THURSDAY, MARCH 9, 1893.

THEORY OF THE SUN.

Théorie du Soleil. By A. Brester, Jz., Docteur ès Sciences. (Amsterdam: Johannes Müller, 1892.)

DR. BRESTER'S preliminary account of his new theory of the sun has already been noticed in our columns (NATURE, vol. xxxix. p. 492). The present volume is a communication to the Amsterdam Academy of Sciences, and gives a complete statement of the principles and their application to the various solar phenomena. The author is careful to point out that he has not contributed a single fact of observation himself, but is content to rely on the work of others. Nevertheless, he is evidently a most careful student, and if his theory cannot be accepted, some of its points are well worth the attention of solar physicists.

Starting with the sun as a mass of incandescent vapours, it does not seem unreasonable to regard, with Dr. Brester, the conditions of such a mass of vapour from a purely chemical point of view. At certain temperatures combinations of some substances will become possible, heat will be developed, and various phenomena may be produced. Dr. Lohse[1] has already suggested that this kind of action might be the cause of the outburst of a new star.

Dr. Brester appears to unreservedly accept Mr. Lockyer's view, that many of the substances with which we are familiar in our laboratories are dissociated into their finer constituents at solar temperatures.

In accordance with the generally accepted notion, he also assumes the sun to be gaseous, and regards the photosphere as a shell of partially condensed matter. He rejects, however, the idea that the sun is in an almost constant state of agitation. Indeed, the unique point of his theory is that the sun is always in a state of perfect tranquillity, and that the so-called "eruptions" do not really indicate the actual displacement of matter, but simply the translation of the luminous condition. He boldly declares (p. 4) that "the solar eruptions do not exist," and looks to the known facts of chemistry to explain the multitudinous phenomena with which students of solar physics have to deal.

What Dr. Brester calls "New Astrochemical Principles" are stated as follows:—

Principle I.—All incandescent celestial bodies are tranquil in themselves, and their quiet interiors are such that the molecules of different densities, arranged by gravitation in concentric spheres, never lose their stratification.

Principle II.—The continued cooling of stars generally produces in their exterior layers an intermittent transformation of chemical energy in the form of heat, and thus produces periodical eruptions of heat.

Let us see how, with these premises, Dr. Brester treats some of the problems of solar physics.

The Formation of Spots.—According to the new theory, spots are openings in the photosphere produced by the heat developed in the chemical combination of dissociated molecules, part of the photosphere being evaporated when such an "eruption of heat" occurs. On this supposition the spot has the same temperature as the photosphere itself, the condition of things being somewhat similar to that of small pools of water in a mass of ice. Dr. Brester shows how this view gives an explanation of the proper motions and other phenomena of spots, but we must needs refer those interested to the book itself for full details.

The Stratification of the Sun's Atmosphere.—All solar physicists agree that in the solar atmosphere there is a stratification of some sort, but there are different views as to the exact nature of it. The old idea was that each vapour extended from the photosphere upwards, reaching to a height depending upon its density. This view had its birth in the observations showing that all the bright lines of the chromosphere appear to reach the photosphere, but Mr. Lockyer showed,[1] that as we have not to deal with a cross section in the observations, the same result would be obtained if the vapours were arranged in true shells. Mr. Lockyer follows up this important fact with the suggestion that the various layers are really concentric shells arranged according to their heat-resisting power, any particular substance finding its level where the temperature is just below that of dissociation for the vapour in question. Dr. Brester, however, goes back to the old view that the layers are arranged in the order of their specific gravities, but modifies it by supposing, with Mr. Lockyer, the vapours to lie in shells. Further, accepting the dissociation hypothesis, he regards some of these layers as finer constituents of what the chemists call elements.

Dr. Brester imagines that Mr. Lockyer's view demands that the most dissociated, and therefore the lightest molecules, should be found in the layers nearest to the photosphere, while the least dissociated, and therefore the heavier molecules, should appear in the outer layers. This, however, is not the case, according to our author; the lighter vapours, such as the hypothetical *helium* and hydrogen being furthest removed from the photosphere; while the heavier, such as iron, appear only in the lower levels. The whole subject has been very fully discussed by Mr. Lockyer in his "Chemistry of the Sun," and space does not here permit all the arguments to be restated. It may be mentioned, however, that, as Mr. Lockyer points out (p. 172), there is no evidence that the various metals are arranged according to densities; the case of magnesium and sodium is instanced, the heavier metal always showing the longer lines.

In a foot-note on p. 17 Dr. Brester states that the various elements need not always appear exactly in the order of their specific weights, "Car la hauteur où seront encore visibles les molecules d'une matière quelconque ne dépendra pas uniquement de leur poids mais de leur nombre aussi." It is by this bare statement that he attempts to explain the great height to which the H and K lines of calcium have been shown by recent photographs to extend, and presumably also such cases as that of magnesium and sodium, which has already been referred to. It is unnecessary to say more on this point, as Dr. Brester practically renounces this point of his theory

[1] *Berlin Akad. Monatsb.*, 1877, p. 826.

[1] "Chemistry of the Sun," p. 305.

The problem of the stratification of the sun's atmosphere does not, therefore, appear to have been advanced by his discussion of the various observations.

Dr. Brester's view of the solar surroundings leads him to suppose that the concentric layers which he postulates are ellipsoidal, so that the photosphere cuts different shells in different latitudes. The fact that there is an equatorial extension of some sort is abundantly demonstrated by eclipse photographs. In the application of this view to the explanation of some of the phenomena presented by the sun Dr. Brester displays considerable ingenuity, and we may refer to some of them, as they suggest points which may have to be taken into consideration in other theories.

The Solar Rotation.—It is a matter of common knowledge that the equatorial regions of the sun, as indicated by the spots, rotate more rapidly than the regions in higher latitudes. On Mr. Lockyer's hypothesis, which supposes sun-spots to be produced by the fall of condensed materials from the cooler regions of the atmosphere, this is explained by the fact that such atmosphere is highest at the equator, and the spot-forming matter thus having a greater forward velocity previous to its descent, will have a greater angular velocity on reaching the photosphere. Dr. Brester's view is a modification of this. Taking for granted that the solar layers are ellipsoidal, and that the photosphere is an independent partially condensed shell, he points out (p. 44) that when the matter of any particular layer condenses to form a part of the photosphere, the increase of density will cause it to descend towards lower layers, and as it will retain its initial velocity, the angular velocity in its new position will be increased. In this way he explains the law of solar rotation, but on account of the absence of knowledge of the densities of the vapours near the photosphere, the question cannot be treated mathematically. On Dr. Brester's view this law applies only to the photosphere itself, the ellipsoidal layers all having the same angular velocity.

This he further applies to the reconciliation of the spectroscopic determinations of the velocity which have been made by Dunér and Crew. Dunér's observations practically confirm the law derived from the observations of spots, while those of Prof. Crew show no change of velocity with change of latitude. Dr Brester points out that most of the lines observed by Crew have been seen bright in the chromosphere, while those observed by Dunér have not been so recorded. Hence he concludes that the lines observed by Dunér are produced by the absorption of vapours actually lying in the interstices of the photosphere—and therefore indicating the same velocity—while those observed by Crew show only the uniform angular velocities of the ellipsoidal shells.

Changes in the Spectra of Sun-spots.—Dr. Brester's theory also gives an explanation of differences in the spectra of sun-spots at different parts of the spot-period. Observations have shown that at maximum the lines which are most widened in spot-spectra are chiefly lines of unknown substances, while at minimum they are chiefly lines of iron and other known substances. When it is remembered that there is a progression in latitude with the advance of the spot-period, Dr. Brester's view can readily be understood; the photosphere in each latitude will have a different composition, and hence change of latitude will be accompanied by change of spectrum. It is only fair to say that the exact nature of this change has not yet been fully investigated, and hence the explanation offered cannot strictly be put to the test. Broadly speaking, however, it is evident from what has already been said, that if Dr. Brester's view be correct, there must be a layer of unknown vapours cutting the photosphere about latitude 15° (the latitude of spots near maximum), and layers of the vapour of iron, or some of its constituents, cutting the photosphere about latitudes 5° and 30° (the latitudes of spots at minimum). Before the view can be properly tested, it is clear that we must have further knowledge as to whether the iron lines widened in spots of high latitude at the beginning of a sun-spot period are identical with those widened in spots near the equator towards the end of the period, and, so far as we know, information on this point is wanting.

The Periodicity of Solar Phenomena.—Dr. Brester first of all dismisses the suggestion of planetary disturbances as the phenomena usually seen are too irregular to be consistent with orbital motion; and other views are also found wanting. He then shows how the second of the astrochemical principles already referred to appears to him to give the necessary explanation. As in our notice of his first essay, we may say that the main idea is that during eleven years the integrated effects of the various chemical combinations which have taken place are such as to very nearly restore the conditions which had existed at the commencement of the period. Slight differences would be produced each time, so that after a long interval wide differences might be expected.

Many other problems are discussed, and Dr. Brester has satisfied himself that his theory is competent to explain them all. Want of space, however, will not permit further reference.

The volume will be a valuable one, if only for the fact that it brings together a great mass of work which has been done in connection with the sun—over 300 authors being quoted—and although we are not prepared to accept his theory in all its points, it is fair to say that some of his arguments are extremely suggestive, and may help in time to unravel some of the mysteries of our central luminary.

In subsequent communications Dr. Brester will extend his theory to the phenomena presented by variable stars, comets, and other celestial bodies. A. F.

ELEMENTARY BIOLOGY.

A Course of Practical Elementary Biology. By John Bidgood, B.Sc., F.L.S. (London: Longmans, Green, and Co., 1893.)

THIS book deals with certain of the types of animals and plants which are included in other elementary works on the same subject. The forms selected are yeast, protococcus, bacteria, mucor, penicillium, chara, fern, flowering plant, amœba, vorticella, paramœcium, hydra, mussel, crayfish, and frog. The author states that "the subjects dealt with cover most elementary biological courses, but apparently do not exactly fit any." The work has, therefore, at any rate, the merit of not having been written merely from the point of view of any particular examination syllabus. A certain amount of originality is also seen in the attempt to combine a more general treatment of the subject with practical directions.

General instructions with regard to the microscope, microtome, and reagents, are given in the introduction; these, however, do not indicate a very wide personal acquaintance with the ordinary laboratory requirements, and the methods of preparation, &c., are mainly copied from Lloyd Morgan's "Animal Biology" and Howes's "Atlas of Practical Elementary Biology." The student is referred to a number of well-known text-books for further information, but it is curious that no mention is made of certain excellent elementary works treating more especially of the types described.

