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THURSDAY, MAY 27, 1875

THE ARCTIC EXPEDITION

ACCORDING to present arrangements, the Arctic Expedition leaves our shores on Saturday next. We feel that this event is one of no ordinary scientific importance, and indeed that it is significant, in a high degree, of a change which has come over the ideas of the governors and the governed alike in this country.

While prior Expeditions have advanced knowledge on their way to a high northern latitude, the present one sails to a high northern latitude for the purpose of advancing knowledge. We believe that the Admiralty authorities are fully aware of the importance of this distinction, and that when the final Instructions about to be issued to Capt. Nares are published, it will be seen that although they have been compelled to lay down a route and to state a goal to be reached if possible, the advancement of natural knowledge as opposed to mere topography is recognised as the main object.

All the best hearts in Britain will beat higher at the thought of this noble British attempt to drive still further back the boundaries of the unknown and the unexplored in spite of the obvious perils with which the attempt is surrounded. The work is undoubtedly one of difficulty, and although a combination of past experience and present discipline may be regarded as certain to restore to us at some future day the gallant men now aboard the *Alert* and *Discovery*, it is almost too much to hope that both the ships will run the gauntlet of the ice-barriers both out and home. Capt. Nares, we presume, has, as the Admiralty Arctic Committee recommended, full authority to abandon the *Alert* in 1877 if the exploration in 1876 has been final or her escape be doubtful, and the possible abandonment of both ships is contemplated in the Committee's Report: this shows that the Admiralty has counted the cost, and the fact that the Expedition sails shows us how the benefit resulting from scientific inquiry is acknowledged by the Government.

Were the officers of the ships less devoted to the scientific side of their work, or less capable of undertaking it than they are, they might be fairly alarmed at the parting gifts of the men of science which they have received this week in the shape of Instruments of all kinds, a special Arctic Manual of Scientific Inquiry of some eight hundred pages, and Scientific Instructions in the branches of work to which the Council of the Royal Society attaches the highest importance. The Manual, which has been edited by Prof. Rupert Jones on the biological, and by Prof. W. G. Adams on the physical, side, is supposed to contain the most important information already acquired on the various inquiries to be prosecuted; the Instructions being intended to show in what direction and in what manner this information can be extended.

A glance at the Manual and Instructions, to which we shall take occasion to refer more at length on a subsequent occasion, will make many regret that they are not among those who, if they are incurring risk and undergoing privations, will, during the greater part of their absence, be living in a new world of surpassing interest from a scientific point of view, as well as of soul-stirring grandeur, not unmixed with awful beauty; a world in which there is almost a new astronomy, where even the colours of the sky are different, and where not only the physicist but the biologist finds fresh wonders at every step.

The Hydrographer of the Admiralty, Capt. Evans, has made a noble contribution to the volume of Instructions, in the shape of three provisional maps of the Magnetic Elements, not only over the whole of the region to be explored, but including Greenland and part of the region to the west of Baffin's Bay and Davis' Strait. The various inquiries to be prosecuted by the officers and the naturalists of the Expedition, Capt. Feilden and Mr. Hart, are dealt with in the Instructions, among others, by Profs. Stokes, Sir Wm. Thomson, Adams, and Tyndall, the Hydrographer, Mr. Hind, Mr. Spottiswoode, Dr. Haughton, Mr. Scott, Dr. Rae, and Mr. Lockyer, on the physical side; and by Dr. Hooker, Profs. Huxley, Allman, Flower, Maskelyne, Ramsay, and Roscoe, Dr. Günther, Mr. Gwyn Jeffreys, Mr. J. Evans, and Mr. Judd on the biological, geological, and mineralogical sides.

Looking at the contents of the Manual, every possible source of information in Arctic Biology, Geology, and Physics would seem to have been ransacked, and the result is a volume which must be of the highest value, not only to those whose only text-book it will be for the next two or three years, but to all who wish for the best information about the region for which the envied explorers sail on Saturday. Among those whose contributions have been printed in the biological department will be found such names as those of Lütken, Mörch, Giesecké, Hooker, Heer, Nordenskjöld, Huxley, E. Forbes, and many others.. All the most notable Arctic explorers have been drawn upon, from Sabine and Parry down to Payer and Weyprecht; while contributions will be found from many of the greatest living authorities on such subjects as Meteorology, Physical Properties of Ice, Tides and Currents, Geodesy and Pendulum Experiments, Terrestrial Magnetism, and the Aurora.

It will be sufficiently evident, therefore, that those men of science who were anxious for Arctic exploration, and on whose recommendation the Government have fitted out the Expedition, have done all in their power to make it as complete as possible. The sending of the *Valorous* to Disco with the *Alert* and *Discovery* will not only enable it to start under the best conditions, but will enable a new lustre to be added to the whole attempt, in the shape of biological and temperature observations in the waters passed through on the return journey, waters which up to now have never been explored. For this we have to thank Mr. Gwyn Jeffreys, for unless he had volunteered to superintend these researches, they certainly would never have been made. It is to be hoped that the authorities have not been unmindful of the importance of at least duplicating all observations as soon as they are made and of depositing them in safe places, so that whatever may be the fate of the ships, the loss to science shall be reduced to a minimum.

Capt. Nares and those who accompany him may be assured that though they will be lost to sight for a long time to come, they will be by no means forgotten, all will wish them success, and every hint of news will be eagerly welcomed. May the two crews return "all told."

SACHS'S "TEXT-BOOK OF BOTANY"

Text-book of Botany, Morphological and Physiological. By Julius Sachs, Professor of Botany in the University of Würzburg. Translated and annotated by Alfred W. Bennett, M.A., B.Sc., F.L.S., assisted by W. T. Thiselton Dyer, M.A., B.Sc., F.L.S. (Oxford: at the Clarendon Press, 1875.)

IN 1868 the first edition of Dr. Sachs's "Lehrbuch der Botanik" appeared in Germany; a second edition was soon called for, and it appeared in 1870; the third was published in 1873, and the fourth was issued about the end of 1874. The third edition was translated into French and annotated by M. Ph. van Tieghem, and now we have an English translation of the same edition from the hands of Messrs. Bennett and Dyer.

The want of a good text-book of Botany, one that would give an accurate idea of the present state of botanical science, has long been felt by English students. We therefore heartily welcome the appearance of the English translation of Sachs's "Lehrbuch der Botanik," because we feel certain that it will supply that want so long felt, and be of the greatest value to both teachers and students. Our text-books had mostly fallen behind the time, the older ideas and theories were still retained instead of being swept away to make room for new facts or for the more correct interpretation of long-known but imperfectly understood phenomena. The illustrations of the older works were often defective, frequently absolutely incorrect, and yet they descended from text-book to text-book with unfailing regularity. Terms were multiplied needlessly, without any correct appreciation of the facts to be indicated by them; lectures became a mere illustrated botanical glossary, the biology and physiology of plants were almost entirely neglected, and the science rendered as repulsive as possible. In the work now before us we have a text-book of Botany which the teacher can confidently recommend to the student as being an excellent guide; as giving an extensive and trustworthy account of the present state of botanical science in Europe; and while it indicates the theories and problems at present occupying the attention of botanists, it points him to the subjects which will best repay the original investigator. The illustrations form an important feature in the work, most of them being original, and the result of laborious investigation: if borrowed, it was only when the objects were inacessible, or because it seemed impossible to give a better than the figure already in use. This gives a freshness to the book, which is a charm in a text-book of Botany.

Prof. Sachs's work is devoted exclusively to Morphological and Physiological Botany, and therefore differs in its scope from the text-books to which botanical students in this country are accustomed. The whole work is divided into three books. Books I. and II. treat respectively of General and Special Morphology, Book III. being devoted to Physiology. No exhaustive account of the characters of the natural orders of flowering plants is given, a feature which at once places Sachs's text-book in marked contrast to our English ones. All that is given is an enumeration of the orders and families according to the systems recently proposed by Braun and Hanstein. But the want of characters of orders and families cannot be felt by the English student, as he can consult the admirable translation of Le Maout and Decaisne's "Traité Général de Botanique," and there get all he can possibly want. Indeed, we may look upon Sachs and Le Maout and Decaisne as forming a complete work, the one treating fully of such parts of botany as are omitted or only very imperfectly dwelt upon by the other.

The General Morphology of Plants is treated of by Sachs in the three chapters forming the first book. The first chapter deals entirely with the morphology of the cell, and is a most exhaustive treatise on the subject. In describing the nature of the cell, Sachs says: "By far the largest proportion of cells in the living succulent parts of plants, *e.g.* young roots, leaves, internodes, fruits, are seen to be made up of three concentrically-disposed layers; firstly, an outer skin, firm and elastic, the cell-membrane or cell-wall, consisting of a substance peculiar to itself, which we call cellulose. Close up to the inner side of this entirely closed membrane is a second layer, also entirely closed, the substance of which is soft and inelastic, and always contains albuminous matter; H. von Mohl, who first discovered this substance, gave it the very distinctive appellation of Protoplasm. In the condition of cells now under consideration it forms a sac enclosed by the cell-wall, in which usually also other portions of protoplasm are present in the form of plates and threads. Absent from some of the lowest organisms, but present in all the higher plants without exception, there lies imbedded in the protoplasm a roundish body, the substance of which is very similar to that of the protoplasm—the nucleus. The cavity enclosed by the protoplasm sac is filled with a watery fluid, the cell-sap. And besides this, there are also very commonly found in the interior of the cell granular bodies, which, however, may be passed over for the moment." Following this we have an account of the formation of cells, and then the cell-wall, the protoplasm, nucleus, granular and other substances contained in the protoplasm, cell-sap and crystals are each described in turn. The union of cells to form tissues is next described, and Sachs gives us a three-fold division of tissues into epidermal, fibro-vascular, and fundamental or "ground tissue." The section devoted to Primary Meristem and the apical cell will be read with interest, and the facts there stated will probably be new to most English readers.

The Morphology of the External Conformation of Plants is treated of in the last chapter of the first book. In English text-books much space is devoted to "Organography," the physiological method of study being chiefly adopted. Sachs, however, draws a wide distinction between members and organs, and in the section on Metamorphosis shows that all "organs" may be referred to a few original forms. The original forms or morphological members are only five in number, viz., Thallome, Caulome, Phyllome, Trichome, and Root. These members do not perform any functions, but they are capable of being "adapted" or metamorphosed into "organs" performing many very different functions. Take the adaptations of a Phyllome or leaf-member as an illustration of this. Sachs mentions that "the thick scales of a bulb, the skin-like (not "cuticular," as given in the English translation, p. 129, top line) appendages of many tubers, the parts of the calyx and corolla, the stamens and

carpels, many tendrils and prickles, &c., are altogether similar (in mode of development) to the green organs which have been termed simply leaves." So with all the other members; they may be modified to perform the most varied functions.

The second book, treating of Special Morphology and outlines of Classification, will probably be found to be the most generally interesting part of the work. It gives a clear and valuable account of all the "classes" of the vegetable kingdom, which, according to our author, are *thirteen* in number, and are to be further arranged in five groups, viz., Thallophytes, Characeæ, Muscineæ, Vascular Cryptogams, and Phanerogams. Here the industry and care of the author are well shown, as he has collected from all trustworthy sources, descriptions of the structure and life-history of typical forms of plants. This classification is slightly modified in the appendix, which is taken from the fourth edition. The distinction between the Algæ and Fungi, namely, that the Algæ contain chlorophyll, while the Fungi do not, is disregarded, and the Algæ, Fungi, and Characeæ made into four classes, the characters being taken from the modes of sexual reproduction. It seems a pity that the division of the Vascular Cryptogams into classes was not reconsidered, as the discovery of the prothallium of Lycopodium breaks down the division into isoporous and heterosporous groups. We prefer a division of the vascular cryptogams into three classes: Filicinæ, Equisetaceæ, and Lycopodinæ. The Filicinæ include four orders—Filices, Marattiaceæ, Ophioglossaceæ, and Rhizocarpeæ—while the Lycopodinæ include three, viz., Lycopodiæ, Selaginellæ, and Isoeteæ. The chapter on the groups of flowerless plants are of great interest, and will be studied with pleasure by those who have only seen the meagre and often untrustworthy account given in some of our text-books.

Passing to the Phanerogams, Sachs considers the distinguishing characteristic of the group to be the formation of the seed. He contrasts the Cryptogams and Phanerogams, and points out the homologies of the reproductive organs. "This organ (the seed) is developed from the ovule, which, in its essential part, the nucleus, produces the embryo-sac, and in this the endosperm and the embryonic vesicle. The latter is fertilised by the pollen-tube, an outgrowth of the pollen-grain, and, after first growing into a pro-embryo, produces the embryo. The phanerogamic plant, which is differentiated into stem-leaves, roots, and hairs, corresponds to the spore-forming (asexual) generation of vascular cryptogams; the embryo-sac to the Macrospore: the pollen-grain to the Microspore: the endosperm is equivalent to the female prothallium; and the seed unites in itself, at least for a time, the two generations, the Prothallium (endosperm) together with the young plants of the second (sexual) generation (the embryo)." Throughout the whole of the chapters of the second book, the influence of the "Theory of Descent" is very evident. Sachs, however, withdraws, in the fourth edition, the pedigree of the vegetable kingdom, which he sketches in Book III. of the present edition. The Phanerogams are divided into three classes, Gymnosperms, Monocotyledons, and Dicotyledons. Our author adheres mainly to the Gymnospermous theory, and certainly the question whether conifers are gymnospermous or not has yet to be decided, notwithstanding the recent controversy of Eichler and Strasburger.

More than one hundred pages are devoted to the Angiosperms, Monocotyledons, and Dicotyledons. In the remarks on the flowers of Angiosperms, many of our long-cherished ideas, the arrangement of stamens, for example, are rudely disturbed. Monadelphous stamens, as in *Malvaceæ*, are shown to be the result of cohesion of primordial stamens, and subsequent branching. The Polyadelphous stamens of Hypericum are formed by branching of three or five primordial stamens. The use of the English terms "regular" and "symmetrical" as applied to flowers, has been a cause of trouble to the translators, and we cannot but express the hope that both these terms may be quietly dropped into oblivion. On the subject of placentation, the statements of Sachs differ from those usually taught in this country. He shows the relation between the parietal and axile forms, and, making two divisions—viz., the ovules produced by carpels, and the ovules produced on the axis—further subdivides both of these into two:—

1. Marginal. Ovules for reflexed margins of carpels.
2. Superficial. Ovules for whole inner surface of the carpel, except on midrib.
3. Lateral. Ovules produced singly or in numbers from floral axis.
4. Terminal. Apex of axis bearing nucleus of ovule.

The formation of the embryo is very carefully described from Hanstein's researches, and the three layers of tissue in the embryo, Dermatogen, Periblem, and Plerom, carefully figured. The great significance of these layers has probably not yet been fully appreciated, and if it holds that axial structures arise from plerom and lateral appendages from periblem tissues, then a most important guide will be obtained enabling us to determine accurately the morphological value of many disputed structures.

In the classification of inflorescences we have Schimper's term Dichasium substituted for the incorrect "dichotomous cyme" used in English works. This is a marked improvement, as it was always a difficulty to the student to find that, although called dichotomous, it was not so. There is also a great difficulty with the terms helicoid and scorpioid. Sachs uses Schimper's terms bostryx and cicinnus. De Candolle, in 1827, used the term scorpioid to distinguish the characteristic inflorescence of Myosotis, the scorpion grass. The recent researches of Kaufmann, Warming, and Kraus, show that the inflorescences of Borragineæ are sympodial arrangements of dichotomies; and we do not think there would be any difficulty in retaining the term scorpioid for them. Bostryx and cicinnus were used by Schimper in 1835, while it was not till 1837 that the brothers Bravais amended De Candolle's definition of scorpioid and introduced the term helicoid. Schimper's terms, therefore, have the priority, and ought to be used. (See Hofmeister's "Handbuch der Phys. Botanik," vol. i. p. 434).

