THURSDAY, JANUARY 25, 1877

THE ENCYCLOPÆDIA BRITANNICA

Encyclopædia Britannica. Ninth Edition. Vol. V. (Edinburgh : A. and C. Black, 1876.)

THE article of greatest scientific interest in this volume is, of course, that on Chemistry. We can conceive of few literary tasks more trying to a duly qualified and conscientious writer than to attempt to give a comprehensive and well-balanced account of the rise, progress, and present position of a science like chemistry within an encyclopædia article of such compass as even the most compliant of editors would tolerate. And we must confess at the outset that it was with some feeling of sympathy for its authors, engendered by this reflection, that we commenced the examination of their essay—a feeling, however, which quickly altered its complexion as the consciousness grew upon us that in everything which is essential it may fairly compare with any one of its predecessors. And than this, no higher praise, we think, is possible.

The article divides itself, naturally, into three parts. In the first part, which we owe to Mr. F. H. Butler, is traced the origin and growth of chemistry. Its only fault is its exceeding brevity ; it is hardly to be expected that within the space of some six or seven pages we can have a picture as lively or as complete as we find in the works of Hoefer or of Hermann Kopp. Of the birth of chemistry very little is said, and only the slightest reference is made to its association with the Greeks, Arabians, and Egyptians. With the rise of the Spagyrists with Paracelsus, who taught that the true use of chemistry is not to make gold but medicines, we seem to perceive the first attempts at a rational pursuit of the study, but the crooked manner in which the sect sought to advance its doctrine of the threefold constitution of matter was too much for the patience even of the gentle Robert Boyle, who had scant mercy for "the sooty empiricks, having their eyes darkened and their brains troubled with the smoke of their furnaces," who were "wont to endeavour to evince their salt, sulphur, and mercury (to which they gave the canting title of hypostatical principles) to be the true principles of things." The growth of Iatro-Chemistry until its final overthrow by Hoffmann so late as the beginning of the eighteenth century is concisely and carefully worked out, and the relations of its doctrines to those of Becher and Stahl are made apparent. Indeed the largest portion of this section of the article is devoted to the Phlogistic period, and the theory itself is set in a proper light. It has been too much the fashion to decry the services of Stahl's great conception, and people have marvelled that men of insight and logical minds—such men as Bergmann, Macquer, Scheele, or Cavendish—could have been hoodwinked by such a doctrine. But the theory was perfectly consistent in the outset, and it was only by the very excellence with which it served the purpose of a great theory that it fell. We are glad to find, too, that the services of Black and Cavendish as the real founders of quantitative chemistry meet with a just appreciation. The labours of Lavoisier are estimated with equal impartiality. For, as Liebig declares, although "Lavoisier discovered no new body, no new property, no natural phenomenon previously unknown . . . his immortal glory consisted in this—that he infused into the body of the science a new spirit ; but"—he is careful to add—"the members of that body were already in existence and rightly joined together." It may be worth while noting that the date of Lavoisier's famous memoir "On the Nature of the Principle which Combines with the Metals during their Calcination and which Augments their Weight," is given as 1755, at which time if, as some authorities declare, he was born in 1745 (our author says 1743), the great chemist would be of the tender age of ten years ; the careful reader would doubtless marvel at so remarkable an instance of precocity did he not discover from the context that the memoir must be antedated by at least twenty years. That *clarté* which was the distinguishing feature of Lavoisier's mind is reflected in his "Traité de Chimie," with an outline of which Mr. Butler fitly closes his account of this stirring epoch. It is instructive to trace the progress of our knowledge of the elementary bodies from the date of the publication of that work. Excluding light and caloric, Lavoisier recognised some thirty simple substances ; since his time the number of the elements has doubled itself, but it is remarkable to observe how slow, with all our appliances, is the rate of discovery in these degenerate days. Gallium, the latest on the list, was brought to light in 1875. If we divide the lapsed portion of the present century into periods of twenty-five years, we find that the times of discovery distribute themselves as follows :—

1800–1825	...	...	...	22 New elements.
1825–1850	...	...	...	10 ,, ,,
1850–1875	...	...	...	5 ,, ,,

And yet, if we may credit M. Mendelejeff and his Laws of Periodicity, we have nothing like our proper complement of elements. Obviously, therefore, if the present rate of increase is to be maintained, the occupation of the chemist will not be gone for some time to come ; ages must elapse before even the alphabet of his science is constructed ; and by the time that Macaulay's Richard Quongti goes to complete his studies at the University of Tombuctoo, attracted by the high scientific character of Prof. Quashaboo, the learned professor will doubtless be engaged on the article "Chemistry," to occupy an entire volume of the 101st edition of the "Britannica," which will still be published by the eminent firm of Black.

Mr. Butler repeats the common statement, that the atomic theory first suggested itself to Dalton during his investigations on light carburetted hydrogen, and olefiant gas ; the matter is probably of little moment, but as an historical fact it may be noted that the germ of his great work is to be found in his "Experimental Inquiry into the Proportion of the Several Gases Contained in the Atmosphere," read before the Literary and Philosophical Society of Manchester in November, 1802. In this paper Dalton states that one of the component gases—the oxygen—has the power of combining chemically, in two different proportions, with nitric oxide, to form two distinct compounds ; and that the quantities by weight of oxygen which thus combine are in the ratio of one to two. It was this circumstance which first aroused Dalton's attention to the fact that one chemical element

can combine with another in two different but definite proportions by weight. The study of the hydrocarbons and of carbon monoxide and dioxide was not taken up until two years later. (See Roscoe's "John Dalton and his Atomic Theory," Science Lectures, 1874.)

It has probably been from considerations of space that Mr. Butler has been unable to do more than glance, in the briefest possible manner, at the progress of modern theory, and we fear that in one or two instances, his reader may complain that in the effort to be concise he has become obscure. The idea of the polyatomicity of the elements is dismissed in a single line. The doctrine of *materia prima* has played such an important part in the past, and if we may judge from the signs of the times, is destined to play a still more important part in the future, that it is surely an omission of some moment to neglect all mention of Prout's hypothesis, of Dumas's extension of it, of its unquestionable influence upon the French school, and of the labours of Stas in connection with it. It is to be regretted too that so little is said of the rise of what may be termed the physical side of chemistry; of, for example, the influence of Dulong and Petit's law, of the law of Avogadro, of Mitscherlich's law of isomorphism, and that no direct reference is made to modern notions of the constitution of matter. It is true that certain of these matters are mentioned in subsequent sections of the general article, but they have their proper place in a historical account of the growth of the science. Lastly, the value of this portion of the article would have been greatly augmented by some reference to the bibliography of chemical history; Mr. Butler will excite the interest and curiosity of many students by his well-written and thoroughly readable sketch; he would have increased their gratitude by informing them how they might satisfy their craving for further knowledge.

The second, and by far the largest, portion of the article (it occupies nearly two-thirds of the whole) treats of Inorganic Chemistry, and is the work of Prof. Armstrong. In its main features it differs considerably from the ordinary run of descriptive treatises, although we question whether any one of them exhibits a more complete *coup d'œil* of the present position of this branch of the science. No space is wasted on mere *technics* (if we may employ a word which is sanctioned by Worcester), and it would be almost impossible for one ignorant of the science to employ it as a *vade mecum*. It is characterised by the manner in which broad and comprehensive principles are grasped and illustrated; entire groups are contrasted or compared, marched up and down as it were, like the skilful handling of battalions. Nevertheless, whilst we cannot but admire the fearless manner of his evolutions, we are afraid that Dr. Armstrong's love and zeal for system and generalisation occasionally allure him upon tender ground. The article is, presumably, not specially written for chemists, although we have no hesitation in affirming that every chemist who reads it will do so with pleasure, and therefore hypotheses such as that Epsom salts may be regarded as the normal magnesium salt of dihydrated sulphuric acid, H_6SO_6, crystallised with five molecules of water; or that the true formula of potassium perchlorate is $K_2Cl_2O_8$; or that the molecule of selenium dioxide is probably not represented by the formula SeO_2; or that the so-called hydrogen disulphide has presumably the composition H_2S_5; which are not the common property of the science, however ingenious and suggestive they may be, as these undoubtedly are, do not, we submit, come within the scope of a treatise which should primarily be a register of facts for the use of general readers. We allow that Dr. Armstrong is generally very cautious in his mode of stating these and similar conjectures, and possibly a very careful reader, whilst admitting their relevancy, would regard them in their proper light of tentative hypotheses; but all readers are not careful; the beaten path, we are told, is the safe path; and although scientific preachers, unlike other preachers, may with impunity be as heterodox as they please among themselves, it may be doubted how far it is expedient to preach any other than perfectly safe doctrine to the laity. This is really the only piece of adverse criticism we have to offer. When facts are known they are stated, and with remarkable perspicacity. As instances of careful and judicious compilation we may refer to the sections on ozone, hydrogen dioxide, and the organo-silicon compounds. A commendable feature is the recognition of the great importance of what we have before termed the physical side of chemistry; and in this respect Dr. Armstrong's treatise is unique: we have no hesitation in asserting that everything of value which recent investigation in the domain of chemical physics has brought to light is carefully interwoven in the proper place. The results of the thermo-chemical work of Thomsen and others; of the work of Troost and Hautefeuille and Brodie on dissociation phenomena; of the researches of Berthelot and others on the state of salts in solution; and of numerous other works scarcely less important, are duly set forth, and in such relation as to enforce their value and applicability. Indeed, in one or two cases we have the results of work which has not yet been fully published, as in the account of the action of nitric acid upon the various metals. It appears that with the exception of silver all the metals give with this acid a mixture, in varying proportions, of free nitrogen and nitrogen dioxide and monoxide. If, however, we compare the behaviour of the acid in the case of the three closely-related metals, magnesium, zinc, and cadmium, the reducing action of the evolved hydrogen is found to be greatest with the magnesium, and least with the cadmium, which result Dr. Armstrong connects with the fact that in the solution of these metals, the greatest amount of heat is evolved by magnesium and the least by cadmium. But that the comparative reducing power of the hydrogen evolved by the action of the three metals stands in no direct relation to the heat developed on solution, appears to be evident from the circumstance that in the case of the deoxidation of solutions of vanadium pentoxide by the action of these metals, the very reverse obtains: magnesium added to the solution of the pentoxide forms the trioxide, and the liquid becomes green; under no conditions, apparently, is this metal able to bring about a lower degree of oxidation; on the other hand, zinc and cadmium carry the deoxidation a stage further, and a lavender-coloured solution of the dioxide is obtained. And it would further appear from experiments which are in progress by the writer of this notice, that the amount of hydrogen which is effective in the work of reduction, as measured by its power of deoxidising ferric sulphate, amounts, in the case of zinc,

to about twenty-two per cent. of that which is evolved; whereas in the case of magnesium, under circumstances as similar as possible, it is only about eight per cent. This, indeed, is but a portion of the broad problem of the connection between the conditions of a chemical change and its amount, one side of which, as Dr. Armstrong shows us, has already been attacked by Messrs. Harcourt and Esson. We may add, in this connection, that it would have conduced to clearness if, in the concise account of the work of these chemists, the term "thiosulphate" had been substituted for that of "hyposulphite," since we have the existence of Schützenberger's acid duly stated a few pages further on, and it, in accordance with Henry Watts's suggestion, is called hyposulphurous acid.

Of the remaining portion of the article, namely, that on organic chemistry, we have but little space to speak. In one respect Mr. Meldola has had the most difficult share of the work, for it is no light task to be obliged to concentrate the essence of modern organic chemistry within less than forty pages. The general arrangement of this section bears considerable resemblance to that of Prof. Schorlemmer's excellent Manual of the Carbon Compounds, and although it, of necessity, cannot be attractive to the general reader, we can congratulate Mr. Meldola on having produced a compilation which will be highly serviceable to chemists. T. E. T.

PACKARD'S LIFE-HISTORIES OF ANIMALS

Life-Histories of Animals, including Man; or, Outlines of Comparative Embryology. By A. S. Packard, jun. (New York: Holt and Co.)

IN the rapidly-shifting condition of our knowledge of the development of all kinds of animals, it is a most difficult thing to produce a satisfactory treatise on Comparative Embryology. None the less such a work is much needed by our university students, and the little book which Dr. Packard has put together may be recommended to them as containing a great deal of the latest information on the subject, well illustrated by diagrams derived from a number of widely-scattered German, French, English, and American periodicals.

At first sight Dr. Packard's book appears considerably better than it really is. The student needs to be cautioned in using it, since it combines with much that is excellent a surprising amount of inaccuracy, and is sadly deficient in critical power. Dr. Packard is a student of German zoological journals, and is too ready to attach a large measure of importance to German work because it is German. Moreover, though he has himself engaged in researches on the embryology of the King Crab and of Insects, he has clearly not worked over a wide field in the subject, and consequently is not able to bring a trained experience to bear on the discrimination of the sound and the unsound observations and speculations of recent writers.

Amongst the good points of the book (to take some of these to begin with) we have a figure supplied by Dr. Bessels of his *Protobathybius Robesonii*; the account and figures of various Monads from James Clark, Dallinger, and Drysdale; the text and figures relating to the Echinoderms; Lacaze Duthier's figures of developing *Dentalium*; figures relating to the development of Arthropods from the works of Bobretzky, Kowalewsky, and Ganin; Morse's figures of developing Terebratulina; Agassiz's Tornaria and Balanoglossus; Wyman's embryonic skates; whilst good figures of larval Ascidians are also given.

Whilst insisting on the service which the book will render to the young student, we shall now point to some of its shortcomings. In the first place it is somewhat misleading to call attention in the title of the book to the two pages which are devoted to man. The Vertebrata altogether, are not treated with the same proportion of attention, relatively to our knowledge of them, as are the lower groups of animals.

It may be pointed out that whilst giving a large number of very useful citations of recent embryological works, Dr. Packard is not uniformly careful to ascribe the use of the terms and genealogical hypotheses which he employs to their rightful authors. In his chapter on the life-history of the Mollusca, he makes use of the terms Trochosphere and Veliger which I introduced into embryological nomenclature in my paper on the Development of the Pond Snail (*Quart. Journ. Micros. Science*, 1874), which he cites at the end of the chapter; he does not, however, ascribe either the terms or the views connected with them to their author. I am induced to mention this omission specially, since Prof. Semper of Würzburg, in his last publication—a heavy octavo discussing the relationship between Vertebrates and Annelids—has made a leading feature of the Trochosphere, appropriating the name as applied by me and the doctrine connected with it, without the slightest acknowledgment. The impropriety of Semper's proceeding is the greater since he makes no mere passing allusion to the Trochosphere, but puts forward a "Trochosphere-theory" which is intended to eclipse the "Gastrula-theory" of Haeckel.

A few points amongst those which we have noted as blemishes may be conveniently cited in order of pages.

Page 3.—We read "Bathybius was first discovered by Prof. Wyville Thomson in 1869, in dredging at a depth of 2,435 fathoms at the mouth of the Bay of Biscay." It was not, but was described and named by Huxley in 1868. Thomson appears to have seen it in 1869, in a living state under the microscope, to judge from his description quoted by Packard. Presumably this was not the sulphate of lime with which Bathybius has since been identified by the same authority.

Pages 24 and 25.—Urella should be Uvella.

Page 54.—"We have by tearing apart a species of Sycandra (or Sycon) perhaps *S. ciliata*, which grows on a Ptilota, found the planula much as figured by Haeckel, Metschnikoff, and Carter, and anyone can with patience and care observe the life-history of the marine sponges." It would have been more satisfactory if Dr. Packard had told us whether the planulæ he saw were like the figures of Haeckel or those of Metschnikoff; they certainly could not have been like both. It is a mistake to dismiss one of the most difficult problems which is now baffling embryologists with the assurance that "anyone can with patience and care" solve it.