The part dealing with plants, which occupies rather more than half the book, is on the whole more satisfactory and contains fewer mistakes than that relating to animals. Most of the woodcuts in the former are taken from well-known sources, and a number of original figures are given of *Aspidium* and of *Lamium album*, which latter is selected as a type of the Phanerogams; the author has evidently worked out the structure of these forms with some care. In the zoological part many of Lloyd Morgan's diagrams have been utilised, and figures are also taken from various other text-books, such as Milnes Marshall's "Frog," Wiedersheim's "Comparative Anatomy," and Quain's "Anatomy." Most of those from the last-named work, with the corresponding descriptions, naturally do not refer to the frog at all, but this fact is not stated. Some of the drawings of invertebrates made by the author are very fair, though they do not indicate much originality; one or two others, such as that of an undischarged nematocyst of hydra, on p. 221, are bad. The sources from which borrowed figures are taken is not mentioned in all cases, although the contrary is stated in the preface.

The author shows very little power of selecting his facts, or of drawing conclusions from them in such a way as to clearly illustrate the general principles of the subject. Many of the details, moreover, are incorrect, and errors of the most serious character occur. It will be sufficient to refer to a few of these in order to indicate the author's looseness of expression and want of acquaintance of parts of the subject with which he deals.

The remarks on the structure and functions of the nucleus, and on the pulsating vacuole in protococcus (pp. 46 and 47) are, to say the least, misleading. This organism may, it is said, "be looked upon as a closed bag with a double wall—the outer of cellulose, and the inner of protoplasm" (p. 50), and the movements of its cilia "probably" drive it through the water (p. 48). The investment of the "spermocarp" of chara is called a "pericarp," and the pro-embryo a "prothallium" (pp. 88 and 89). The description of karyokinesis (p. 108) does not show much knowledge of recent observations. On p. 90, line 10 from top, the word "sexual" has by an oversight been printed as "several." The oosphere is confused with the fertilized ovum on p. 133, although the term oosperm is correctly used on previous and subsequent pages. The description of the part played by the nucleus in the processes of reproduction and conjugation in vorticella on pp. 211 and 212 is somewhat incomprehensible. One gathers on pp. 220 and 221 that it is comparatively easy to distinguish the nerve cells in hydra in preparations simply traced up in water and stained with methyl-blue, and in optical sections of the entire animal prepared with osmic acid. We may mention that it has recently been shown by Albert Lang that the bud in hydra is *not* "a product of both ectoderm and endoderm" as stated on p. 223. The Metazoa are said to be *all* "characterized by . . . the possession of a digestive cavity (*enteron*)" (p. 224). On p. 234 we read that the "kidneys (nephridia)" of the mussel are "sacculated organs whose walls carry a mass of tubules," and one gathers that the small irregular opening leading from the kidneys into the "ureter" is quite easy to recognise. Fig. 194A, representing the brain of the frog, is taken from the old figure by Ecker, in which the "olfactory lobes" are separated by a cleft, and the primary fore-brain is said to be the same thing as the thalamencephalon (p. 333). We do not see the object of introducing a description of the complicated human auditory apparatus in the chapter on the frog. The account of the processes of maturation, fertilization, and segmentation of the ovum of the frog is extremely incomplete and inaccurate, and one might even infer from one sentence on p. 331 that the nucleus was quiescent during the division of the egg! We are told that the ectodermic invaginations which give rise to the "nares" become "continuous with the mesenteron" (p. 335). The description of the development of the lungs (p. 334), together with the figure copied from Wiedersheim, refer to the mammal, and not to the frog. In the account of the development of the body-cavity (p. 335), it is said that the latter, "extended upwards through the lateral mesoblastic plates, nearly meets in the middle line beneath the notochord, and so pinches the alimentary canal with its glands into the body cavity"; and on page 333 it is stated that the notochord "pierces the mesoblast and divides it into right and left halves." The numbering of the *five* aortic arches given in Fig. 225, and that of the *three* mentioned in the text is incorrect (p. 336). We learn that metamorphosis begins soon after the development of the gills (p. 336). The account of the development of the urinogenital ducts on p. 338 is quite incorrect as applied to the frog. In Chapter XVIII. one gathers that the processes of digestion in all the Cœlomata are quite similar to those which occur in the higher forms, which are then briefly described.

Even if we accept the author's dictum that "he will know a good deal of botany who knows Chara and Lamium thoroughly," and give him full credit for having worked up some parts of the subject practically, we must remind him that a wider knowledge than this implies is advisable before attempting to write a book on general biology. After reading the preface and introduction, one is led to expect that the high ideal set up by the author as regards actual personal observation would at any rate have led him to examine carefully and accurately all the types described; it is very disappointing to find that this has not been the case. In conclusion we venture to repeat Darwin's advice as quoted on p. 200 of this book: "Give full play to your imagination, but rigidly check it by testing each notion experimentally."

W. N. P.

VAN'T HOFF'S "STEREOCHEMISTRY."

Stéréochimie. Nouvelle Edition de "Dix Années dans l'Histoire d'une Théorie." Par J.-H. van't Hoff. Rédigée par W. Meyerhoffer. (Paris: Georges Carré, 1892.)

THE second edition of this work was very fully reviewed in these columns in 1887 (vol. xxxvii. p. 121), and we will therefore content ourselves with noticing briefly the new matter contained in the present edition.

We must, however, premise that the stereochemistry of the carbon compounds is based on the assumption that the four monad atoms or groups satisfying the four affinities of a carbon atom are situated at the solid angles of a tetrahedron, the centre of which is occupied by the carbon atom itself, and on the allied conception of the "asymmetric" carbon atom—"asymmetry" arising when the four attached atoms or groups are dissimilar, in which case two enantiomorphic arrangements are possible for any given set of four such atoms or groups (see the notice already referred to). In the first French edition, which bore the title "La Chimie dans l'Espace," the author discussed the greatly increased possibilities of isomerism to which this new theory led. Since then chemists have used the theory as a guide in the search for cases of isomerism, and numerous new isomeric compounds have been discovered, the existence of which could not have been predicted as long as the old constitutional formulæ written in one plane were employed. The history of this branch of organic chemistry has, during the past seven or eight years, been one continuous triumph for the theory. One of the most striking proofs of the value of these stereochemical views is to be found in Emil Fischer's well-known researches on the sugar group. In the group of the glucoses of the aldehyde-alcohol type, for example, the presence of four asymmetric carbon atoms has to be assumed, and the theory predicts the existence of no fewer than sixteen isomerides with a normal carbon chain, as compared with the one form admissible under the older view. Several of the predicted forms have been prepared, and the relative distribution of the positive and negative asymmetric carbon atoms within the molecule has been determined by E. Fischer. This and other work confirmatory of the theory, is described and discussed in the present volume.

The theory of the asymmetric carbon atom owes its origin to the difficulty of otherwise explaining the optical rotatory power of various organic compounds. Quite recently, P. A. Guye has suggested that the numerical value of this optical rotatory power is dependent upon the relative masses of the substituting atoms or groups attached to the asymmetric carbon atom, and that if two of the four different substituting radicles are of equal mass the rotatory power will cease. He was unable to verify this view in all strictness, since, in the cases of this kind which he studied, such as that of methyl-ethyl-aldehyde $(C_2H_5)(CH_3)\,CH\,(COH)$, in which $C_2H_5 = COH = 29$, there was optical activity. The probable explanation is, that, as suggested by Guye, not only the masses of the groups, but also the interatomic distances, of which the atomic volume is a measure, come into play here. However, by varying the weight of a given group attached to an asymmetric carbon atom—thus, by substituting successively different homologous radicles—it was found possible to produce a concomitant variation in the rotatory power of the compound, to make it increase or decrease at will, and even to change its sign. This variation is shown in ascending the series of the esters of tartaric acid and its di-acetyl and di-benzoyl derivatives. But whereas the weight of the alkyl-group in the esters determines the amount of the rotatory power, no such influence can be perceived in the case of the metallic salts of tartaric acid, all of which display in solution the same rotatory power, irrespective of the atomic weight of the metal. The clue to this anomaly is furnished by the electrolytic dissociation theory of Arrhenius, according to which the dissolved salts are present in the form of their dissociated ions, so that, in the case of the dissolved metallic tartrates, it is the ion $CO_2(CH.OH)_2CO_2$ which is alone responsible for the rotation. Arrhenius's theory thus receives striking confirmation from an unexpected quarter.

The subject of compounds containing closed chains is fully discussed in the present edition, and the "cis" and "trans" isomerism discovered by von Baeyer is described.

The relative position of the substituting groups in the stereo-isomerides is also discussed.

The concluding chapter deals with the stereochemistry of nitrogen—a question which had not emerged when the previous edition was published. Some of the information given under this heading is rather meagre; but doubtless the omissions are intentional and they are largely compensated for by a very complete bibliography of the subject.

The work is in every sense authoritative, and we cordially recommend it to all interested in the most recent developments of organic chemistry. F. R. J.

OUR BOOK SHELF.

Die Fossile Flora der Höttinger Breccie. By R. von Wettstein. With 7 plates. (Vienna: Imperial Printing Office, 1892.)

THE Höttinger Breccia is a formation about 50 feet thick in the neighbourhood of Innsbrück, and situated about 1200 metres above sea-level. The upper part consists of about 35 feet of coarse conglomerate, with fossils chiefly confined to a bed some 3 feet thick, while the remainder is occupied by alternating beds a foot or two in thickness of white or reddish sandstones and breccias, which are for the most part very fossiliferous. It has been well known to collectors of fossil plants for upwards of thirty years, and though at first regarded as of tertiary age, is now uniformly recognised as quarternary, possibly inter-glacial, or more probably post-glacial. The lower part is characterised by the occurrence of many herbaceous plants, such as the violet, strawberry, coltsfoot, Prunella, &c., which are replaced above to some extent by *Cornus sanguinea*, *Rhamnus Frangula*, an alder, willow, &c., indicating, perhaps, a change in the forest growth without necessarily implying any considerable interval of time. The flora is almost wholly of existing species, and in the main does not differ essentially from that which might be found in a similar situation at the present day; but six of the species no longer flourish at such an altitude, and a few others, like the box, are absent in Northern Tyrol, while there are also indications in the relative sizes of the leaves of others that the climate was milder. Perhaps the Alps were less elevated and the sea nearer at the time, but interest is given to the problem by the undoubted presence of *Rhododendron ponticum*, which at present only flourishes in a much warmer climate far to the east, but, from its discovery in other localities, was evidently thoroughly indigenous in the Alps. The author regards the flora as a relic of the "steppe-flora" which then spread over the greater part of Europe, and of which numerous traces still exist, especially in Switzerland and Lower Austria, where plants of Oriental facies, such as the yew, box, holly, Ephedra, Sumach, hornbeam, feather-grass, maidenhair, &c., are its lingering remains.

