenses; that a given displacement of the object along the axis causes a displacement of the image in the same direction, but in the square of the ratio.

Further, that a picture drawn with the camera lucida under these conditions has the perspective of an object magnified in the square of the ratio, when it is brought within the proper distance of the eye.

The field of view of the perspective microscope is small, but may be increased by using more than two lenses, and the author's researches gave him reason to believe that, with glasses of wide angle specially constructed, a high power, with sufficiently large field, might be obtained. Several uses, other than microscopic, were indicated, to which the instrument can be applied.

The paper was accompanied by diagrams showing, in two different ways, the changes of position of the principal foci and principal points, &c., of a system of two lenses as the distance between them is varied.

A piece of moss was shown under the instrument, in magnified perspective.

"On the Thermo-dynamic Properties of Substances whose Intrinsic Equation is a Linear Function of the Pressure and Temperature." By Geo. Fras. Fitzgerald, F.R.S.

Prof. Ramsay and Mr. Young have found that within wide limits several substances in the liquid and gaseous states have the following relation connecting their pressure (p), temperature (T), and specific volume (v),

$$p = a\mathrm{T} + b,$$

where a and b are functions of v only.

Now in this case the following are the forms that the thermodynamic equations assume: T is temperature, and ϕ is entropy, and I is the internal energy.

Then $$\mathrm{I} = \gamma + \lambda,$$

where γ is a function of temperature only, and λ a function of volume only.

Also $$\phi = \Gamma + \alpha,$$

where Γ is a function of temperature and α of volume only.

Also, the specific heat at a constant volume is a function of the temperature only.

It would be most important if by some method, König's for instance, or by inserting a small microphone into a tube, the velocity of sound in substances in various states could be accurately determined, as that would enable us to determine separately the specific heats at constant pressure and constant volume.

Linnean Society, January 20.—W. Carruthers, F.R.S., President, in the chair.—Mr. J. Benbow and Mr. F. S. J. Cornwallis were elected Fellows of the Society.—It was announced from the chair that H.R.H. the Prince of Wales had officially entered his name on the roll of the Society.—The President made the presentation of an oil-portrait of Francis Masson, F.L.S., elected 1796.—Prof. Bayley Balfour exhibited specimens and showed the microscopic structure of the "ginger-beer plant." He pointed out that, although well known and used by many people as a means of manufacturing an acid drink out of sugar solution and ginger, yet no scientific account of the organism had appeared except a short note by Worthington Smith in the *Gardener's Chronicle*. It has the appearance of a white Nostoc, and is composed of a Bacterium (passing through all forms of rods, coils, and filaments), which apparently constitutes its greater part; and associated with this is a sprouting fungus. Judging from descriptions and figures by Kern of the "Kephir," used in the Caucasus to induce fermentation in milk, the ginger-beer plant closely resembles this; but there are many points of difference. The plant is said to have been introduced into Britain by soldiers from the Crimea.—A letter was read from Mr. Benj. Lowne referring to an exhibition by him of photographs from microscopical specimens of the retina of insects. One section represented the retinal layer detached from the opticon; other sections showed the basilar layer: thus practically affording evidence that the nerves terminate in end organs, rods placed in groups beneath the opticon—a view promulgated by Mr. Lowne in his memoir published in the Society's Transactions.—Mr. J. W. Waller exhibited a block of wood, part of an oak grown in Sussex containing an excavated tunnel and live larva of the longicorn beetle *Prionus coriarius*.—Mr. Thiselton Dyer showed and made remarks on two sheets of Arctic Alpine plants from Corea.—Mr. F. Darwin and Miss A. Bateson read a paper on the effects of stimuli on turgescent vegetable tissues, of which we hope to give an abstract in an early issue.—Mr. J. R. Vaizey read a paper on the morphology of the sporophore in mosses. According to his researches, the seta of mosses consists of an outer sclerenchyma, within which is parenchymatous tissue, and in the middle the "central strand"; this latter being surrounded by a single layer of cells, forming the endoderm, derived from the outer meristem of the growing apex. It consists of two forms of tissue, one being of thin-walled prosenchymatous cells destitute of protoplasm, their function being to conduct water: this the author terms *proxylem*. Surrounding this is a second cylinder of elongated cells with thickened walls, containing granular protoplasm; this tissue he terms *prophloëm*. On tracing the proxylem downwards, it is found that it gradually encroaches on the other tissues by the "foot," until it takes on the character of conducting tissue. The stomata on the theca are confined to the hypophysis: the form of stomata in which the guard-cells communicate is internally typical only of Polytrichaceæ and *Funaria*. In the young sporagonium five distinct meristems occur with different laws of cell-division; one form with an axial solid cylinder he terms "endomeristem." It gives rise to the central strand in the seta, and in the theca to so much of the tissue of the columella as lies within the sporagenous zone, the cells round this being derived from the "epomeristem," whilst the sporagonium layer is itself derived from the endomeristem. The hypophysis is an absorbing and assimilating organ, and performs all the functions of a leaf, and should be classed as a phyllome. The water-conducting tissue of the sporagonium only differs from the xylem of Vasculares in the absence of spiral thickening and lignification of the cells. The prophloëm differs even less from the phloëm of some Vasculares, and though no sieve-like tubes have been made out, yet they are wanting also in some Vasculares, *e.g. Selaginella*. The author compares the development of the sporagonium in some respects to certain parasitic plants; and he draws the conclusion that the Muscineæ are descended from an ancestor common to them and Vasculars, similar to the Anthocerotheæ, finally hoping in a future paper to deal with their phylogeny, specially referring to the vascular system and its homologue, the central strand of the Musci.