Page 96.—"Sprat" for young oysters should be "spat." Salensky's observation on the young oyster, and his erro-

neous interpretations, are quoted with simple faith by Dr. Packard; so, too, are the same author's observations on Gasteropod development.

Page 105.—A serious error is here revived as to the identity of the velum of the Gasteropod larva, and the wings of such Pteropods as Styliola. The older observations of Gegenbaur, and the later ones of Fol, have shown that the velum co-exists with, and is quite distinct from, the expanded wing-like foot-lobes of the Pteropods.

Page 117.—The mode of development of Grenacher's Cephalopod is not, as stated by Dr. Packard, "totally different" from that of the common cuttle-fishes. It differs only in the somewhat smaller size of the nutritive yelk. The marginal cilia have no significance.

Page 120.—"Peripatus has been proved by the researches of Mr. Moseley to be a tracheate insect, for in the young genuine tracheæ exist, though they disappear in the adult, or at least have not been discovered." We should have expected to find Dr. Packard less inaccurate in what relates to the Arthropods. The above is altogether misleading; what Mr. Moseley found was that the adult Peripatus is richly supplied with tracheæ. He did not find tracheæ in the embryos, but he found still more important evidence of Arthropod character, namely, the presence of a pair of foot-jaws, the first post-oral pair of appendages becoming modified in the course of development, so as to function as mandibles.

Page 207.—Amphioxus is said to possess "primitive kidneys like the segmental organs of Worms." Of all the varied attempts to fix upon renal organs in Amphioxus there are none which quite warrant this statement. The fact is that nothing corresponding to the segmental organs of Worms has ever been described in Amphioxus, excepting the "pigmented canals." Though sometimes one epithelial area and sometimes another is declared for the time to be "renal," functionally if not morphiologically, the truth is that no renal organs at all are known to exist in Amphioxus.

Notes like the preceding might be multiplied were it worth while. Though such inaccuracy of statement does somewhat lessen the value of Dr. Packard's book, it is nevertheless one which is really welcome, and serves very well the main purpose for which it was designed, viz., that of conducting the commencing student over the recent literature of that young giant, Comparative Embryology.

E. RAY LANKESTER

OUR BOOK SHELF

Descriptive Catalogue of a Collection of the Economic Minerals of Canada, and Notes on a Stratigraphical Collection of Rocks. Exhibited at the Philadelphia International Exhibition. (Montreal, 1876.)

THE geological survey of Canada, under the direction of Mr. Selwyn, F.R.S., has placed in the Philadelphia Exhibition a collection of minerals and rock specimens of much interest, as they very fairly represent the geological productions of the Dominion, as far as the operations of the survey have extended. The descriptive catalogue of these "exhibits" (we regret the use of this new-fangled Americanism in a Canadian work) has been ably drawn up by the Geological Corps of Canada under the following heads:—1. Metals and their ores. 2. Materials used in the production of heat and light. 3. Minerals applicable to certain chemical manufactures, and their products. 4. Mineral manures. 5. Mineral pigments and detergents. 6. Salt, brines, and mineral waters. 7. Materials applicable to common and decorative construction. 8. Refractory materials, pottery-clays, and pottery. 9. Materials for grinding and polishing. 10. Minerals applicable to the fine arts and to jewellery. 11. Miscellaneous minerals. This catalogue is sufficiently comprehensive, while the arrangement is well adapted for easy reference.

Along with the descriptions of the specimens under each head we frequently find a condensed account of the origin and progress of various industrial pursuits. Thus under the head of Class 2, "Materials used in the production of heat and light," we have short notices of the more important collieries in the eastern provinces of Canada, together with observations on the origin of the petroleum springs of Ontario. The region in which the petroleum beds occur is situated in the western part of Ontario, around the town of Petrolia, occupying about eleven square miles of level ground, covered to a depth of about 100 feet with bluish clay. The oil is tapped by borings, which penetrate a series of bluish dolomites, shales, and marls to a depth of 380 feet under the clay, when a productive stratum is struck, and the oil, accompanied by sulphurous saline water, flows into the bore-hole, or well. The strata penetrated in boring the oil-wells, belong apparently to the "Hamilton," "Chemung," and "Portage" groups, representing according to Sir W. Logan, the upper portion of our Devonian beds,[1] but the petroleum itself is believed to originate in the lime-stones of the "Corniferous" formation which lie underneath; the strata occur in the form of a flattened dome. Another source of petroleum is the "Trenton" group, much lower down in the geological series, and referable to the Lower Silurian period. The geological position of the petroleum beds, as well as cases of actual observation, all go to show that the source of the mineral oil is animal, not vegetable. The limestones of the Corniferous, Gaspé, and Trenton groups are more or less coralline, and from the observations which Sir W. Logan records, it would appear that the oil is derived from the decomposition of the animal matter which originally filled the cells of the coral-rock. In such a position the oil has been observed, where these palæozoic limestones crop out at the surface, and where the limestone is overlaid by sandstone, as in the United States, or by shales or other materials, as in Canada. The animal oil has saturated these latter to such a degree that they have become underground reservoirs which can be made available by artificial means.

The notes by Mr. Selwyn on the collection of rock-specimens suggest several points on which we should like to dwell, did space permit. We shall only, however, refer to the remarkable case of metamorphic action to which he calls attention; namely, that to the south-east of the Valley of the St. Lawrence the formations are highly metamorphosed, their representatives to the north of that river being in their unaltered condition. This change takes place along a great line of dislocation ranging from Lake Champlain to Quebec and Gaspé, as described by Dr. Sterry Hunt. The change in the condition of these beds, none of which are probably older than the Devonian period, is so great, that the hand-specimens are undistinguishable from others collected in Eastern Canada or Ontario of undoubted Laurentian age. That metamorphic rocks may be of any geological period is a fact of which students of geology should be reminded; for we have recently had evidence before us, that some of the rising generation of geologists are still instructed in the exceedingly erroneous view that there is a "metamorphic system" of rocks forming the base of the general series.

E. H.

[1] "Geology of Canada," p. 20.

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.*]

Holly Berries and Rare Birds

WITH reference to the statement which has been made by Mr. McNab of the Botanic Gardens in Edinburgh, corroborated by Mr. Darwin and others in England, that holly berries are, this season, extremely scarce, it may be interesting to note that so far as this district is concerned, the holly is, on the contrary, unusually rich in fruit. For many years I have never seen so abundant a crop, and I suspect this will be found to be the case all over the West Highlands.

We have had a most unusual winter, from its extreme mildness, skies almost continually densely overcast, and the persistence of east wind. The rainfall for 1876 was not much in excess of our average—fifty-three inches. We have had little snow, and only one severe gale of wind. But the barometer has been frequently very low, in sympathy with the destructive gales both to the north and to the south of us.

I don't know whether it is due to any of those circumstances of climate that we have had two very rare birds--the great grey shrike, and the greater spotted woodpecker.

The shrike was seen here about twelve years ago, on one occasion; and a specimen of the woodpecker was killed about fifty years ago. About the time when the shrike was seen here on the last occasion, several specimens were shot in different parts of the low country; but this winter I have seen no case mentioned of the bird being observed. ARGYLL

Inveraray, January 20

On the Southern Tendency of Peninsulas

THE attention of those interested in physical geography has long been attracted to the remarkable fact that almost all the great peninsulas of the earth trend southwards, and that the majority, at any rate, have an island, or group of islands, at their southern extremity. Thus Mrs. Somerville, calling attention to this, says:—"The tendency of the land to assume a peninsular form is very remarkable, and it is still more so that almost all the peninsulas trend to the south, circumstances that depend on some unknown cause which seems to have acted very extensively. The continents of South America, Africa, and Greenland, are peninsulas on a gigantic scale, all directed to the south; the peninsula of India, the Indo-Chinese peninsula; those of Korea, Kamtchatka. Florida, California, and Aliaska, in North America; as well as the European peninsulas of Norway and Sweden, Spain and Portugal, Italy and Greece, observe the same direction. . . .

"Many of the peninsulas have an island, or group of islands at their extremity, as South America, which is terminated by the group of Tierra del Fuego; India has Ceylon; Malacca has Sumatra and Banca; the southern extremity of Australia ends in Tasmania, or Van Diemen's Land; a chain of islands runs from the end of the peninsula of Aliaska; Greenland has a group of islands at its extremity; and Sicily lies close to the southern termination of Italy."

Now may we not correlate this with the remarkable preponderance of ocean in the southern hemisphere, which M. Adhémar has suggested to be due to the alteration of the centre of gravity of the earth, caused by the great southern cupola of ice? However that may be, the preponderance of water in the south is very remarkable. Taking each parallel as unity, the proportion of sea is as follows:—

60° North	0·353	10° South	0·786
50° ,, ...	0·407	20° ,, ...	0·777
40° ,, ...	0·527	30° ,, ...	0·791
30° ,, ...	0·536	40° ,, ...	0·951
20° ,, ...	0·677	50° ,, ...	0·972
10° ,, ...	0·710	60° ,, ...	1·000
0° ,, ...	0·771		

Without at the present moment entering upon any discussion as to the cause which has produced this remarkable result, the fact at any rate seems to throw some light on the southern direction of promontories, for which, as far as I am aware, no cause has yet been suggested. For let us suppose three tracts of land, each trending north and south, each with a central backbone, but one with a general slope southwards, one with a northward slope, and the third without any. The first will, of course, form a peninsula pointing southwards, because as we proceed southwards, less and less of the surface will project above the water, until nothing but the central ridge remains. The second tract, however, would also assume the same form, because, though by the hypothesis the land does not sink, still the gradual preponderance of water would produce the same effect.

If, moreover, the central mountain ridge, as is so generally the case, presents a series of detached summits, the last of such elevations which rises above the water level will necessarily form an island, situated, with reference to the land, like those mentioned by Mrs. Somerville.

Lastly, in the third case, the gradual diminution of water would tend to neutralise the effect of the slope, and if the two were equal, the land would form, not a pointed peninsula, but an oblong tract.

If there is anything in the above suggestions it will throw some light on the southern trend of peninsulas by bringing them under the general law to which is due the remarkable preponderance of ocean in the southern hemisphere. JOHN LUBBOCK

Down, Kent

Basking Shark

IN looking over some old numbers of NATURE, which I had not been able to read, owing to my absence from Florence, I came across Dr. E. Perceval Wright's interesting article on the basking shark, *Selache maxima* (NATURE, vol. xiv. p. 313), which I read with much pleasure, and on which I would beg to offer a few observations, which I hope will not be considered as coming too late.

First and foremost, Dr. Wright in justly lamenting the absence of information on a most strange and singular form of Elasmobranch fish, far from being rare on the British coasts, entirely omits to mention the exhaustive and most important memoir on the genus *Selache*, published by Prof. P. Pavesi, of Pavia, in the *Annali del Museo Civico di Storia Naturale di Genova*, edited with so much ability, and mostly at his own private expense, by my friend, the Marquis G. Doria. In Italy we usually take much pains to be *au jour* of foreign scientific literature, and we are striving to do our best to form a good scientific literature of our own, therefore we may be excused if we feel anxious that it should be more generally known and appreciated abroad. Doria's *Annali* include most important zoological papers, and form already eight big volumes, which have cost the editor no small amount of pains and money; and it is most desirable that they should not escape the notice of working zoologists out of Italy. Indeed I may refer to some of the leading English zoologists, and more especially to my friend Dr. P. L. Sclater, to corroborate my assertion.

Prof. Pavesi's paper, "Contribuzione alla Storia Naturale del genere Selache," is continued in the sixth volume of Doria's *Annali*, published in 1874; and had Prof. Wright read it, he would have discovered that the very conflicting opinions on *Selache*, *Polyprosopus*, and *Pseudotriacis* had been most carefully examined, discussed, and sifted, that all the anatomical and zoological labours of well known and little known *savants* on the subject had been carefully analysed and critically studied by Prof. Pavesi, who in illustrating in a very lucid and minute manner the zoological affinities and anatomical peculiarities of a fine specimen of *Selache* captured at Lerici, near Spezia, on April 25, 1871, has succeeded in solving the Gordian knot which confused the true relations of the three genera above cited, and refers those strange Selacoids to two forms: *Selache maxima* (Gunn) and *S. rostrata* (Macri). To the latter species, characterised by a most singular snout, is to be referred the Lerici specimens, now in the Museum of the University of Genoa; one captured near Reggio (Calabria) in May, 1795, and described by Macri as *Squalus rostratus*; and lastly, the basking sharks, captured on the Western British coasts, and described in an incomplete manner as *Polyprosopus* by Couch, and as *Squalus* or *Cetorhinus rostratus* by Cornish.

Prof. Pavesi has largely illustrated the anatomy of *S. rostrata* in his memoir, especially the skeleton of the Lerici specimen which is preserved entire in the Genoa Museum; he also describes and figures the strange baleen-like fringes which adorn the branchial arches. HENRY J. GIGLIOLI

Florence

[We have also received a communication from Rev. M. Harvey, of St. John's, Newfoundland, mentioning that a spe-

cimen of the basking shark had been captured entangled in some salmon nets off the south shore of Conception Bay in August, 1876. Mr. Harvey thinks that the shark was probably feeding on caplin, as the Bay was full of shoals of this little fish. The teeth in his dried specimen were about a quarter of an inch in length, though probably in the fresh state they hardly projected beyond the gums. For other details we would refer Mr. Harvey to Prof. Pavesi's memoir quoted above, with the hope that he may still further continue his interesting investigation of the fauna of Newfoundland.—ED.]

The "Challenger" Collections

IT is a rather remarkable proof of the increased interest taken in natural science, that no one worth listening to has ventured to make a remark in disparagement of the *Challenger* expedition, or to utter a growl at the liberal support accorded to it from the national fund. This goes far to show that extensive classes of the community are able in various degrees to appreciate the objects and results of the expedition. One of these results is the collection of specimens in natural history. It is on the final destination of this collection that I wish to offer a suggestion. Within my own recollection it would have been difficult to name half-a-dozen public museums in Great Britain and Ireland where a series of objects, such as could be formed out of the duplicates in the *Challenger* collection, would be sure of meeting with a suitable reception. The number now would probably exceed a score, exclusive of museums in public colleges and schools; at a rough estimate the total number may be put down as at least forty. The supporters of these museums, as public tax-payers, have willingly contributed towards the expenses of the late noble and successful expedition; but it is not alone on this ground that I would respectfully urge a recognition of their claim to share in the treasure trove, but rather on the ground of the impulse that might be given to the study of natural science, and to the cordial support of plans for further expeditions of a like character.

For reasons which will be obvious on reflection, it would be a great saving of time and trouble to those engaged in the arrangement of the specimens if public museums were invited to send in, on or before a certain fixed day, to some central board, an expression of their desire to participate in the benefit of the *Challenger* collections, at the same time stating the grounds of their claim, and the department in natural science in which they would prefer to receive contributions. The examination and determination of these applications must be a work of time, therefore the sooner the plan is set on foot the better. Monographs will probably be published, and museums will purchase them; but they cannot buy the specimens, and the value of the monographs to any institution will be increased tenfold by the possession of authenticated specimens of some of the species described. Of course there are universities and other centres of scientific teaching which must come first; but I respectfully and earnestly protest against drawing the line of exclusion too stringently. There is now a great national opportunity for encouraging in a substantial way the instruction given in lectures and science classes, which often languishes for want of illustrations. I know of stores of natural history treasures. If only they had been dispensed in wisely apportioned nuclei, how valuable, by this time, might have been the collections accumulated round them. If selection amongst the claimants be impossible, might not series be made up for loan or sale? It will be unworthy of the way in which the *Challenger* work has been done, if even a single Rhizopod shall find its resting-place in a dust-hole.