The work is carefully prepared, doubtful determinations, except in the case of the Arbutus and a new buckthorn allied to *Rhamnus latifolia* of the Canaries, are eschewed, and the photographic illustrations, pencilled over by the artist, are extremely satisfactory. J. S. G.

Observational Astronomy. By Arthur Mee, F.R.A.S. (Cardiff: Daniel Owen and Co., 1893.)

THIS small book should serve the purpose for which it is issued; the object being to provide the beginner with an inexpensive treatise to enable him to become familiar with and interested in the practice of observational astronomy. For this reason the author limits himself to the purely descriptive side of astronomy, dealing with the sun, planets, comets, and meteors, giving numerous references where necessary. Short chapters are given on eclipses, transits, occultations, and "the sidereal firmament," the latter treating of double and coloured stars, &c. The chapter on the telescope contains many practical hints, besides numerous woodcuts, while that devoted to the moon is very pleasant reading, and gives a good account of the more general features. The illustrations, as will be gathered from the above, are very numerous, many of them being from the pen of the author himself. With respect to these, we must add that the one given on p. 72 of the Orion nebula does not remind us of the most beautiful object in the heavens, while on p. 66 Donati's comet is depicted minus the two long streamers which made this object so striking. The book concludes with a short obituary of the Rev. T. W. Webb and an appendix containing brief contributions from Denning on comets and meteors, Gore on variable and temporary stars, Seabroke on double star measurement, and a few others.

W. J. L.

Mechanics and Hydrostatics for Beginners. By S. L. Loney, M.A. (Cambridge University Press, 1893.)

THIS is the latest addition to the series of elementary text-books recently launched by Mr. Loney. The same high standard of excellence is maintained, and the author must again be congratulated on his efforts to place in the hands of a beginner a book which will give him correct ideas of the laws and principles which are included in a study of mechanics.

It consists of three parts, statics, dynamics, and hydrostatics, each part containing the usual chapters. If the reader should fail to understand the chapter on the laws of motion, he must attribute it either to his want of ability or the nature of the subject, for we fail to see how the author could improve his remarks on this part of the subject. We are glad to observe that the words "rate of change" find their way into the statement of the second law, for its definiteness is increased thereby. More than the usual care appears to have been devoted to the selection of suitable examples; some of them are exceptionally good, and thus add to the usefulness of the book. Occasionally the trigonometrical ratios are used, but their definitions will be found in the appendix; we are afraid, however, that the suggestion that their values for certain angles should be committed to memory is not a wise one. G. A. B.

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 intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Glacier Theory of Alpine Lakes.

THE letter of the Duke of Argyll against the theory of the formation of alpine lakes by glacial action shows such an amount of misconception of the theory itself, and so completely ignores the great weight of evidence in its favour, that a few words on the other side seem desirable.

The Duke says that glaciers "do not dig out," do not "act like a ploughshare," but, when moving down a slight incline do "scoop," as well as rub down and abrade. No observer of glaciers has ever stated, so far as I know, that they do "dig out," and it is equally erroneous to say that they "scoop," for that implies that it is the end of the glacier that acts. But the end is its weakest point, where it is melting above and below, and where consequently it can do practically nothing. The whole action of a glacier is a grinding action, and its grinding power is greatest where it is thickest, and where, consequently, it presses on the rocks with the greatest weight. The result of this grinding is seen in the muddy stream issuing from all existing glaciers; while the well-known "till" is the product of the rock grinding mill of ancient glaciers and ice-sheets.

Notwithstanding the Duke's disbelief in ice-sheets I venture to think that their former existence has been demonstrated both in Scotland and Ireland; but leaving this point, I wish to make a few remarks on the extreme inadequacy of the earth-movement theory to account for the facts. In the first place it is certain that no alpine lake can possibly have a long life, geologically speaking. In the course of a few thousands of years, certainly in less than a hundred thousand, all alpine lakes would be filled up by the sediment brought into them. It follows that all the existing lakes must have been formed about the same period, and that, geologically, a very recent one, and corresponding approximately with that of the well-known glacial epoch. But if these lakes were all formed by earth movements, either just before the glacial epoch came on, or during its continuance, or afterwards we have to explain the remarkable fact that such movements only occurred within the limits of glaciation, never beyond those limits. In Wales, Cumberland, and Scotland, in the Alps, in Scandinavia, in Finland, in the northern United States and Canada, in Mongolia and Thibet, in Tasmania and New Zealand, we have thousands of rock-basin lakes, amid palpable signs of glaciation. But the moment we pass beyond the glaciated districts, mountain lakes abruptly cease. There are hardly any in Spain, none in the Great Atlas, none in Sardinia or southern Italy, except in the volcanic areas and away from the mountains, none in any of the West Indian islands with their fine mountain-ranges, none in the peninsula of India or in Brazil. And there is exactly the same distribution of fiords. We have them in Norway, in West Scotland, in Alaska, in South-West America, and in New Zealand, all characterised by deeper water within than at their outlets, and all in glaciated countries, but nowhere else in the world.

Now it is simply impossible to believe that at a very recent period there should have been earth-movements of such a character as to produce lakes, but always in glaciated districts and never beyond them, unless the movements were a result of the glaciation. This has not, I believe, been yet suggested; but, in view of the modern theory that any considerable loading of the surface produces subsidence, it is at least a possible explanation. But there are some important facts that seem more in favour of the grinding out of the lake-basins by the enormous weight of ice accumulated over their sites during the height of the ice-age. Looking at a geological map of the Alps it will be seen that most of the lakes are more or less bordered by tertiary or secondary rocks. Lakes Annecy and Bourget are in miocene and eocene; the lake of Geneva on the north side is miocene or jurassic; the lake of Neuchatel, miocene; lakes Thun and Brienz, eocene or jurassic; lake Lucerne, eocene and miocene; lakes Zug and Zurich in miocene; lake Constance miocene; lake Maggiore is mostly in gneiss, but it is very suggestive that it is here comparatively shallow, but becomes suddenly deeper and reaches its maximum depth in its lower portion where it is bordered on the east by the jurassic beds; lake Como also has its greatest depth in triassic rocks, the upper portion, where gneiss prevails, deepening gradually southward as in a submerged valley. Equally suggestive is the fact that in the eastern Alps of Tyrol and Carinthia, where gneiss, porphyry, and the older stratified rocks prevail, and where glaciers are not now so extensive, there are hardly any lakes, except on the northern borders, where a considerable number occur in eocene, cretaceous, jurassic, or triassic formations.

These various facts as to the distribution of alpine lakes—their almost total absence in all parts of the world outside of glaciated districts, and within glaciated districts their prevalence in the newer and more easily denuded rocks—are what have to be explained by the advocates of the theory of earth-movements, and this, so far as I am aware, they have never attempted to do. Equally important, and equally difficult to explain on the earth-movement theory, is the fact that alpine lakes are almost always situated just at those spots where, by means of converging valleys, the glaciers would become heaped up and attain their maximum thickness, or where there is good evidence that they have been very thick; and it is the grinding power of this enormous weight of ice, acting differentially as regards the softer and harder rocks, that has worn out hollows in pre-existing valleys now occupied by lakes. In almost every case, too, it will be seen that there is a constriction or narrowing of the valley towards or beyond the lower end of the lake, which, by preventing the free escape of the ice, has increased its thickness and grinding power.

In the presence of such important series of facts as those here referred to, mere opinions, or even small and detailed cases of difficulty, can have no weight; but there is yet another consideration, which most geologists will admit is antagonistic to the earth-movement theory. The whole tendency of geological observation is in favour of the usually very slow rate of earth-movements, while it is equally in favour of the comparatively rapid action of denudation by running water. But in order that earth-movement could form a lake, it would be necessary that the rate of elevation or depression should be so great that the river could not keep pace with it by cutting down its channel; and, considering that all the rivers in question are rapid mountain streams carrying great quantities of sediment, this will be admitted to be a very improbable supposition. But when we add to this the still greater improbability that such rapid earth movements have occurred in scores and hundreds of cases, all at about the same time, geologically speaking, and all just in those spots where it can be shown that during the glacial period ice must have accumulated, and where the rocks were of such a character as to admit of being ground away; and yet further, that no similar earth movements producing similar results have recently occurred in any part of the globe beyond the limits of glaciation, the whole assumption becomes so hugely improbable as to render the theory of lake-formation by ice-grinding easy in comparison.

Sir Charles Lyell considered that the gravest objection to the glacial-erosion theory was the entire absence of lakes where they ought apparently to exist; and he instanced the valley of Aosta and the Dora Baltea, the glacier of which produced the enormous moraines of Ivrea. The valley of the Rhone above Martigny may be adduced as another example of the absence of lakes where they might be expected. But this kind of difficulty will apply to many other valleys, and can only be answered by general considerations. In both these cases the valleys are comparatively broad and open, and have a rather rapid descent. It is probable, therefore, that the ancient glacier in both was of a nearly uniform thickness, so that its wearing action on the floor of the valley would be tolerably uniform. To produce a lake we require essentially a differential action. There must be much more rapid degradation in one part than in another, due either to greater ice-accumulation or to softer rocks in one part than in another. In both the valleys referred to there is much uniformity in the rock-formations throughout, and even if some lakes or chains of lakes had been formed, the enormous amount of debris still brought down may well have filled up and altogether obliterated them. The absence of lakes in certain valleys cannot be considered an argument of any value until it is ascertained by borings that none have been formed and filled up again. It must also be shown that the whole conditions are such as to produce that amount of differential grinding down, without which no lake can be expected to have been formed.

It certainly seems to me that all the facts, all the probabilities, all the converging lines of evidence, are in favour of the glacial theory, to which the only serious objection is the assumption that glaciers cannot move uphill. But that they can do so, and have done so, is now admitted by most students of glacier-motion. Mr. Jamieson, and other Scotch geologists, have proved that glaciers, over 2000 feet thick, have travelled up lateral valleys, and up the slopes of many hills and mountains; and when we consider that the Rhone glacier was 5000 feet thick just above the lake of Geneva, and more than 2000 feet thick where it abutted against the Jura, we can have no difficulty in admitting that it might have travelled up the very gentle slope of the lake bottom, which appears to be less than 100 feet in a mile in its steepest parts.

ALFRED R. WALLACE.

Waves as a Motive Power.

HAVING frequently observed the swimming motions of the fishes in our Aquarium—and occasionally of porpoises in the open sea—I have tried to make use for propelling boats of the same principle of locomotion, as exemplified particularly in the tail-fin.