The floral diagrams given by Sachs will be found very useful, and we also think that the adoption of the floral formulæ will be a great assistance to the student. Sachs uses the collective terms for the whorls throughout in his floral formulæ—calyx, corolla, androecium, and gynoecium, while the translators have substituted the name of the

individual member of each whorl, sepal, petal, stamen, carpel. This, we venture to think, is a mistake. We have now used for some time the contractions Ca. Co. An. Gn., which we prefer, the only objection being that this formula contains eight letters instead of five.

Many and great difficulties must have been encountered in translating the second book, and these difficulties seem to have been successfully overcome. We have no doubt that further experience will suggest changes and improvements even in the admirable book now before us.

The third book treats of Physiological Botany, and is divided into seven chapters. The first chapter is devoted to the molecular forces in the plant, and the second to the chemical processes in the plant. Naegeli's theory that organised bodies consist of isolated particles or molecules between which water penetrates is here fully described, and the value of the theory in explaining nutrition and growth by intussusception pointed out. The movements of water and gases in plants are also treated of in this chapter. The second chapter deals with the elementary constituents of the food of plants, assimilation and metatastasis, and respiration in plants. Sachs describes the separation of oxygen and fixation of carbon as assimilation, and limits the application of the term respiration to the taking up of oxygen and liberation of carbon dioxide. The influence of external conditions, as temperature, light, electricity, and gravitation in plants, forms the subject of the third chapter. The mechanical laws of growth, including the movements of growing parts, are fully described in chapter iv. This chapter will be read with much interest, and many of the statements will be found to be new to English students. The fifth chapter gives a careful *résumé* of what is known regarding the movements met with in full-grown parts of plants, whether periodic or dependent on the action of stimuli. Chapter vi. is devoted to the phenomena of sexual reproduction, the sections on the influence of relationship on sexual cells, and on hybridisation being of much importance. The last chapter is devoted to the origin of species, to varieties, and to the Theory of Descent.

In closing the book after giving the above brief sketch of its contents, we cannot but express our satisfaction at the manner in which Messrs. Bennett and Dyer have done their work. The notes appended to the English edition are of much value, and will assist the student in his studies. We have but one objection to the work, and that is its high price as compared with the German edition. Surely the price will be an obstacle in the way of its extensive circulation. Could anything be done to obviate this? Sachs himself has already issued the physiological portion of the third German edition separately. Why not permit students to obtain one or other of the three books separately? Or might not an abridgment be made, somewhat on the principle of Prantl's Lehrbuch? As a text-book it must exercise a most powerful influence on botanical teaching in this country, and while it will supersede all other text-books for advanced students, we fear that its size and price may prevent it being so widely used as it ought to be. With Sachs' text-book within reach, teachers and students will be themselves to blame if they are behind the time in botanical science. Then, the English edition being translated from the third German edition, students can readily keep up their knowledge, because the "Botanischer Jahresbericht," beginning as it does in 1873, will refer them to all the more recent literature. While we have thus expressed our entire satisfaction with the work of the translators and annotators, let us not forget to mention that the way in which the work is got up does credit both to the Clarendon Press and Messrs. Macmillan and Co.

W. R. M'NAB

DR. CHAMBERS'S "MANUAL OF DIET"

A Manual of Diet in Health and Disease. By T. King Chambers, M.D. (Smith, Elder, and Co., 1875.)

THERE are many writers who, immediately they place pen to paper, seem to be affected with a certain formality of diction and severity of style which prevents them doing justice to their subject in the eyes of the more easily satisfied public, who, while desiring instruction, prefer it to be mixed with a certain amount of that form of interest which can be given it by an apparent "at homeness" on the part of the author. Dr. Chambers does not suffer from this fault. In the work before us he has produced one of the most readable as well as practical manuals on diet which we could want to see. The interest is maintained from beginning to end, and much valuable information is given on many of the important topics of everyday life without the uncomfortable sensation of any effort being needed to obtain it.

The subject is treated of under three headings: General Dietetics, Special Dietetics of Health, and Dietetics in Sickness. The author commences with the question—What is the natural food of man? Flesh-eating animals have teeth, jaws, and limbs suitable for capture and tearing, vegetable feeders have bulky viscera, and so on. Applying similar arguments to the human race, "to judge by form and structure alone, the natural food of an adult man must be pronounced to be *nothing*;" from which we must necessarily deduce, as is indicated by other considerations, that man as man assumed his special characters *after* he commenced the employment of instruments for offence and defence. In fact, the developed heel, with which is correlated the non-arboreal habit, is incompatible with the naturally defenceless condition of our species.

The space which is gained by the omission of the chapters on the chemistry, botany, &c., of food stuffs to be found in most works on diet and food, is, as we are told in the preface, employed in a full discussion of many matters connecting food and drink with the daily current of social life. The number of observations which will come home vividly to almost anyone turning over the pages of this work is so numerous that we think a few quotations will give the best idea of their scope. For instance, salads form an important article of diet in every family. "The salad ought to be dressed by one of the daughters of the house, after she has herself dressed for dinner, singing, if not with voice, with her clean, cool fingers, sharp silver knife, and wooden spoon—

> "Weaving spiders, come not here;
> Hence, you long-legged spinners, hence:
> Beetles black, approach not near;
> Worm nor snail, do no offence."

Since the introduction of railways the difficulty in procuring good mutton is acutely felt in all but large cities, and the author makes a suggestion which, where carried

out, would much reduce the inconvenience. He recommends those who can do so "to join a 'mutton club,' buying the lambs of a full-sized breed, and keeping them to at least three-and-a-half years old before killing. The price per pound will not be less than charged by the butcher, but it will supply an article twice as good as his." The remarks with reference to eggs are also very much to the point. "High game has fortunately gone out of fashion, and the most frequent form in which we now meet with decomposing albuminoid matter is that of a fusty egg. Some housekeepers seem to consider this quite good enough for made dishes, and thus spoil material worth ten times what they save by their nasty economy. No egg should be allowed to enter the kitchen that has the slightest smell of rotten straw."

In accordance with the opinion of most of the medical profession and of a large body of the public, we read that "as a regular beverage for a healthy person there is no wine in the English market equal to claret." No doubt the statistics of a few years hence will prove that the present reaction against port and sherry will make itself evident in the considerable diminution of the number of those who are liable to be attacked with the gout, and so demonstrate the advantages of the lighter wine.

In the section on the special dietetics of health many important remarks are to be found. Hints are given to those who pursue the commercial, the literary, and professional life, special chapters being devoted to each. The regimen of infancy and motherhood, of childhood and youth, are not omitted. Dr. Chambers is not the only author who inveighs against afternoon tea, and we cannot agree with the argument on which his objections are based. He tells us that "the dilution and washing away of the gastric secretion weakens its power of digesting the subsequent dinner, improperly blunts the appetite, and not unfrequently generates flatulence and dyspepsia." But the gastric juice is not secreted if solid food is not taken, and any fluid introduced into the stomach can hardly but be absorbed within a quarter of an hour or so. The substitute suggested, "a biscuit, and an orange or an ice," is, in our estimation, much more injurious.

Over thirty pages are devoted to the question of the value of alcohol, the results being too lengthy to summarise on the present occasion. They are well worth reviewing. "So me well-meaning persons think to discencourage intemperance in drink by affecting a cynical carelessness as to the quality of that which is consumed.

However little a man's purse allows him to drink, let it be good."

The question of the dietetics of disease will appeal to all who have the charge or any interest in those who are invalided. They bear the same practical impress as the other portions of the work. Though some of the author's suggestions may appear to be founded on a somewhat dogmatic basis, they all have an element of truth in them which may lead the reader to think twice of the reasons why he is accustomed to adopt any line of action which may be directly opposed to them.

OUR BOOK SHELF

An Elementary Exposition of the Doctrine of Energy. By D. D. Heath, M. A., formerly Fellow of Trinity College, Cambridge. (Longmans, Green, and Co.)

IN this book we have a very good elementary exposition of the Doctrine of Energy; perhaps, however, better adapted for the use of schools than for the general public. Indeed, we are told in the preface that the work was developed from a set of lectures given to the senior classes of Surrey County School. In his discussion of fundamental units the author makes some very good and original remarks. He tells us, for instance, in connection with the first law of motion, that "the *rate* and the *direction* of motion with and in which (respectively) a bo dy is moving at any moment is to be considered as part of its *actual condition* at that moment, which it will retain until some adequate cause changes either the velocity or the direction, or both. We may reasonably inquire *how it got* the motion it has, as we may how it came by its shape or its temperature; and again, under what circumstances it will change any of these properties; but not *why*, having got them, it keeps them."

After dismissing the subject of fundamental units, the writer goes on to dynamical energy, a subject which is fully and fairly discussed. The author next proceeds to thermal and other energies, and ends by a brief account of molecular theories. If we have any fault to find, it is that undue preference seems to be given to the British system of units, while the decimal system is overlooked.

We think, too, that in the introductory part of the work the author is not very clear in his statement with regard to energy, where he tells us we may define it to be "the capacity or power of any body or system of bodies, when in a given condition, to do a certain measurable quantity of work; that is, to change its own condition and that of other bodies, exhausting its power by the using of it." We think that the second part of this definition might have been omitted with advantage.

The author, as he tells us in his preface, has endeavoured to give the young student some conception of the *possibility* of explaining the conservation of energy by the theory that all phenomenal changes are really in themselves changes of motion and position among the molecules or ultimate atoms of substances; and he adds the hope that he has succeeded in presenting this as exhibiting a probable surmise, which may be false without vitiating the doctrine previously developed.

This strikes us as being very well put. The conservation of energy would hold if we imagine the universe to be composed of ultimate atoms with forces acting in lines between them; but should it be found that this last conception is inapplicable to portions of the universe, as, for instance, the medium which conveys light, nevertheless it does not follow that the conservation of energy does not still hold true.

The Commercial Handbook of Chemical Analysis. By A. Normandy. New edition, enlarged, by Henry M. Noad, Ph.D., F.R.S. (London: Lockwood and Co., 1875.)

WHEN the late Dr. Normandy first published his work on Commercial Analysis the Adulteration Act did not exist, and the book was chiefly used by chemical manufacturers and by the small class of practical analysts. Dr. Noad's enlarged edition of the work appears very opportunely, and it will be found to be essential to the analysts appointed under the new Act. It contains, in alphabetical order, a concise list of all ordinary substances which can require to be analysed in connection with food and drink, and in addition the methods of analysing many substances which can only be required in special manufactures, or are only used as drugs. Each article commences with an account of the substance in its pure state: this is followed by a list of the most common impurities or adulterations, and then by the best means of detecting them. The adulterations of some common commodities are somewhat startling; thus, bread may contain rye and barley flour, oatmeal, pea and bean meal, potato starch and rice flour, while of mineral constituents there may be lime, alum, magnesia, ground soapstone,

and sulphate of copper. The substances sometimes employed to colour sweetmeats, liqueurs, jellies, &c., include some of the most fatal poisons, such as the acetate, arsenite, and carbonate of copper, chromate and iodide of lead, and the sulphides of arsenic and mercury. Indeed, we well remember going over a sweetmeat manufactory, and on remarking on the bright yellow colour of some large comfits we were told that chrome yellow was employed to produce it, our informant evidently having no idea that the substance is a most virulent poison. A long article is devoted to the adulteration and fabrication of wines, and the "plastering" and "fortifying" of sherries is discussed at length. In all cases the most recent results are given, and the work is well edited and carefully written. A glossary at the end of the book will be found useful both to the analyst and the student.

LETTERS TO THE EDITOR

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

"The Unseen Universe"

WE have read with satisfaction (NATURE, vol. xii. p. 41), your very candid and fair *précis* of our recent work, "The Unseen Universe." There are, however, one or two comments added in which the writer seems to have misapprehended our meaning, possibly from the fact that in the first edition of such a work the arrangement may be regarded as not having quite taken its final shape.

To begin, we fail to understand what the reviewer means when he says, "It is a mere theological dogma to say that what energy perishes in the visible passes into the invisible universe; and the dogma is worthless as a physical principle on which to build any physical reasoning."

Our views will be found on p. 159 of our book: "*May we not say that when energy is carried from matter into ether it is carried from the visible into the invisible?*" Surely the ether may be looked upon as forming part of the invisible universe, and also as having received a large portion of the energy which was once attached to visible matter.

Our object was to show that we introduced no new dogma inconsistent with the received ideas regarding energy, inasmuch as these contemplate an invisible universe as truly as we ourselves do.

The second point upon which we would remark is the assertion of the reviewer that by regarding the visible universe as an infinite whole, the arguments on which its end and its beginning are inferred seem to vanish. In reply to this we would remark, that even allowing (which we are not disposed to allow) that the visible universe is infinite, this would not affect our argument against its past eternity. Our argument (see p. 127 of the book) is, that *the dissipation of the energy of the visible universe proceeds*, pari passu, *with the aggregation of mass, and the very fact therefore that the large masses of the universe are of finite size is sufficient to assure us that the process cannot have been going on for ever.*

THE AUTHORS OF "THE UNSEEN UNIVERSE."

Sense of Humour and Reason in Animals

IN the recently published edition of the "Descent of Man" there is some additional matter concerning the above subjects, and as the following illustrative cases fell under my own observation, I think it is worth while to publish them as supplementary to those adduced by Mr. Darwin.

Several years ago I used to watch carefully the young Orang Outang at the Zoological Gardens, and I am quite sure that she manifested a sense of the ludicrous. One example will suffice. Her feeding-tin was of a somewhat peculiar shape, and when it was empty she used sometimes to invert it upon her head. The tin then presented a comical resemblance to a bonnet, and as its wearer would generally favour the spectators with a broad grin at the time of putting it on, she never failed to raise a laugh from them. Her success in this respect was evidently attended with no small gratification on her part.

I once had a Skye terrier which, like all of his kind, was very intelligent. When in good humour he had several tricks, which I know to have been self-taught, and the sole object of which was evidently to excite laughter. For instance, while lying upon one side and violently grinning,* he would hold one leg in his mouth. Under such circumstances nothing pleased him so much as having his joke duly appreciated, while if no notice was taken of him he would become sulky. On the other hand, nothing that could happen displeased him so much as being laughed at when he did not intend to be ridiculous. Mr. Darwin says:—"Several observers have stated that monkeys certainly dislike being laughed at" (p. 71). There can be little or no doubt that this is true of monkeys; but I never knew of a really good case among dogs save this one, and here the signs of dislike were unequivocal. To give one instance. He used to be very fond of catching flies upon the window-panes, and if ridiculed when unsuccessful, was evidently much annoyed. On one occasion, in order to see what he would do, I purposely laughed immoderately every time he failed. It so happened that he did so several times in succession—partly, I believe, in consequence of my laughing—and eventually he became so distressed that he positively *pretended* to catch the fly, going through all the appropriate actions with his lips and tongue, and afterwards rubbing the ground with his neck as if to kill the victim: he then looked up at me with a triumphant air of success. So well was the whole process simulated, that I should have been quite deceived, had I not seen that the fly was still upon the window. Accordingly I drew his attention to this fact, as well as to the absence of anything upon the floor; and when he saw that his hypocrisy had been detected, he slunk away under some furniture, evidently very much ashamed of himself.