HENRY H. HIGGINS

Traces of Pre-Glacial Man in America

IN NATURE, vol. xv. p. 87, you have given an outline of a paper by Prof. Hughes, read before the Cambridge Philosophical Society, "in which he criticised the evidence offered to support the view that man existed on the earth during or before the glacial period." As concerning the question of the antiquity of man in North America, I would first call attention to the remarks on this subject by the late Prof. Jeffries Wyman, the most cautious and careful of archæologists, who writes:[1] "The ancient remains found in California, brought to the notice of the scientific world by Prof. J. D. Whitney, and referred by him to *the Tertiary period*, &c," to which is added a footnote, that "*the ample evidence collected by Prof. Whitney, but not yet published, substantiates the opinion given above with regard to age. The omission of the Calaveras skull would not weaken the evidence as to the existence of man in the Tertiary period in California.*" Inasmuch as the Glacial period occurred at the close of the Tertiary period, if Prof. Whitney's discoveries are conclusive, as to this side of the Atlantic, does it not follow that man must have existed, certainly in Asia, prior to the glacial epoch? We are assured by all ethnologists, that man migrated from Asia to America, and now we are offered proofs of his American sojourn, of a date preceding the occurrence of glacial conditions. Speaking of the Eskimo, Dr. Peschel remarks[1]: "The identity of their language with that of the Namollo, their skill on the sea, their domestication of the dog, their use of the sledge, the Mongolian type of their faces, their capability for higher civilisation, are sufficient reasons for answering the question, whether a migration took place from Asia to America, or conversely from America to Asia, in favour of the former alternative; yet such a migration from Asia, by way of Behring's Straits, must have occurred at a much later period *than the first colonisation of the New World from the Old one.*" Again, in speaking of the Red Indians, he remarks[2]: "It is not impossible that the first migrations took place at a time when what is now the channel of Behring's Straits was occupied by an isthmus. The climate of those northern shores must then have been much milder than at the present day, for no currents from the Frozen Ocean could have penetrated into the Pacific." This reference to a milder climate must necessarily refer to the genial warmth of Pliocene times; for scarcely under other circumstances can we find time enough to explain the various phases of lost civilisations, especially in South America. Whether or not the supposed traces of glacial and pre-glacial man in Europe be really such—if the archæology of North America has, so far, been correctly interpreted—then, unless they have been totally destroyed, unquestionable traces of such early man will be ultimately discovered; but if such "finds" should never gladden English archæologists, the earnest workers in America have rendered it certainly true that in Asia, and doubtless in Europe, man did exist during the closing epoch of the Tertiary period, if there is, indeed, no error in the supposition that our American aborigines migrated from the Old World.

CHAS. C. ABBOTT

Trenton, N.J., U.S.A., December 16, 1876

[1] "Fresh Water Shell-mounds of Florida." Fourth Memoir of Peabody Academy, Salem, Mass., U.S.A., December 1874, p. 45.

Glacial Drift in California

IN a recent letter from my brother residing in California, he describes a curious moraine or drift formation, which may, perhaps, be as new to some of your readers as it was to myself. His description, with a few verbal alterations, is as follows:—

"The plains for a distance of from five to twenty miles from the foot of the Sierra Nevada are covered with what are locally termed 'hog-wallows.' The surface thus designated may be represented on a small scale by covering the bottom of a large flat dish with eggs distributed so that their longer axes shall lie at various angles with one another, and then filling the dish with fine sand to a little more than half the height of the eggs. The surface of the sand and of those parts of the eggs which rise above it, gives a fair representation of the 'hog-wallow' land. The mounds, which are represented by the eggs, vary from two to five feet in height, and from ten to thirty feet in diameter, some being nearly circular, some oval, while others are more irregular in shape. Those nearest the foot-hills are the largest, and they gradually diminish in size as they extend out into the plain. They are composed of gravel and boulders of irregular sizes, generally covered with a surface-soil, but sometimes bare. These tracts, which are very extensive in some parts of the State, have been till lately unexplained; but it is now generally admitted that they are due to the retreat of the broad foot of the glacier, leaving behind it a layer of *débris* or moraine-matter, which has become arranged in its present form by the innumerable rills that issued from the retiring sheet of ice. A living glacier has lately been discovered far up in the Sierra Nevada, near the head waters of the San Joaquim River."

Perhaps some of your geological readers may know it any similar formations occur elsewhere; and may favour us with their views as to whether so extensive and uniform a deposit could be due to a retreating glacier alone, or would not rather require the agency

[1] "Races of Man," by Dr. Oscar Peschel. New York, 1876, p. 396.
[2] *Ibid.*, p. 400.

of a temporary submergence to spread out the *débris* with such uniformity. During the retreat of the waters, pluvial action might perhaps wash away the softened soil in the regular manner described.

ALFRED R. WALLACE

The Number of Species of Insects

PROF. HUXLEY is very much within the mark when he estimates the species of insects at "about 100,000, if not more." Were I to estimate the number of described species at 200,000, I believe the figures would also fall short of the truth, even allowing a liberal margin for synonyms. In one order alone (*Coleoptera*) it is estimated that 80,000 species have been described.

I could enlarge upon the bearing these figures have upon theories on the geographical distribution of animals, but content myself with the remark that the groups of insects selected by writers on the subject are those in which colour is most prominent and structure least differentiated.

Lewisham, January 12 R. MCLACHLAN

[WE sent the above to Prof. Huxley, who has appended the following note.—"It was not my object to give an accurate estimate of the total number of species of insects. Gerstaecker, in the new edition of Broun's 'Thier-reich,' gives 200,000 as the total number of species of *Arthropoda*; but I dare say that Mr. McLachlan has good grounds for the claim he puts in for insects alone. "T. H. HUXLEY"—ED.]

Meteor

PRECISELY at 6 P.M., on the 19th inst., I saw a splendid meteor traverse the sky from a point about midway between Orion's belt and the Pleiades to a point directly under the moon, and about 10° above the horizon. It was pure white and dazzling, lasted about five seconds, emitted no sparks, except at the moment of disappearance, and was about half the size of the moon at the time. R. M. BARRINGTON

Bray, Co. Wicklow, January 21

Diurnal Barometric Range at Low and High Levels

YOUR notice under this head (vol. xv. p. 187) of my paper on the daily inequalities of the barometer at Mount Washington and Portland, Maine, has hit a blot of which I was unconscious until now. Had I been more than a student writing one of his first essays in meteorology, I should probably, like yourself, have suspected something wrong in the Portland curve. The morning maximum and the afternoon minimum, as you point out, occur very much earlier than is usual.

Differences varying from +0·027 inch to −0·004 inch between your averages of General Myer's figures and those given in my paper did not surprise me, as mine were intended to represent the temperature of 60° F., while you have probably taken the observations either as already reduced to 32°, or have yourself reduced them to this temperature. My own impression is and was that the printed observations are not corrected for temperature, and in order to make the comparison with as little change as possible in the original figures for the three stations I brought each to something near a mean temperature for the three attached thermometers. Unfortunately, and here comes the blot, I now find that, by some mischance, in taking out the differences for Portland the external temperatures were taken instead of those by the attached thermometer. I exceedingly regret this, and shall as early as practicable make the required correction.

Fortunately this error does not affect the purport of my paper or the suggestions which I offer in it towards the explanation of the long-vexed question of the cause or causes of the daily inequality of the barometer.

An acquaintance with the variations of the daily barometric curves, which depend on change of season and difference of locality, would undoubtedly be of assistance in drawing these curves when the observations for only a few hours are given, but the six hours for which the Portland figures are given are so well distributed as to leave little uncertainty as to the general form of the curve in this case. I should not, however, be satisfied with any curve for the Portland observations which, when analysed by the usual formula and reconstructed from the co-efficients thus obtained, did not reproduce the original observations, and also the interpolated values for the other hours, within a limit of error of 0·001 inch. Unless your curve can stand this test I shall not be satisfied with your deductions as to the epochs of maximum and minimum values. Having had much experience in drawing such curves, I venture to assert that the Portland observations, whether taken as they are printed or after a correction for temperature, will still give the morning maximum and afternoon minimum of the barometer much earlier than is usually the case in this country. If my paper draws attention to any singularity of this kind it will mitigate the disappointment caused by the mistake in the temperature correction.

I append the times of maxima and minima for Portland, May, 1872, as corrected; also similar data for five years at the Naval Observatory, Washington, U.S., and for Oxford, England.

Times of Daily Maxima and Minima of the Barometer for the Month of May.

	First Min.	First Max.	Second Min.	Second Max.
	h. m.	h. m.	h. m.	h. m.
Portland, Maine:—				
1872	1 30	7 30	15 30	21 20
Washington, U.S.:—				
1862	1 30	9 0	17 30	22 40
1863	1 30	8 20	17 30	22 40
1864	1 20	10 10	17 0	22 0
1865	1 50	9 0	16 0	22 30
1866	1 20	8 30	17 0	21 30
Mean for five years	1 30	9 0	17 0	22 16
Mean from calculation as given by Prof. J. R. Eastman ...	2 0	8 0	16 50	22 20
Mean for sixteen years at Oxford, England	3 55	7 55	16 25	22 45

Liverpool, January 5 W. W. RUNDELL

Former Climates

IT appears to be established that a climate favourable to the growth of coal plants and coral builders has prevailed in latitudes where the sun now shines for about seven months out of twelve.

Without inquiring how it came about that a warm sea once washed polar coasts, it would be interesting to learn whether the plants and animals concerned in the production of coal forests and coral reefs can flourish under these conditions of light supply.

Holmwood, Putney Hill D. PIDGEON

Tape-worms of Rabbits

HAVING had occasion to dissect a number of wild rabbits, I have been surprised to find that the majority of them are infested with a large species of tape-worm. Can any of your readers inform me whether the life-history of this parasite has ever been made out? The case appears to be a remarkable one, because the host cannot here be suspected of ever taking animal food. Unless, therefore, we suppose that the tape-worm of a rabbit differs from other tape-worms in not passing through a hydatid stage, it becomes difficult to explain the very general occurrence of this species.

GEORGE J. ROMANES

POLARISCOPE OBJECTS

THE following is an interesting combination:—When the polariser and analyser are crossed, insert a concave plate of quartz cut parallel to the axis, with its axis inclined at 45° to that of the polariser, add to this a quartz wedge cut also parallel to the axis, having its axis placed perpendicular to that of the concave plate. The coloured circles, shown by the concave plate alone, will be seen to be displaced in the direction of the thicker edge, to a distance dependent upon the angle of the wedge. Also, as the wedge is made to slide in or out, the circles will be seen to expand or contract, according as the thicker or thinner part of it is presented to the field of view.

The explanation of this is to be found in the fact that a combination of two crystalline plates is optically equivalent to a single plate, whenever the axes of the plates are either parallel or perpendicular to one another. This follows immediately from a comparison of the mathematical expressions for the intensity of the light at any

part of the field in the two cases. The expressions will be found in Verdet (Oeuvres, tome vi. p. 110), who further remarks that, if the two sections are parallel, the addition of the second is equivalent to an augmentation, or a diminution of the thickness, according as the two plates are both positive or both negative, or are one attractive and one repulsive. If the principal axes of the plates are perpendicular, the addition of the second plate is equivalent to a diminution of the thickness when the plates are of the same sign, and to an augmentation of thickness when they are of opposite signs.

When, as in the case proposed, the second plate is a wedge, the effect of the combination will be the same as if the flat side of the concave plate were cut away wedgewise, but in direction opposite to that of the actual wedge. Optically, then, the bottom of the concavity will be thrown towards the side on which the combination is optically thinnest; *i.e.*, on which the actual wedge is thinnest.

The sliding of the wedge will not alter the displacement of the centre, which is dependent on the angle, and not on the thickness of the wedge, but it will alter the total thickness of the compound plate, and consequently the diameter of the circles.

In addition to the above, I may mention another piece devised and constructed for me by Mr. C. D. Ahrens. This consists of two quartz cones, one hollow, the other solid, fitting into one another; one cone is of right-handed, the other of left-handed, quartz, and the axis of each is parallel to that of the crystal. The polarisation figure due to this combination is of course a series of concentric circles, which expand or contract when the analyser is turned in one direction or in the other.

If the field of view be examined at various distances from the centre, it will be found that there is a distance, viz., where the right and left-handed cones compensate one another, at which there is no colour, but only an alternation of light and darkness. In the immediate neighbourhood of this the red and orange assume the brown and drab hues due to low illumination, in accordance with Helmholtz's experiments; beyond this the colours are more brilliant; while at still greater distances, where the thickness of one cone much exceeds that of the other, the colours become more pale.

Combe Bank, W. SPOTTISWOODE

MUSEUMS

THE subject of Museum management and arrangement having lately been commented upon by Prof. Flower in a lecture delivered at South Kensington Museum, and printed in NATURE of December 14, 28, *et seq.*, and also by Prof. Boyd Dawkins in an address to the Manchester Literary and Philosophical Society, noticed in NATURE of December 7, it may not be an inopportune time to suggest to those who have the management of these institutions the desirability of their mutual co-operation in order to develop them to their fullest extent. The great progress which has been made during the past few years in the establishment of museums in the various provincial towns of this country is highly creditable to those who have assisted in the movement, and the influence which they might have, if properly utilised and developed, on the education and intellectual progression of the people, gives them a forcible claim to national and individual support.

There is no doubt that the present financial support given to museums is totally inadequate to maintain them in an efficient state, and we hope to see this remedied to some extent in the next session of Parliament, by the adoption of Mr. A. J. Mundella's Bill for Increasing the Library and Museum Rate, the penny rate not realising sufficient money, except in large and wealthy towns, to serve the purpose for which it is intended. Mr. Mundella's Bill gives the power to levy a rate, not exceeding 2*d.* in the pound, for the purpose of establishing and maintaining free libraries and museums, and in those towns where there is no museum, but only a library or libraries, the rate not to exceed 1½*d.* in the pound. This slight increase would not press heavily on any section of the ratepayers, while it would enable many of our libraries and museums which are now languishing for want of funds to go on in their wide sphere of usefulness with increased vigour and zeal.

The important conference of the mayors of towns and chairmen of museum committees, which was held in Birmingham on the 5th instant, to discuss and urge the claims of museums and galleries of art to some of the surplus funds remaining from the International Exhibition of 1851, and also to the duplicates which are stored away in Government collections, is a step in the right direction, and we hope that it will be productive of good results.

With the more general diffusion of education among the great masses of the people which it is hoped will result from the passing of the recent elementary education acts, the class of readers and students will be greatly enlarged, and we might naturally look for something being done by the Government to meet the increased demand for books and objects of study which is likely to follow; and we see no reason why museums themselves should not be occasionally converted into schoolrooms where teachers could bring their zoological, geological, and other natural science classes, and find well-arranged material for illustrating their lessons. Of course we take it for granted that these sciences will eventually be taught in all elementary schools under Government control.