I fixed a fin (blade) of elastic material like a helm to the end of a canoe; moving that fin laterally to and fro, the same went forwards. I have since learned that this "motor" was used already twenty-five to thirty years ago by Ciotti, a Sicilian; it is of course only an exact version of the method of sculling with one oar, familiar to all boatmen. Whilst trying my canoe and models of boats I soon became convinced that a boat ought to move forward if elastic fins are fixed to it, directed backwards, in such a manner that their flat sides are pressed against the surrounding water, when the boat rolls and pitches. The elastic fins, whilst overcoming the resistance of the water, curve like the fins of a fish, driving the water backwards and consequently pushing the boat forwards.

The canoe was provided with two horizontal fins at the stern and two vertical ones at the keel, total surface 0·2 square metres; speed against rather sharp wind and waves estimated at 25 metres per minute. I was unable to take exact measurements, as the canoe was accidentally sunk before the experiment was complete.

I then provided another boat, three metres long, at each of the two pointed ends with a horizontal fin (later on two), and at the keel with two vertical fins; these were all made of steel sheet, 1 – 0·8 mm. thick, subsequently replaced with aluminium bronze. The boat covered, against a gentle sea and wind, the distance of 900 metres in 25 minutes. Putting the fins obliquely the boat turned towards the right or left; directing one group of the fins forward, and another of equal surface backward, their action was paralysed, and in similar manner it was easy to make the boat turn round on the spot or to move backward.

The changing of the surface of the fins (0·3 to 0·6 square metres) caused very little difference in the speed produced. The same movements of the boat take place if the rocking is caused artificially.

I undertook a series of trials, in which I wish to acknowledge with thanks the kind assistance of Mr. Nelson Foley. The first result was that the *rolling* yields so little power, (very little energy being sufficient to prevent rolling,) that the vertical fins as a source of power may be nearly neglected in the calculations.

As to *pitching*, the power resulting from the action of the waves against gravity is proportioned to (weight of boat with crew) × (number of undulations) × (height of waves). But only a small portion of the energy developed in moving the boat up and down acts upon the fins (surface of boat in water-line three square metres, surface of fins 0·3 to 0·6 square metres), and of this remaining available force a considerable portion is lost by the low efficiency of the fins. Supposing, for the sake of argument, the efficiency to be 25 per cent., the propelling capacity in a moderate sea works out to the fraction of a man's power.

Considering these circumstances it seems doubtful, even with considerable rocking and using boats of more advantageous forms than mine, if it will be possible to have a much higher speed than 2000 metres per hour. It appears also that the available force will be hardly sufficient to struggle successfully against strong winds and currents.

I do not therefore prognosticate too confidently any practical value to the motor, but should be very glad if some of your readers would inform me as to any similar experiments which may already have been made. H. LINDEN.

Zoological Station, Naples, February 19.

Blind Animals in Caves.

As a reader of Mr. Herbert Spencer's writings and a disciple of his, I shall be very glad to lift Prof. Lankester's glove. In the first place I would point out that the process he describes is not natural selection in the ordinary sense; natural selection is the death of the unfit and the survival of the fittest. In the suggested process neither the animals with perfect eyes, nor those with imperfect, are destroyed in the struggle for existence; they are simply segregated. But this is of minor importance. The question is whether there is any foundation for the hypothesis suggested.

Prof. Lankester supposes that the individuals born with defective eyes have remained in the dark places, while those with perfect eyes have followed the glimmer of light and escaped. But he has overlooked the fact that blind cave-animals are *born or hatched at the present day with well-developed eyes*. It is clear, therefore, as in every other case to which the law of recapitulation applies, that the variations to which the evolution is due occurred at a comparatively late period in the life of the individual. Why did not all the individuals escape when they were young, and could still see without spectacles? When the imperfection of the eyes did occur, what ground is there for assuming that it was a congenital variation? It seems to me perfectly certain that it was a deterioration of the eyes caused by the fact that the individual had lived in the dark all its life. In short, I hold that the law of recapitulation in development, the law of metamorphosis, or biogenetic law, as Haeckel called it, is itself a sufficient proof of the inheritance of acquired characters. This argument has never been met or even considered by any of those who talk of congenital fortuitous variations without defining them.

The evidence for the statement I have made is, I confess, not quite complete, but it is sufficient for my present purpose. In Semper's "Animal Life," p. 80, there is an account of *Pinnotheres Holothuriæ*, based on the author's direct observations. This species lives in the respiratory trees of Holothurians, and in the adult the eyes are degenerate and invisible on the exterior of the animal. The young is hatched as a zoæa with perfect typical eyes; even when it enters the host it retains its eyes, but afterwards the eyes degenerate and become covered over by the carapace. In the common mole, to take an instance among mammals, the optic nerves are degenerate in the adult, so that there is no connection between eye and brain; but in the embryo both eyes are connected with the brain by well-developed optic nerves. I am not at present acquainted with any observations on the young of Proteus, or the blind fish Amblyopsis, or the blind Crayfish of the mammoth cave, but I am quite confident that the young in all these cases have relatively well-developed eyes. At any rate Prof. Lankester to support his theory must prove that they are blind from the beginning; for if they are not then it is clear that the variations which we have to consider took place during the life of the individual living in the dark, and consequently the support of Prof. Lankester's suggestion vanishes. Prof. Lankester again writes of the deep sea as though it were as destitute of light as the mammoth cave, or the subterranean home of the Proteus, but this is notoriously not the case. With regard to fishes, Dr. Günther says that below the depth of 200 fathoms small-eyed fishes as well as large-eyed occur, the former having their want of vision compensated for by tentacular organs of touch, whilst the latter have no such accessory organs, and evidently see only by the aid of phosphorescence; in the greatest depths blind fishes occur with rudimentary eyes, and without special organs of touch. Dr. Günther mentions fifty-one species of fishes living at depths beyond 1000 fathoms, and among these only three *Aphyonus gelatinosus*, *Typhlonus nasus*, and *Ipnops Murrayi* are blind. It is, I think, sufficiently evident that the biology of the deep sea is quite different from that of subterranean caves or habitats. J. T. CUNNINGHAM.

Plymouth, February 27.

BESIDES panmixia and emigration of the more perfect-eyed individuals, as explained by Prof. E. Ray Lankester, allow me to suggest another cause for the dwindling of the eyes in cave-dwelling animals.

Prof. Weismann says that the degeneration "can hardly be of direct advantage to the animals, for they could live quite as well in the dark with well-developed eyes." I submit, however, that in a place permanently dark the eye is not merely useless, but, as a delicate and vulnerable part, it becomes a positive source of danger to the animal. No longer helping the creature to avoid obstacles or danger, it is, in proportion to its size, exposed to injury, destructive inflammation, and the attacks of parasites in a manner which must not seldom lead to the death of the individual. As other senses become more acute, and the eye recedes, this danger diminishes, and when the eye has become a mere rudiment, "hidden under the skin," its presence ceases to be a disadvantage, and so degeneration does not proceed to complete suppression.

It is a wonder that Mr. H. Spencer should have overlooked Prof. Lankester's explanation, for the English editor of Prof. Weismann's fifth essay has not failed to call attention to it.

Mirfield, February 27. A. ANDERSON.

[Darwin has himself drawn attention, in regard to burrowing animals, to the conditions pointed out in the above ("Origin of Species," 6th edition, p. 110).—ED.]

Foraminifer or Sponge?

I AM glad to find that Mr. Pearcey agrees with me in regarding *Neusina Agassizi*, Goës, as identical with *Stannophyllum zonarium*, Hæckel. But with respect to its systematic position I do not as yet see sufficient reason to differ from Prof. Hæckel in regarding it as a sponge, although I have never observed flagellated chambers and cells any more than he. The large masses of foreign bodies always present in this organism offer very serious difficulties in sectionising it, and as long as we are not absolutely certain about its cellular structure we are justified in thinking with Hæckel that general appearance and the presence of oscula, pores, subdermal cavities, horny skeleton, &c., are sufficient to characterise the form as a sponge.

Mr. Pearcey mentions six genera of Foraminifera which he thinks approach closely to *Stannophyllum*. I am sorry I cannot see much similarity. The chitinous lining in the tube-like body of some Foraminifera certainly bears not the slightest resemblance to the distinct fibrous stroma of *Stannophyllum*, which reminds me much more of the filaments of the true horny sponge *Hircinia*. If anything tells in favour of Mr. Pearcey's view, it is the concentric lines of *Stannophyllum*, which recall the foraminiferal rather than the sponge type of growth.

The final decision of this question can of course only be expected from an examination of the cell-structure.

University College, Liverpool, R. HANITSCH.
February 25.

A Magnetic Screen.

DURING the last vacation St. John's College, Oxford, has been lit with the electric light, and a transformer of the dynamomotor type, weighing over seven tons, has been placed within about sixty feet of the electrical testing room of the Millard Laboratory, which is furnished with several reflecting galvanometers. I greatly feared that the instruments would suffer much from the magnetic field of the large transformer. When it was found that no other space could be given up for the machine, I devised a method of construction which the Oxford Electric Lighting Company very kindly carried out for me when building their dynamo house. My method is to construct a wall of scrap iron round the three sides of the dynamo nearest to our laboratory. The iron wall is about eight inches thick, and is made by building two brick walls parallel to one another, and filling the interspace with scrap-iron; a delicate magnetometer used for testing the field at unprotected and protected points equidistant from the magnets, when the machine is in action and not so, shows that the iron wall is an effective barrier to the magnetic influence. I venture to make known this method of shielding off a magnetic field, because in these days of electrical invasion it may be of use in protecting physical instruments from being seriously disturbed, and rendered useless for any but the roughest determinations. FREDERICK J. SMITH.

Trinity College, February 28.

ON ELECTRIC SPARK PHOTOGRAPHS; OR, PHOTOGRAPHY OF FLYING BULLETS, &c., BY THE LIGHT OF THE ELECTRIC SPARK.[1]

II.

Going back now to the photographs, the next one was taken with the view of illustrating the effect on the inclination of the waves of the velocity of the bullet. In this case the bullet was aluminium; it was only one-seventh the weight of the regulation bullet. In consequence of its lightness it travelled about half as fast again as the ordinary bullet (not $\sqrt{7}$ times as fast as it would have done if the pressure of the powder-gases had been the same in the two cases), and in consequence of the higher speed the inclination of the waves is still greater than in the previous case. Further, in this case the bullet was made to pierce a piece of card shortly before it was photographed. The little pieces that were cut out were driven forward at a high speed, but, being lighter than the bullet, they soon lost a large part of their velocity; they had in consequence lagged behind when they were photographed, but though travelling more slowly (they were still going at more than 1100 feet a second) they yet made each its own air wave, which became less and less inclined as the bits lagged more and more behind; each, moreover, produced its own trail of vortices like that following the bullet. The well-known fact that moving things tend to take the position of greatest resistance, to avoid the effect of which the bullet has to be made to spin, is also illustrated in the photograph. The little pieces that are large enough to be clearly seen are moving broadside on, and not edgeways, as might be expected.