Anthropological Institute, January 25.—Anniversary Meeting.—Mr. Francis Galton, F.R.S., President, in the chair.—The following were elected Officers and Council for the ensuing year:—President: Francis Galton, F.R.S. Vice-Presidents: Hyde Clarke, J. G. Garson, M.D., Prof. A. H. Keane. Secretary: F. W. Rudler. Treasurer: A. L. Lewis. Council: G. M. Atkinson, Sir W. Bowman, Bart., E. W. Brabrook, Sir George Campbell, M.P., C. H. E. Carmichael, A. W. Franks, F.R.S., Lieut.-Colonel H. H. Godwin-Austen, F.R.S., Colonel J. A. Grant, C.B., T. V. Holmes, Prof. A. Macalister, F.R.S., R. Biddulph Martin, Prof. Meldola, F.R.S., Prof. Moseley, F.R.S., C. Peek, F. G. H. Price, Charles H. Read, Lord Arthur Russell, H. Seebohm, Prof. G. D. Thane, M. J. Walhouse.

Chemical Society, December 16, 1886.—Dr. Hugo Müller, F.R.S., President, in the chair.—The following were duly elected Fellows of the Society:—Messrs. Horace Edward

Brothers, Francis J. H. Coutts, Tamemasa Haga, Henry John Hardy, Michitada Kawakita, Walter Leach, Stephen James Pentecost, Henry Joshua Phillips, P. Yeshwant Sheshadri, Tetsukichi Shimidzu, Joseph Stapleton, William Phillips Thomson, Hikorokuro Yoshida.—The following papers were read :—Researches on the constitution of azo- and diazo-derivatives ; (1) Diazoamido-compounds, by R. Meldola, F.R.S., and F. W. Streatfeild.—The influence of silicon on the properties of iron and steel, part 1, by Thomas Turner.—The distribution of nitrifying organisms in the soil, by R. Warington, F.R.S.—Isomeric change in the phenol series ; the action of bromine on the dibromonitrophenols, by A. R. Ling.—Some azines, by Francis R. Japp, F.R.S., and Cosmo Innes Burton.

January 20.—Dr. Hugo Müller, F.R.S., President, in the chair.—The following papers were read :—Some silicon compounds and their derivatives, by J. Emerson Reynolds, M.D., F.R.S.—Chromo-organic acids ; part 1, certain chromoxalates, by Emil A. Werner.—Note on the constitution of the double chromic oxalates, by W. N. Hartley, F.R.S.—Remarks on recent papers by A. Baeyer and J. Thomsen on the constitution of benzene, by Alex. K. Miller, Ph.D.