The following example of *reason* in a dog is the most striking that has ever fallen within my personal observation. A son of the above-mentioned terrier followed a conveyance from the house at which I resided in the country, to a town ten miles distant. *He only did this on one occasion*, and about five months afterwards was taken by *train* to the same town as a present to some friends there. Shortly afterwards I called upon these friends in a different conveyance from the one which the dog had previously followed; but the latter may have known that the two conveyances belonged to the same house. Anyhow, after I had put up the horses at an inn, I spent the morning with the terrier and his new masters, and in the afternoon was accompanied by them to the inn. I should have mentioned that the inn was the same as that at which the conveyance had been put up on the previous occasion, five months before. Now, the dog evidently remembered this, and, reasoning from analogy, inferred that I was about to return. This is shown by the fact that he stole away from our party—although at what precise moment he did so I cannot say, but it was certainly *after* we had arrived at the inn; for subsequently we all remembered his having entered the coffee-room with us. Now, not only did he infer from a single precedent that I was going home, and make up his mind to go with me; but he also further reasoned thus:—"As my previous master lately sent me to town, it is probable that he does not want me to return with him to the country: therefore, if I am to seize this opportunity of resuming my poaching life, I must now steal a march upon the conveyance. But not only so, my former master may possibly pick me up and return with me to my proper owners: therefore I must take care only to intercept the conveyance at a point sufficiently far without the town, to make sure that he will not think it worth his while to go back with me." Complicated as this train of reasoning is, it is the simplest one I can devise to account for the fact, that slightly beyond the *third* milestone the terrier was awaiting me—lying right in the middle of the road with his face towards the town. I should add that the

* This habit of violently grinning is not, I believe, uncommon among Skye terriers—the pure original breed of Skyes, I mean, and not the broad-nosed shaggy-coated animals which have almost supplanted them. The habit is very remarkable, for there can be no doubt, I think, that it is intended to imitate laughter. Many intelligent dogs understand the meaning of laughter as implying good humour. I have a setter just now, which always rouses up and whines for admittance to a room when he hears a good laugh going on, wagging his tail the while, in proportion to the varying intensity of the laughter; but I do not know of any other breed of dogs which actually *imitates* it—at all events not with such evident purpose as do Skye terriers. The purpose is evident, not only because the gesture is never made at any other time than when the animal wishes to be particularly agreeable; but also because the grin is carried to a highly unnatural degree—much more, *e.g.*, than the strongest snarl would require; and, which is stranger still, I have frequently seen my terrier on such occasions shaking his sides in a convulsive manner—an action he never performed at any other time.

second two miles of the road were quite straight; so that I could easily have seen the dog if he had been merely running a comparatively short distance in front of the horses. Why this animal should never have returned to his former home on his own account, I cannot suggest; but I think it was merely due to an excessive caution which he also manifested in other things. Be the explanation of this, however, what it may, as a fact he never did venture to come back upon his own account, notwithstanding there never was a subsequent occasion upon which any of his former friends went to the town but the terrier was sure to return with them, having always found some way of escape from his intended imprisonment.

Regent's Park, N.W. GEORGE J. ROMANES

Equilibrium of Gases

IN a former letter (NATURE, vol. xi. p. 486) I ventured to express an opinion contrary to that of most authorities, that the temperature of a vertical column of gas at rest would tend to diminish from below upwards.

I then stated that there was nothing to counteract the tendency to the upward diminution of energy which must result from gravitation. I am indebted to Mr. S. H. Burbury for pointing out to me that a counter-action exists in the removal from the system, at every point of the ascent, of those molecules whose vertical energy at that point is *nil*. The total mean energy of the molecules may thus remain the same, although a constant deduction is made from the energy of every molecule remaining in the system.

Mr. Murphy's argument (NATURE, vol. xii. p. 26) from the absence of cumulus in the Arctic regions, is also a sound one as far as it goes, and fairly counterbalances that derived from tropical calms and storms.

I must therefore withdraw my dissent from the generally received doctrine of the tendency to equality of temperature in a vertical column. R. C. NICHOLS

Athenæum Club, May 20

Contributions to the Natural History of the Wolf (*Canis pallipes*) of Northern India

HAVING had the opportunity of examining a number of wolf-cubs, it may not be without some interest to record my observations in your useful journal.

This year (1874–75) I examined fourteen batches or litters of wolf-cubs between December 18 and February 1. Judging from the apparent ages of the different litters, I should fix the breeding time of the wolf from about the middle of October to about the end of December. But the majority are bred in December, as out of the fourteen batches I could approximately fix the birth of eleven of them in some date of December. On the 29th of December a full-grown she-wolf, in milk, was brought to me, with seven cubs, which appeared to be about a week old. She had ten teats. The eyes and ears of the cubs were closed; their ears were drooping; their general superficial colour was sooty brown, with an under colour, that is, at the roots of the hairs, of dirty light tan. The latter colour was more marked on the head and flanks, while the sootiness was more decided on the hinder part of the body. They all had a milk-white chest-spot varying in size. Six of them had white hairs at the tips of their tails.

All those I examined, of about this same age, had similar characters. When the eyes of young wolves open, and they begin to crawl, about the third week, their general colour is a dirty light tan, washed with soot. As they grow, their ears become erect, their general colour a uniform light tan, with only the tips of the hairs dark, the tail being the darkest part of the animal. After the sixth week or so, the white chest-spot emerges into the light fawn colour of the remainder of the chest, and a dark collar on the under part of the neck becomes visible. This collar looks as if dark grey ashes were brushed across the greyish white of the neck. All those I examined which looked older than four or five weeks had this collar. But it disappears again as the wolf gains its adult colouring, becoming merged into the uniform creamy white of the neck and chest. Out of seventy-nine wolf-cubs which I examined, all but one had a white chest-spot, varying in size from a few hairs to a patch the size of a rupee. Fourteen of them had white tips to their tails, varying in size. Seventeen of them had white tips to one or more of their feet. These white marks leave no doubt about the close relationship between the wolf and the domestic dog. The sex of seventy-four cubs was noted, belonging to thirteen litters. Forty were males, and thirty-four were females. The number of young at a birth was from three to eight.

Lucknow E. BONAVIA

OUR ASTRONOMICAL COLUMN

1 LEPORIS (FL.).—This star is wanting in both Argelander's *Uranometria* and in Heis's Atlas, though the estimations of magnitude are very accordant; indeed, with the exception of Lalande, who calls it 6½ observers including Flamsteed, Bradley, Piazzi, and Johnson appear to have uniformly estimated it . It is 4ʸ *s.p.* ϵ Leporis, a star of the 4th magnitude. Baily has this note: "The star is designated as of the 9th magnitude in the *British Catalogue*; but I apprehend this is a typographical error, as it is stated to be the 6th in the original entry." Yet, the star having been omitted by Argelander, and particularly by Heis, there remains a suspicion of variability of light.

THE COMET OF DECEMBER 1872 (KLINKERFUES—POGSON). The observation of a telescopic comet by Mr. Pogson, at Madras, on the mornings of December 3 and 4, 1872, in consequence of a telegraphic message from Prof. Klinkerfues, of Göttingen, that Biela's Comet had "touched the earth" on November 27, and might be sought for near the star θ Centauri, will be fresh in the recollection of our astronomical readers. The remarkable shower of meteors on that evening had exhibited a radiant almost identical in position, with the diverging point, which meteors moving in the orbit of Biela's Comet would have, and hence the assumption of our close proximity to this body during the meteoric display. Places of the comet detected by Mr. Pogson in the first interval of favourable weather after receiving the telegram were communicated by him in the same month to the Astronomer Royal and Prof. Klinkerfues, but without details of the observations upon which they were founded. With the aid of these positions the question of identity of Pogson's Comet with one of the bodies forming Biela's Comet was examined. There was at the outset this difficulty in the way of entertaining the idea of identity, that if Biela's Comet were actually close to the earth on the evening of November 27, its perihelion passage would have taken place on the 27th of the following month, ten or eleven weeks later than the date indicated by Michez's orbit as perturbed to 1866; nevertheless, since the comet was not detected in 1865-66, in the track it should have followed according to Michez's calculations, though the largest telescopes were employed in a search for it, there remained the possibility of disturbance of the mean motion in 1852, when observations were last obtained, from some unknown cause. Klinkerfues, therefore, assuming the elements of Biela's Comet, examined their relation to Pogson's places, and arrived at the conclusion that the identity of the comet observed at Madras with one of the two Biela comets could hardly be doubted. Subsequently, Prof. Oppölzer, of Vienna, gave attention to the subject: he remarked that with Michez's orbit of Biela, Pogson's observations were not represented upon any supposition as to date of perihelion passage, but with the semi-axis of Biela, and assumed small distances of the comet from the earth at the time of the Madras observations, he deduced several sets of the other elements bearing greater or less similarity to those of Biela, and indicating a very near approach to the earth on November 27th: his conclusion was, that Pogson's Comet stands with high probability in intimate connection with the meteor-shower of that evening; and it is at least possible that the observed object was really one of the heads of Biela.

Since these investigations, the full details of the Madras observations have been published in the *Astronomische Nachrichten*, and Prof. Bruhns, of Leipsic, has

submitted them to very complete discussion, the results of which he has just made known. His inferences are generally opposed to those drawn by Klinkerfues and Oppölzer. With one of the systems of elements given by the latter, he calculates the apparent path of the comet from Nov. 30 to Dec. 8, finding, as was to be expected, a good agreement with Pogson's observations, and with the rate of motion in R.A. given by his comparisons on the first morning, that of Dec. 3, but the ephemeris does not agree with the rate of motion on the following morning, which, Pogson's differences are sufficient to prove, had not diminished. And it should here be observed that the differences of R.A. were evidently obtained with considerable precision, as might be looked for from so practised an observer as Mr. Pogson. The orbit here referred to is as follows :—Mean anomaly, Dec. 3·0 Berlin time, – 5° 6′·8 ; longitude of perihelion, 141° 9′ ; ascending node, 244° 34′ ; inclination, 10° 28′ ; angle of excentricity, 54° 17′, the semi-axis major being that assigned by Michez for Biela's Comet, and corresponding to a mean daily motion of 530″·1. Again, Bruhns observes that it speaks further against the identity, that by all the ephemerides, at least from Nov. 23 to Dec. 3, the first days in the northern and later in the southern hemisphere the comet should have been more conspicuous than at the time of Pogson's observations, and it is unlikely that it would have escaped notice, particularly in the northern hemisphere. He so far agrees with Oppölzer, that no assumed date for perihelion passage will bring about an agreement of places calculated from the elements of Biela, with those observed ; and that an extension of the comet's period of revolution to 2528 days, without a near approach to the planet Jupiter, is most improbable. In Oppölzer's orbit given above, the inclination is 10° 28′, while that deduced by Michez is 12° 22′; and to prove that such diminution is not to be accounted for by perturbation during the assumed near approach of Biela to the earth about the time of the meteor-shower, he has calculated the effect of the earth upon the elements of Biela, with the perihelion passage fixed to Dec. 27·75, the epoch which would occasion the nearest approach of the two bodies. The inclination of the orbit to the ecliptic is found to be increased 1′·6 only, the node is advanced 0′·4, the perihelion longitude 7′·3, and the angle of excentricity is diminished 1′·6. The earth's perturbations during such a near approach as is possible in the orbit of Biela (for 1866) would not therefore account for a change of elements sufficient to represent the places of Pogson's Comet. Bruhns then makes two assumptions with regard to the ratio of the curtate distances of the comet from the earth at the times of the Madras observations on Dec. 3 and 4, and in both cases arrives at *retrograde* orbits : the motion of Biela's Comet is *direct*. The first of these orbits from which he computes an ephemeris is as follows (we adapt the longitude of perihelion and the inclination to the catalogue form of expressing them) :—Perihelion passage 1872, Dec. 15·3763 Greenwich time ; longitude of perihelion, 332° 28′ ; ascending node, 33° 11′ ; inclination, 31° 13′ ; perihelion distance, 0·035205. Hence the track of the comet would be—

12h.	R A. h. m.	Decl. ° ′	DISTANCE FROM Sun.	Earth.
Nov. 5	11 10·3	20 13 S.	1·251	1·606
,, 13	11 37·3	23 42	1·073	1·359
,, 21	12 18·1	28 10	0·879	1·118
,, 29	13 27·8	33 14	0 663	0·906
Dec. 3	14 21·5	35 4	0·541	0·828
,, 7	15 30·0	34 50 S.	0·405	0·787

We believe there is little doubt that, so far as can be ascertained from Pogson's two days' positions and the rate of motion indicated by his comparisons, the orbit of the comet observed by him was *retrograde*, and therefore agree with the inference of Prof. Bruhns that it had no relation to Biela's Comet, or, we may add, to the magnificent meteoric display of 1872, Nov. 27, notwithstanding the singularity of its discovery by Pogson, in consequence of the telegram sent to him by Klinkerfues, which was grounded on the opposite opinion.

*LECTURES AT THE ZOOLOGICAL GARDENS**

IV.

May 13.—*Mr. Garrod on Antelopes and their Allies*

THE true Ruminant Animals characterised among Artiodactylate Ungulata by the absence of incisor teeth in the upper jaw, as well as by the possession of a stomach in which three separate compartments, named paunch, honeycomb bag, and reed, are always present,† naturally fall into three different families, the Chevrotains, the Deer, and the Antelopes. The first and last of these remain for consideration.

In the Antilopine, or Cavicorn section, as the latter name implies, the horns are hollow organs. They are epidermic in structure, being composed of hairs agglutinated together to form tubes, which are moulded and fixed upon osseous protuberances of the frontal bones. These "horn cores" are quite different in their nature from the antlers of the deer tribe, as they persist throughout the life of the individual, and are perfectly continuous in their structure with the bones from which they spring. The horns themselves bear much the same relation to the thin layer of vascular membrane which covers the "cores" that the nails on the fingers do to the subjacent soft parts ; in the Rhinoceros the horn or horns, though similar in structure, are solid throughout. In many species the horns are present in both sexes, and in one genus (*Tetraceros*) there are two pairs, one attached near the anterior and the other near the posterior margin of the frontal bones.

Many attempts have been made to classify these animals by means of the peculiar structures which are found in some species and not in others. Among the most important of these are the condition of the muffle, or tip of the nose, which is moist in some, as in the ox, and hairy in others, as the sheep. The gland below the eye is also a varying feature, being largely developed in the Indian Antelope, for example, and absent in the Eland. In most species there are two small "false hoofs," remnants of the second and fifth digits, behind the true foot. These, however, are absent in the Royal Antelope and the Pallah. Whether the horns are cylindrical, as in the Chamois, or grooved, as in the Koodo ; straight, as in the Oryx, arched, as in the Ibex, or spiral, as in the Markhour ; smooth, as in the ox, or transversely ringed as in most, are also tangible characters, by the combination of which with others of less significance various endeavours have been made to arrange the family. These, nevertheless, are none of them satisfactory, on account of the large number of the possible combinations which are to be actually found, at the same time that the relative importance of the different included characters is scarcely capable of being estimated.

There are two animals, the Giraffe of Africa and the Pronghorn, or Cabrit, of the western regions of North America, which are evidently closely allied to the Antelopes, and are probably nothing more than extreme modifications of them. In both, the horn processes or horns are developed in both sexes, at the same time that neither possess false hoofs. The abnormal feature in the Giraffe is found in the horn-like developments, which are pedestals of bone, covered with the ordinary skin of the body, and capped with a tuft of hair. These pedestals, however, differ very materially from those in the Muntjacs among the Deer, and from the horn-cores of the typical

* Continued from p. 28.

† A fourth, the manyplies, is found in all but the Chevrotains.

Cavicornia, in being independent ossifications, situated, on the suture between the frontal and parietal bones instead of simple outgrowths from the frontal only. A median excrescence on the forehead, in front of the above-mentioned processes, is the result of a protrusion upwards of the bones in the part.

The Pronghorn (*Antilocapra*) has well-developed horns. They are attached to ordinary bony cores, exactly similar to those of the Antelopes. They are, however, unique of their kind in that they are branched or bifurcate at their tips, a second smaller point springing from the anterior margin of the flattened stem, and running forward with a gentle curve, convex upwards. In another respect these horns are even more peculiar. Mr. Bartlett, the Superintendent of the Society's Gardens, was the first to show, from a specimen living in the Gardens, that the Pronghorn is in the habit of annually shedding its horns from off their cores. This surprising discovery has since been fully confirmed; at the end of each season the core being found covered with a skin from which the fresh horn is developed.