In order to illustrate the other fact that the angle of the waves also depends on the velocity of sound in the gas, I filled the box with a mixture of carbonic acid gas, and the vapour of ether, a mixture which is very dense, and through which sound in consequence travels only about half as fast as it does in air, and which will not explode or even catch fire when an electric spark is made within it, or directly act injuriously upon the photographic plate. The increased inclination of the waves is very evident in Fig. 10.

These waves, revealed by photography, have a very important effect on the flight of projectiles. Just as in the case of waves produced by the motion of a ship, which, as is well known, become enormously more energetic as the velocity increases, and which at high velocities produce as a matter of fact an effect of resistance to the motion of the ship of far greater importance than the skin friction, so in the case of the air waves produced by bullets; in its flight the resistance which the bullet meets with increases very rapidly when the velocity is raised beyond the point at which these waves begin to be formed. This being the case, I have thought it might be interesting to see whether the analogy between the behaviour of the two classes of waves might be even nearer than has already appeared, and on turning to the beautiful researches of Mr. Scott Russell, published in the Report of the British Association for the year 1844, in which he gives a very full report on water waves and their properties, I found that he had made experiments and had given a diagram showing what happens when a solitary wave meets a vertical wall. The wave, as would be expected, is, under ordinary conditions, reflected perfectly, making an angle of reflection equal to the angle of incidence, and the reflected and incident waves are alike in all respects. This continues to be the case as the angle gets more and more nearly equal to a right angle, *i.e.* until the wave front, nearly perpendicular to the wall, runs along nearly parallel to it. It then at last ceases to be reflected at all. The part of the wave near the wall instead gathers strength, it gets higher, it therefore travels faster, and so causes the wave near the wall to run ahead of its proper position, producing a bend in the wave front, and this goes on until at last the wave near the wall becomes a breaker.

In order to see if anything similar happens in the case

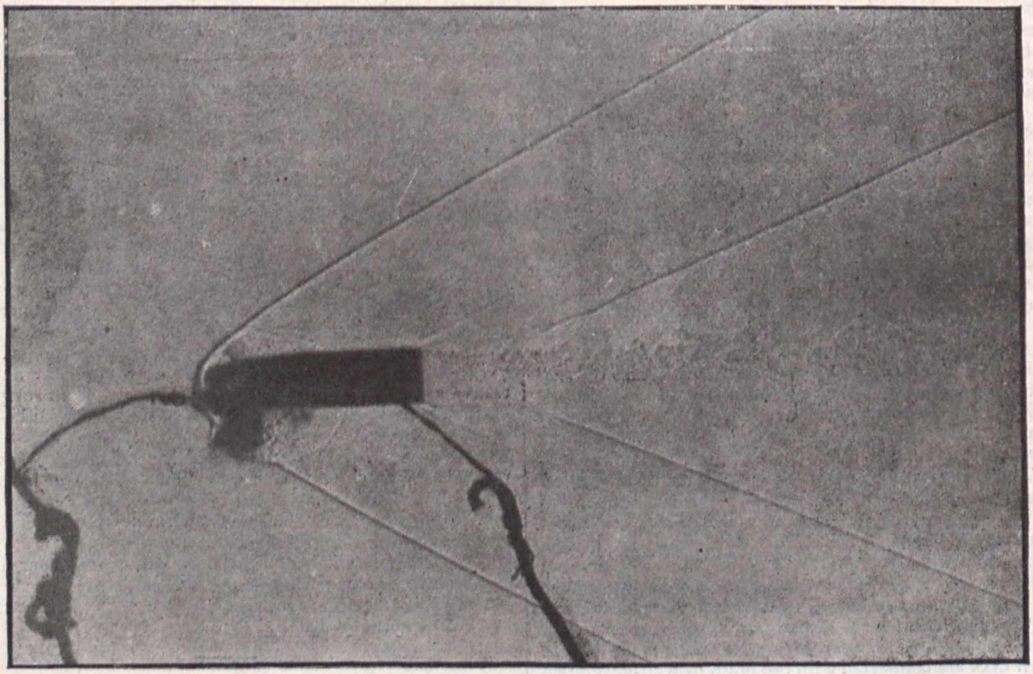

Fig. 10.

[1] Lecture delivered at the Edinburgh meeting of the British Association by C. V. Boys, F.R.S. Continued from page 421.

of air waves, I arranged the three reflecting surfaces of sheet copper seen in Fig. 11, and photographed a magazine rifle bullet when it had got to the position seen. Below the bullet two waves strike the reflector at a low angle, and they are perfectly reflected, the dark and the light lines changing places as they obviously ought to do. The left side of the V-shaped reflector was met at a nearly grazing incidence; there there is no reflection, but, as is clear on the photograph, the wave near the reflector is of greater intensity, it has bent itself ahead of its proper position as the water wave was found to do, but it cannot form a breaker, as there is no such thing in an air wave. The same photograph shows two other phenomena which are of interest. The stern wave has a piece cut out of it by the lower reflector, and bent up at the same angle. Now if a wave was a mere advancing thing the end of the bent-up piece would leave off suddenly, and the break in the direct wave would do the same. But according to the view of wave propagation put forward by Huygens, the wave at any epoque is the resultant of all the disturbances which may be considered to have started from all points of the wave front at any preceding epoque. The reflector, where it has cut this wave, may be considered as a series of points of disturbance arranged continuously in a line, each, however, coming into operation just after the neighbour on one side and just before the neighbour on the other. The reflected wave is the envelope of a series of spheres beginning with a point at the place where the wave and the reflector cut, growing up to a finite sphere about the end of the reflector as a centre; beyond this there are no more centres of disturbance, the envelope of all the spheres projected upon the plate, that is, the photograph of the reflected wave, is not therefore a straight line leaving off abruptly, but it curls round, as is very clearly shown, dying gradually away to nothing. The same is the case, but it is less marked, at the end of the direct wave near the part that has been cut out.

The other point to which I would refer is the dark line between the nose of the bullet and the wire placed to receive it. This is the feeble spark due to the discharge of the small condenser which clearly must have been on the point of going off of its own accord. The feeble spark precedes—or is to all intents and purposes simultaneous with, it cannot follow—the main spark which makes the photograph. The feeble spark heated the air, and the light from the main spark coming through this line of heated air was dispersed, leaving a clear black shadow on the plate. One spark casts a shadow of the other. Now it is evident that if the spark at the nose of the bullet had followed instead of having preceded the main spark by even so much as a three-hundred-millionth of a second, the time that light took to travel from one to the other, it would not have been able to cast a shadow. We have the means of telling, therefore, which of two sparks actually took place first, or perhaps the order of several, even though the difference of time is so minute. Perhaps this method might be of some use in researches

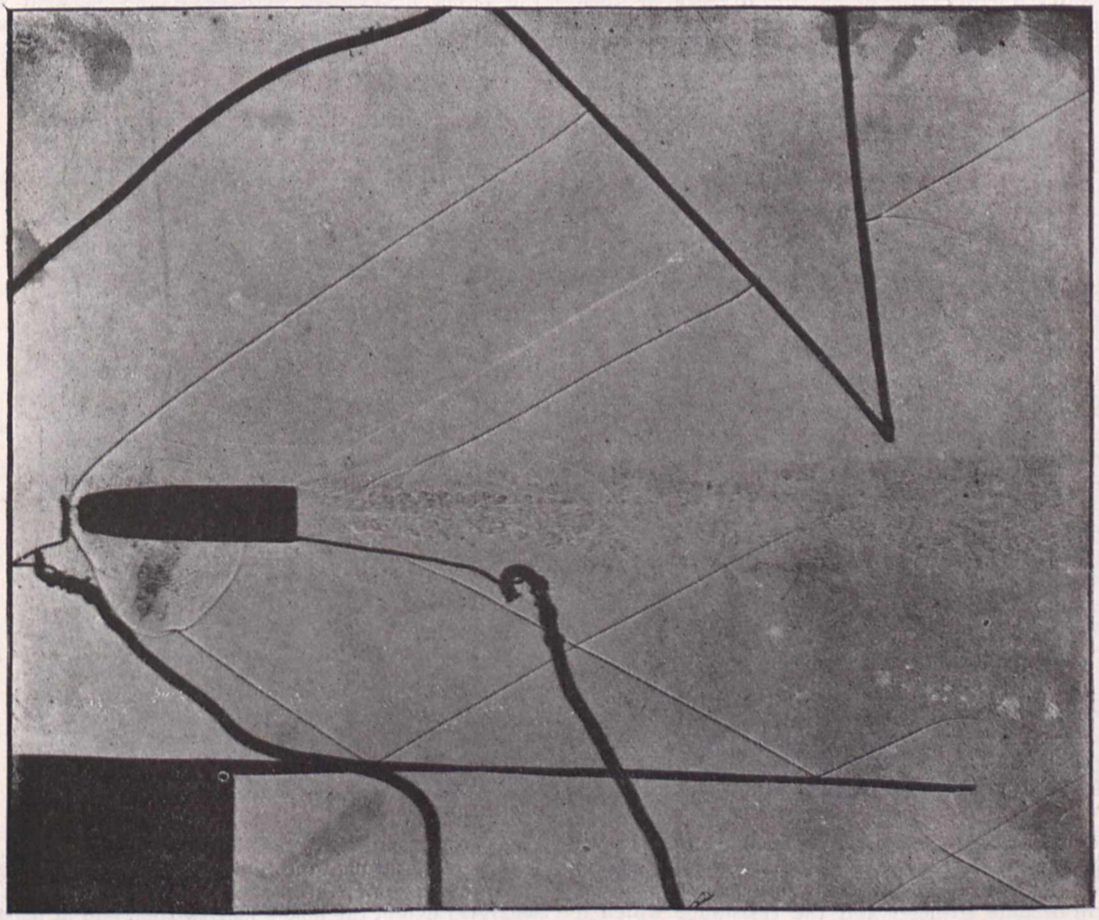

FIG. 11.

now attracting so much interest in connection with the propagation of electrical waves.

On returning to the non-reflection of the air wave in the upper part of the figure we have here, I imagine, optical evidence of what goes on in a whispering gallery. The sound is probably not reflected at all, but runs round almost on the surface of the wall from one part to another.