With regard to the preservation and arrangement of specimens in museums, those who had the pleasure of listening to Prof. Flower's lecture cannot have failed to carry away some useful suggestions, and his remarks, together with those of Prof. Boyd Dawkins on the neglected and unsatisfactory state of many of our museum collections, are well worth the consideration of those in charge of them. What ought fairly to be the aim and scope of a provincial museum is a question which each town must to a great extent answer for itself, as it must depend on the resources of the neighbourhood and on the facilities possessed for obtaining certain classes of objects; and curators would do wisely to content themselves with doing only what can be done thoroughly and well, be it ever so little, and not to accept objects simply with the view of filling empty cases. We are well aware that curators are not always responsible for the incongruities which get into a museum, and if the refusal of objects were always left with them, we should not have museums sinking into advertising establishments or mere curiosity shops. We do not, however, intend now to go into this subject, but in order that all the important matters connected with the work of museums may receive full and careful consideration, we would suggest that an association be formed, to consist of curators and others engaged in the arrangement of museums. Such an association need not in any way interfere with those now existing, as there is a sufficiently wide field for discussion and action included in the work and development of museums without treading on the ground occupied by other associations. By holding periodical meetings and constantly changing the place of meeting from town to town, the various museums of the kingdom could be inspected, and their contents and plan of arrangement discussed and criticised. Friendly communications would thus be opened among all museums, and exchanges could be arranged to their general advantage. Much might be said as to the necessity and work for such an association, but we content ourselves, for the present, with suggesting it, and now leave the matter to be taken up by those most intimately concerned.

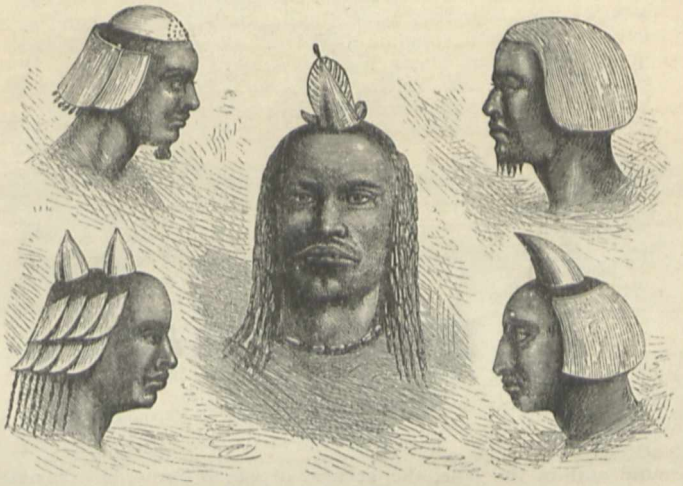
E. H.

ACROSS AFRICA[1]

OUR readers are no doubt already familiar with the main results of Commander Cameron's remarkable march across the continent of Africa; many details concerning it have appeared through various channels. These, however, have only been sufficient to whet the appetite of all who take an interest in African exploration for the complete narrative; this we find quite as interesting and informing as we had reason to believe it would be. Commander Cameron has not attempted to produce a highly polished summary of the copious notes he seems to have taken by the way; he takes the reader along with him step by step and day by day over the long and to him often tedious route he had to travel, and in the end the reader finds he has become possessed of a substantial amount of new information concerning one of the most important sections of one of the most interesting continents.

Commander Cameron's story is so well known that to summarise it here would merely be to repeat what we have already given on various occasions. The primary object of the expedition which he commanded, it will be remembered, was to seek and succour the great Livingstone, whom Stanley had just discovered, after the explorer had been hidden in the centre of Africa for five or six years. Cameron as leader, with Dr. Dillon, Lieut. Murphy, and poor young Moffat, who had sold his all to enable him to find and help his uncle, set out from Bagamoyo with a large following, early in 1873. They had only got as far as Unyanyembé in October when they were sadly surprised by the bearers of Livingstone's remains, the great traveller having died in the previous May on the south of Lake Bangweolo, almost on the same day as his enthusiastic nephew perished on the threshold of his search for his uncle. Under the new circumstances Lieut. Murphy decided to return, Dillon was compelled by the state of his health to accompany him, and Cameron resolved to proceed alone to take up and continue the work of his immortal predecessor. By doing so, he rightly believed he was carrying out the spirit of his instructions. Dillon's sad end, a few days after he left Cameron, is already known to all.

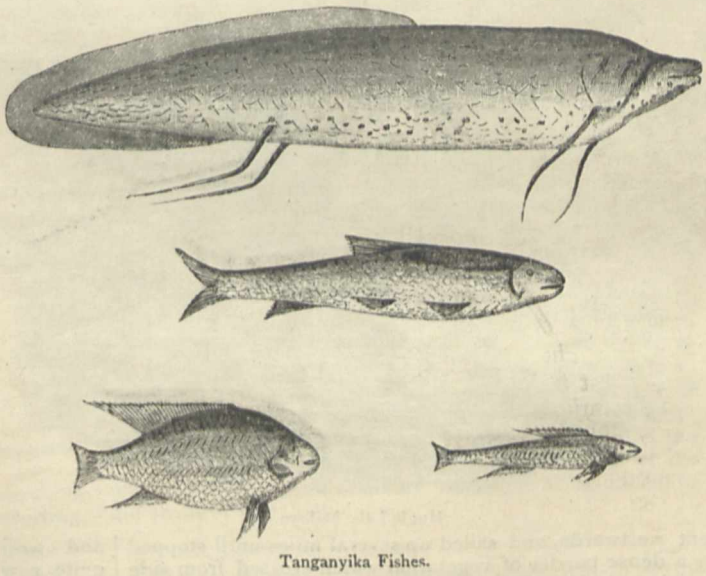
Cameron's route may be divided into four sections. First, from the coast to Ujiji; second, the survey of Lake Tanganyika; third, his journey to Nyangwé, on the banks of the broad Lualaba; and fourth, from Nyangwé, south and west, to the west coast. The first part of this route is already to a considerable extent familiar to those who have read the narratives of Burton, Speke, and Stanley. Nevertheless, it will be found that Commander Cameron has added considerably to our knowledge of its appearance, its products, and its people. The admirable series of levels which he was able to take from first to last, and the results of which are condensed in the section that accompanies his interesting map, shows that the ground rises till about the thirty-fourth degree west, when it slowly slopes to the centre of the continent, which is a wide hollow or basin, rising very gradually towards the western coast, on which side the descent is very steep. The country between the coast is varied in character, sometimes level, and sometimes very hilly, frequently swampy and liable to be inundated by the overflow of the numerous rivers which water it, but very often well wooded, thickly populated, and fertile. It is cut up into a number of states inhabited by various small tribes independent of each other, the appearance, manners, and customs of which are frequently referred to by Commander Cameron. Of the Wanyamwesi, especially, he has much to say, for at Unyanyembé, in their territory, he was detained for many weeks by fever, and indeed did not reach Ujiji till February, 1874, after innumerable troubles caused by his scratch lot of followers,



Heads of Men of Manyuéma.

and being fleeced at every hand by the chiefs through whose villages he had to pass.

Cameron was well-received and well-treated by the Arab traders at Kawelé, the capital of Ujiji, and here he fortunately secured Livingstone's papers. After measuring a short base-line, he set out on March 13 to circumnavigate the southern half of Lake Tanganyika. Our readers will remember that Burton and Speke were able



Tanganyika Fishes.

to survey a comparatively small portion of the lake in the neighbourhood of Ujiji, while Livingstone and Stanley coasted the east side of the northern part, and a portion of the north-west coast. Cameron has, therefore, by his survey been able to add considerably to our knowledge of this interesting lake. He sailed along the eastern side of the southern half, crossed to the west just before reach-

[1] "Across Africa." By Verney Lovett Cameron, C.B., D.C.L., Commander R.N. 2 vols. (London: Daldy, Isbister, and Co., 1877.)

ing the end of the lake, passed up the west side, examined the Lukuga, and returned to Ujiji on May 9. His work contains a great deal of information as to the result of this survey, and he has been able to lay down, we have no doubt with considerable accuracy, the contour of the shores. These are mostly high and rocky, covered with trees and other vegetation, often fringed with dense reeds, and cut up by a multitude of streams. Animal life of all kinds, quadrupeds, birds, insects, fishes, abounds

Nyangwé from the River.

around and in the lake, the scenery of which Cameron describes as of surpassing beauty. The western shores are well peopled by a fairly industrious population, but many portions of the east coast have been devastated by slave-hunters, evidences of whose destructive raids were seen all along Cameron's route. With regard to the river Lukugu, which Cameron believes to be the outlet of Lake Tanganyika, and an affluent of the Lualaba, he has some interesting notes. He believes he traced a distinct current westwards, and sailed up several miles until stopped by a dense barrier of vegetation which crossed from side to side. As we said when referring to this point previously, we do not think much is to be gained by discussing the question in its present shape. It is not as if no further data were to be obtained, the question is one capable of demonstration by the attainment of additional information, and we hope that Mr. Stanley will be able to set it at rest as satisfactorily as he has settled the contour

Hut in Lake Mohrya.

of the Victoria Nyanza. To Cameron geographers are greatly indebted for the large additions he has made to a knowledge of Lake Tanganyika.

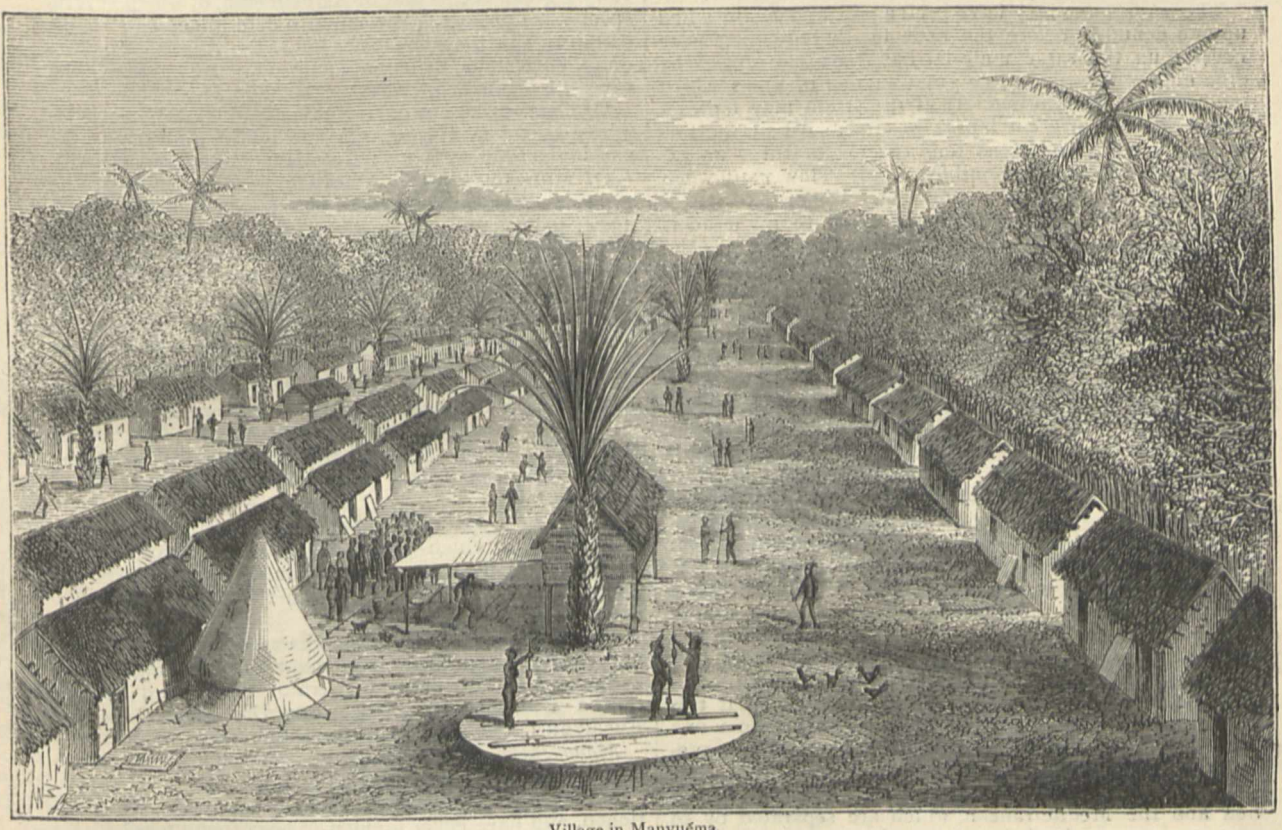
About a fortnight after his return from this survey—which, we ought to say, was carried out amidst innumerable difficulties caused by the timidity and inefficiency of his crews—Cameron crossed the lake to make for Nyangwé in the hope of obtaining boats to take him down the Lualaba. He passed over pretty much the same route as did Livingstone, whose memory he still found alive among the people. The two main districts in this route are Uguhha and Manyuema, and the people are among the most interesting with whom Cameron came in contact. In Uguhha copper is largely worked, and shaped into curious cross-bars, and in Manyuema iron ore is found and largely smelted in elaborately and ingeniously-constructed furnaces. The people of Manyuema are in many respects peculiar, and although undoubted cannibals, superior to the tribes around them. Cameron believes them to be a superior intrusive race, the lower classes being aborigines. They live in well-built houses, arranged in neat villages, and are of fine physique. They seem well deserving of further study.

At Nyangwé Cameron was well treated by an old Arab who had been kind to Livingstone, but to his great disappointment he failed in obtaining boats to carry out his cherished purpose. He was assured by many people, both here and in his journey southwards, that the Lualaba, a fine broad stream at Nyangwé, flowed westwards into a large lake, Sankorra, to which men came in large boats capable of holding 200 people, for the purpose of trading. From the interesting data collected by Cameron we must say that he has good reason for connecting the Lualaba with the Congo, and regarding the latter as the great drainer of all the region to the west and north-west of Tanganyika. The Lualaba is in the very lowest part of the great Central African basin, is a river of very large volume, which, in the upper part of its course receives various affluents, and it is difficult to conceive what other south-west African river except the Congo could carry off all this drainage. Still there is an extensive region, from about 5° N. to 10° S. waiting to be explored, and until this is done we think it premature and unnecessary to maintain any positive theory on the subject. The solution cannot now be far off with so many expeditions either on the field or about to be sent out. The data obtained by Commander Cameron are of great value, and will form an important guide to subsequent explorers.

In company with an Arab trader, Cameron proceeded southwards in the hope of being able to work his way north to Lake Sankorra. In this, too, alas, he was grievously disappointed, his designs being thwarted on every hand by the caprices of besotted chiefs and brutal slave-hunters, and the cowardly fears of his own men. The greater part of the ground from Nyangwé to the coast region, south and west, over which Cameron now travelled, is quite new, never having been before explored by any European, so far as is known. Much of the second volume, on this account, possesses novel interest. Most of the country is fertile, well watered, and well wooded. Innumerable streams were crossed, and so level is the watershed between the streams going east and those going west, that during floods, which seem to be frequent, their courses must sometimes be changed. About 200 miles

south of Nyangwé, Cameron came to Kilemba, the headquarters of Kasongo, the chief of the extensive district of Urua, and where is the principal station of the remarkable Arab trader, Jumah Amerikani. This individual has extensive trading connections over Central Africa, is a man of considerable intelligence, and was able to give Cameron much geographical information which he had gathered during his widespread journeys. Cameron was compelled to remain at Kilemba for about eight months, and had it not been for the ever-to-be-remembered kindness of this humane and generous Arab trader, his life must have been intolerable, even if he had been able to preserve it. The treatment of Cameron by this remarkable man is beyond all praise. Cameron found at Kilemba a black slave-hunter from the Portuguese settlements, than whom probably a more barbarous blackguard does not exist. The cruelties practised by this man and the chief Kasongo are almost incredible and painful to read of. The whole country here is being rapidly devastated by these slave-hunters from the west coast, and until their fiendish practices are put a stop to, the country can never be opened up either to exploration or legitimate traffic.