Respecting the geographical distribution of the Cavicornia, none are to be found in Australasia or in South America. Very few inhabit North America; the Bighorn Sheep, one of the Bisons, the Musk Ox, the Mountain Goat, and the Pronghorn embracing them all. Africa is the head-quarters of the sub-order, and specially of the Antilopine family. In Europe the Bison is a native of Poland, the Chamois and the Ibex of the Alps; whilst the peculiar Saïga reaches our side of the Caspian Sea. Among the best known Indian Antelopes are the Sasin or Antelope *par excellence*, and the Nilghau.

The Chevrotains, or Tragulidæ, form a group of small, deer-like animals, without horns, which were formerly associated with the Musk Deer. The investigations of Prof Flower have, more than any others, proved the independent nature of the group, which approach in their internal anatomy to the Pigs. The third stomach of other Ruminants—the Psalterium—is wanting. In the axis vertebra, the odontoid process, instead of being scooped into a spout, as in the Deer and Antelopes, is peg-like, as in the Swine. The second and fifth metacarpal bones are completely developed from end to end, and the lateral marginal intervals of the upper jaw between the canine and molar teeth are not cut away, as they are in other Ruminants. These and other peculiarities in the teeth, &c., are quite sufficient to divide off the sub-order as an independent one, ranking with the others previously described. The number of genera and species are very inconsiderable, there being two of the former (*Hyomoschus* and *Tragulus*), and not half a dozen of the latter. *Hyomoschus* inhabits Western Africa, occupying much the same ground as does the Chimpanzee. In it the metacarpal bones remain separate during the life of the animal, as in the Swine, and not in the other Ruminants. The fur is spotted like that of most young deer, throughout life. *Tragulus* is found, two species—*T meminna* and *T stanleyanus*—in India, the Napu (*T javanicus*) and one or two others making Java and Sumatra their abode.

(*To be continued.*)

RARE ANIMAL AT THE MANCHESTER AQUARIUM

AMONG the numerous new accessions brought together to swell the list of special attractions for the throngs of Whit-week visitors at the Manchester Aquarium, one of the latest arrivals is especially deserving of notice in these columns. This is an example of the so-called "Congo Snake" (*Muræno̱phis tridactyla*), from the neighbourhood of New Orleans, a singular eel or snake-like animal, belonging, nevertheless, to neither of the classes represented by those two types, but rather to the true Amphibia. Judging from its shape, proportions, and colour, the uninitiated would certainly pass it as an ordinary eel, from which, on closer examination, it will be found to differ in possessing no fins, small bead-like eyes a mere puncture in the place of the ordinary gill-operculum, though more especially in having stationed at each extremity of the attenuated body a pair of feeble little legs, and each leg furnished with three slender toes. These legs may be described as almost rudimentary, but they are at the same time used by the animal, and with more marked effect than might be presupposed, when crawling over the ground at the bottom of its tank. Rising into the midst of the water, it can further swim with great rapidity, progressing then by rapid undulations of its body from side to side, after the manner of a true snake. The length of this specimen is about two feet six inches; greatest diameter, in the centre of the body, one inch and a half, tapering off from the posterior pair of legs into an attenuate and slightly compressed tail. The colour closely resembles that of an ordinary eel, being slate-grey on the dorsal surface and sides down to the lateral line, and below this, ash colour. Along the lateral line is a double row of minute punctures, the orifices, no doubt, of mucous glands similar to those obtaining in true fishes. The animal has to repair to the surface of the water to breathe, but this is at distant intervals, a large quantity of air being drawn through the nostrils into the lung-pouch by a singular inflation of the throat, repeated several times in succession. This specimen is exhibited in one of the octagon table tanks in the centre of the saloon, eighteen inches in depth, so that when taking in its supply of air it does not altogether leave the ground, but raises itself in a semi-erect position until the head touches the surface of the water. With the head just an inch or two below the surface, and standing, as it were, upon its posterior legs, with the anterior pair held out helplessly in the water, is a very favourite attitude with this creature, though at the same time an essentially grotesque one, reminding the observer of the somewhat similar attitude and general appearance, on a colossal scale, of the larva of *Ourapteryx* or other of the Geometria moths. In its native swamps the "Congo Snake" is reputed by the black population to be highly venomous, an injustice to the poor creature as great as when applied by our own benighted countrymen to the harmless Newt or Triton of English ponds and streams, and of which it is merely a highly interesting and most extraordinary exotic type.

We are indebted for this rare and, indeed, at present, we believe, in this country, unique example of this species to Capt. A. H. Mellon, of the Dominion and Mississippi Steamship Company, to whose influential and friendly assistance we are also under further obligations for a fine young alligator some two feet long, the trophy of a preceding voyage.

W. SAVILLE-KENT

THE PROGRESS OF THE TELEGRAPH *

VI.

IT has already been observed that from the limited speed on the wire, the development of any extended system of telegraphic communication between the centres of commerce in a country where great distances have to be reached, involves a vast outlay in the duplication of the circuits necessary to afford the requisite transmitting powers, and that by the adoption of the automatic process, in addition to the accuracy of its performance, the greater speed obtained upon long circuits enabled the telegraphic service to be conducted by a much smaller number of wires, thus reducing in a most important degree the outlay of capital expended on con-

* Continued from p. 32.

struction. It is not, however, only by the automatic process that the full transmitting capacity of a conducting wire can be attained. Metallic conductors under certain conditions are capable of transmitting more than one current at the same instant of time, both in the same and in opposite directions; and by a very ingenious system of adjustment of electric resistances and balance of currents, perfected by Messrs. Stearns, Edison, and Prescott, the American electricians, intelligence can be transmitted and recorded over a single wire in opposite directions at the same moment. This system of transmission is known as "Duplex" and "Quadruplex" Telegraphy, and is already extensively employed by the Western Union Telegraph Company in the United States, and over several of the more important circuits in Great Britain. The "Duplex" system is working in America between nearly all the principal cities, and has recently been introduced between Port Hastings, on the island of Cape Breton, where the land circuits are in connection with the submarine cables, and San-Francisco, a distance little short of 5,000 miles. The "Quadruplex" system has been successfully introduced between New York and Boston, with a transmitting capacity upon a single wire equivalent to the transmitting power of four wires worked upon the ordinary Morse system. Thus, by employing arrangements such as the "Duplex" and "Quadruplex," a circuit may be worked either as one wire, or two, three, or four wires, according as the transmitting capacity of the circuit may require to be increased.

As is well known, several sounds may be conveyed at one and the same time by vibrations through a rod without interference, and it is difficult to realise the accuracy with which every vibration is reproduced by anyone who has not witnessed an illustration of the "transmission of sound" by solid conductors. So it is with "Duplex" and "Quadruplex" transmissions through the same wire in opposite directions at the same moment of time; it is equally difficult to realise how distinct signals can be received at either end without interfering with or destroying each other; and yet the principles involved are very simple and easy of explanation.

By the Duplex system, one of the most difficult problems incident to the successful development of telegraphic lines has been solved, namely, how to provide for the annual increase (averaging 20 per cent.) in the amount of business without the annual expenditure on capital account for the erection of additional wires. In the United States, over 150,000 miles of wire are in operation, the rate of increase being something like 20,000 miles per annum, and the Duplex system is capable of doubling the carrying capacity of these wires. The great value of the Duplex system consists in its capability to double the capacity of a wire at any moment, should injury by storm or conflagration interrupt the circuits. By its means, the moment one wire is restored to continuity it becomes equivalent to two, and a second wire raises the carrying capacity of the circuits to four wires, and by skilful manipulation the system may be introduced and adjusted on a circuit in about a minute. From the earliest days of telegraphy it has been well known that two currents, either in the same or in opposite directions, could be passed simultaneously through a conducting wire; indeed, by this means, often has the frame of mind and temper of the operator at the distant station been clearly read at the receiving station, even though situated some hundred miles distant. When the direction of the currents from the two stations are passed into the wire in the same direction, the directive force of the needle becomes more decided, and when the direction is contrary the motion of the needle will be comparatively neutralised and scarcely perceptible. The effect of a current transmitted along a wire from one station upon a galvanometer needle while currents are being transmitted from another station has therefore been long known. How this circumstance has been applied to the indication of distinct signals will now be explained.

Let us suppose two stations, A and B, are to be connected for signalling each other upon the Duplex system: the action of the coils in the instruments at the respective stations is so arranged that neither station's local or outgoing current shall affect its needle when passed into the line, its dial being left free to indicate the effects produced by the incoming current from the distant station. For this purpose it is necessary to wind the coils of the instruments with two parallel wires after the manner of a differential galvanometer. Now, as is well understood in testing a line wire for resistance between two stations with a differential galvanometer, until the artificial resistance interposed has been made equal to that of the line to be tested, the battery current passed by the key into the galvanometer will move the needle in the one direction if the artificial resistance is too small, and in the other direction if the resistance is too great. It is only when an accurate balance is obtained—that is, when the two resistances have been made equal—that a current will not move the needle, because then the current is equally divided between the coil connected with the artificial resistance and that connected to the line, which two coils being wound in opposite directions counteract one another. Thus, so long as the artificial resistances (rheostats) at each end of the line are equal to that of the circuit, each station will see the current sent by the other, while neither station will see upon his own instrument the current he is passing into the line; and for this reason, that the currents sent by each station divide equally between the line and the rheostat, passing through the coils in opposite directions, and have therefore no effect upon the needle of the sending instrument. When the distant station sends a current, it either increases or diminishes the effect of the home current; in the first case, it augments that portion which passes through the coil connected to the line, so that more flows into the line than into the rheostat, and the needle moves. In the second case, it reduces the current flowing to the line, and more will flow through the rheostat, moving the needle in an opposite direction. Thus it is seen that the two currents do not pass one another, but that when both stations signal at the same time, the current sent by either of them acts upon the distant instrument by determining whether the currents sent by that station shall pass through the line or the rheostat. Thus we see that when station A signals separately, the current is equally divided in passing through its instrument coil, and its effect is neutralised upon the needle, but it passes through both coils of the distant instrument in the *same* direction, and therefore produces a signal. If both A and B depress their contact keys at the same moment, the currents from the two batteries are united so far as the line wire is concerned, and this produces an effect upon the differential arrangements at each equivalent to a lessening of the resistance of the line, and therefore more current flows to the line than through the rheostat. It is thus seen that the Duplex system affords a means of increasing the transmitting capacity of a wire; and an invention which practically converts one wire into two, three, or four, as the necessities of business may require, is of great value.

A short historical summary of the introduction and progress of the electric telegraph, from its earliest application in a practical form to the establishment of its present world-wide reputation and utility, will be naturally of interest to the general reader; and the following short sketch may convey in a succinct manner the step by step progress that year by year has registered the index of improvement. It is not intended in any way to make the present sketch personal: some well-known names must of necessity be referred to, and the reader should also be informed that the narrator in this instance has personally been more or less connected with the progress of the

telegraph from 1844, the date at which this story commences, to 1875, the period under review. In the year first mentioned Charles Wheatstone, Professor of Natural Philosophy at King's College, London, was at the same time connected with a musical instrument and publishing business in Conduit Street, Regent Street. In that house many of his important improvements and patents in connection with the electric telegraph were carried out, and many of the drawings connected with the filing of the specifications of those patents were, by permission of the directors of the East and West India Dock Company, elaborated by a clerk in the Dividend Office of the Dock House, Billiter Square; resolutions standing in the Minute Book of the Dock Board authorising the devoting of his spare time in the office to Mr. Wheatstone's telegraph drawings, and afterwards a resignation in favour of an appointment in the then projected Electric Telegraph Company. So it was that the evening's explanations by Mr. Wheatstone to Mr. Holmes in Conduit Street were arranged by day at Billiter Square.

Prefaced with these preliminary remarks, the more immediate subject matter of the present paper will be commenced. It is a matter of history that the early telegraph patents of Cooke and Wheatstone were disposed of for a sum of 120,000*l.* to a Company called the Electric Telegraph Company, in which the late John Lewis Ricardo, M.P. for Stoke-upon-Trent, was at once the mainspring and vital element. Of this amount Cooke retained 90,000*l.*, and Wheatstone received 30,000*l.* This sum included the transfer to the Company, besides other matters, of the telegraph line between Paddington and Slough, on the Great Western Railway, already alluded to in the earlier pages of this summary. As already mentioned, this short line was a kind of Madame Tussaud—daily advertisements, and a profusion of visitors entertained, or, as they imagined, duped or bamboozled, at one shilling a head, into the belief that standing before the little instrument in the Paddington station, it would *there* and *then* convey their thoughts, and in intelligible language return a response from a station some twenty miles distant. Inquiries as to the "time of day," "state of weather," or general health of the operator, served to test the accuracy of the new invention. Nevertheless, nine out of every ten persons who were attracted by the printed placards sown broadcast about the station, left the Paddington terminus as little impressed with any belief that what they had seen represented the future germ of a great invention, as if they had viewed the automaton chess player. Necromancy, witchcraft, and delusion seemed to be the parting impression on their minds as they left, in return for their shilling charge. The announcement as issued in 1844, inviting the patronage of the public, is here reprinted; it affords an amusing souvenir of the early history of the telegraph:—

[*Facsimile of Announcement.*]

"Under the Special Patronage
OF ROYALTY.

INSTANTANEOUS COMMUNICATION
between Paddington and Slough, a distance of nearly twenty miles, by means of the
ELECTRIC TELEGRAPH,
which may be seen in operation Daily, from nine in the morning till eight in the evening at the
GREAT WESTERN RAILWAY, Paddington Station,
and the TELEGRAPH COTTAGE, close to the Slough Station.
Admission—One Shilling, Children and Schools halfprice.

Since this very interesting Exhibition has been opened to the Public, it has been honoured by the visits of His Royal Highness Prince Albert, the Emperor of Russia, the King, and Prince William of Prussia, the Duke de Montpensier, His Royal Highness the Duke of Cambridge, the Duke of Wellington, Sir Robert Peel, the Foreign Ambassadors, and most of the nobility, &c.

"In no way has the science of Electricity been made so subservient to the uses of man, as in its application to the purposes of Telegraphic Communication, which is now brought to the *height of perfection*. The working of this beautiful apparatus is not in the least degree affected by the weather, intelligence can be sent by *night* equally well as by *day*; distance is no object; by its extraordinary agency communications can be transmitted to a *thousand miles* in the same space of time, and with the same ease and unerring certainty, as a signal can be sent from London to Slough. According to the best authorities, the electric fluid travels at the rate of 280,000 *miles in a second*.

"The Electric Telegraph has been adopted by Her Majesty's Government, and the Patentees have just completed a line of communication between London and Portsmouth, agreeably to directions received a short time ago from

THE RIGHT HONORABLE THE LORDS OF THE ADMIRALTY.

"In the late trial of John Tawell, at Aylesbury, for the murder at Salt Hill, near Slough, the Electric Telegraph is frequently mentioned in the evidence, and referred to by Mr. Baron Parke in his summing up. The *Times* newspaper very justly observes 'that had it not been for the efficient aid of the Electric Telegraph, both at the Paddington and Slough stations, the greatest difficulty, as well as delay, would have been occasioned in the apprehension of the prisoner.' Although the train in which Tawell came to town was within a very short distance of the Paddington Station before any intelligence was given at the Slough Telegraph Office, nevertheless, before the train had actually arrived, not only had a full description of his person and dress been received, but the particular carriage and compartment in which he rode were accurately described, and an officer was in readiness to watch his movements. His subsequent apprehension is so well known, that any further reference to the subject is unnecessary.