Royal Microscopical Society, January 12.—Rev. Dr Dallinger, F.R.S., President, in the chair.—Mr. J. Mayall, Jun., directed the attention of the meeting to eleven photo-micrographs sent by Dr. van Heurck, and which the latter thought showed results of exceptional merit. The one of *A. pellucida* by transmitted light was rather striking ; it showed apparently two series of lines which were resolved into dots, and, so far as he was aware, this was the best of the kind which he had yet seen. But Dr. van Heurck did not say whether it was taken from a specimen mounted in a dense medium or not, and he thought also that several important questions of technique were omitted which it would have been very useful to have had mentioned. In the pamphlet which accompanied the photographs, Dr. Royston-Pigott was quoted to the effect that they were quite free from what used to be called "diffraction-spectra," which now here have no existence whatever ; but on examination, unless he was much mistaken, they had been painted out, or otherwise blotted out, from the negative, so that Dr. Royston-Pigott, in his remarks upon this supposed fact, had made what the French called a *boulette*. If it was desired to give each photograph a real value, the background should not be interfered with, and each impression should have the particulars as to magnification, mounting, and other data for identifying the object, the possession of which was essential in order to form any reliable opinion. As regards the longitudinal lines of *A. pellucida*, as shown in the untouched negatives of these photographs, Dr. van Heurck said he had submitted them to Prof. Abbe, who replied that, as they appeared closer than the diffraction-lines, that was a satisfactory demonstration of their existence in the object. As to the photograph of *P. angulatum*, in which a central spot was shown, all who were familiar with the object were aware that they could get the appearance of a central spot or not, according to how they looked at it : it was a question of change of focus. *Surirella gemma*, he thought, was not better shown than in Dr. Woodward's photographs. Then there were photographs of Nobert's lines, which were said to be of the 18th and 19th bands ; but here again there was nothing to enable one to identify them or to say that they were not the 14th and 15th bands.—Mr. M. Pillischer exhibited his new "Kosmos" microscope.—Mr. T. Charters White read a note on tartar from teeth of the Stone Age.—Mr. Crisp exhibited a cylinder of glass, which, though it had plane ends, acted as a concave lens, and solved some of the questions which had been raised as to the images formed in insects' eyes. He also explained Prof. Exner's method of preparing similar cylinders from celloidin and gelatine, when the effect of convex lenses was obtained.—Mr. Crisp directed the attention of the meeting to the figures of enormous microscopes in Schott's "Magia Naturalis," 1657. These had long puzzled microscopists, who were at a loss to understand what could be the object in making microscopes of the large size which was indicated by the comparison with the observers as looking through them. In Traber's "Nervus Opticus," what was undoubtedly meant for drawings of the same microscopes, the mystery was solved, for if Schott's figures were rubbed out, and single eyes were substituted for them, as Traber did in his drawings, the scale of the microscope represented was, of course, strikingly altered, and it was seen that they were small hand microscopes after all.—Mr. J. Medland exhibited and described his portable cabinet for microscopic slides.—Mr. Crisp exhibited Stein's electric microscope.—Mr. A. W. Bennett gave a *résumé* of his paper on freshwater Algæ (including chlorophyllaceous Protophyta of North Cornwall), with descriptions of six new species, illustrated by coloured diagrams.—Mr. J. Mayall, Jun., gave a very interesting account of a recent visit to Jena, where he had been afforded every facility for examining all the processes of manufacture as carried out in the factories of Dr. Zeiss. He also described his interviews with Prof. Abbe, and the way in which they had together tested numerous objectives which he had taken for the purpose.—Dr. A. C. Stokes's paper, on some new American freshwater Infusoria, was read.—The nominations for the new Council were read, and auditors appointed.