While staying here Cameron visited an interesting little lake, Mohrya, studded with houses built on high piles. He also heard of a people who dwell in caves in this region; we believe that Livingstone refers to this in his "Last Journals." Cameron also paid a visit to a Lake Kassali, a short distance south of Kilemba, and which contains many floating islands; but he was not permitted to reach the shores. He has collected much interesting information about the people among whom he was compelled to sojourn, and collected many notes from various sources concerning the geography of the region. But the capricious restrictions under which



Village in Manyuéma.

he was placed compelled him to lead a life of comparative idleness, so that when Kendele, the brutal slave-hunter, whose pleasure he was compelled to await, was ready to march with his ill-gotten human booty, the wearied traveller was heartily glad. This was in June, 1875, and starved and nearly dead with scurvy he reached Benguella in November.

Of the value of Commander Cameron's work we think there can be but one opinion. Every page is interesting, and he has been able to add materially to our knowledge of the hydrography, the geology, the people, and products of the important part of Africa he traversed. The general results he discusses in two concluding chapters, and botanists will be pleased to find in an appendix an enumeration of the plants collected in the region about Lake Tanganyika, drawn up by Mr. Oliver. The flora of the region, Mr. Oliver states, may be taken as belonging to the basin of the Congo.

THE TROPICAL FORESTS OF HAMPSHIRE[1]

III.

WE have in the series of beds, the aspect and formation of which I have endeavoured to describe, a total thickness of perhaps somewhere about 1,000 feet. We read in Lyell's "Geology" and other works that river and delta deposits are accumulated with comparatively great rapidity, as in the case of the Rhone delta above Geneva, which has advanced one-and-a-half miles in historical times. Throughout the Bournemouth district we have in the great and sudden deposits of coarse grit evidence of quick deposition. We also find leaves folded over with half an inch of sediment between the folds, and leaves sun-cracked

[1] Continued from p. 261. This concluding article is the substance of a paper read by Mr. J. S. Gardner, F.G.S., at the Geologists' Association, January 5.

and divided with that or more difference in level between the segments, which also shows extreme rapidity of deposition ; and although we have proof that we in some cases see the actual soil in which some of the smaller plants grew, still penetrated by their roots, there is no evidence of its having been long occupied, or that it indicates more than a rapid fern growth between recurring floods. We have further, in the fine state of preservation of some of the leaves, which have been doubtless buried before decay set in, and in the breaking up and redeposition of beds, evidence of rapid accumulation ; yet we must not hastily conclude that the time required for the formation of these deposits was, even geologically speaking, short. We over and over again see beds, one above another, which have been cut through and carried away after they had become consolidated, that is, after the muds had become so hard that they have resisted the dissolving power of water and been rolled and redeposited as pebbles and boulders.

The same spots may have been again and again silted up and denuded before the beds finally remaining were covered up, the same material has been rearranged by different currents perhaps a great number of times, whilst the constant unconformability of the strata may indicate periods of rest or great lapses of time. All our facts as to the depression of areas tend to show that it is an extremely slow and imperceptible process—slower still when the general depression is intermittent. We have further a totally different kind of evidence, which to my mind is still stronger, of the vast ages that rolled away during the deposition of these beds. This is the significant fact that the entire marine fauna was completely changed. By this I mean that we have in the London clay a fauna that migrated away, a fauna familiar to us and characterised by great nautili and other shells, crustacea, &c., peculiar to it. In the succeeding Bracklesham beds we have another totally distinct fauna, so that the duration of the land period was sufficiently long for the fauna of the London clay sea to be entirely changed before the return of the sea whose fauna we have recorded in the Bracklesham beds. In the Barton beds which overlie the Bournemouth deposits, we have again an extensive fauna, most distinctly characterised and widely separated from that of either of the preceding beds just mentioned.

In many cases it is recognised that variations in fauna are dependent upon the depth of the sea, but such cannot be the case in this instance since we get species belonging to the same genera, so closely resembling each other, that we cannot but infer that they lived under similar conditions. And when we come to see, as we do, that this applies to all the groups, the inference drawn from one individual group accumulates to an evidence which presents itself as at any rate approaching certainty. The well known case of the difference in the fauna of the Red Sea and the Mediterranean, which are separated by so narrow a strip of land, has been often referred to as a possible explanation of how different fossil faunas occurring close together may have existed contemporaneously, and do not imply any lapse of time during which changes of climate occurred; but although in many cases it is impossible when a purely hypothetical theory is brought forward to bring an argument to disprove it, yet in this case there is no evidence whatever in its favour, and what little evidence there is bearing on the question, is directly opposed to it ; therefore the other seems the more reasonable explanation. The great changes in the flora which I shall mention to you, although principally due perhaps to the great change of level of which we have other indications, may also indicate long lapse of time, long enough as I have said for the marine fauna of Bracklesham to develop, to disappear, and to give place to that of Barton.

These deposits, which have been neglected by geologists, are of extreme importance as being one of the few records we have of land surface. The rocks in which organic remains are found are aqueous rocks, principally marine ; the remains of aquatic animals are more numerous than are those of terrestrial animals, and are, for the same reason, far more numerous than those of plants. Such facts as these give great interest to series of land remains of so complete a nature. We can form an idea of how incomplete our terrestrial records are when we consider that whilst upwards of 4,400 plants are growing in Great Britain, about 700 only are known fossil, whilst 513 testaceous mollusca now inhabit Great Britain, and 4,590 were known fossil as far back as 1862.

The Bournemouth flora seems to consist principally of trees or hard-wooded shrubs, comparatively few remains of the herbaceous vegetation being preserved.

Parasitic fungi are abundant. Ferns, extremely rare in the lower part of the series, become abundant, as far as the remains go, almost to the exclusion of other vegetation, towards the close of the middle period. The prevailing group seems that of Acrostichum, of which several species are present. We can also determine, with almost certainty, the presence of Angiopteris, Anemia, Nephrodium, Gleichenia, Lygodium, and there are, besides these, several undetermined forms.

Of Conifers we have Cupressus and Taxodium, determined by De la Harpe, with the addition of Dacridium and indications of Pinus ; Cycads have disappeared.

Of Monocotyledons we have indications of reeds and rushes ; Pandanus is represented by its fruit, Nipadites ; palms are very abundant, especially in the lowermost beds of Corfe, the middle beds of Studland, and the upper middle beds of Bournemouth. Massolongho has determined Chamoecyparites, in addition to which many fan and feather palms exist, belonging to Flabellaria, Sabal, Phœnicites, and a genus new to the Eocene, Iriartea. A gigantic aroid is also very abundant, and the Smilaceæ occur in all the fossiliferous beds throughout, and are represented by five or six species.

The Dicotyledons are, however, most abundant, and it is probable that a vast number of species will be determined from these beds. De la Harpe's list included in 1856 :—

Apetalæ.—Populus, Ulmus, Laurus, Quercus, and Artocarpidium, to which Massolongho added Daphnogene. To these we may now add Carpinus, Fagus, Castanea, Salix, Platanus, Ficus, Celtis, numerous Proteaceæ, Cinnamomum.

Polypetalæ.—Elæodendron, Rhamnus, Prunus, Juglans, Cluytia, have been already noticed by De la Harpe. We will add, *fide* Massolongho, Ceratopetalum, and as new to the Bournemouth flora, Acer, Dodonæa, Celastrus, Eucalyptus, and a number of Leguminosæ.

Monopetalæ.—De la Harpe has determined Diospyros ; to this may perhaps be added Porana.

Cactus and Stenocarpus have been previously mentioned, and have never previously been found fossil.

In addition to these we have probably represented almost every genus described from continental Eocene floras, but it is premature, for the reasons already stated, to go further into this question at present. The forms I have mentioned will, however, give you a general idea of the composition of the flora.

It will have been gathered from the anniversary addresses of our president, Mr. Carruthers, that the remains of plants are, if possible, of more interest and importance than those of marine animals, as whilst we have already some idea of the succession and development of animal life, especially of the more purely marine orders of crustacea, mollusca, echinodermata, &c., we know very little of the history and development of plant life. Mr. Carruthers laid stress on the somewhat sudden occurrence of dicotyledons as being unfavourable to the hypothesis of evolution in descent. I concur with him fully that it is difficult to realise that the absence of dicotyledons can be due to any cause but their absence from the then existing vegetation, yet there are certain causes

tending to make their preservation difficult, which may perhaps be taken into account.

Some kinds of coniferous plants resist decay, when immersed in water, more completely than do almost any dicotyledons, and this resistance may, owing to their resinous nature, be very greatly increased when the immersion is in sea-water. This supposition is borne out by a fact I have noticed, that in some Eocene beds, such as the marine beds at Bournemouth, the Bembridge marls, the Bracklesham beds, coniferous remains preponderate, whilst from the two latter places I have never seen remains of dicotyledons at all, although there is evidence in these cases that dicotyledons were abundant on all surrounding land areas. This may partly account for their complete absence in marine cretaceous rocks in England, where, as in the gault, &c., foliage, fruit, resinous gums in the form of amber, remains of coniferæ, are preserved. The foreign cretaceous rocks, in which an abundance of dicotyledons is met with, are principally of fresh-water origin.

It should be borne in mind that our Chalk period contains a deep sea fauna, and we have no record in England as to what were the prevailing contemporaneous shallow water forms of life in other regions. I have great doubts, however, as to the correct position of many of the foreign so-called cretaceous beds. Those of America, from which most of the list of dicotyledons of this period is derived, appear to me, from the character of their fauna, to be either Lower Eocene, or at most filling in the gap between our chalk and London clay. Most of the shells have a marvellously Eocene-like aspect, and I take it that the presence of an ammonite, and some few other forms of shells, which in England do not range above the Chalk, should not be taken as conclusive evidence of the antiquity of the bed, as although migrated from our seas, they may very well have lived on in other regions. It is inconsistent to assume that no ammonite lived on in any part of the world to a more recent period than that of our Chalk; the finding of pleurotomaria and other supposed extinct cretaceous shells in Australian waters, should not be forgotten. The same doubts apply to many of the European leaf deposits; many of these are isolated patches, and their age has been inferred rather from the character of the leaves than from their stratigraphical position. The age of many of the so-called Miocene leaf-beds is admitted now to be extremely doubtful.

What little evidence we may expect to find in these beds seems to me likely to be in favour of the theory of evolution by descent, although until the flora has been worked out, it is premature to offer an opinion. By far the greater number of the plants belong to the lowest division of the dicotyledons, the *apetalæ*, a minority are *polypetalous*, whilst none can, as far as I know, with certainty be assigned to the highest (according to Haeckel) group, the *monopetalæ*.

Prof. Ettingshausen has traced the gradual development of some of the Miocene forms into existing species, notably that of *Castanea atava* to *Castanea vesca*; when he was here last summer and saw my collection, he especially picked out the castanea from Bournemouth as carrying the history of this genus a step further back, and linking it with the oak—as it possesses an oak-like character of venation. I would merely add that many botanists who have studied fossil plants, as Unger, Schimper, and others, are profoundly impressed with the amount of botanical evidence that has already been brought forward in support of the theory of evolution.

OUR ASTRONOMICAL COLUMN

Red Star in Cetus.—No. 4 of Sir John Herschel's list of red stars at p. 448 of his Cape Observations is placed by him in R.A. 1h. 19m. 8·7s., N.P.D. 123° 26′ 1″ for 1830, with the remark "most beautiful orange red. Two observations," and he estimated it 6m. Dunlop in his catalogue of 253 double and triple stars in vol. iii. of the *Memoirs of the Royal Astronomical Society*, gives the position of a highly-coloured object thus: for 1827, R.A. 1h. 19m. 43s., N.P.D. 123° 31′, and calls it "a very singular star of the seventh magnitude, of an uncommon red purple colour, very dusky, and ill-defined;" he made three observations upon it, and notes that it had a small star preceding and another following it. We may presume that these stars are identical, with an error of position on the part of one or other observer, most probably on Dunlop's, whose catalogue contains a number of errors; and it may also be supposed that this is the star spectroscopically examined by Secchi, which he calls No. 11 of Schellerup's catalogue of red stars, but places in 35° 17′ S. declination (A.N. 1737), perhaps through a misprint. In this state of uncertainty as to the star's true place, meridional observation appears very desirable. So far we believe it is not to be found in any catalogue, founded on such observations; it does not occur in the zones published in the Washington volumes 1869-71, a most valuable series, nor in those of Prof. Ragona in the *Giornale Astronomico e Meteorologico del R. Osservatorio di Palermo*, vols. i. and ii., neither is it found in the southern catalogues of the Cape, Madras, or Melbourne Observatories. Sir John Herschel's place reduced to 1877·0 is R.A. 1h. 21m. 19·0s., N.P.D. 123° 11′ 16″. Secchi says of the star he examined, "couleur rose; spectre à zones discontinues."

Variable Stars.—There is considerable probability that Lalande 12863-5 should be added to the list of variable stars. His estimates of magnitude are 6½ and 8½; it is 6 on Harding's Atlas and in Argelander, 6·7 in Heis, 7·3 in the *Durchmusterung*, but does not occur in Piazzi, Bessel, or Santini. Piazzi has a star of the ninth magnitude about 1¼° distant (VI. 190), which, oddly enough, he places in the Lynx. The position of Lalande's star for the beginning of 1877 is in R.A. 6h. 35m. 23s., N.P.D. 83° 32·3′.

Will some one of our southern readers record the actual magnitude of μ Doradus? At present we have the following estimates indicating a long period of variation. La Caille 5m. about 1751, Brisbane 6m. about 1825, Jacob 9·5m. in 1850 and 9·2m. in 1855; while Moesta states that between February, 1860, and January, 1861, he had always found it 8½m. or 9m. The law of variation may be similar to that of 34 Cygni, P Cygni of Schönfeld, the so-called Nova of 1600.

A Fifth Comet in 1851.—In a small tract entitled "Ragguagli Popolari sulle Comete Periodiche," by Prof. Ragona, published at Palermo, in 1855, there is reference to a comet stated to have been discovered at Rome by Prof. Calandrelli, director of the Pontifical Observatory, in the morning twilight on November 30, 1851, which both the discoverer and the writer of the tract considered to be the short-period comet of Brorsen, due in perihelion in the autumn of that year. By comparison with B.A.C. 4798, the following position resulted:—

1851, November 29, at 17h. 32m., M.T. at Rome.

Right Ascension, 14h. 21m. 38s. Declination, + 1° 47′ 2″. This position Prof. Ragona compares with the elements of Brorsen's comet according to Dr. van Galen, and found the differences between calculation and observation + 35′ 27″ in R.A., and + 11′ 1″ in declination. But notwithstanding this approximation, it is certain it was not the periodical comet of Brorsen that was observed by Calandrelli, Dr. van Galen's prediction having been vitiated by a serious error of calculation, so that, instead of arriving at perihelion on November 10, the date assigned by him in *Ast. Nach.*, No. 782, the comet passed that point in its orbit about September 25, and consequently on November 30 was far removed from the position of the body observed by Calandrelli, which was therefore a new comet.

It is stated that Calandrelli published an account of his observations in the Roman journals in December, which was transferred to the official journal of Palermo on the 11th of the same month. Perhaps a reference to the Italian journals might bring to light a further observation or observations; the comet is said to have been bright, but the weather about the date of discovery was unsettled, and for several days previously had prevented observations of any kind.

COLOURED BELTS ON JUPITER.—In connection with the supposed periodicity in the appearance of marked colour on the belts of this planet, the observations of Gruithuisen, of Munich, in the years 1836-40 possess interest. They are found in his *Astronomische Jahrbuch*, 1839, p. 76, 1840, p. 99, and 1841, p. 101. He first noticed the colour on April 23, 1836, at 9½h., when, observing with a 30-inch refractor of 2¾ inches aperture, and power 150, the single central belt then visible had a brown tint throughout, and he states that, hardly believing his own vision, he called a person who was at hand, and on asking him what colour the belts presented, he replied "the colour of rust." With a 5-feet telescope, power 120, the brown tint was not distinguished. On subsequent occasions he found that with the highest powers of the telescope the belt appeared of a bright reddish brown, while with the lower powers it was merely of a dark shade, and hence concluded that the intensity of light was disadvantageous to discerning the colour. In addition to the brown tint of the central belt, it was remarked that the planet near its north pole had a bluish-grey tint in May, 1836; a few months later Dr. Albert, a pupil of Bessel, observing with a 30-inch telescope, found the polar region "quite blue." The length of Gruithuisen's descriptive remarks prevents their being transferred to this column, but we refer to the observations, as his annual volumes are not often met with here, and the fact of such observations having been made forty years since may not be generally known. That these tints should have been conspicuous with such small optical aid is worthy of note.