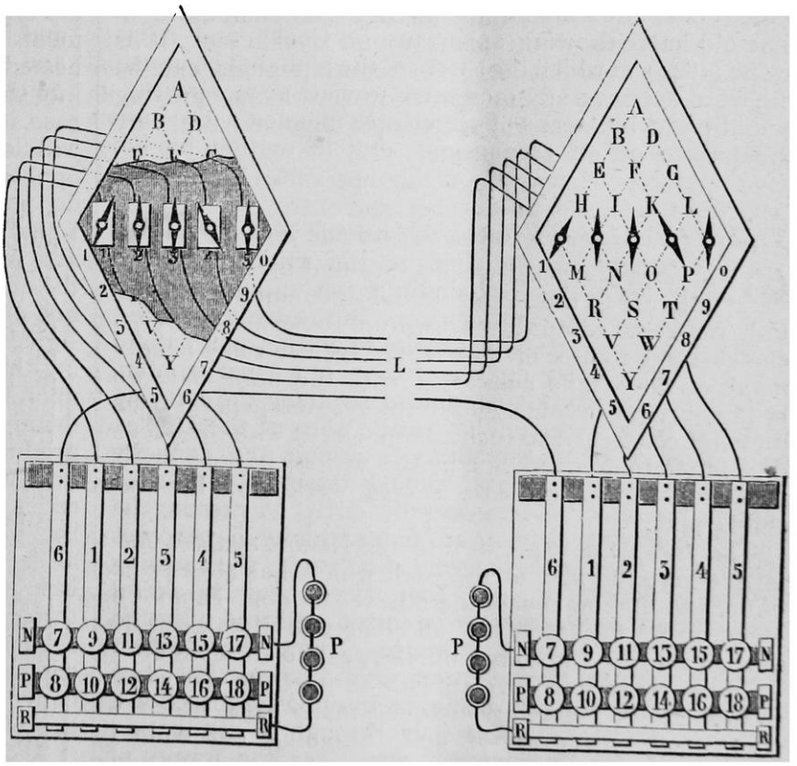


FIG. 26.—Cooke and Wheatstone's five-needle telegraph.]

"The Telegraph Office at Paddington Station is at the end of the Up-train Platform, where a variety of interesting apparatus may be seen in constant operation."

The first office of the Electric Telegraph Company was at 345 Strand, a site now occupied by the Gaiety Theatre. In those days (1846) scientific men of renown crowded the instrument room to witness the progress of this great invention: George Stephenson, the Astronomer Royal, Brunel, Vignoles, G. P. Bidder, Samuda, Rennie, Fairbairn, and most of the leading engineers of the day. In

345, Strand, the magnetic disturbances and interference with transmitted signals from auroræ and earth-currents were first observed and the observations tabulated, which have since proved useful, notwithstanding the then defective construction of the recording apparatus; here also the earliest lines of railway telegraph were inaugurated; the long five-inch astatic combination of the double needle and single needle instruments was employed, taking the place of less perfect apparatus. It must be remembered that, previous to the introduction of the double and single needle instruments, very cumbersome apparatus had been employed. There was the five-needle instrument, requiring five wires for the five needles, and a sixth wire for the return current (Cooke and Wheatstone's patent, 1837);

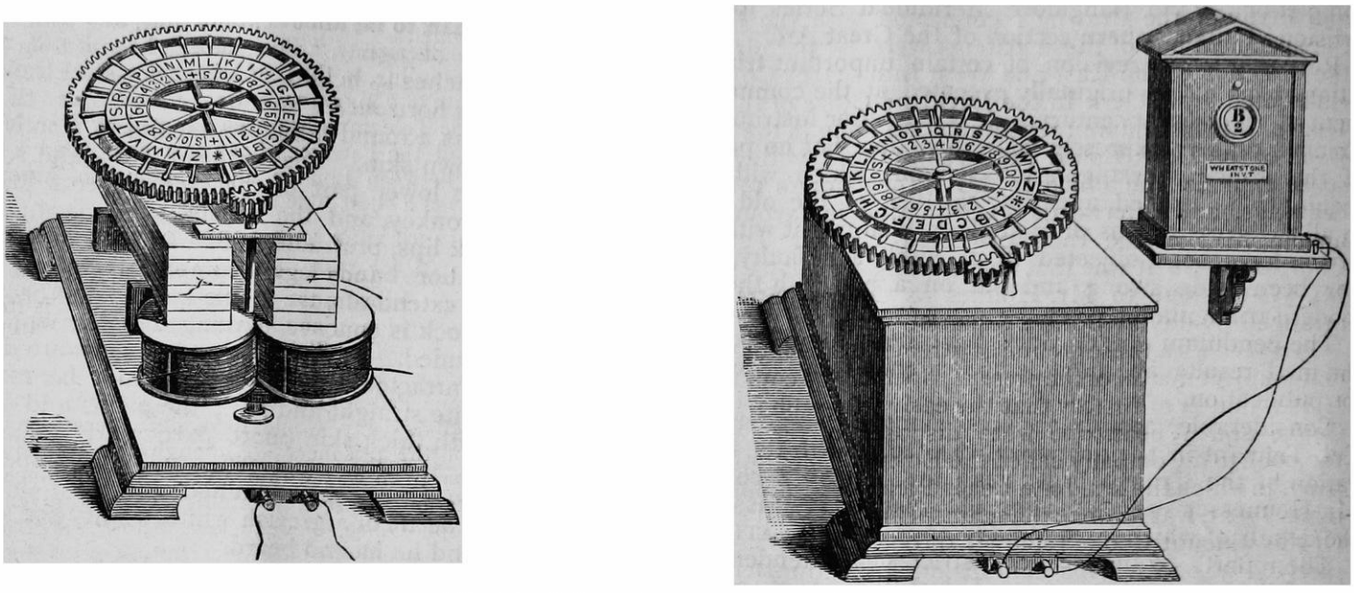


FIG. 27.—Wheatstone's letter-showing dial telegraph, 1840.

the respective letter or signal being indicated by the concurrent deflection of two pointers. Obviously, this instrument became useless for extended circuits, the capital cost of outlay for the six wires restricting its use. The old letter-showing apparatus of Cooke and Wheatstone (1840), in which the letters of the alphabet composing the word are severally presented to view at an opening in a dial-plate by means of an electro-magnet acting upon the pallets of an escapement, put in motion by independent clockwork. The communicator of the instrument is furnished with a dial-plate similar to that of the indicator, so that on the rotation of the dial of the communicator by the operator, the necessary succession of make and break currents of electricity are sent through the wire and controlled so as to actuate the motion of the index-pointer of the indicator at the distant station.

(*To be continued.*)

*THE INDIAN TRIGONOMETRICAL SURVEY**

ONE does not usually expect to find much of general interest in the Report of a Trigonometrical Survey. Col. Walker's admirably drawn-up Report, however, includes some matter of more than special value; indeed, many of the details connected with the immediate work of the Survey are calculated to interest the general reader, they are concerned to such a large extent with the peculiar difficulties to be overcome by the various parties, difficulties which make ordinary survey work look like mere child's play.

The Index Chart prefixed to the Report enables one to form a very full idea of the work which has already been done, and of how much there is yet to do. From Cape Comorin to Peshawur and all along the Himalayan frontier, and from Kurrachee on the west to Burmah on the east, the country is covered with an intricate net-work of triangulation, including, however, many gaps which will take many years to fill up. Shooting out from the northern border of the system of triangulation are numerous aurora-like lines indicating the secondary triangulation to fix the peaks of the Himalayan and Sooliman ranges. We cannot go into the details of the work of the Survey, and must content ourselves with a brief summary of the out-turn of work during the year under review, and with a reference to a few of the more interesting side topics.

Of Principal Triangulation, with the great theodolites of the Survey, seventy triangles, embracing an area of 7,190 square miles, and disposed in chains which, if united, would extend over a direct distance of 302 miles, and in connection with which three astronomical azimuths of verification have been measured. Of Secondary Triangulation, with vernier theodolites of various sizes, an area of 5,212 square miles has been closely covered with points for the topographical operations, an area of 3,650 square miles has been operated in *pari passu* with the principal triangulation but exterior thereto, and in an area of 12,000 square miles—in the ranges of mountains to the north of the Assam Valley which are inhabited by independent tribes—a large number of peaks have been fixed, many of which have already been found serviceable in the geographical operations now being carried on with the military expedition against the Dufflas. Of Topographical Surveying, an area of 534 square miles has been completed in British portions of the Himalayas, on the scale of one inch to the mile, an area of 2,366 square miles in Kattywar on the two-inch scale, and areas of 690 and 63 square miles respectively, in Guzerat and in the Dehra Dún, on the scale of four inches to the mile. Of Geographical Exploration much valuable work has been done in Kashgharia and on the Pamir Steppes, in connection with Sir Douglas Forsyth's mission to the Court of the Atalik Ghazi, and several additions to the geography of portions of Great Thibet and of Nepaul have been obtained through the agency of native explorers.

In the course of the operations of the year under review the northern section of the Brahmaputra Meridional Series has been completed, whereby two important circuits of triangulation formed by it with the Assam and East Calcutta Longitudinal Series to the north and south, the Calcutta Meridional and the Eastern Frontier Series to

* General Report of the Operations of the Great Trigonometrical Survey of India, during 1873-74, by Col. J. T. Walker, R.E., F.R.S., Superintendent of the Survey (Dehra Dun; Office of the Superintendent, G. T. Survey, M. J. O'Connor, 1874.)

the west and east, have been closed. The Straits of the Gulf of Manaar have been reconnoitred, with a view to connecting the triangulation of India with that of Ceylon, which has been found to be feasible.

Probably the most important features in the operations of the principal triangulation of the year are the resumption of the chain of triangles in Burmah, and the completion of the Bangalore Meridional Series for the revision of the southern section of the Great Arc.

Referring to the revision of certain important triangulations which were originally executed at the commencement of the present century with very inferior instruments, Colonel Walker expresses his conviction that no portion of the principal triangulation remains which will ever require to be revised, and that the last of the old links in all the great chains of triangles which might with any reason have been objected to as weak and faulty, have now been made strong and put on a par with the best modern triangulation.

The pendulum observations have been completed, and the final results are now being computed and prepared for publication.

Considerable assistance was, moreover, rendered to Col. Tennant in the operations connected with the observation of the Transit of Venus; the Appendix contains Mr. Hennessey's account of his observations at Mussooree, the details of which have already appeared in NATURE.

The reports of the various district superintendents are very full, and contain a good deal that is of general interest; the accompanying district sketch-maps are of great use in enabling one to read these reports with understanding. We shall briefly refer to some of the points of more general interest.

In Major Branfill's report on the Bangalore Meridional Series, a very interesting phenomenon is noticed in connection with the Cape Comorin base-line. The operations of 1873–74 were intended to close in a side of the polygon around the base-line which had been completed in 1868-69; but it was found that one of the two stations on the side of junction had disappeared. This station was situated on a remarkable group of Red Sand Hills, where, in 1808, Col. Lambton had constructed a station by driving long pickets into the drift sand; in 1869 Major Branfill, finding no trace of these pickets, had caused a masonry well to be sunk to a depth of ten feet, where it reached what was believed to be firm soil below; but during the interval of four years this well had been undermined, and nothing remained thereof but some scattered *débris*. It would appear that the sand hills travel progressively in the direction from west-north-west to east-south-east, which is that of the prevailing winds in this locality; if Col. Lambton's station was situated on the highest point of the hills and in a similar position relatively to the general mass as Major Branfill's, then the hills must have travelled a distance of about 1,060 yards to the E.S.E., for the results of the triangulation show that this is the distance between the positions of the two stations; thus the rate of progression would be about seventeen yards per annum. From Major Branfill's Notes on the Tinnevelly district, which are appended to the General Report for 1868-69, it appears that certain measurements of the eastward drift had made it as much as 440 yards in the four years 1845-48; but the distance between the trigonometrical stations of 1808 and 1869 probably affords the most accurate measure which has hitherto been obtained of the rate of progress of this remarkable sand-wave, which gradually overwhelms the villages and fields it meets with in its course, and has never yet been effectually arrested; numerous attempts have been made, by growing grass and creepers and planting trees on the sands, to prevent the onward drift, but they have hitherto been unsuccessful.

Mr. Bond, one of Major Branfill's staff, managed to procure an interview with a couple of the wild folk who live in the hill jungles of the western Ghâts, to the south-west of the Palanei hills. A strange dwarfish people had often been heard of as frequenting the jungles near the station of Pémalei, in the north-west corner of the Tinnevelly district, but until Mr. Bond caught these two specimens no trace of them had been seen by the members of the Survey. These two people, a man and a woman, believed themselves to be 100 years old, but Mr. Bond supposes the man to be about twenty-five, and the woman eighteen years of age. "The man," Mr. Bond states, "is 4 feet 6½ inches in height, 26¼ inches round the chest, and 18½ inches horizontally round the head over the eyebrows. He has a round head, coarse black, woolly hair, and a dark brown skin. The forehead is low and slightly retreating; the lower part of the face projects like the muzzle of a monkey, and the mouth, which is small and oval, with thick lips, protrudes about an inch beyond his nose; he has short bandy legs, a comparatively long body, and arms that extend almost to his knees: the back just above the buttock is concave, making the stern appear to be much protruded. The hands and fingers are dumpy and always contracted, so that they cannot be made to stretch out quite straight and flat; the palms and fingers are covered with thick skin (more particularly so the tips of the fingers), and the nails are small and imperfect; the feet are broad and thick skinned all over; the hairs of his moustache are of a greyish white, scanty and coarse like bristles, and he has no beard.

"The woman is 4 feet 6½ inches in height, 27 inches round the chest (above the breasts), and 19½ horizontally round the head above the brows; the colour of the skin is sallow, or of a nearly yellow tint; the hair is black, long, and straight, and the features well formed. There is no difference between her appearance and that of the common women of that part of the country. She is pleasant to look at, well developed, and modest." Their only dress is a loose cloth, and they eat flesh, but feed chiefly on roots and honey.

"They have no fixed dwelling places, but sleep on any convenient spot, generally between two rocks or in caves near which they happen to be benighted. They make a fire and cook what they have collected during the day, and keep the fire burning all night for warmth and to keep away wild animals. They worship certain local divinities of the forest—Rákas or Rákári, and Pé (after whom the hill is named, Pé-malei)."

The woman cooks for and waits on the man, eating only after he is satisfied.

The means taken for tidal observations in the Gulf of Kutch promise to lead to valuable results. The object of these observations is to ascertain whether secular changes are taking place in the relative level of the land and sea at the head of the gulf. Very great difficulties were found in selecting suitable stations for fixing the tide-gauges, as the foreshores of the gulf consist mainly of long mud-banks, which often stretch miles into the sea, and are left bare at low water, when they are intersected by innumerable tortuous and shallow creeks, whose shifting channels would be very unfavourable positions for tide-gauges. Only three points suitable for tidal stations were met with on the coasts of the gulf: at Hanstal Point, near the head of the gulf; at Nowanár Point, half-way up, on the Northern or Kutch coast; and at Okha Point, on the southern coast, opposite the island of Beyt. None of these points, however, are situated in ports or harbours, where piers, jetties, landing-stages, or docks might have been utilised; on the contrary, they are all situated at some distance from the nearest inhabited localities, and present no facilities whatever. The operations had thus to be of the very simplest nature. The only practicable plan was to have the tide-gauges set up on shore, over wells sunk near the high-water line, and connected with the sea by piping. The wells are iron cylinders, with an internal diameter of twenty-two inches, which slightly

exceeds the diameter of the float; the cylinders were made up in sections of fifty inches in length, the lowest of which is closed below with an iron plate, and the whole, when bolted together, forms a water-tight well, into which water can only enter through the piping for effecting the connection with the sea. The piping is of an internal diameter of two inches, which has been computed to be sufficient to permit of the transmission of the tidal wave to the well without sensible retardation. Iron piping is laid from the well to the line of low water; it is brought vertically up from the bottom of the well nearly to the surface of the ground, and is then carried down to the sea, where flexible gutta-percha piping is attached, and carried into the deep water. The outer piping terminates in a "rose," which is suspended a few feet above the bed of the sea by a buoy, in order to prevent the entrance of silt as much as possible, and it can be readily detached from the iron piping whenever it has to be cleaned.