We are now in a position to see how the reflection or non-reflection of air waves produced by a passing bullet, when they meet with some solid body, may produce a practical result which might be of importance in some cases. Suppose a bullet to be passing near and parallel to a wall. Then if the velocity of the bullet and its distance from the wall are such that the head wave meets the wall at an angle at which it can be reflected, especially, as in the case of Fig. 11, if the reflected ray can only return into the path of the bullet after it has gone, then no influence whatever can be exerted upon the bullet by its proximity to the wall. If, however, the head wave would, if undisturbed, meet the wall at such an angle that it could not be reflected, as for instance, in Fig. 12, when the head wave can be reflected by neither of the walls between which the bullet is passing, obviously the wave will become stronger and the resistance which it offers will, I imagine, become greater, and if in this case the upper plate be removed this extra resistance will be one-sided and must tend to deflect the bullet. This is quite distinct from the well-known effect of a bayonet upon the path of a bullet; when a bayonet is fixed the rush of powder gases between the bullet and the bayonet is quite sufficient to account for the deflection which every practised marksman allows for.

I have devised a method by which a problem of some difficulty, about which authorities are, I believe, by no means in accord, may be solved with a fair degree of certainty. The problem is this, to find what proportion of the velocity of a bullet is given to it after it has left the barrel, or, what comes to the same thing, to find the position in front of the barrel at which the speed is a maximum. The cause of this is evident. When the bullet has left the muzzle the imprisoned powder gases, under enormous pressure, rush out, making a draught past the bullet of the most tremendous intensity tending obviously to drive it forward. While this draught does most assuredly hurry the bullet on its forward course, it does not tend to make it spin round any faster. Now if the bullet were not hurried on at all after it left the muzzle it would, travelling as in a screw of the same pitch all the way from the breach of the rifle up to the point at which it is photographed, have turned round a certain number of times which depend upon the distance travelled and the pitch of the screw. If, however, the longitudinal motion is hurried and the rotational is left unaltered the pitch will be lengthened outside the barrel and the rotation will have been less for any position than it would have been if the bullet had not been accelerated in this way. If, therefore, we can find to what extent the bullet has turned actually at the place at which it has been photographed, we can find the apparent rotational lag and so working backwards get a measure of the velocity acquired after leaving the muzzle. In order to accomplish this I drilled a series of holes transversely through the bullet, each one at an angle to the previous one, the whole series being such that to whatever extent the bullet had twisted, one at least, and perhaps two, would allow the light of the spark to shine through it upon the photographic plate. Then from the photograph it is easy to see through which hole the light shone, and knowing in what position this was in the breach, it is easy to find what fraction of half a turn over or above any whole number of half turns the bullet has twisted. Strictly the measure should be made at different distances to eliminate all uncertainty, but the only shot I have taken was sufficient to show that there was a rotational lag equivalent, according to the measure made by Mr. Barton, to something under a two per cent. acceleration outside the barrel. I do not attach any importance to this figure; the experiment was made with a view to see if the method was practicable and this it certainly is. I would recommend, where accuracy is required, that having found as above about how much the

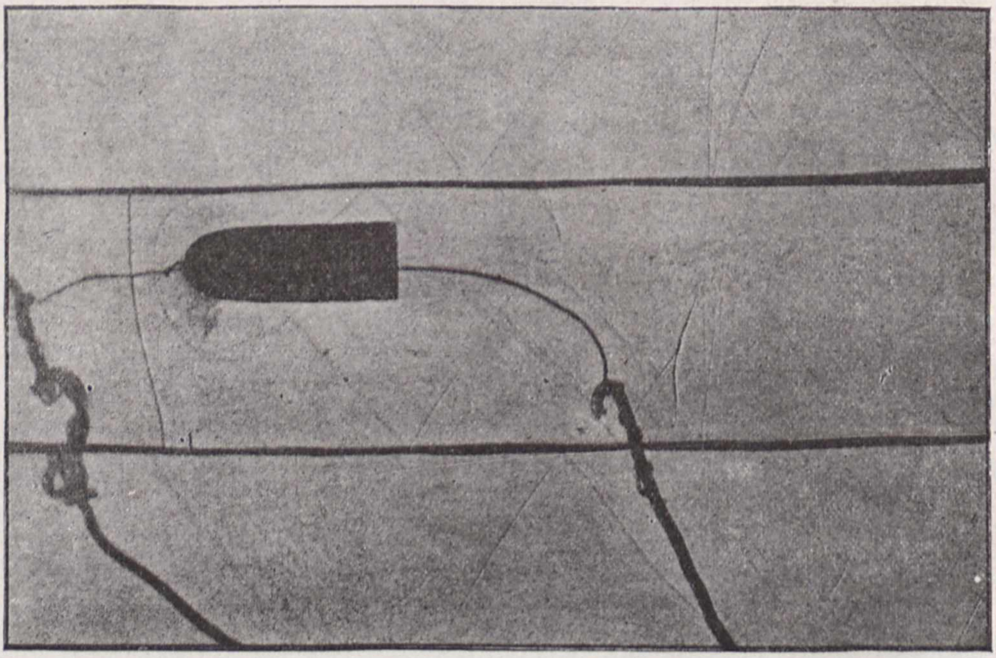

Fig. 12.

bullet has turned, that a second bullet should be drilled with a series of holes at about the corresponding position differing very slightly from one another in angular position, so that several would let the light through and thus give a more accurate measure of the rotation.

There is a point of interest to sportsmen which has given rise to a controversy which the spark photographs supply the means of settling. The action of the choke bore has been disputed, some having held that the shot are made to travel more compactly altogether, while others, while they admit that the shot are less scattered laterally, as may be proved by firing at a target, assert that they are spread out longitudinally, so that if this is the case the improved target pattern is no criterion of harder hitting, especially in the case of a bird flying rapidly across the direction of aim.

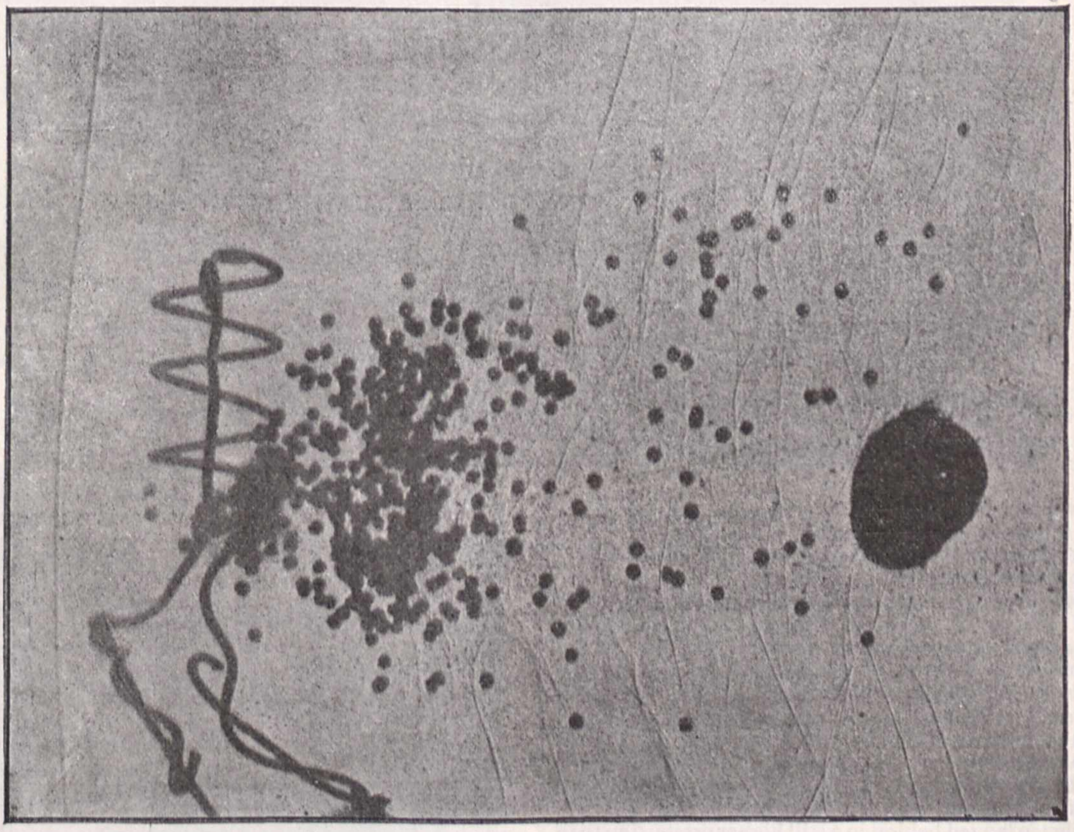

FIG. 13.

I was unfortunately not able, in the limited space and time that I have been able to employ, to take photographs of the shot at a reasonable distance from the gun, but I have taken comparative photographs at three or four yards only in which every shot is clearly defined, and in which it is even easy to see on the negative where the shot have been jammed into one another and dented. The difference in the scattering at this short distance is not sufficient for the results to give any information beyond this, that shot are as easily photographed as bullets, and that no difficulty need be apprehended in attempting to solve any question of the kind by this method. The photograph, Fig. 13, represents the shot from the cylindrical or right-hand barrel. The velocity now is so low that individual waves are no longer formed by each shot. The whole space, however, occupied by the shot is filled with air waves of the greatest complexity. They are not due to the cause already explained, but are, I believe, formed by the imperfect mixture of air with powder gases still accompanying the shot. The imperfect mixture of the two gases causes light to be deflected in its passage, thus producing striæ just as at the first mixing of whisky and water, striæ are seen (sometimes attributed to oil !), which disappear when the mixture is complete. I would mention, for the benefit of any one who may be tempted to continue these experiments, that a pair of wires such as are found to do so well when bullets have to be caught are not suitable, as one is sure to be shot away before such a bridge of shot is made between them as will allow a spark to pass. However, by using thick copper wires, one bent in the form of a screw, with the other along the axis, no such failure can occur and every shot that I have taken in this way has been successful. One can of course test the action of any material mixed with the shot. For instance, in one case I mixed a few drops of liquid oil with the shot and found them more widely scattered in consequence, not, as has been stated, held together by the oil as if they were in a wire cartridge. Of course, solid grease or fat may, and no doubt does, produce such a result, but liquid oil certainly does not.

And now I wish to conclude with a series of photographs which show how completely the method is under control, how information of a kind that might seem to be outside the reach of experiment may be obtained from the electric spark photograph, and how phenomena of an unexpected nature are liable to appear when making any new experiment. The result, however, is otherwise of but little interest or importance.