THE INTRA-MERCURIAL PLANET.—In M. Leverrier's last communication to the Paris Academy on the planet assumed to exist within the orbit of Mercury, it was mentioned that, with the elements adopted, or very similar ones, a solar conjunction would occur on March 22, and a transit over the sun's disc was possible, though uncertain. A close examination of the disc is therefore to be recommended on March 22 and 23, and there is reason to believe that observers in widely-differing longitudes are prepared to undertake it. If no transit should then occur, eight or nine years may elapse before one is possible at the spring node.

CHEMICAL NOTES

ATOMIC WEIGHTS OF CAESIUM AND RUBIDIUM.—M. Godeffroy gives an account in Liebig's *Annalen* of some determinations he has made on the above subject. To obtain pure material he employs Redtenbacher's method for the separation of the caesium, rubidium, and potassium, by preparing their respective alums, separating these by fractional crystallisation, and finally converting them into pure chlorides of the metals. The determination of chlorine in the non-diliquescent caesium chloride, gave, as the mean of four closely-agreeing experiments, the atomic weight of caesium as equal to 132·557, the atomic weights of chlorine and silver being taken as 35·46 and 107·94 respectively; from analogous experiments the author finds the atomic weight of rubidium to be equal to 85·476.

ON THE SPECIFIC HEAT OF GASES.—In *Poggendorff's Annalen*, clvii., E. Wiedemann gives a most interesting communication on this matter, in which he criticises the experiments of Regnault on the same subject, and describes a new method of determining the specific heats of gases introduced by himself. On comparing the author's results with those of Regnault it is found that the method employed by the former is not inferior in accuracy to that of Regnault, and also that a great economy of material may be effected by using Wiedemann's process; this economy giving the experiments greater range in a comparatively shorter time. The following tables give a synopsis of the numbers and numerous tables given in Wiedemann's paper:—

Specific Heats of Equal Weights.

	I.	II.	III.	IV.
	0°	100°	200°	
Air	0·2389	—	—	0
Hydrogen	3·410	—	—	0
Carbon monoxide ...	0·2426	—	—	0
Carbon dioxide ...	0·1952	0·2169	0·2387	22·28
Ethylene	0·3364	0·4189	0·5015	49·08
Nitrous oxide	0·1983	0·2212	0·2442	23·15
Ammonia	0·5009	0·5317	0·5629	12·38

Specific Heats of Equal Volumes.

	V.	VI.	VII.	VIII.	IX.
	0°	100°	200°	Specific weight.	$\frac{P\,V}{P'\,V'}$
Air	0·2389	—	—	1	1·00215
Hydrogen	0·2359	—	—	0·0692	—
Carbon monoxide...	0·2346	—	—	0·967	1·00293
Carbon dioxide ...	0·2985	0·3316	0·3650	1·529	1·00722
Ethylene	0·3254	0·4052	0·4851	0·9677	—
Nitrous oxide ...	0·3014	0·3362	0·3712	1·5241	1·00651
Ammonia	0·2952	0·3134	0·3318	0·5894	1·01881

Columns I., II., III., contain the true specific heats at the temperatures indicated; column IV. the difference of specific heat at 0° and 200° expressed in percentage of the specific heat at 0°. Columns V., VI., VII., represent the true specific heats in reference to the unit of volume, the specific heat of the unit volume of air being taken as 0·2389; column IX. gives Regnault's proportions of the products of the volumes V and V′, and the pressures P and P′, when P is at the pressure of one, and P′ at the pressure of two atmospheres. Herr Wiedemann thinks that the specific heat determined in these experiments seems to be composed of two parts, the heat caused by work expended on the expansion of the gases in overcoming outside pressure, and secondly, the heat employed in the internal work of the gas itself. He also thinks that attempts to determine the separate parts of the heat of molecular motion, of which the specific heat is composed in constant volumes—of the heat of atoms according to Naumann—and also the attempt to establish simple relations between the two to be still premature, as the alteration of the specific heat with the temperature would cause these effects to have different relations between different temperatures. The author thinks that the alteration of specific heat of the gases with the temperature cannot be explained by the deviation of such gases from the perfect gaseous condition. As an illustration of this he cites the case of ammonia gas, which, although more remote from the state of a perfect gas than nitrous oxide or carbon dioxide, still possesses smaller variations of its specific heat with change of temperature than either of these latter gases.

ACTION OF ANTIMONY PENTACHLORIDE ON CERTAIN ORGANIC SUBSTANCES.—The action of this re-agent on some organic substances has lately been investigated by C. W. Lossner, who gives an account in the *Journ. pour Chimie* of the results he obtained. When chloroform and antimony pentachloride are gently heated together, preferably in sealed tubes to 100° C., the chloroform becomes converted into carbon tetrachloride. Ethyle

bromide is attacked by antimony pentachloride, the whole of the bromine being liberated and ethyle chloride formed. The action of antimony pentachloride on ethene bromide differs according to the quantities employed. With the same number of molecules of the two substances the chief product is ethylene chlorobromide, whilst with two molecules of pentachloride to one of ethene bromide the product is ethene chloride. Ethene bromide is not acted on when similarly heated with phosphorous pentachloride. The product of the reaction of acetic acid with antimony pentachloride is monochloracetic acid, accompanied by another substance with a higher boiling point. When salicylic acid is gradually added to antimony pentachloride, monochloro- and dichloro-salicylic acids are produced along with other products; monochloro-salicylic acid is found in small quantities only. Dichloro-salicylic acid on being boiled with potash for a considerable length of time exchanges its chlorine for hydroxyl, yielding gallic acid accompanied with pyro-gallic and oxy-salicylic acids. When para-oxybenzoic acid is acted on by two or four molecules of antimony pentachloride the mono- and dichlorinated acids are found respectively. From these reactions it is evident that the action of antimony pentachloride differs from that of its analogue, phosphorous pentachloride, since it simply parts with its chlorine, which replaces hydrogen in the acid radical, instead of replacing the hydroxyl group by chlorine, as is generally the case when phosphorous pentachloride acts upon organic substances.

Action of Chlorine on Peroxydes.—MM. Spring and Arisqueta continue (*Bull. Acad. de Belg.*, xlii. p. 565) their researches into the action of chlorine on peroxydes of metals, for the purpose of elucidating the very important question whether the atomicity of certain bodies is variable (as supposed by Kolbe and Blomstrand), *i.e.*, whether whilst one atom of a body in a molecule is, say, tri-atomic and possesses basic properties, another atom of the same body may be pent-atomic and partake of the properties of an acid, or whether the atomicity remains invariable, as supposed by Kékulé and the authors of the paper. Former researches induced M. Spring to conclude that the atoms of chlorine possess constantly the same properties in all their compounds with oxygen, which would be contrary to the alleged varying atomicity. Now, studying the action of chlorine upon the peroxyde of silver, the authors prove, by a very delicate experiment, that its result is the formation of a peroxyde of chlorine, a body previsedby the theory, but unknown until now, and they conclude, therefore, that the structure of peroxydes of silver and of chlorine is identical, which identity gives a new argument in support of the invariability of the atomicity of chlorine and silver.

Boron and its Specific Heat.—Boron occurs, it is known, in two different forms, in the amorphous state, and in crystals. M. Hampe has recently found (*Liebig's Annalen der Chemie*) that both the black and the honey-yellow crystals are not pure boron, but compounds of the element; the black crystals consisting of albuminium and bromine in the proportions AlB_{12}, and the yellow crystals of aluminium, carbon, and boron, $C_2Al_3B_{48}$. Boron has hitherto been numbered among the few elements which show a departure from Dulong and Petit's general law of the constancy of specific heat into atomic weight, and M. Weber sought the reason for this departure in the case of boron, as in those of carbon and silicon, in the fact that the specific heat varies with the temperatures, but at high temperatures reaches a value which establishes an agreement with Dulong and Petit's law. The determination of the specific heat of boron, however, as also M. Weber's experiments, were made with crystals of boron. Now, since, according to M. Hampe, these crystals are not pure boron, but compounds of it, the whole question as to the validity of Dulong and Petit's law for the pure element boron remains an open one. All the attempts made by M. Hampe to produce pure crystallised boron had been without success. He is engaged in further investigating whether the amorphous boron can be produced in absolute purity.

Heated Air.—Dr. Kayser, of Nuremberg, has lately conducted a number of experiments upon the effects of heating ordinary air, with especial reference to the warming of dwellings. The results appear in the last report of the Munich Industrial Museum, and may briefly be summed up as follows:—Air previously free from carbon monoxide was invariably found to contain this gas after heating. The tests were performed with chromic acid, and also with cuprous chloride. In order to test the products of the decomposition of the dust present in the air, about sixty litres of air, which had been heated, were drawn through an ordinary apparatus for determining carbonic acid, which contained absolute alcohol. The liquid assumed a yellowish brown colour, and flakey masses were suspended in it. The flakes were found to consist chiefly of carbon. After filtration and evaporation of the solution, a brown residue was obtained. This was insoluble in water, intensely acrid, and possessed a resinous, empyreumatic odour. The estimations of carbonic acid and water before and after heating showed no difference worthy of mention.

NOTES

Contributions are being collected in Stockholm for the establishment of a scientific college. The *Dagblatt* states that steps will be taken at once to fill the chairs in philology, the natural sciences, history, &c.

Baron von Richthofen, for a long series of years president of the Berlin Geographical Society, has accepted a call to the Chair of Geography in the University of Bonn.

The large collections brought back by the German exploring expedition in the *Gazelle* under the command of Baron v. Schleinitz have been formed into a separate museum in Berlin. The ethnographical section is especially rich and valuable, embracing many objects brought from islands where the natives are rapidly disappearing.

The Society for African Exploration at Berlin has been amalgamated with the newly-formed German branch of the international societies, under the leadership of the King of Belgium. During the three years of its existence it has been exceedingly active, and has expended the following sums:—Dr. Güssfeldt's Loango expedition, 9,200*l.*; expedition of Homeyer, Lux, and Pogge to the Cassandje, 1,000*l.*; Dr. Lenz's journey to the Ogowe, 1,000*l.*; various stations and shorter excursions, 2,500*l.* It has at present over 5,000*l.* in its treasury. The first session of the newly-formed *Deutsche afrikanische Gesellschaft*, was held in Berlin on January 16. The society confines its field of operations to Central Africa, proposing to open up this region "to civilisation, travel, and commerce, by the establishment of permanent stations and the maintenance of exploring parties." The energies of the society will also be directed to the repression of slavery. A letter was read from the Crown Prince of Germany, expressing his desire to take an active part in furthering the objects of the Society. A request for pecuniary assistance from the Government has already been presented to the Chancellor of the Empire.

The Berlin *Afrikanische Gesellschaft* has received telegraphic news from Dr. v. Pogge, the African explorer, who landed last week in Lisbon, stating that he had succeeded in penetrating to the long-sought-for country of King Muata Yambo in Central Africa. A detailed report is awaited with interest in geographical circles.

Dr. O. Lenz, the African traveller, has been forced to return to Europe with a shattered constitution. For a number of years

he has indefatigably pursued his researches in equatorial Africa, having led, during this period, the three German exploring expeditions into the Ogowe and Gaboon region.

THE Council of the Italian Geographical Society have agreed to present Sir George Nares with its gold medal.

AT the last meeting of the Paris Geographical Society the Abbé Durand gave an address, the object of which was to prove that the Portuguese crossed Central Africa in the fifteenth and sixteenth centuries, from the Congo to Mozambique.

THE Norwegian geologist, K. Pettersen, is planning a new expedition to Spitzbergen during the coming summer, which shall aim at a thorough geological survey of the island. A petition has been presented to the Norwegian Government requesting a grant for the undertaking.

AT the meeting of the Royal Geographical Society on Monday, Dr. Mullens read a paper on "Later Explorations in Madagascar," giving an account of five journeys of unusual importance, and over entirely new ground, by English missionaries in Madagascar during the last two years.

ON January 13 the Sumatra Expedition of the Dutch Geographical Society embarked at Nieuwediep for the east. A corps of leading scientific men have been gathered together for this expedition, and interesting as well as valuable results are expected from their researches. A great portion of their time will be devoted to the exploration of the as yet unvisited Diambi region, which is represented by the natives as abounding in useful woods and minerals. The Dutch Government has displayed a lively interest in the undertaking, and has placed at the service of the expedition a steamer completely fitted out for a two years' cruise. If favourable reports are brought back it is intended to send colonies to the above-mentioned district.

ON January 10 the St. Petersburg Academy of Sciences celebrated its 150th annual anniversary in an extraordinary gathering, at which the Emperor and royal family were present. Count Lütke, the president, reviewed the past activity of the Academy in a short address. The great medals of merit were assigned this year to Profs. Beilstein and von Bunge. The Emperor of Germany and M. Lesseps were among the list of those elected as honorary members. Among the fourteen leading scientific men elected as corresponding members, were Profs. Frankland, Newton, and Wright, England; Prof. Kirchhoff, of Berlin; Prof. Fiorelli, of Naples; Profs. Berthelot, Egger, and Decaisne, of Paris.

ON January 12, Prof. Wilhelm F. B. Hofmeister, one of the leading German botanists, died at the age of fifty-two. Although a self-taught botanist, he attracted attention at an early age by his publications on embryology and the physiology of plants, and was elected member of several royal academies. In 1863 he was called to the ordinary professorship of botany in Heidelberg, and in 1873 accepted a call to Tübingen, where he was active until the time of his death. But a short time since he received from Holland the great medal of Boerhaave—worth 75*l.*—in recognition of his botanical investigations. Among Prof. Hofmeister's principal works are "Die Entwickelung des Embryo der Phanerogamen. Eine Reihe mikroscopischer Untersuchungen," "Vergleichen der Untersuchung der Keimung, Entfaltung und Fruchtbildung höheren Kryptogamen, und der Samerbildung der Coniferen," and an extensive handbook of physiological botany, published in conjunction with de Bary, Irmisch, and Sachs.

WE regret to record the death, on the 11th inst., of Mr. Alfred Smee, F.R.S., F.C.S., F.R.C.S., F.L.S., &c. Mr. Smee was born June 18, 1818. He was educated at St. Paul's School, and afterwards at King's College and St. Bartholomew's Hospital, and was elected Fellow of the Royal Society at the early age of twenty-one. As an eminent and well-qualified medical man he held many offices, including that of Surgeon to the Bank of England. To scientific men he is best known as the inventor of the battery known as Smee's Battery, and which for certain purposes is still more useful than any other form of battery. For this he got the Gold Medal of the Society of Arts in 1840. He was author of numerous works, of which we note the following:—"Elements of Electro-Metallurgy," "Sources of Physical Science," "Elements of Electro-Biology," "On the Monogenesis of Physical Forces," "Lecture on Electro-Metallurgy," "My Garden," "The Mind of Man."

THE French *Officiel* publishes the regulations for the appointment of professors of hydrography by the Government. There are to be three classes of them. The third class is to be recruited by competitive examination from officers of the national navy and captains of the mercantile navy. They are to be appointed by the President of the Republic, according to the award given by the jury of admission. The jury is to be composed of an admiral or vice-admiral president, two examiners from the marine department, a hydrographical engineer, and a professor of hydrography.