After many difficulties, and even dangers to life, Capt. Baird's party managed to get the gauges erected and set to work, and what with the tidal observations, observations of the barometric pressure, the velocity and direction of the wind, and the amount of rainfall—for each station has been provided with means for making such observations—very valuable results may be expected.

Lieut. Gibbs's notes on the portion of the Dang Forests, in the Guzerat district, visited by him in 1874, are of great interest, and we regret that space forbids us referring to them in detail. His observations on the inhabitants of this region are of special value; he also seems to have paid considerable attention to the fauna, flora, and geology of the district.

Capt. Heaviside's lively narrative of the pendulum work in India, of his journey home, and of the operations at Kew, will also be read with interest.

Two narratives of somewhat unusual interest are given in the Appendix. One of these, by Lieut.-Col. Montgomerie, gives an account of a journey to the Namcho or Tengri Núr Lake, in Great Thibet, about ninety miles north of the Brahmaputra, by a native explorer, during 1871-72. The explorer was a semi-Thibetan, a young man who had been thoroughly trained for the work, and who was accompanied by four assistants. The party set out from Kumaon in November, and crossed the Brahmaputra at Shigatze, and amid considerable hardships made their way northwards, reaching the lake about the end of January, when they found it completely frozen over, although the water is so salt as to be unfit for drinking. The party intended to travel all round the lake, which is 15,200 feet above the sea, fifty miles long and from sixteen to twenty-five miles broad, and intended to proceed further to the northward and take complete surveys, but were robbed of nearly all they had, and were thus compelled to beat a rapid retreat, which they did by way of Lhásá.

During the great part of his journey to the Namcho Lake the explorer found the streams all hard frozen, and he was consequently much struck by the number of hot springs that he met with, and more especially by the great heat of the water coming from them, his thermometer showing it to vary from 130° to 183° Fahrenheit, being generally over 150°, and often within a few degrees of the boiling point, being in one case 183° when the boiling point was 183¾°. The water generally had a sulphurous smell, and in many cases was ejected with great noise and violence; in one place the force was sufficient to throw the water up from forty to sixty feet. These springs in some respects seem to resemble the geysers of Iceland.

To the south the lake is bounded by a splendid range of snowy peaks, flanked with large glaciers, culminating in the magnificent peak "Jáng Ninjinthanglá," which is probably more than 25,000 feet above the sea. The range was traced for nearly 150 miles, running in a north-easterly direction. To the north of the lake the mountains were not, comparatively speaking, high, nor were there any high peaks visible further north as far as the explorer could see from a commanding point which he climbed up to. He only saw a succession of rounded hills with moderately flat ground in between them. Immediately north he saw a lake of about six miles in length, which he was told was called Bul Cho, from the borax (bul) which is produced there in large quantities, supplying both Lhásá and Shigatze with most of the borax that they require.

The Tengri Núr or "Namcho" Lake is considered to be a sacred place, and although at such a very great distance from habitations and so high above the sea, it boasts of several permanent monasteries and is visited by large numbers of pilgrims. There are several islands in the lake, two of them large enough for monasteries: at the time the explorer was there the Lámas on the islands kept up their communication with the shore by means of the ice, but he did not hear as to what was done in summer. Fish are said to be abundant, and modern lake shells were found on the shore as well as fossil shells, which were very numerous and of all sizes.

The narrative contains many other valuable observations made on the people and the country through which he travelled; there is a good map of the route.

The other narrative is quite equal in interest to that just referred to. It consists of extracts from a native explorer's narrative of his journey from Pítorágarh in Kumaon *viâ* Jumla to Tadum, and then down through Nepaul, along the Gandak River, to British territory. The explorer, who had to exercise much determination and ingenuity, took minute notes by the way of all he saw, and has added much to our knowledge of the geography, the people, and the products of a region comparatively unknown. He had to cross many rivers by the way, which was generally done by means of ropes suspended between the banks. The explorer wished to proceed much further than Tadum, which is a little beyond the Brahmaputra, in Great Thibet, but was prevented by the head man of the village. He started on July 1, 1873, and reached British territory again about the end of November, after having travelled nearly 500 miles. We have space to notice only one interesting phenomenon which he observed. At Muktináth, near Kágbeni, about 11,280 feet above the sea, in N. lat. 29° and E. long. 83° 45′, about 600 feet south of the temple, is a small mound with a little still water at its base, having a sulphurous smell. From a crevice in this mound, at the water's edge, rises a flame about a span above the surface. The people of the place told the explorer that the water sometimes increases in quantity sufficiently to flow into the crevice; the flames then disappear for a while, and there is a gurgling noise, a report, and the flames burst up and show again. This spot is called Chume Giarsa by the Bhots.

Our readers will see, from the cursory glance we have been able to take at this Report, that it contains much valuable matter apart from the immediate work of the Survey, the members of which are doing good service to India and to science.

THE BIOLOGICAL DEPARTMENT OF THE BRITISH MUSEUM

THE newly-issued Report of the condition and development of the British Museum has, so far as biologists are concerned, a special interest. Its results may be considered as an index of the public feeling on the importance of the study of Natural History. Looked at in this light, we think that specialists in all the departments may feel hopeful. The acquisitions to the Zoological Department have been numerous (30,699 in all), over 6,000 being Vertebrata, "the majority being either entire

animals preserved in spirits, or skeletons." The spirit collection till recently has been much neglected, and all who have wished to prosecute their investigations into the more intricate details of zoology and comparative anatomy —into points of myology, nerve distribution, &c., quite as important as, but much less easily arrived at than, osteological characters—may justifiably look forward to the time when the national collection will contain, preserved in their entirety, examples of all reasonably-sized species.

"In the acquisition by purchase of skeletons, particular care has been taken [we are told] that they should be those of animals captured in a wild state, the skeletons of mammals (and birds) which have been brought up or have lived for some time in menageries, showing rarely, if ever, a perfect development of the osseous system. Scarcely less caution is required in admitting specimens of this kind into the collection for the sake of their skins." There is a great deal of truth in these remarks, but there are many new species of animals, such as the new Mourning Kangaroo, brought over by M. d'Albertis, and the Hairy-eared Rhinoceros (*Rhinoceros lasiotis*), discovered by Mr. Sclater, and now enjoying perfect health in the Zoological Society's Gardens, which are only known from these individuals.* It would be a loss to the collection if these were not obtained when opportunity afforded, and we are glad to know that the small kangaroo referred to has died and has been secured by Dr. Günther.

We are informed that over three thousand students who have visited the department during the past year, with the object of consulting the various portions of the collections, "have been assisted and attended to." All, we are convinced, will agree in expressing their best thanks to Dr. Albert Günther, who, as the worthy successor of the late Dr. J. E. Gray, has done all in his power to place every facility in the way of those who are desirous of studying Natural History.

NOTES

M. LEVERRIER was expected in England during the present month; but as the revision of his planetary theories, and especially of the Theory of Saturn, in which he has been occupied for some time, is not yet completed, his visit to this country will be delayed.

THE Emperor of Brazil has sent to Prof. Virchow, accompanied by an autograph letter in French, an interesting collection of skulls and skeletons, amongst which are some found in ancient caverns of Brazil. The collection has been made at the Emperor's request by the director of the Museum at Rio, Señor Ladislas Neto. The Emperor regrets that he did not have the pleasure of making Prof. Virchow's acquaintance at Berlin when he visited that city, as the Professor's investigations "are highly esteemed even by those to whom, like myself, it is not given to be more than friends to science."

THE Geographical Society of Rome gave a banquet, on May 11, to the celebrated African traveller Dr. Nachtigal; many of the members and several notabilities of the city of Rome were present in honour of the guest. The Vice-president of the Society, Senator Amari, proposed the health of the guest, who had just returned from a journey through Fezzan, Bornu, Wadai, and Darfur. Dr. Nachtigal, in reply, wished success to the scientific expedition to Central Africa planned by the Society; he considered that this expedition would be an honour to the whole Italian kingdom.

THE transfer of the India Museum to the Eastern Galleries of the International Exhibition Buildings, South Kensington, having been completed, the collection was thrown open to the Institute of Civil Engineers, who had a brilliant *conversazione* in the galleries on Tuesday evening; there were about 2,500 present. Considerable advance has been made in the arrangement of the valuable collections belonging to the Museum, though it must necessarily take some time before everything can find its proper place. There are two galleries, the upper and the lower. In the former, the Manufactures and Arts of India are represented; in the latter, which are not yet finished, the Natural History of Hindostan, the mineral, vegetable, and animal products, are represented. No doubt the India Museum, as it will ultimately be arranged, will become a favourite and instructive resort of the public, and we hope it is only the first step towards the realisation of Dr. Forbes Watson's great scheme of an Indian Institute.

MR. H. H. SCLATER, the naturalist to the Rodrigues section of the late Transit of Venus Expedition, and the Rev. A. E. Eaton, who held the same position at Kerguelen's Land, are both working out the materials which they collected during their stay in the islands which they visited. The former zoologist has obtained a great number of remains of the extinct Solitaire, one skeleton and several skulls being perfect; besides the remains of several other species of birds. Mr. Eaton's specimens include the skeleton of one Cetacean, two Seals, and several species of Petrels.

DR. LYON PLAYFAIR has withdrawn his bill for restricting experiments on animals, on account of the appointment of a Royal Commission on the subject, the names of the members of which have not yet been published.

PROF. LEIDY, the distinguished American biologist, is now in this country.

THE volcanic phenomena in Iceland, of which we have already given some details (vol. xi. p. 514) seem still to be as active as ever, and indeed to be gaining in intensity. Outbreaks have occurred since the beginning of the year to the middle of April, when the latest news left. In March the Dyngjufjöll was incessantly vomiting fire, the eruption was steadily spreading over the wilderness, and the whole region of the My-vatn Mountains was one blazing fire. So large a district of the surrounding country has been covered with ashes that the farmers have been obliged to remove in order to find pasture for their stock. Early in April a new eruption had broken out in a south-easterly direction from Barfell, more than half-way to the east, between it and the Jokulsa. A party went out from Laxárdal to explore, and on approaching the place of eruption they found the fire rising up from three lava craters, in a line from south to north, which it had piled up around itself on a perfectly level piece of ground. At a distance of fifty to eighty fathoms to the west from the craters a large fissure had formed itself as the fire broke out, and the land had sunk in to the depth of about three fathoms. Into the hollow thus formed the lava had poured at first, but now it flowed in a south-westerly direction from the two southern craters. The northernmost crater had the appearance of being oblong, about 300 fathoms in length, and from this crater the molten red-hot lava was thrown about 200 or 300 feet into the air in one compact column. The top of this column then assumed a palmated appearance, and the lava fell down in small particles, like drops from a jet of water, which, as they became separated from the column, grew gradually darker, and split into many pieces, bursting into lesser and lesser fragments as they cooled. No flames were observed, but the glare proceeds from these columns and the seething lava in the craters. At times the explorers could count twenty to thirty of these columns. No real smoke accompanied the eruption, but a bluish steam, which expanded and whitened in colour as it rose to a greater distance from the crater, and such seemed to be the power of this blue jet of steam that it rose straight into the air for many hundreds of fathoms in despite of a heavy wind blowing.

* A second specimen of the latter species has been just received by Mr. C. Jamrach.

A SHOCK of earthquake was felt at Spezzia, Italy, on May 20. It is possible that the earthquakes which were felt almost daily in Italy a few weeks since were connected with the Icelandic phenomena; generally, any volcanic commotion in Iceland occurs simultaneously with volcanic or seismic phenomena in Italy.

THE University of Cambridge proposes to confer the honorary degree of LL.D. upon Dr. Samuel Birch, F.S.A., the Keeper of Oriental Antiquities in the British Museum.

THE death is announced, on Feb. 5 last, at the age of thirty-five years, in the interior of Africa, of Mr. Frank Oates, F.R.G.S., who, since the beginning of 1873, has been travelling in that country with the twofold object of acquiring an accurate knowledge of its natural features and of studying its fauna. After spending some time in the Matabele country, north of the Limpopo River, towards the end of last year Mr. Oates proceeded to the Victoria Falls, on the Zambesi. Shortly after leaving the Zambesi, when near to the Makalake towns, he succumbed to fever. Mr. Oates's effects, it is hoped, will be brought home by a personal friend, who has recently gone up country from Pietermaritzburg. They include a large number of specimens of natural history and curiosities which Mr. Oates had collected, besides all his notes and papers, and are expected to prove of very considerable interest. Mr. Oates had already made a successful expedition into North and Central America.

THE Report read at the Anniversary of the Royal Geographical Society on Monday shows a net increase of 202 members, the roll of ordinary members now reaching the total of 2,960 The total income of the year was 7,511*l.* 11*s.* 10*d.*, all but about 500*l.* of which has been disbursed. Medals were presented to Count von Beust on behalf of Lieuts. Weyprecht and Payer, and to the successful competitors in the public schools examinations. A presentation gold watch was handed by the chairman, Sir H. C. Rawlinson, to Col. Montgomerie, of the Indian Trigonometrical Survey, for transmission to Mr. W. H. Johnson, the explorer of Kuen Lun and Khotan. The President, in his address, referred to the losses by death sustained by the Society, to the Arctic Expedition, to the Admiralty Surveys in the *Challenger*, the *Basilisk*, the *Shearwater*, and other vessels, and to other geographical topics.

MR. WILLIAM MACLEAY, of Sydney, who has fitted out the expedition for the exploration of New Guinea, is, we believe, an ardent naturalist. The ship he has purchased is named the *Chevert*, and has been placed under the command of Captain Edwards. Mr. Macleay accompanies the expedition, which left Sydney on the 18th inst.

THE body of an American, John Blackford by name, has recently been found in a large ice-block in the vicinity of Mont Blanc, after several days of thaw. The unfortunate tourist had tried three years ago to ascend Mont Blanc without a guide, and had not since been heard of. Features and clothes are perfectly preserved.

IN the vicinity of Salzwedel an immense layer of rock-salt has been discovered. Borings had been made for some time past with a view to discovering coal; the formation of limestone, however, in which these experiments were made, is extremely hard, and the borings made but small progress. At the beginning of this year the first specimens of rock-salt were obtained at a depth of about 730 feet. The borings have now gone 250 feet deeper, and the rock-salt remains the same. It is the intention of the proprietor to go to a depth of 2,000 feet.

MR. MALLET'S paper on "The Nature and Origin of Volcanic Heat and Energy," read to the Royal Society in 1872, and published in Phil. Trans. for 1873, has been translated in full into German by Dr. A. von Lasaulx, Professor of Geology at the University of Bonn, and published as a separate work. We regret that a few clerical errors which escaped correction until the original paper was published, together with the necessary errata, have been overlooked by the translator. The errors are, however, self-evident, and occur in the German translation in paragraphs 186 to 198. The errors originate by dividing, in place of multiplying, a certain number of heat units at line 11, par. 186, and do not affect the argument of the paper.

A LITTLE medal of palladium, with hydrogen occluded in it, now at Leeds, is described by the compiler of the "Yorkshire Exhibition Guide" in the following terms:—"A medal and plate formed of the new metal, palladium, will be interesting to scientific men. The discovery of this metal by Prof. Graham a few years ago finally settled the long-disputed point as to whether or not the gas hydrogen was a metal. He proved that palladium was simply hydrogen condensed. This may be easily exemplified by placing a piece of the metal under the receiver of an air-pump and exhausting the air. The solid metal at once flies off as a gas, and on re-admitting the air it shrinks again into its former size. The little medal shown contains 100 times its volume of the gas." The writer's wild remarks display so much ignorance, that it is to be feared, notwithstanding their calm positiveness, they can hardly be attributed to a firm and cheerful faith in molecular mobility.