I thought I should like to watch the process of the piercing of a glass plate by a bullet from the first shock step by step, until the bullet had at last emerged from

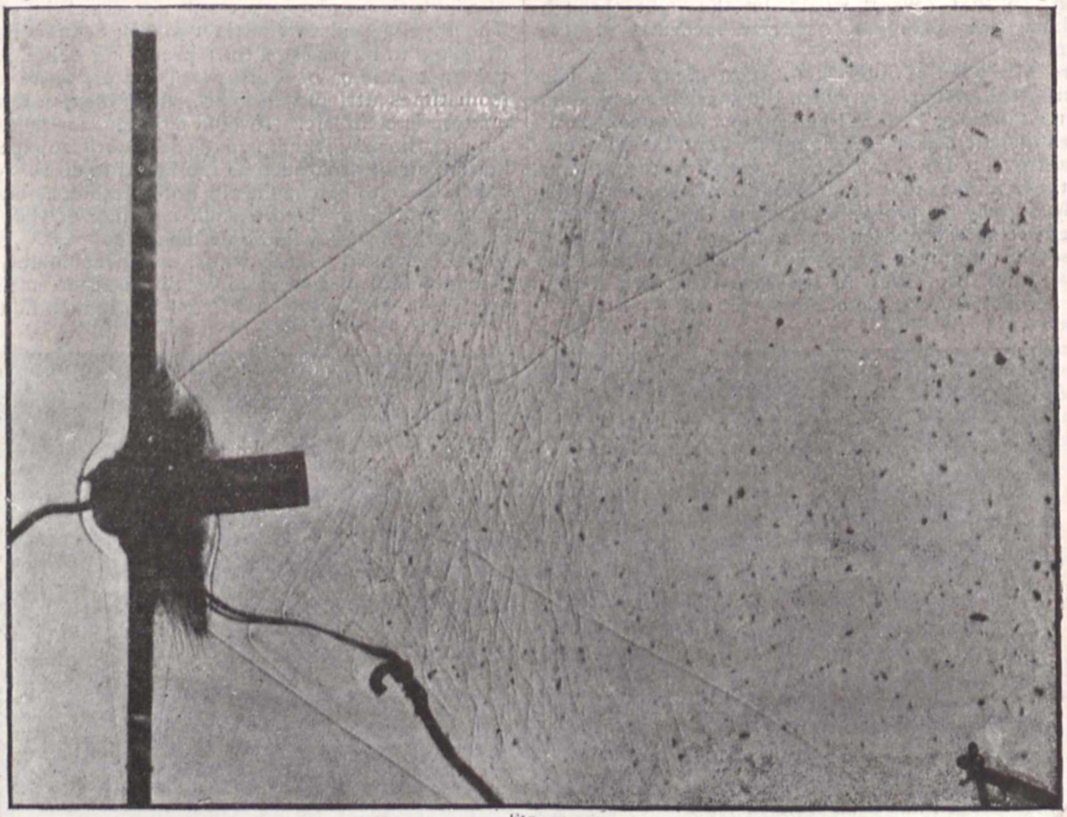

FIG. 14.

the confusion it had created. In Fig. 14 the glass plate is seen edgeways just after the bullet has struck it. It is clear at once that the splash of glass dust backwards is already four or five times as rapid as the motion of the bullet forwards. A new air wave is just beginning to be created in front of the glass-coated head of the bullet and two highly-inclined waves, one on either side of the glass, reaching about three-quarters of the way to the edge, have sprung into existence. These are more clearly seen in the next figure; meanwhile it may be well to point out that the fragments of paper which are following the bullets have in this case—as the card was much nearer to the glass plate than in those previously taken—some of them lost so much of their velocity and have in consequence lagged behind in a still higher proportion than the others, that they are travelling at less than 1100 feet a second; the more backward ones carry in consequence no air waves and there is no means of telling from the photograph that they are moving at all. In Fig. 15 the bullet has struggled about half way through the plate. The waves on either side of the plate have now reached the edge and are on their way back towards the centre again. They are caused in this way. When the bullet strikes the plate the violent shock produces a ripple or tremor in the glass which travels away radially in all directions, leaving the glass quiet behind. The rate at which this ripple travels may be found from the angle which these new air waves make with the plate, for taking any point on the plate and measuring up to the point where the air wave meets the plate and also the distance in air to the nearest point of the inclined air wave, we get two distances, the ratio of which is the ratio of the velocity of the disturbance in the glass to the velocity of sound in air. But much more than this is shown. An examination of the negatives or of a photographic print and even, but less clearly, of the print in the text shows that these inclined air waves are made up of a series of dark and light lines at a very slight

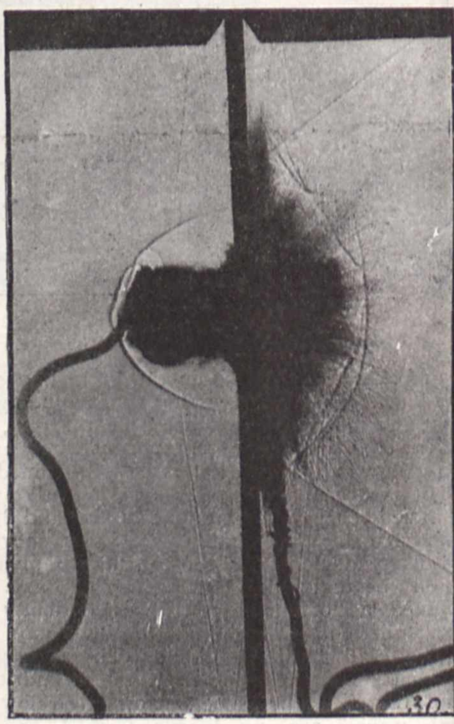

FIG. 15.

inclination to the air wave itself, so that as we travel

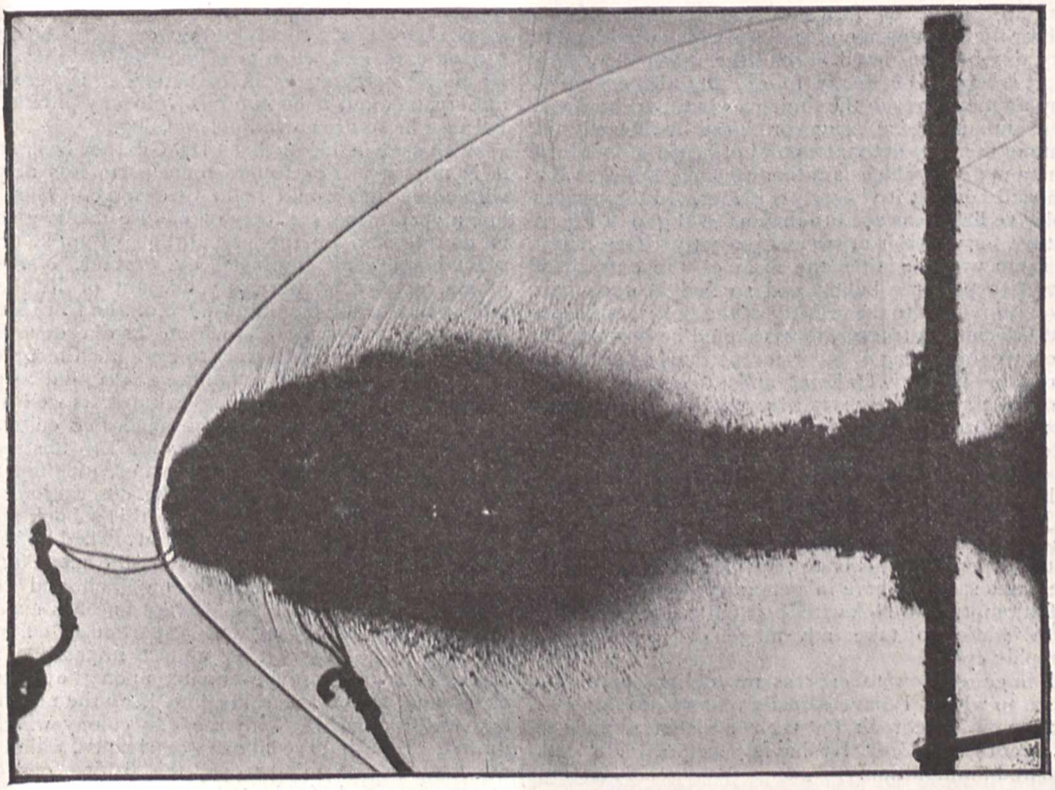

FIG. 16.

along the air-wave it is alternately dark outside and light outside. These indicate the successive positions in which

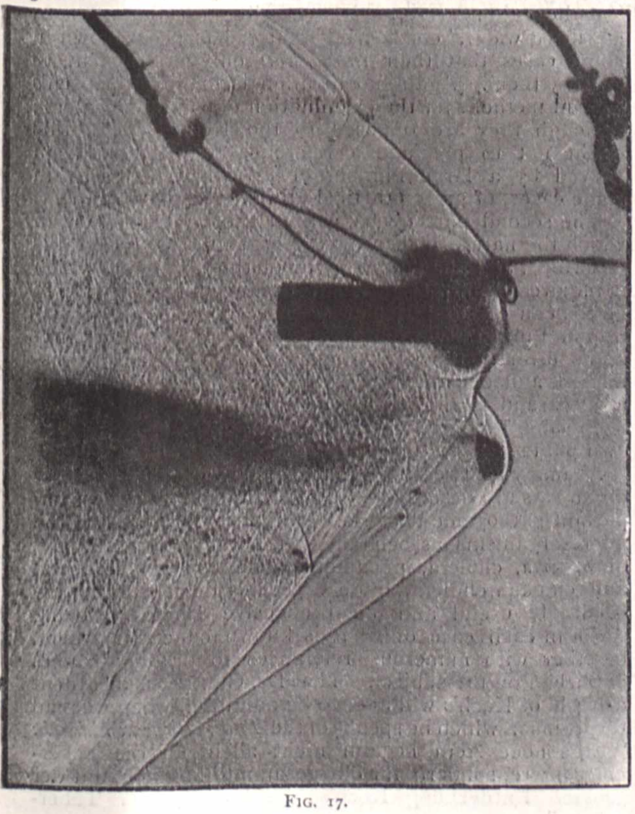

FIG. 17.

the glass first moved outwards to compress the air or first moved inwards to rarefy it so that the wave length of the ripple may thus be found, and finally it is seen that where the waves are waves of compression on one side of the plate they are waves to rarefaction on the other, indicating that it was a transverse and not a mere longitudinal disturbance that ran along the plate from the centre outwards and back again after reflection from the edge. In addition to this the fact that the reflected wave is still on its inward course proves that up to this time the plate is whole, as a wave cannot be propagated in a broken plate. Fig. 16 illustrates the state of affairs when the bullet has travelled about five inches beyond the plate. It has not yet emerged from the cloud of glass dust. The new head wave is very conspicuous. In the original negative, about half way between the bullet and the plate, the inclined waves due to the tremor in the glass plate may be detected, but they are too delicate to be reproduced by the printing process. They supply the information as to how long the plate remained whole or rather if the bullet had been caught a little sooner before these faint waves had lost so much of their distinctness they would supply this information with great exactness. Meanwhile the figure shows that the plate is now broken up completely. It is true it is still standing, and the stern air wave is seen reflected from the upper part of it, but this is because the different parts have not yet had time to get away; their grinding edges, however, have cast out from the surface little particles, and these are seen over the whole extent of the plate. After about fifteen inches the bullet is quite clear of the cloud of dust (Fig. 17); one piece only of the glass, no doubt the piece that was immediately struck, has been punched out and is travelling along above the bullet at a speed practically equal to its own. I am also able to show the plate itself in this and a still later stage, when at last the separate pieces have begun to be visibly moved out of their position and in some cases slightly turned round.