THE credit asked by the French Government for public instruction in 1878 is 52,000,000 francs. In 1877 it was 49,000,000, and in 1876 only 39,000,000.

THE electric light is becoming common in Paris in connection with works that have to be carried on during the night. A large lamp fed by a six-horse power has been established in the Avenue de l'Opéra, and others are employed in the Trocadero in connection with the building of the Exhibition Palace. The gramme machine and screw regulator are employed.

THE first number is issued of an important publication, *The Wild Flowers of America*, by Dr. G. L. Goodale, Professor in Harvard University, with coloured illustrations by Isaac Sprague. The present number consists of figures of five species, in four plates, and the plates are accompanied by a botanical description together with some gossip about folk-lore, popular names, &c. The paucity of figures of even the commoner American plants will render the work very welcome to botanists. The name of the artist is a sufficient guarantee of the faithfulness of the drawing, and the colouring appears to us to be successful.

CAPT. H. W. HOWGATE, Acting Signal Officer, U.S.N., suggests the following method of attaining the North Pole:—To be able to take advantage of the occasional breaking-up of the ice-barrier with the greatest certainty and with the least expenditure of time, money, and human life, it is essential that the exploring party be on the ground at the very time the ice gives way and opens the gateway to the long-sought prize. This can only be done by colonising a few hardy, resolute, and experienced men at some point near the borders of the Polar Sea, and the most favourable one for the purpose appears to be that where the *Discovery* wintered last year. Such a party should consist of at least twenty men, and should be provided with provisions and other necessary supplies for three years, at the end of which period they should be visited, and, if still unsuccessful in accomplishing the object, revictualled and again left to their work. It is stated that an effort will be made to induce the U.S. Government to adopt this plan.

BEHM'S last *Geographischer Jahresbericht* shows a total of thirty-six geographical societies in existence at present.

DURING the middle of January the South of Norway has been visited with the severest snowstorm experienced since 1818. In some of the villages snow covers the roofs of the houses to the depth of sixteen feet, and dwellings have been unable to sup-

port the overlying weight. Communication is dependent upon the use of snow-shoes.

THE Prussian Universities granted during the past year 500 doctor's diplomas upon the basis of a thesis and oral examination. Göttingen bestowed 139, Berlin, 90. Twenty honorary degrees were granted during the same period.

M. FIZEAU has been elected Vice-President of the French Academy of Sciences for the coming year, from the section of the mathematical sciences; the President is M. Peligot. Of the Academy's *Mémoires*, tome xxxix., in course of publication, is reserved for works of M. Chevreul, on dyeing, on an error of reasoning frequent in sciences which are concerned with the concrete, science in relation to grammar, history of opinions on the chemical nature of bodies of chemical and living species, &c. The Academy is also publishing a number of documents on the Transit of Venus. Tomes xxiii., xxiv., and xxv. of *Mémoires des Savants Étrangers* contain memoirs on the theory of running waters, a system of irrigation, the succinic series, the carboniferous flora of the department of the Loire, the transformation and equivalence of chemical forces, the transparence of flames, vision of scintillating lights and nocturnal transparence of the atmosphere, the Phylloxera, &c.

THE *Bulletin de la Fédération des Sociétés d'Horticulture de Belgique* for 1875 is just published, and illustrates the great activity with which this branch of science is pursued in the little kingdom. Besides the official papers connected with the federation, and reports from twenty-five associated societies, the volume contains the "Correspondance botanique" for that year, a list of botanists and horticulturists holding official positions throughout the world, a sketch of the life of Mathias de l'Obel (Lobelius), by E. Morren, and several other papers by the same writer.

MR. THOMAS COMBER reprints from the *Transactions* of the Historic Society of Lancashire and Cheshire, a useful paper entitled "Geographical Statistics of the Extra-British European Flora," containing a considerable mass of information which will be valuable to anyone interested in the subject of the distribution of continental species, and the causes of the range which they now enjoy.

HUNGARY is developing no small degree of activity in matters of scientific interest. The president of the Royal Society for Natural Sciences at Pesth reported in the annual Session of January 17, that the present membership amounts to 4,650. Five subjects for prize treatises were announced, one of which was on the chemical resources and industries of the kingdom.

THE phenomenon of the "black drop" has recently been made the subject of experimental study by M. Ch. André, who has communicated his results to the French Academy. Without stopping to describe his artificial transit, we may state that he had a battery communicating with the planet Venus, the other with the limb of the sun; and at the moment of geometrical contact a current was produced, which was registered on a Brequet chronograph. On the same instrument was inscribed parallelly the hour given by a Winnerl pendulum, and the mark produced by the observer pressing down a Morse key. The conclusions of M. André are, shortly, as follows: The black drop is not an accidental fact, but one that is necessary and characteristic of the phenomenon. With sufficiently strong light, the bridge is always produced at the moment of geometric contact, however perfect the telescope. It may be made to disappear entirely in the retinal image, either by increasing sufficiently the absorbent power of the dark glass used, or by placing before the objective a screen formed of a large number of very narrow rings separated by dark rings of the same width, also by diminishing the intensity of the luminous source. In each case the transit is produced in a geometric manner. All these facts accord with the theory of diffraction rightly interpreted. The ligament is not a real obstacle to observation of the transit. There is a *simultaneous phase* for all telescopes, whatever their apertures, which corresponds to geometric contact, and after a suitable education one may observe with an error equal at the most to 0·75s. for internal contact of ingress, and 1·50s. for internal contact of egress. The total error, then, may be reduced to 2·5s. Now to have the solar parallax to a hundredth of second of arc, it is sufficient not to commit, in the duration of transit, an error above five seconds of time; hence the observation of the transit of Venus may furnish this parallax to nearly five-thousandths of a second of arc.

A PAIR of Kœnig Ut^4 forks will show the phenomenon of sympathetic resonance at much greater distance than a pair of Ut^3 forks. The common explanation is that as double the number of impulses are delivered in a second, double the energy is conveyed to the distant fork. This is questioned by Mr Robert Spice (*American Journal of Science and Arts*), in view of the law of forces radiating from a centre. At twenty feet, in fact, the intensity of resonance of Ut^4 forks is undoubtedly greater than the intensity of Ut^3 forks at six feet. With Ut^3 forks of bell-metal he got, at forty feet, a greater result than that obtained with the steel Ut^4 forks of Kœnig. The hypothesis he offers is this: *The intensity of sympathetic resonance of forks on their cases increases with the angular deviation or motion of the prongs.* By means of an electro-chemical registering apparatus Mr. Spice finds that when a fork (between Ut^3 and Ut^4) is in vibration, its stem or handle alternately rises and falls in accord with the period of the fork, through about $\frac{1}{800}$ inch. In sympathetic resonance the case gives the stem this up-and-down motion, which is conveyed to the prongs and sets them in motion, as a hand might start a pendulum suspended from it (by moving laterally, say, one inch each way). This motion of $\frac{1}{800}$ inch may be looked on as a constant. If we decrease the length of the fork without altering the constant, we thereby allow of a greater initial angle, the result of which is the same as shortening the pendulum cord. Thus we are in a position to explain the deportment of the bell-metal forks. The velocity of sound in bell-metal is much less than in steel; hence, retaining similar thicknesses in both cases, an Ut^3 fork in bell-metal would be shorter than an Ut^3 fork in steel. Therefore, though we retain the vibration number, we gain advantage from the shortness of the fork, and hence from the increase of angular motion of the prongs.

THE applicability to liquids of Kirchoff's law as to the subdivision of galvanic currents in bifurcating metallic conductors having been doubted, Prof. Lenz has recently (*Bull. de l'Ac. de St. Pétersb.*, vol. xxii., No. 3) made a series of experiments with solutions of sulphates of copper and zinc and of nitrate of silver. He arrives at the conclusion that the subdivision of galvanic currents in liquids follows exactly the same laws as their subdivision in metallic conductors.

IN a paper "On Evolution in Geology," in the January number of the *Geological Magazine*, Mr. W. J. Sollas, starting from the ground that the energy of the earth and the sun is a continually diminishing quantity, and must at the beginning of geological history have been far in excess of its present amount, briefly discusses the influence of this greater quantity of energy on geological changes. He arrives at the conclusion that all main factors of geological changes, viz., the denudation, reproduction, and the elevation and depression of strata, must have notably and rapidly decreased in intensity; and, alluding to the opposition met with from geologists by Sir W. Thomson's views, he insists on the mistake of attempting to check the results as to the age of the world obtained by the physicist with those de-

duced by the geologist," which last are based on the rate of changes produced now, during a period of diminished energy of all main geological factors.

THE Chair of Botany at Aberdeen, we learn from the *Gardener's Chronicle*, is likely to be vacant shortly. Among the candidates are mentioned the names of Dr. J. B. Balfour, Rev. Dr. Brown, Dr. W. R. M'Nab, and Dr. Traill.

MR. C. P. OGILVIE, who has been studying the art of aquarium management at the Royal Aquarium, Westminster, has been appointed Curator and Resident Naturalist to the aquarium recently completed at Great Yarmouth, Norfolk.

THE distance between Paris and Marseilles is 863 kilometres, not 1,820, as stated in our note on p. 266 last week.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus*) from East Africa, presented by Mr. L. C. Brown; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Cecil Long; a Pig-tailed Monkey (*Macacus nemestrinus*) from Java, presented by the crew of H.M.S. *Dwarf;* a Bay Lynx (*Felis rufa*) from North America, presented by Mr. W. Otho N. Shaw; two Teguexin Lizards (*Teius teguexin*) from South America, presented by Mr. A. Stradling; an Ocelot (*Felis pardalis*), an Azara's Fox (*Canis azaræ*) from South America, a Tataupa Tinamou (*Crypturus tataupa*), two Talpacoti Ground Doves (*Chamæpelia talpacoti*), two Scaly Doves (*Scardafella squamosa*) from Brazil, a Chopi Starling (*Aphobus chopi*), a Chilian Sea Eagle (*Geranoaëtus aguia*) from Pernambuco, deposited; two Ring-tailed Lemurs (*Lemur catta*) from Madagascar, purchased.

SCIENTIFIC SERIALS

THE *American Journal of Science and Arts*, January.—Contributions to meteorology, being results derived from an examination of the observations of the United States Signal Service, and from other sources, by Elias Loomis.—On some points in connection with vegetation, by J. H. Gilbert.—Observations on a property of the retina first noticed by Tait, by Ogden N. Rood.—On grains of metallic iron in Dolerytes from New Hampshire, by George W. Hawes.—On certain phenomena of binocular vision, by Francis E. Nipher.—Notes on the Vespertine strata of Virginia and West Virginia, by William M. Fontaine.—On the production of transparent metallic films by the electrical discharge in exhausted tubes, by Arthur W. Wright.

THE *Verhandlungen des naturhistorischen Vereins der preussischen Rheinlande und Westfalens* (Jahrg. 33, Part 1.) contain the following papers of interest:—Geological, Mineralogical, and Anthropological Section: On some new discoveries in the Jurassic formation west of the river Weser, by W. Treukner.—On a diseased ox's rib from the calcareous tuff-stone in the vicinity of the Toenisstein saline spring (Rhenish Prussia), by Prof. Schaaffhausen.—On some bronze implements found near the Weser river, by the same.—On a petrified piece of wood with the image of a human face, by the same.—On the so-called periclinic combinations of Albite by Prof. vom Rath.—On Skorodite-crystals, on plagioclase, and on Brookite crystals, by the same.—On a pine cone found near Dormagen, on the Rhine, together with Roman coins and antiquities, by Prof. Schaaffhausen.—On Capellini's researches on pliocene man in Tuscany, by the same.—On some stone implements recently found, by the same.—On geological researches made at Nagyag and Vöröspatak, in Transylvania, by Prof. vom Rath.—On olivine from Dockweiler and on crystallised slakes, by Dr. Mohr.—Physical Section: On Mallet's theory of volcanic force, by Prof. A. von Lasaulx.—On a further simplification of the electrodynamic fundamental law, by Prof. Clausius.—On anomalous dispersion of light, by Prof. Ketteler.—On the effects of a stroke of lightning, by Herr Gieseler.—Zoological and Anatomical Section: Synoptical review of the genera and species of *Stilpnoida*, by A. Förster.—On the respiration of *Limnacæ*, by Prof. Troschel On a specimen of *Pediculus capitis* with extremely large system of tracheæ, by Dr. Bertkau.—On Dareste's investigations on the reproduction of eels, by Prof. Troschel.—On the *Cephalopoda* of the German upper chalk, by Dr. Schlüter.—On the spermatogenesis of *Amphibia*, by Prof. von la Valette St. George.—Botanical Section: On the influence of interior and exterior causes upon new formations in plants, by Prof. Vöchting.—On the fruit of *Raphia taedigera*, by the same.—On some phenomena observed in the botanical garden of Poppelsdorf, near Bonn, during the summer of 1875, by Herr Körnicke.

SOCIETIES AND ACADEMIES

LONDON

Royal Astronomical Society, January 12.—Mr. William Huggins, D.C.L., president, in the chair.—Mr. Robert John Baillie, Mr. Henry Vere Barclay, the Rev. Daniel Dutton, Mr. Samuel Haywood, Dr. Louis Stomeyer Little, Mr. Richard Pearce, Commander William James Lloyd Wharton, R.N., H.M. surveying ship *Fawn*, and Mr. Jesse Young, were elected Fellows of the Society.—A paper by Mr. Marth giving an ephemeris for the satellites of Uranus for the year 1877, was read. This is one of a series of papers which Mr. Marth has presented to the Society giving ephemerides useful for physical observations of the major planets and their satellites. It was remarked by the president that these ephemerides involve much labour in their construction, and the astronomical world is greatly indebted to Mr. Marth for their production.—A paper by Prof. Harkness on the theory of the horizontal photoheliograph was read. The instrument consists of a heliostat and a long focussed object-glass, in the principal focus of which the negatives are taken; the distortion produced by secondary magnifiers is thus avoided, and very accurate means are adopted for determining the shrinkage of the collodion film upon the plate and the accurate orientation of the photograph.—Mr. Wentworth Erck read a paper on an improved eye-piece for viewing the sun. His method is to use a small glass prism as a reflector which is placed within the image of the sun, so that only a portion of the rays from a part of the disc are reflected into the eye-piece at any one time; the effects of heating are thus reduced to a minimum, and for viewing small areas of the sun the eye-piece is preferable to that suggested by Mr. Dawes in which the light of the whole image is reflected and the small area to be observed is viewed through a diaphragm which is exposed to the heating effects of the reflected rays.—A paper by Mr. Knott was presented to the society; it contains a catalogue which he has been some years in preparing, and gives a very large number of micrometrical measures of double stars which have been made with a very fine eight-inch refracting telescope formerly the property of Mr. Dawes.

Chemical Society, January 18.—Prof. Odling, F.R.S., vice-president, in the chair.—The secretary read a paper by Dr. Jäger on some derivatives of dithymyltriclorethane, a substance produced on adding a mixture of sulphuric and acetic acids to a mixture of thymol and chloral. By heating this compound with zinc dust it yields dithymylethane and dithymylethene.—Mr. Kingsett then read a preliminary notice by Dr. Heike and himself on some new reactions in organic chemistry and their ultimate bearings, showing that the colour reaction known as the "Pettenkofer reaction" produced by the action of sulphuric acid on sugar and cholic acid extended to many other substances, some of which did not require the admixture of sugar to produce the colour. This was followed by a paper on dinitrosoorcin and dinitro-orcin, by Dr. J. Stenhouse and Mr. C. E. Groves, in which the methods of preparation and properties of these compounds were fully described.—The last communication, by Mr. T. Carnelley, was on high melting points with special reference to those of metallic salts, Part 3.—The meeting was then adjourned until Thursday, February 1.