PARIS

Academy of Sciences, January 31.—M. Gosselin, President, in the chair.—On the commensurability of the mean movements in the solar system, by M. F. Tisserand. The object of this paper is to throw some light on the delicate question, how far exact commensurability is compatible with the stability of two or more bodies revolving round a common centre, as maintained by Gauss, and more recently by Gyldén and Harzer, and denied by W. Meyer in his memoir on "The System of Saturn," Geneva, 1884.—Metals and minerals from ancient Chaldæa : on the sources of tin in the Old World, by M. Berthelot. The analysis of certain metallic remains from the Palace of Sargon at Khorsabad and from Tello in Babylonia, combined with recent reports of tin mines now being worked in various parts of Khorassan, suggests the question whether tin may not have been derived from that region by the Assyrians and Chaldæans long before its arrival from the more remote Sunda Islands and Malay Peninsula in the East, or from Cornwall and one or two other parts of Europe in the West.—Experiments on the effects of transfusions of blood in the head of decapitated animals, by MM. G. Hayem and G. Barrier. The results are described of experiments on the head of dogs immediately, and some time after separation from the trunk, such as those studied some thirty years ago by M. Brown-Séquard, but not since renewed by physiologists. The authors conclude generally that the extinction of feeling and will is extremely rapid, if not instantaneous, after decapitation ; that conscious life may be sustained by the immediate injection of arterial blood from any animal of the same, or even of a different species ; and that such transfusion, made after some minutes' delay, may stimulate certain automatic and multiple reflex movements, but is powerless to re-awaken either sense or will.—Observations of the new comets of Brooks and Barnard, made at the Paris Observatory (equatorial of the West Tower), by M. G. Bigourdan.—Observations of the same comets made at the Observatory of Bordeaux with the 0·38 m. equatorial, by MM. G. Rayet and Courty.—On a method for determining the constant of aberration, by M. J. C. Houzeau. The author points out that the fundamental principle of this method, as recently submitted to the Academy by M. Lœwy, had already been indicated by him in a paper on the study of the movements of the stars, published in 1871, in vol. xxxviii. of the Mémoires of the Belgian Academy.—On the mean periodicity of the spots in Jupiter, by Dom Lamey. By a careful study of older maps of this planet (which is still in a state of incandescence analogous to that of the sun), combined with more recent observations at the Observatory of Grignon, the author deduces a mean periodicity of 5·43 ± 0·07 years for its spots.—On the theory of algebraic forms with p variables, by M. R. Perrin.—Researches on the transmission of electricity of feeble tension through the medium of hot air, by M. R. Blondlot. This is a summary of the author's researches on the transmission of an electric current through heated air, which form the subject of a memoir presented by him to the Academy. It is shown that hot air has, properly speaking, no resisting power, and he feels inclined to attribute the phenomenon to the principle of *convection*, as described by Faraday.—On the variable period of the currents in the case of circuits containing an electro-magnet, by M. Leduc.—On a halo accompanied by parhelia, observed at Fontainebleau on January 28, by M. A. Bouisson. This phenomenon, observed between 9.30 and 10 a.m., presented the appearance of a luminous circle, with a radius of about 23°, concentric with the sun, passing from a light brown in the centre to a greyish-yellow on the periphery. A second luminous circle, concentric with the preceding, with a radius of about 47°, showed in its upper segment the colours of the rainbow, red on the inner side. Tangential to both circles were vividly coloured arcs, the brilliancy of the latter decreasing

rapidly towards the extremity, while a luminous horizontal band passing through the centre of the sun stretched across the firmament, showing three parhelia—two very bright on the small, one faintly illumined on the large, circle.—Combinations of the glycerinates of soda with the monatomic alcohols, by M. de Forcrand. This paper deals with the glycerinates of methylic, ethylic, propylic, isobutylic, and amylic soda.—On the comparative actions of solar heat and light, by M. E. Duclaux. It is shown that all the effects of combustion produced by heat may also be produced by light; but the reverse does not hold, there being a large number of reactions, which light alone seems capable of determining. All these reactions are resumed in the displacement of the primitive molecule, which becomes decomposed in a few simpler elements, such as the formic, acetic, and butyric acids, the methylic and ethylic alcohols, &c.—On the properties of inosite, by M. Maquenne. Continuing his study of this substance, the author shows that in its transformation it may give rise to several well-defined aromatic compounds. Its other properties, he considers, may now be anticipated theoretically.—On a combination of paratoluidine and chloride of copper, by M. E. Pomey.—On the composition of the grains of *Holcus sorgho*, and their application to the agricultural industry in the south of France, by M. Bordas. The analysis of this grain shows a mean of 42 per cent. of starch, 100 kilogrammes yielding 26 litres of good alcohol at 33° above proof.—On the jugal and pterygoid stems in the vertebrates, by M. A. Lavocat.—On the heterogamy of *Ascaris dactyluris*, by M. Macé.—Reply to M. Balbiani on the subject of *Leucophrys patula*, by M. E. Maupas. The author shows that he has in no way exaggerated the novelty and interest of his observations on the various reproductive processes of this organism, as asserted by M. Balbiani.—On diurnal and nocturnal physiological variations of the cerebral pulse, by MM. Rummo and Ferrannini. The authors' observations establish a complete cycle or periodicity in these variations, from which they hope to deduce the biological theory of normal sleep.—On the secreting ducts and aquiferous apparatus of *Calophyllum*, by M. J. Vesque.—On certain phenomena of linear corrosion in the limestone formations of Couzon, Rhone Valley, by M. Ferdinand Gonnard.—On the epoch when the submerged valleys of the Gulf of Genoa were formed, by M. A. Issel. All these riverain valleys along the coast of Liguria appear to have been submerged towards the close of the Messinian and during the Astian epoch.