THE French Academy of Sciences, at its private meetings, is at present deliberating upon the means of diminishing the expenses of publishing the *Comptes Rendus* without injuring the interest of science. The yearly expense of editing that journal is about 70,000 francs, after deducting the receipts from the sale, which is not very large. The Academy has a very liberal free list, the number of copies presented amounting to many hundreds. It has been proposed by M. Leverrier to use a smaller type. Objections have been raised by some members, who wish merely to diminish the number of pages allotted to the several papers. But it is very likely that the former suggestion will be adopted, and steps taken to make the *Comptes Rendus* less bulky. The *Comptes Rendus* forms yearly two thick quarto volumes. The eightieth volume is in course of publication. The number of pages published since the 1st of June, 1835, is about 100,000.

THE Report of Brigadier-General Myer, Chief Signal Officer of the United States for 1874, has just been received. This Report, giving an admirable *résumé* of the meteorology of the United States for 1873–74, and exhibiting throughout an earnestness and a vigour in the successful application of the science to practical matters, we shall take an early opportunity to bring before our readers.

SYMONS' "British Rainfall," showing the distribution of rain over the British Isles during 1874, as observed at about 1,700 stations, has just been published. It contains, in addition to the usual large mass of valuable information detailing the rainfall of the year, a notice of the remarkable rainfall of October 6, and a map showing its distribution over England and south of Scotland; and papers on the measurement of snow and on the rainfall at certain health-resorts in the United Kingdom. We observe with much satisfaction that the editor has obtained the services of nine gentlemen as county superintendents, to assist him in collecting the rain returns of their respective districts, it being in this way that the observation of this important element will best be rendered still more complete. The publication of the monthly as well as the annual amounts of rain for the whole of the 1,700 stations is very desirable, and it is hoped that in an early issue of the "British Rainfall" it will be done.

A NEW street in Magdeburg has just been called "Guerike Street." Our readers know that Otto von Guerike, some time Burgomaster of Magdeburg, was the inventor of the air-pump.

ON May 20 the Plenipotentiaries of France, Austria, Germany, Italy, Russia, Spain, Portugal, Turkey, Switzerland, Belgium,

Sweden, Denmark, the United States, the Argentine Republic, Peru, and Brazil, signed, at Paris, the International Convention for the adoption of the metrical system of weights and measures. A special clause reserves to the States not included in the above list the right of eventually adhering to the Convention.

IT was the Hon. T. Elder (not Eden), who, with Mr. Hughes, bore the expenses of Col. Warburton's journey across Australia, the narrative of which we noticed in last week's NATURE (p. 46).

THE French Association for the Advancement of Science meets at Nantes this year, under the presidency of M. d'Eichtal, an influential banker largely connected with railway interests. The local committee is presided over by the Mayor, and a large sum has been collected for defraying the expenses connected with the meeting.

THE annual report of the trustees of the Museum of Comparative Zoology, of Cambridge, U.S., for 1874 has just been published, and contains the current history of that distinguished establishment, as also the list of the additions to its various departments. The strict economy necessary to relieve the Museum from its embarrassments, after the death of Prof. Agassiz, has effected its purpose, and its financial condition is rapidly approaching a satisfactory state.

PROF. ALEXANDER AGASSIZ announces that the experience of the past two years has shown the impossibility of conducting the Anderson School of Natural History, Penikese Island, upon the plan originally intended. The trustees find themselves at the end of the means at their disposal. To enable them to carry on the school it is proposed to charge a fee of fifty dollars for the season, and they hope that a sufficient number of pupils can be secured to warrant them in going on. Even with the proposed charges there will be a considerable deficit (as was the case last year) to be met by the friends of the Penikese School.

WE believe that M. Wallon, the French Minister of Public Instruction, is to present a law for the organisation of the higher education in France.

THE *Watford Observer* of May 22 contains reports of two papers read at the last meeting of the Watford Natural History Society: "Introductory Remarks on the Observation of Periodical Natural Phenomena," by Mr. J. Hopkinson, F.L.S., and "Notes on the Observation of Plants," by the Rev. Dr. W. M. Hind. It is gratifying to see local societies turning their attention to subjects of so much importance.

DURING the first three days of last week the Geologists' Association made an interesting excursion to Charnwood Forest, in Leicestershire. A full report of the proceedings appears in the *Leicester Chronicle* for May 22.

MESSRS. CHAPMAN AND HALL have just published a translation of F. Jagor's "Travels in the Philippines," of the German edition of which we were able to give a favourable review in vol. viii. p. 138. The translation seems to us to be well done, and the book contains a good map and many illustrations; it merits a favourable reception from the English reading public.

WE have an evidence of the activity of research in the United States in the following list of American Microscopical Societies furnished by the *American Naturalist*:—Agassiz Institute, Sacramento, California; Academy of Natural Sciences, Philadelphia, Biological and Microscopical Section; American Association for the Advancement of Science, Microscopical Section; American Microscopical Society of New York; Bailey Club, New York; Boston Microscopical Society; Boston Society of Natural History, Microscopical Section; Dartmouth Microscopical Club, Hanover, N. H.; Fairmount Microscopical Society of Philadelphia; Indiana Microscopical Society, Indianopolis, Ind.; Kirtland Society of Natural History, Cleveland, Ohio, Microscopical Branch; Louisville Microscopical Society, Louisville, Kentucky; Maryland Academy of Sciences, Baltimore, Section of Biology and Microscopy; Memphis Microscopical Society, Memphis, Tenn.; New Jersey Microscopical Society of the City of New Brunswick, N. J.; Providence Franklin Society, Providence, N. J., Microscopical Department; San Francisco Microscopical Society; Society of Natural Sciences, Buffalo, N.Y., Microscopical Section; State Microscopical Society of Illinois, Chicago, Ill.; State Microscopical Society of Michigan, Kalamazoo, Mich.; Troy Scientific Association, Troy, N.Y., Microscopical Section; Tyndall Association, Columbus, Ohio, Microscopical Section. Eight of these societies have been established within the last two years.

WE have received the Eighth Annual Report of the Perthshire Society of Natural Science, from which we regret to see that there has been rather a falling-off in the prosperity of the Society, arising mainly from indifference on the part of the majority of its members. In this, as in most other similar societies, the work is done by but a small portion of the members. Still the Society is working well in various ways, and this report contains a long and interesting address by the President, Sir Thomas Moncrieff, on the work done by the Society during the past year. We hope the publication of this Report will be the means of rousing a larger number of the members to take an interest in the work of the Society.

THE Report for 1874, read at the thirteenth annual meeting of the West Riding Consolidated Naturalists' Society, embracing a large number of Field Clubs in the West Riding, is a very favourable one. At the time of the meeting, some months ago, the number of members was 545, and the Report states there is good reason to believe that studies in the various branches of Natural History are now diligently and earnestly pursued.

THE additions to the Zoological Society's Gardens during the past week include a Black Ape (*Cynopithecus niger*) from Celebes, presented by the Hon. Evelyn H. Ellis; a West Indian Agouti (*Dasyprocta antillensis*) from Trinidad, presented by Mr. Christopher James; a Coypu Rat (*Myopotamus coypu*) from South America, presented by Mr. Robert E. Paton; a King Penguin (*Aptenodytes pennanti*) from the Falkland Isles, presented by Mr. L. Cobb; an Indian Cobra (*Naia tripudians*), two Russell's Vipers (*Vipera russelli*), three Carpet Vipers (*Echis carinata*), an Indian Eryx (*Eryx johnii*), an Indian Python (*Python molurus*), three Indian Rat Snakes (*Ptyas mucosa*), and five Long-snouted Snakes (*Passerita mycterizans*), from India, presented by Dr. John Shortt; two Rendall's Guinea Fowls (*Numida rendalli*) from West Africa, two King Parrakets (*Aprosmictus scapulatus*) from New South Wales, deposited; a Molucca Deer (*Cervus moluccensis*), born in the Gardens.

SCIENTIFIC SERIALS

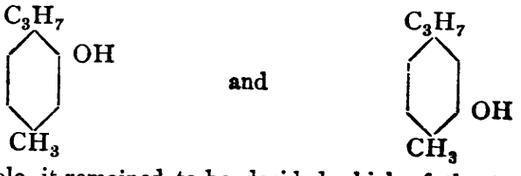
Journal of the Franklin Institute, April.—The following are the principal original papers in this number:—Report on a test trial of a Swain turbine water wheel, by J. B. Francis, C.E.—On the moments and reactions of continuous girders, by M. Merriman, C.E.—Compound and non-compound engines, steam jackets, &c., by C. E. Emery, C.E.; this is the first part of a paper presenting a discussion of the results of experiments made on several U.S. Government steamers.—First part of a paper on experiments made at the Mare Island Navy Yard, California, with different screws applied to a steam launch, to ascertain their relative propelling power, by Chief Engineer B. F. Isherwood, U.S.N.—New processes in proximate gas-analyses, by Prof. Henry Wurtz, continued from a former number.—On the cause of the light of flames, being a translation from the German of W. Stein, who discusses the results attained by Prof. Frankland.

Der Naturforscher, Feb. 1875.—This valuable publication contains abstracts of many important papers published elsewhere, most of which are noticed separately in NATURE; but there are also numerous original papers. We point out the following:—On the elements of the flora of the Chalk period, by C. v. Ettingshausen.—On the nature of lichens, by P. Magnus. This is an account of the difference of opinion existing amongst the authorities on the subject in question, some of whom do not think lichens uniform organisms, but rather suppose them to consist of a fungus which draws the greatest part of its organic substance from the Algæ (the so-called lichen Gonidia) round which it grows, while others do not agree with this view; the author, however, tends to the adoption of the idea as a correct one.—On the Biela Comet shooting stars observed by Herr Winnecke at Strasburg on Dec. 3 last.—On the revival of Rotifera, by Mr. Leidy.—On the atmospheric peroxide of hydrogen, by Herr Houzeau.—On the colour and specific gravity of sea-water; observations made on board the German Expedition corvette *Gazelle* on her voyage to the Kerguelen Island, under the superintendence of Herr von Schleinitz. These observations seem to show that the blue colour of sea-water stands in close relation with the quantity of salt the water contains, and that as the salt decreases the colour passes from blue to blue-green and dark green. There seems to be such regularity in this, that simply according to the specific gravity of the water the shade of colour could be determined which the water must show, and *vice versâ*. The transparency of the water seems also to increase with its quantity of salt; that of blue water was found to be 4·7 meters, while that of dark green only 2·5 meters.—On the nature and the laws of adhesion, by J. Stefan.—On the assimilation of nitric and sulphuric acids by germinating peas, by Herr Kellner.—New researches on some absorption phenomena of field-soils, by Herr Eichhorn.—On the spectra of comets, by H. C. Vogel, with special reference to Coggia's Comet.—On the copulation of spores of Algæ, by P. Magnus.—On the digestion of albumen, by R. Maly.—On a new method to investigate the nature of electric discharges, by Herr A. M. Meyer.—On a new theory of the sensation of light, by Herr E. Hering. This theory refutes that of Young and Helmholtz, which adopts three simple colours, red, green, and violet, and sometimes requires certain psychic processes for explaining certain facts. Herr Hering tries to do away with these processes in question.—On the new malleable glass, by Herr J. Fahdt.—On the decomposition of preserved wood, by Max Paulet.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Feb. 15.—This number contains an article on the universal meteorograph, by Prof. Van Rysselberghe, of Ostend. The instrument was fully explained by the inventor at a recent meeting of the Meteorological Society.

March 1.—The subject of rain and the barometric minimum is here further discussed by Prof. Reye, who finds that his views agree in the main with those of Herr Hann. Both these meteorologists recognise the latent heat of vapour as moving force in rotating storms; this causes the air to ascend and fresh air to be drawn in. According to Herr Hann, the barometer only sinks fast after a large whirl with a strong ascending current has been formed. Prof. Reye agrees with him in thinking that the rotatory movement contributes to rarefaction in the centre and thus renders possible the occasional long duration of minima. But he differs with him regarding another point. He considers that the ascending central current can only last so long as its temperature, derived from condensation, exceeds that of the surrounding air, and that this higher temperature must make pressure lower beneath the ascending current than around the cyclone. Dr. Hann, on the contrary, affirms that condensation has little effect on pressure, and that the minima of storm-centres are not caused by rainfall. Mohn's theory of the propagation of storms in the direction of largest rainfall cannot hold good if the latter view be correct. Loomis has shown how American storms generally move towards the area of greatest rainfall. Mohn finds from observations of 210 European stations that moisture is most prevalent on the front side of depressions. Thom testifies to the enormous rainfall accompanying storms in the Indian Ocean. Prof. Reye calculates that if it were possible for rain to fall to the amount of 1 mm. at any place without producing any indraught of air, the barometer would fall $\frac{8}{9}$ of a millimetre, and generally in that proportion. Now, in hurricanes, such a condition is more nearly approached than in thunderstorms or steady rains. In the vortex, air and vapour rise so rapidly that they cannot part with much heat, and at the same time the inflow of the lower strata is retarded and the outflow of the upper strata accelerated by centrifugal force. There still remains, after liberated latent heat has been employed in expansion, a portion which has been disregarded, equivalent to the *vis viva* of the whirling mass and the work of expansion performed in ascending. With all this evidence he maintains his theory.—In the *Kleinere Mittheilungen* we have the last part of Dr. Ucke's paper on atmospheric oxygen, containing tables which give its variations in quantity at different seasons, with reference to the means of all stations together, and of the stations taken separately. At Seringapatam the difference between summer and winter is least, viz., 1 per cent.; London shows 4, Brussels 6, Vienna 8, Petersburg 9, Samara 14, and Barnaoul 16 per cent. Proximity of the sea and elevation obviously produce the low figures, and the more easterly a place lies on the continent the greater are the differences between the seasons.

THE *Gazzetta Chimica Italiana*, fasc i. e ii. 1875, contains the following original papers, besides a great number of abstracts from other serials:—On two new derivatives of phloretic acid, by W. Koerner and P. Corbetta. These are researches on methyl- and ethyl-phloretic acids and their products of oxidation. The authors arrived at the conclusion that phloretic acid can most probably be regarded as phenolisopropionic acid of the formula $C_6H_4 . OH . CH \begin{cases} CH_3 \\ COOH \end{cases}$.—On the origin of the sulphides and hyposulphides found in natural sulphur waters, by Prof. E. Pollacci.—Researches on some derivatives from natural and artificial thymol, by E. Paterno. The author considers acetylic, methylic, ethylenic, and the sulpho-methylic derivatives of both thymols, and points out their differences.—On paratoluic nitride and some of its derivatives, by E. Paterno and E. Spica.—A note from Dr. M. Fileti, on a glucosate of copper.—Account of experiments made by the same author and E. Paterno, to obtain a carbo-cymenic acid. The experiments made until now with natural thymol and its artificial substitute obtained from cymene, show that both are hydroxyl derivatives of the same cymene, which upon oxidation gives paratoluic acid, and therefore contains the propyl and methyl group in the positions 1 to 4; the difference rests therefore only in the position of the hydroxyl, and as only the two following oxy-derivatives of parapropylmethylbenzine



were possible, it remained to be decided which of the two formulæ applied to natural and which to artificial thymol. The nature of the cresols obtained by Engelhardt and Latschinoff, and by Kekulé, by the action of phosphoric anhydride on the isomeric thymols, has rendered it very probable that the first of the above formulæ represents the natural thymol, the other the artificial one. The authors made the experiments of converting sulpho-cymenic acid into carbo-cymenic acid, which has the following formula, $C_6H_3 \begin{cases} C_3H_7 \\ CH_3 \\ COOH \end{cases}$, and then tried to oxidise the latter, by which they would have finally solved the above question. They have not quite succeeded yet, although they hope to publish their final results shortly.—On the supposed emission of carbonic acid from the roots of plants, by M. Mercadante and E. Colosi. The authors pretend that no such emission exists.—The remainder of the number consists entirely of summaries from other journals, most of which we have already noticed.