Zoological Society, January 16.—Prof. Newton, F.R.S., vice-president, in the chair.—Capt. H. W. Feilden, exhibited and made remarks on some of the birds collected by him in the Arctic regions during the recent North Polar Expedition. Sixteen species were enumerated as having been met with on the shores of the Polar Basin, and north of 82° N. lat., but some of these only occurred as stragglers.—The Rev. Canon Tristram exhibited and made remarks on a specimen of a rare terrestrial Dormouse (*Eliomys melanurus*), obtained by him in Southern Palestine, where it is found in desert places.—Mr. P. L. Sclater, F.R.S., exhibited and called attention to a collection of mam-

mals, birds, reptiles, fishes, and insects, which had been made by the Rev. George Brown during his recent residence in Duke of York Island, and during excursions to the neighbouring islands of New Britain and New Ireland.—Prof. A. H. Garrod read a note on a variety of the domestic swine in the Society's collection, and pointed out that the presence of rudiments of a supplementary digit between the third and fourth digit might be the cause of the consolidation of the hoof, observable in this variety.—A communication was read from Mr. Henry Durnford containing notices of the habits of some small mammals obtained in the neighbourhood of Buenos Ayres.—A communication was read from Mr. Gerard Krefft, containing notes on a young living Cassowary (*Casuarius australis*), which had been obtained from North Australia, and was destined for the Society's collection.—A communication was read from Mr. G. French Angas, containing a description of a new species of *Helix*, from South Australia, which he proposed to call *Helix* (*Rhagada*) *kooringensis*.—A second paper by Mr. Angas contained the description of two genera and twenty species of marine shells, from different localities on the coast of New South Wales.

Geological Society, December 20.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Bartholomew Parker Bidder, Robert William Cheadle, David Grieve, Player Isaac, James Love, Kerry Nicholls, William Ridley, William Joseph Spratling, and George Blake Walker were elected Fellows of the Society.—The President announced that the late Dr. Barlow had left to the Society by will the sum of 500*l.*, to be invested and to constitute a fund under the title of the Jameson-Barlow Fund," the proceeds to be applied annually, or at intervals of two or more years, at the discretion of the Council, in such manner as shall seem to them best for the advancement of the study of geology. Dr. Barlow also left to the Society, under certain restrictions, his collections of geological specimens, and a selection of books from his library. The President further announced the donation to the Society, by the Earl of Enniskillen, of the drawings made by Mr. Dinkel, from Sir Philip de Malpas Grey-Egerton's collection, for the illustration of Prof. Agassiz's great work on Fossil Fishes, presented in accordance with the promise made by his Lordship at the meeting of May 24.—The following communications were read:—On *Pharetrospongia strahani*, a fossil Holorhaphidote Sponge from the Cambridge Coprolite Bed, by W. J. Sollas, F.G.S.—On the remains of a large Crustacean, probably indicative of a new species of *Eurypterus*, or allied genus (*Eurypterus? stevensoni*) from the Lower Carboniferous series (Cement-stone group) of Berwickshire, by Robert Etheridge, jun., F.G.S., Palæontologist to the Geological Survey of Scotland. The fragmentary Crustacean remains described in this paper are referred by the author to a large species of *Eurypterus*. They are from a rather lower horizon in the Lower Carboniferous than that from which *Eurypterus scouleri*, Hibbert, was obtained. The animal was probably twice the size of *E. scouleri*. The remains consist of large scale-like markings and marginal spines which once covered the surface and bordered the head and the hinder edges of the body segments of a gigantic Crustacean, agreeing in general characters with the same parts in *E. scouleri*, but differing in points of detail. For the species, supposing it to be distinct, the author proposes the name of *E. stevensoni*.—On the Silurian Grits near Corwen, North Wales, by Prof. T. McKenny Hughes, F.G.S. The author commenced with a description of sections near Corwen, in North Wales, from which he made out that the grits close to Corwen were not the Denbigh grits, but a lower variable series, passing in places into conglomerate and sandstone with subordinate limestone and shale. The series, under the name of "*The Corwen Beds*," he described in detail, having traced them round the hills south of Corwen, also near Bryngorlan, south of the Vale of Clwyd, on Cyrnybrain, and south of Llangollen. He had noticed in places a kind of double cleavage affecting the lower series, but not the upper, and also fragments of cleaved mudstone included in the upper, from which he inferred a disturbance of the older rocks previous to the deposition of the newer. He exhibited a selection of fossils, and said that immediately below the Corwen beds there were none but Bala fossils. In the Corwen beds all the few fossils found were common to the Llandovery rocks, some of them, as *Meristella crassa* and *Petraia crenulata*, being peculiar to that formation. In the flaggy slates above the Pale Slates he had found Graptolites and Orthoceratites of the same species as those found in the Denbigh Flags. He considered that the Corwen Beds were on the horizon of the May Hill or Llandovery group, and should be taken as the base of the Silurian, thus including in the Pale Slates or Tarannon Shale a thick series which intervened between the Corwen Beds and the flaggy slates of Penyglog.—On mineral veins, by W. Morgan, communicated by Warington W. Smyth, F.R.S.

Meteorological Society, January 17.—Annual General Meeting.—Mr. H. S. Eaton, president, in the chair.—The Council in their Report to the Fellows expressed their satisfaction at the progress that had been made by the Society during the year. The first point on which they thought there was reason for congratulation was the publication in their journal of the daily observations taken at Hawes and Strathfield Turgiss and of the monthly abstracts of the observations at thirteen other stations. The increase in the number of Fellows was considered worthy of special reference, as it is an indication not only of the vitality of the Society but also of the advance which meteorology is now making amongst the professional and general public. They also referred with much satisfaction to the enlargement of the Quarterly Journal as well as to the printing of the Catalogue of the Library and of the List of Fellows, which have both been issued during the year. They drew special attention to the report of Mr. Symons on the new stations which have been inspected and brought into relation with the Society. The financial position, notwithstanding the large outlays during the year, was very good. The report also contained the very interesting discussion by the Rev. T. A. Preston, of the observations on natural periodical phenomena.—The following gentlemen were elected Officers and Council for the ensuing year:—President, Henry Storks Eaton, M.A. Vice-Presidents: James Park Harrison, M.A., John Knox Laughton, F.R.A.S., Robert James Mann, F.R.A.S., Charles Vincent Walker, F.R.S. Treasurer, Henry Perigal, F.R.A.S. Trustees: Sir Antonio Brady, F.G.S., Stephen William Silver, F.R.G.S. Secretaries: George James Symons, John W. Tripe, M.D. Foreign Secretary. Robert H. Scott, F.R.S. Council: Percy Bicknell, Arthur Brewin, F.R.A.S., Charles Brooke, F.R.S., Edward Ernest Dymond, John Evans, F.R.S., Rogers Field, Assoc. Inst. C.E., Charles Greaves, M. Inst. C.E., William Carpenter Nash, Rev. Thomas Arthur Preston, M.A., William Sowerby, F.L.S., Capt. Henry Toynbee, F.R.A.S., George Mathews Whipple, F.R.A.S.

PARIS

Academy of Sciences, January 8.—M. Peligot in the chair.—The following papers were read:—Exploration of the Gulf of the two Syrtes, between Sfax and Benghazi, by M. Mouchez. This was in the early part of last year. The author sketches the character of the coast, and refers to difficulties he had with the natives, who are very hostile to Frenchmen, but receive Englishmen with ovation, for defending the Sultan. They had some curious very old arms. The great recent development of the Alfa trade on the Algerian coast is notable, and the fact that while 75 per cent. comes to England and 18 per cent. to Spain, only 4 per cent. comes to France. M. Mouchez regrets this small consumption by his country.—Theorems relating to series of triangles of the same perimeter satisfying four other conditions, by M. Chasles.—Does ozone combine with free nitrogen in presence of alkalies to form nitrous compounds and nitrates? by M. Berthelot. He verifies Schönbein's observations on the formation of nitrous compounds during slow oxidation of phosphorus in contact with air, but he had not observed oxidation of free nitrogen by ozone in presence of alkalies. He points out some sources of error in Schönbein's experiments.—Note on the alteration of urine, *à propos* of recent communications of Dr. Bastian, by MM. Pasteur and Joubert. Dr. Bastian had said that M. Pasteur in repeating his experiment had exceeded the point of saturation of the urine (with solid potash). MM. Pasteur and Joubert have re-examined the point, in careful experiment, and produced exact neutralisation; though they consider this not indispensable for fertilisation. Dr. Bastian would have got quite different results from what he described, had he used KO, HO, which alone can properly be called *potash*.—Observations on the interior structure of one of the masses of native iron of Ovifak, by M. Daubrée. In its section it presented the aspect of a loop of iron from a refining hearth, the scoriæ of which had been very incompletely expelled by compression with the hammer or rolling mill.—Note on the fall of a meteorite which took place on August 16, 1875, at Feid Chair, in the circle of La Calle, province of Constantine, by M. Daubrée. It fell about midday; a noise was heard like a thunderpeal, and there was a train of blackish smoke with brilliant light in the middle of it. The mass, which weighed 380 grammes, rebounded

to about 30 metres further on, making a hole. It is of the most common type of sporadosiderites.—M. van Tieghem was elected member in the section of Botany, in place of the late M. Brongniart.—Report on a memoir of M. Haton de la Goupillière, entitled "Researches on the Brachistochrone of a Heavy Body with regard to Passive Resistances."—Determination of the polar distance in magnets, by M. Benoit.—Experiments on the coagulation of fibrine, by M. Schmidt. This is essentially a process of fermentation; soluble albuminoid substances are changed by the action of a specific ferment and in presence of a small quantity of neutral salts of alkaline metals, into insoluble bodies. The ferment does not pre-exist; it is formed when the liquids are brought into abnormal conditions. The places of its formation are the white corpuscles of the blood, the lymph, chyle, and pus, and the cells of certain tissues, which undergo decomposition, the liquid then receiving from them a new quantity of fibrinoplastic substance. Meanwhile all the fibrinogen substance disappears as such, while the fibrinoplastic substance in excess, with the ferment becomes a constituent part of the serum. A temperature of zero retards considerably the formation of the ferment; concentrated neutral salts of alkaline metals hinder it almost entirely. They also paralyse the action of the ferment in the liquids.—On the spontaneous disappearance of a disease which for seven years attacked the vines in the island of Cyprus, by M. Dubreuil. It seems to have been öidium; its disappearance is attributed to the growing of abundance of sumach among the vines.—On the construction of open manometers, for measuring high pressures, by M. Cailletet. In his apparatus a metallic tube (70m. long 2mm. inner diameter) is soldered into a reservoir of mercury at the foot of a hill side. At the free end above is adapted a wide glass tube. When the mercury is compressed in the reservoir it rises to the glass tube. This upper part is movable by reason of the flexibility of the metallic tube, and may be shifted between stakes fixed on the slope. The pressure developed is measured by the difference of levels of the mercury in the glass tube and the reservoir.—Effects of heat on voltaic circuits completed by an electrolyte, by M. Hellesen. In one arrangement two test tubes are connected by a tube near the top and fitted with saturated solution of sulphate of copper; a copper plate is inserted in the upper part in one, another in the lower part in the other; and the former is heated with a spirit lamp. A considerable current is had.—Action of sulphate of lime on alkaline sulphates, by M. Ditte.—On the camphor of patchouli, by M. de Montgolfier.—Note on the life and survival of spermatozoids within the mammalian egg, by M. Campana.

January 15.—M. Fizeau in the chair.—The following papers were read:—Exploration of the Great Syrtes, by M. Mouchez. He describes this coast as in great part an utter desert of sand, without tree or dwelling; and the beach strewed with wreck of vessels whose surviving crews were probably massacred. Careful survey was made of some 250 leagues of coast line, also observation of the tide (total amplitude at Syzygies about 1·5m.), the strange atmospheric refractions preceding and following the sirocco, the declination of the needle, and natural history.—Note on the question of the nature and the contagion of the disease called typhoid fever, by M. Bouillaud. M. Pasteur referred to his researches in which he had proved the disease of silkworms to be both contagious and infectious in the highest degree and not at all epidemic, in the ordinary sense. The same would probably hold good for typhoid fever. M. Chevreul also made some remarks.—Spectroscopic study of the new star observed by M. Schmidt, by P. Secchi. His observations chiefly confirm those by M. Cornu.—On the application of photography to observation of the transit of Venus, by M. Angot. This treats of the measurement of direct parallactic effect; which can be measured (1) by the angle of position; and (2) by the distance of the centres of the two stars. In the former it is difficult in practice to get with sufficient exactness a fixed direction as origin for the angles of position. The American expeditions have come nearest solving the problem, and their results will aid to a judgment on the method. In the second method, the determination of the angular value of the images is a difficulty; M. Angot shows how it may be met. A third method, based on the fact, that for objects uniformly illuminated, with straight borders and dimensions far above the zone of diffraction, the increase of the image of a luminous object is equal to the diminution of that of a dark object in like circumstances, seems at first irreproachable, but, in practice, leads to much error, because (1) the diameter of Venus is far from being large with reference to the extent of the diffracted zone; and (2) the luminous intensity of different parts of the sun is not uniform.—Experiments on the coagulation of fibrine, by M. Schmidt. He distinguishes *proplastic* liquids, which do not contain ferments but contain substances generative of coagulation; *plastic* liquids, which coagulate spontaneously and contain ferment and which are generators of fibrine; and *fibrinogenous* liquids, serosities which contain the substance fibrinogen.—Second note relative to the effects produced by Phylloxera on the roots of various American and indigenous stocks, by M. Foey.—Effects of dilute sulphocarbonates on vines, by M. Maistre.—On the simultaneous determination of annual constants of aberration and of parallax, by M. Trepied. Observations of declination will give at once and with the same weight, the special constants of aberration and parallax for each of the stars, and these determinations, made at two stations suitably chosen will enable us to appreciate the influence of the absolute movement of translation of the solar system on the phenomenon of aberration.—On the relations which necessarily exist between the periods of the quadratrix of the most general algebraic curve of degree *m*, and, *à fortiori*, of a particular curve in its degree, by M. Marie.—The phenomena of the radiometer explained by means of pyro-electricity, by M. de Fonvielle. Pyro-electric phenomena occur not only at the surface of certain crystals when subjected to a variation of temperature, but any non-conducting body submitted to the action of luminous rays is heated, then electrified more or less according to its nature and the intensity of the action. M. Fonvielle thinks all the phenomena hitherto observed in the radiometer may be thus explained.—Note on a new derivative of albuminoid matter, by M. Schützenberger—On the optical properties of Mannite, by MM. Müntz and Aubin.—Action of chlorochromic acid on organic matters, by M. Etard.—Chemical studies on mistletoe (*Viscum album*, Linn.), by MM. Grandeau and Bouton: 1. The composition of the stem differs essentially from that of the species of trees on which it grows. 2. The composition varies with the species. 3. Mistletoe contains much more potash and phosphoric acid than its supporting trees, and much less lime. 4. It seems to live on the tree like a plant on the soil; it takes from the yellow parts gorged with nutritive juices, the incombustible matters necessary for its organisation.—On testing of wines for fuchsine and other similar colouring matters, by M. Béchamp.—On the passage of plasma through living unperforated membranes, by M. Cornu. It passes in a manner contrary apparently to the laws of endosmose.—On the winter of 1877, by M. Renou.—M. Archereau presented prepared carbons for the electric light, said to increase the stability and illuminating power. They consist of carbon agglomerated and compressed, mixed with magnesia.

CONTENTS