BERLIN

Meteorological Society, December 7, 1886.—Prof. von Bezold in the chair.—Dr. Hellmann stated that he had examined the observations of the County Fire Insurance Society in Schleswig-Holstein for the years 1874-83 for the purpose of investigating the question of lightning flashes in this province, and communicated the results of that investigation. As is the case in every other locality in which investigations of this description had been carried out, it was shown that generally over the whole province of Schleswig-Holstein there is an increase in the amount of damage wrought by lightning for the decade in question. On a comparison, however, of the different districts, it was found that the territory to the south of the Eider had experienced an abatement of damage by lightning, while to the north of the Eider, along the North Sea, and especially in the marshes, there had been a considerable increase. A computation of damage from lightning for one year demonstrated a very decided maximum in August in the continental, southern, and south-eastern districts, whereas in the north and west a summer maximum of less intensity and two still weaker maxima in May and October became apparent. In respect of a daily period it appeared that in the case of the first group of districts a maximum appeared in the hours from noon to 3 in the afternoon, while in the remaining part of the province the maximum was attained from midnight to 3 in the morning. This night maximum was specially characteristic of winter. The frequency of thunderstorms had no relation to the danger from lightning. The number of destructive lightnings depended in large part on the way in which the houses were roofed. The number was considerably greater in the case of soft than of hard roofs. In the case of churches the danger from lightning was 39 times, in the case of windmills 52 times, as great as in the case of houses having hard roofs. In regard to the cause of the different degrees of danger from lightning in the different districts, investigation indicated two points as determinative: first, the way in which the ground was built upon, and second, the geological nature of the ground. Whilst in the west, which was very liable to destructive strokes of lightning, the farmsteads were detached and scattered over the whole land; in the east and south they were grouped together into villages, and the danger from lightning was always considerably less for larger collections of houses than for scattered houses forming the only prominent objects throughout wide spaces. In point of fact, the danger from lightning was everywhere considerably less for towns than for rural districts. With reference to the geological bearings of the question, the danger from lightning was least for calcareous sand and greatest for clay. Dr. Hellmann had likewise discussed the statistics of lightning for Baden and Hesse Darmstadt, with the result that he found during the period investigated a considerable increase of damage by lightning for the southern part of Baden, and a decrease for the north of Baden and for Darmstadt. Besides a confirmation of the results arrived at for Schleswig-Holstein there appeared in the Baden-Darmstadt region a decided preponderance of danger from lightning in the Rhine plain as contrasted with a very low degree of danger in the mountains.

BOOKS AND PAMPHLETS RECEIVED

Notes of a Naturalist in South America: J. Ball (Kegan Paul and Co.).—United States Commission of Fish and Fisheries, Report, 1884: (Washington).—Berichte von dem Erzbischöflich-Haynaldschen Observatorium zu Kalocsa in Ungarn: C. Braun (Münster).—The Steam-Engine: G. C. V. Holmes (Longmans).—The Esclepiad, No. 13, vol. iv. (Longmans).—Quarterly Journal of Microscopical Science, January (Churchill).—Brain, January (Macmillan and Co.).—Journal of the Statistical Society, December (Stanford).

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