IN the 2e fascicule of the *Bulletin de la Société d'Anthropologie de Paris* for 1874, M. Dareste concludes his reply to M. Broca's theory of the mode of formation of double monsters, considering them under the several types named by Isidore G. Saint-Hilaire, "janiceps, iniopes, synotes," and "deradelphes." In a later meeting of the Society, M. Broca entered at great length on the consideration of the "Doctrines of Diplogenesis," and endeavoured to show the untenability of the hypothesis which ascribes this abnormality to fusion rather than to excess of development, and an inherent tendency in the embryo to a repetition or doubling of parts.—A letter was read from M. Prunières, in which he describes the artificial perforations discovered by him in human skulls belonging to the period of dolmens. As early as 1868 the writer first drew attention to the numerous cases in which cranial and other human bones had

been found bearing evidence of having been cut or perforated by instruments belonging to the polished stone age. M. Broca, in describing the crania submitted to his notice by M. Prunières, draws attention to a similar condition in a skull sent to him by Mr. Squier, and taken by the latter from an ancient Peruvian tomb, in which a square opening had been made, evidently by a saw, and probably a few days before death; and he mentions that among the Kabyles and other African tribes trepanning is resorted to in the present day for comparatively unimportant diseases, while Hippocrates refers to the process as one established in his time among the Greeks. M. Broca does not, however, assume that cranial perforations among primitive races in Europe had any connection with surgical processes, but is rather disposed to assume them to have been the result of certain obligations of religion.—M. J. de Baye describes circumstantially the caverns and recesses, amounting to more than one hundred, which he has recently discovered and explored in the Valley de Petit-Morin, in Marne.—M. Bertrand has presented the Society with a cast of a reindeer horn, on which is distinctly traced with a flint instrument the figure of a reindeer grazing, which was found at Thaïnghen, near Lake Constance.—MM. de Quatrefages and Hamy, in offering their colleagues the second edition of their great work on "Crania Ethica," which is entirely devoted to the consideration of the Cro-Magnon race, entered into an exposition of their views in regard to the relations existing between the Troglodytes of Perigord and certain southern races, including not only the Basques, but Kabyle tribes from the Beni-Menasser and Djurjura regions.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, May 13.—Prof. Cayley, F.R.S., vice-president, in the chair.—The Rev. C. Taylor read a paper on some constructions for transforming curves and surfaces. The basis of the paper was a neglected work on conic sections, "which for originality and thoroughness is in its own special department unsurpassed." The author was G. Walker, F.R.S., of Nottingham, and his work appeared in 1794. The tediousness of the style may account for the fact that the work was not appreciated. Dr. Hirst and the Chairman made some remarks on the paper.—Mr. J. W. L. Glaisher communicated some notes on Laplace's coefficients.—A short paper by Mr. Harry Hart, on a linkwork for describing sphero-conics and sphero-quartics, was taken as read.

Chemical Society, May 20.—Prof. Abel, F.R.S., president, in the chair.—Mr. A. H. Smee read some notes on milk in health and disease. From the results of numerous experiments he finds that when cows are fed on sewage grass alone the milk soon goes putrid, and the butter made from it is soft, and rapidly becomes rancid. He also noticed the outbreaks of typhoid which had occurred in various places owing to sewage water having been used to cleanse the dairy utensils or to reduce the quality of rich milk to the lowest standard permitted by law. A long and interesting discussion followed, after which Mr. W. H. Deering read a paper on some points in the examination of waters by the ammonia method, in which he proposes certain modifications to facilitate the application of the Nessler test and eliminate incidental errors. There was also a communication from Prof. H. Howe on some Nova Scotian Triassic Trap minerals.

Geological Society, May 12.—John Evans, V.P.R.S., president, in the chair.—The following communications were read.—Notes on the occurrence of *Eozoon canadense* at Côte St. Pierre, by Principal Dawson, F.R.S. The author commenced by describing the arrangement and nature of the deposits containing *Eozoon* at the original locality of Côte St. Pierre on the Ottawa River. The Eozoal limestone is a thick band between the two great belts of gneiss which here form the upper beds of the Lower Laurentian. *Eozoon* is abundant only in one bed about four feet thick; but occasional specimens and fragments occur throughout the band. The limestone contains bands and concretions of serpentine, and is traversed by veins of chrysolite; the former an original part of the deposit, the latter evidently of subsequent formation. A thin section, 5½ inches in depth, showed: (1) Limestone with crystals of dolomite and fragments of *Eozoon*; (2) Fine-grained limestone, with granules of serpentine, casts of chamberlets of *Eozoon* and of small Foraminifera; (3) Limestone with dolomite, and containing a thin layer of serpentine; (4) Limestone and dolomite with grains of serpentine and fragments of supplemental skeleton of *Eozoon*; (5) Crystallised dolomite, with a few fragments of *Eozoon* in the state of calcite; (6) Limestone containing serpentine, as No. 2. The author criticised some of the figures and statements put forward by Messrs. King and Rowney, and noticed two forms of *Eozoon*, which he proposed to regard as varieties, under the names of *minor* and *acervulina*. He stated that fragments of *Eozoon*, included in dolomitic limestones, have their canals filled with transparent dolomite, and sometimes in part with calcite. In one specimen a portion was entirely replaced by serpentine. The author called particular attention to the occurrence of serpentinous casts of chamberlets, single or arranged in groups, which resemble in form those of the Globigerine Foraminifera. These may belong either to separate organisms or to the acervuline layer of the *Eozoon*; the author proposes to call them *Archæospherinæ*, and describes them as having the form and mode of aggregation of *Globigerina*, with the proper wall of *Eozoon*. The author discussed the extant theories as to the nature of *Eozoon*, and maintained that only that of the infiltration of the cavities of Foraminiferal structure with serpentine is admissible. He particularly referred to the resemblance of weathered masses of *Eozoon* to Stromatoporoid corals.—Remarks upon Mr. Mallet's theory of volcanic energy, by the Rev. O. Fisher, F.G.S. Mr. Mallet's paper, read before the Royal Society in 1872, was discussed by the author *seriatim* as far as it seemed open to criticism. With respect to the condition of the earth's interior, whether it be rigid or not, Sir W. Thomson's arguments for rigidity were referred to, and geological difficulties in accepting his conclusions suggested. Mr. Mallet's views regarding the formation of oceanic and continental areas, that they have on the whole occupied nearly the same positions on the globe at all periods from the very first, were objected to on the ground that all continental areas with which we are acquainted are formed of water-deposited rocks, and that therefore those areas must at some time have been sea-bottoms; and if these wide features have not occupied the same positions which they now do from the very first, Mr. Mallet's explanation fails, that they were caused by unequal contraction when the crust was first permanently formed and thin. It was also shown that the theory of unequal *radial* contraction cannot account for the difference of elevation between continental and oceanic areas upon reasonable assumptions. For if we consider the crust to have been 400 miles thick (which cannot be considered *thin*), and to have cooled from 4000° F. to zero (a most extravagant supposition), then, if the crust had contracted one-tenth more beneath the oceanic area than it had done beneath the continental, we should only get a depression of one mile for the oceanic area, using Mr. Mallet's mean coefficient of contraction. The main feature of Mr. Mallet's theory was then discussed, viz., that "the heat, from which terrestrial volcanic energy is at present derived, is produced locally within the solid shell of our globe, by transformation of the mechanical work of compression or crushing of portions of that shell, which compressions and crushings are themselves produced by the more rapid contraction by cooling of the hotter material of the nucleus beneath that shell, and the consequent more or less free descent of the shell by gravitation, the vertical work of which is resolved into tangential pressures and motion within the shell." Mr. Mallet's mode of estimating the amount of heat derivable from crushing a cubic foot of rock was explained, and it was accepted as a postulate, that the heat developed by crushing one cubic foot of rock would be sufficient to fuse 0·108 of a cubic foot of rock; or, in other words, that it would require nearly the heat developable by crushing ten volumes to fuse one. Mr. Mallet considers that the heat so developed may be localised. But Mr. Fisher inquires why, since the work is distributed equally with the crushing, the heat should not be so also; and, since no cause can be assigned why one portion of the crushed portion of rock should be heated more than the rest, assumes that all which is crushed must be heated equally. In short, he is of opinion that if Mr. Mallet's theory were true, the cubes experimented upon ought to have been themselves fused. After paying a just tribute of admiration to Mr. Mallet's elaborate and highly important experiments upon the fusion and subsequent contraction of slags, the author remarked upon Mr. Mallet's estimate of the probable contraction from cooling of the earth's dimensions, showing that it had been based on untenable assumptions. (The author of the paper, however, holds that the contraction of the dimensions of the globe has been greater than *mere* cooling will account for.) Upon the concluding portions of Mr. Mallet's paper, in which

he estimates that the amount of energy afforded by the crushing of the solid crust would be sufficient to account for terrestrial vulcanicity, some strictures were made; but it was held that, if the main proposition had not been proved, these calculations were not of essential importance.

Meteorological Society, May 19.—Dr. R. J. Mann, president, in the chair.—The following papers were read:—On some practical points connected with the construction of lightning conductors, by Dr. R. J. Mann. This paper dealt especially with the material and dimensions of conductors, the nature and influence of points, the essentials of earth contacts, connection with metallic masses forming a part of the construction of buildings, the power of induction in producing return shocks, the dangerous action of metal chimney-pots upon unprotected chimney shafts, and the facility with which houses may be efficiently protected when the defence is made part of the original design of the architect. The conditions which were finally insisted upon as indispensable to efficiency of protection were:—1. Ample dimension and unbroken continuity in the lightning rod. 2. Large and free earth contacts, with frequent examination by galvanometers of the condition of these to prove that they are not in process of impairment through the operation of chemical erosion. 3. The employment of sufficient points above to dominate all parts of the building. 4. The addition of terminal points to the conducting system wherever any part of the structure of the building comes near to the limiting surface of a conical space having the main point of the conductor for its height, and a breadth equal to twice the height of that point from the earth for the diameter of its base. 5. The avoidance of all less elevated conducting divergencies within striking distance of the conductor, and especially such dangerous divergencies of this character as gas-pipes connected with the general mains, and therefore forming good earth contacts.—On certain small oscillations of the barometer, by the Hon. Ralph Abercromby. These small oscillations of the barometer (sometimes called "pumping") have long been associated with gusts of wind, but the precise nature of their action has not been determined. The author gives two examples as typical:—1. Window looking S., wind nearly S., in strong gusts. In this case the first motion of the barometer was always upwards about 0·01 inch, as if the effect of the wind being arrested by the house was to compress the air in the room. 2. A corner house, one window to S., another to W., wind S. in strong gusts. With the W. window open there were violent oscillations, but in this case the first motion was always downwards. On opening the S. window as well, the pumping ceased. The explanation seems to be, that the wind blowing past the W. window drew air out of the room, but when the S. window was opened as much air came in as was drawn out, and the pumping ceased. It is well known to medical men that many acute diseases are aggravated by strong winds; and the author has observed this distress to be associated with the pumping of the barometer. He suggests the following practical methods of palliation:—If windows can be borne open, try by crossing, or otherwise altering the drafts, to diminish the distress. When, as in most cases, windows cannot be open, all doors and windows should be closely shut, as well as the vent of the chimney, if there is no fire; and, if possible, the patient should be moved to a room on the lee side of the house.—Proposed modification of the mechanism at present in use for reading barometers so that the third decimal place may be obtained absolutely, by Mr. R. E. Power.

PARIS

Academy of Sciences, May 10.—M. Frémy in the chair.—The following papers were read:—On the substitution by approximation within determined limits of the relation of variables of a homogeneous function to two variables of another homogeneous function of the same degree, by M. H. Resal.—A letter by M. Faye, on the distribution of temperature on the sun's surface and the recent measurements of M. Langley.—Observations on the Pandaneæ of New Caledonia, by M. A. Brogniart.—On a locomotive on stilts instead of wheels, by M. Tresca.—On a law connected with the work performed by steam-engines, by M. A. Ledieu.—The President then welcomed M. Fleuriais, the chief of the party of observers sent to Pekin to observe the Transit of Venus. M. Fleuriais then read a detailed description of the work done by the expedition and of the journey, which was accompanied by many difficulties.—Observations on the epoch of disappearance of the ancient fauna of Rodrigues Island, by M. Alph. Milne-Edwards.—Memoir on the formulæ of perturbation, by M. E. Mathieu.—On some properties of algebraic curves, by M. Laguerre.—On the toxicological effects of the bark of *Mancône*, by MM. Gallois and Hardy.—On observations made with different Phylloxera, by M. Lichtenstein.—The Minister for Public Instruction transmitted to the Academy a letter, dated Capetown, Feb. 22, 1875, from M. Lanen, and containing interesting data regarding the fauna and the flora of the Kerguelen Islands. These data are due to the observations made by Dr. Kidder, a naturalist who was attached to the Transit of Venus party sent to those islands by the United States.—A note by M. Garnier, on the use of glycerine in the treatment of glycosuria.—On the theory of storms, a reply to M. Faye, by M. Peslin.—On the presence of sulphuric anhydride in the gaseous products of the combustion of iron pyrites; note by M. A. Scheurer Kestner.—On the quaternary lignites of Jarville, near Nancy, by M. P. Fliche.—M. d'Abbadie then spoke on the first results of observations made by M. de Rossi, on the microscopical movements of freely-suspended pendula.—M. Virlet d'Aoust, in relation to the recent catastrophe with the *Zenith* balloon, pointed out the danger in the quick passage through strata of air of variable densities.

May 17.—M. Frémy in the chair.—The following papers were read:—Meridian observations of the minor planets, made at the Observatories of Greenwich and Paris during the first quarter of 1875. The planets observed were the following:—1, 46, 49, 59, 33, 24, 67, 15, 18, 94, 103, 109, 134, 7, 124, 25, 47, 53, 54, 73, 84, and 101. This communication was made by M. Leverrier.—Observations by M. Leymerie, on a note of M. Trutal relating to a Pliocene deposit in the Eastern Pyrenees.—On the swimming-bladder of *Caranx trachurus*, and on the hydrostatic function of that organ, by M. A. Moreau.—On chemical and physiological ferments, by M. A. Müntz.—Experiments and observations relating to glutinous fermentation, by M. A. Baudrimont.—A note by M. de Tastes, on the theory of cyclones.—Anatomical, physiological, and pathological researches on the human ovum in its relation to the diseases of the fœtus, by M. G. J. Martin Saint-Ange.—Observations of the moon and of moon culminating stars, made at Melbourne Observatory, by Mr. Robert Ellery (communicated by M. Leverrier).—On mercury-cataracts, by M. C. Decharme.—A note by M. de Fonvielle, on the precautions to be used when making balloon ascents to a great height.

BOOKS AND PAMPHLETS RECEIVED

FOREIGN.—Zeitschrift für Wissenschaftliche Zoologie: Carl Theodor von Siebold, Albert von Kolliker, und Ernest Ehlers (Leipzig, W. Engelmann).—Jahrbücher für Wissenschaftliche Botanik: Dr. N. Pringsheim (Leipzig, W. Engelmann).—Recherches sur les Phénomènes de la digestion chez les Insectes: Felix Plateau (Bruxelles, F. Hayez).—Le Scoperte del Fusinieri. Influence de la pression de l'air sur la vie de l'homme. 2 vols.: D. Jourdanet (Paris, G. Masson).—Der Venusmond und die Untersuchungen über die früheren Beobachtungen dieses Mondes: Dr. F. Schorr (Braunschweig, Friedrich Vieweg und Sohn).—Etudes Premières et Secondes sur les seiches du lac Léman: F. A. Forel (Lausanne, Rouge et Dubois).—Repertorium für Meteorologie: Dr. H. Wild (Russia).—Annales de l'observatoire Physique Central de Russie: Dr. H. Wild (Russia).—Traversée du Détroit par le Capitaine P. Boyton. (Boulogne-sur-Mer, Charles Aigre).

CONTENTS