I have merely given this evening an account of a few experiments which in themselves perhaps are of little interest, but they at any rate show the capability of this method for the examination of subjects which would in the ordinary way be considered beyond the reach of experiment. It is hardly necessary to say that the examples given by no means reach the limit of what may be done, I have examined the explosions produced by fifteen-grain fulminate of mercury detonators and of heaps of iodide of nitrogen, a material which is rather unmanageable, as if a fly even walks over it it violently explodes. In these cases the explosive flash was used to make the B gap of Fig. 4 conducting, for which it answered perfectly. One might in the same way examine the form of the outrush of powder gases past the bullet, and so find at once their velocity with respect to the velocity of the bullet, and I see no great difficulty in tracing, if this should be desired, the whole course of a single bullet for perhaps as much as 100 yards by means of photographs taken every few inches on its way. Though it may not be evident that these or similar experiments are of any practical importance, there can be no doubt that information may be readily obtained by the aid of the spark photograph, as in fact has been shown by Prof. Mach, Lord Rayleigh, Mr. F. J. Smith, and others, which without its aid can only be surmised, and that if, as in other subjects, the first wish of the experimentalist is to see what he is doing, then in these cases surely, where in general people would not think of attempting to look with their natural eyes, it may be worth while to take advantage of this electro-photographic eye.

I wish in conclusion to express my obligation to the gentlemen to whom I have already referred, to Messrs. Chapman and Colebrook for their assistance, and to Messrs. Moore and Grey for having supplied me with weapons and ammunition.

MICRO-ORGANISMS AND THEIR INVESTIGATION.[1]

As the field of bacteriological investigation becomes extended, we have of necessity constant additions to the various methods rendering possible the pursuit of researches in these novel directions. We have only to look at the first edition of Hueppe's "Methoden der Bakterien-Forschung," published in 1885, consisting of 174 pages, and compare it with the bulky volume of 488 pages which forms the fifth edition, to see at a glance the advance which has been made in the matter of methods alone. In Flügge's "Die Mikro-organismen" we have another type of book, dealing exclusively with micro-organisms themselves, and the information which has been gathered together concerning them, whilst all details of bacteriological practice are purposely omitted. Dr. Günther has attempted a welding together of these two types of book, special attention being given to microscopical technique with which his name is indeed more particularly associated.

The first part is devoted to a survey of our knowledge concerning bacteria in general, commencing with the earliest observations of Leeuwenhoek in 1683. In this review we find an account of their morphology, the principles upon which their classification is attempted, &c., together with a detailed account of the most recent methods for their cultivation and subsequent study, including careful directions for the use of the microscope, and a most elaborate description of the available means for staining bacteria.

The second part is confined to a consideration of the best-known pathogenic and non-pathogenic micro-organisms.

There could not be a more admirable account of the numerous manipulations involved in bacteriological investigations; all the minutiæ are described with the utmost care, and what is usually left for the student to learn in "profiting by his experience" is here carefully anticipated, and if he tumbles into any pitfalls, it is not because he has been without warning.

With such a big task as Dr. Günther has set himself it is not surprising to find some parts less amply dealt with than they would seem to deserve. Thus we find but a very meagre supply of culture media given, there is no mention of the preparation of milk, or of the special solutions employed by Pasteur, Naegeli, and others, neither is there any account of Kühne's silica jelly, which since our knowledge of the fact that certain organisms will only flourish in media devoid of all organic matter, ought surely to have been included.

On the other hand a minute description is given of gelatine-plate, dish and tube cultures, as well as of the most modern methods for the anaërobic cultivation of bacteria, &c. In connection with the abstraction of certain colonies from gelatine-plates, mention may be made of a piece of apparatus (the description of which was only published after Dr. Günther's book appeared) originally devised by Fodor, and called "Bakterien-Fischer," which has been, under the name of "Bakterienharpune," more recently modified and considerably cheapened by Unna. Every one has experienced the difficulty of fishing out a particular colony in a crowded plate, how it is almost impossible to look through the microscope and fix upon the centre to be abstracted, and at the same time keep the needle steady and ensure touching only the one colony which is required. By using the above contrivance, which can be attached to the microscope, the fishing out of such centres is greatly facilitated.

The examination of air for micro-organisms is only very slightly touched upon, as is also the bacteriological investigation of water. It is a little rash to assert that "pathogenic micro-organisms can live for a long time in sterilised water," considering that it has been shown in some cases that their *immersion* only is sufficient to destroy them. Again, no mention is made of Hansen's special methods for the examination of particular waters; although they are opposed to the Koch school, this ought not to preclude a reference to what has been proved by a large number of investigations to be, in some cases, of great practical utility.

The second part opens with a short introduction, in which the nature of pathogenic organisms in general is described, and an account given of the rigid proof which is required before a particular organism may be said to be the cause of a particular disease. Protective inoculation and immunity are briefly referred to, and Metschnikoff's brilliant theories of phagocytosis summarily dismissed, and declared incapable of standing the test of the "careful experimental criticism to which they have been submitted by Flügge, Baumgarten, and the author's own pupils."

As many as twenty-seven different varieties of micro-organisms are described in the section on the most important pathogenic bacteria. Amongst these we find the micro-organisms associated with anthrax, tuberculosis, diphtheria, cholera, pneumonia, tetanus, typhoid fever, and chicken-cholera, more especially dealt with, an exceedingly useful and comprehensive summary being given in each case of what is known concerning them, together with numerous references to original papers published on the subject. That Dr. Günther is an ardent disciple of Koch's will at once be admitted, when we read the terms in which he speaks of the *Tuberculinum Kochii*: "Eine neue Aera begann nicht allein für die Tuberculoselehre, sondern für die gesammte Medicin, mit der grossen Entdeckung Koch's der Heilung der Tuberculose."

[1] "Einführung in das Studium der Bakteriologie." By Dr. Carl Günther. Second Edition. (Leipzig: Georg Thieme.)
"Technique Bactériologique." By Dr. R. Wurtz. Encyclopédie Scientifique des Aide-Mémoire. (Paris: Gauthier-Villars et fils, 1892.)

Amongst the non-pathogenic forms we find an account of the *Micrococcus agilis*, which was found by Ali-Cohen in drinking water. This was not the first motile coccus found, as is stated by Günther, for previous to this, Mendoza isolated and described a motile form which he called *Micrococcus tetragenus mobilis ventriculi*. The *Micrococcus agilis* was the second variety found; whilst later, in 1890, Loeffler also discovered and described a motile coccus. It is surprising, therefore, to read that Ali-Cohen's variety is the only motile micrococcus known. The list has further been quite recently (1892) enriched by the discovery by Maurea of a motile sarcina, which he has designated *Sarcina mobilis*.

A fine set of seventy-six photographs, mostly taken from original preparations, together with a very exhaustive index, completes the volume. Amongst the photographic figures the series of twelve representing anthrax in every stage of development from the individual bacteria to their appearance as colonies on gelatine-plates, and growing in test-tube cultivations, are particularly beautiful; the surface colonies photographed after forty-eight hours' growth are especially characteristic and successful.

In the handy little volume "Technique Bactériologique," of Dr. Wurtz, chief of the laboratory for experimental pathology in the Faculty of Medicine in Paris, we have an entirely different stamp of book. We read in his preface: "On ne trouvera, dans ce précis de Technique bactériologique, ni l'historique, ni l'exposé detaillé des nombreuses méthodes techniques qui ont été préconisées jusqu'à ce jour en microbiologie. Conformément au programme tracé par la Direction de *l'Encyclopédie Scientifique des Aide-Mémoire*, nous nous sommes efforcés d'exposer, aussi clairement que possible, les notions qu'un débutant doit posséder à fond avant d'aborder l'étude proprement dite des microbes."

Proceeding on these lines Dr. Wurtz gives us a very clear and precise account of all the various important stages passed through in bacteriological manipulations, commencing with a chapter on the principles of sterilisation.

But a novel feature in this volume is the description of the various methods of conducting experiments on animals for bacteriological purposes. This is carefully recorded and supplemented by woodcuts, and would appear to be a most useful addition, for although the possibilities of carrying out such experiments in this country are very limited, yet in those cases where they are permitted such an accurate description of the methods to be adopted should prove very helpful, more especially as in very few of the German and English bacteriological text-books is any account to be found for the information of those desiring to undertake such investigations. A chapter is also devoted to the enumeration of the substances, in as far as they have been investigated, which are elaborated by micro-organisms and a description of the most convenient methods for their successful extraction.

The crisp and concise language which characterises the book, together with the judgment displayed in its compilation, show that the author possesses, not only a full grasp of his subject, but is also highly skilled in the art of communicating it to others.

GRACE C. FRANKLAND.

THE ORDNANCE SURVEY.

A DEPARTMENTAL committee was appointed by the Board of Agriculture in April, 1892, to inquire into the condition of the Ordnance Survey. The committee consisted of Sir John E. Dorington, M.P. (chairman), Sir Archibald Geikie, F.R.S., Mr. Henry W. Primrose, Mr. William Mather, M.P., Mr. H. J. Roby, M.P., and Mr. Charles Fortescue Brickdale, with Major Duncan A. Johnston, R.E., as secretary. The matters referred to then were:—

1. What steps should be taken to expedite the completion and publication of the new or revised one-inch map (with or without hill-shading) of the British Isles?

2. What permanent arrangements should be made for the continuous revision and speedy publication of the maps—1 in 500 (towns), 25 in., 6 in., and 1 in. scales?

3. Whether the maps as at present issued satisfy the reasonable requirements of the public in regard to the style of execution, form, information conveyed, and price, and whether any improvement can be made in the catalogue and indexes?

After the appointment of the committee Mr. T. Ellis, M.P., asked in the House of Commons a question which showed that there was dissatisfaction with regard to the inaccuracy and incompleteness of the names of places in the map of Wales; and this question was also referred to the committee.

The report of the committee has just been issued, and includes the following recommendations:—

1. That the 1 in. map be produced in the following forms:—
(*a*) An engraved outline map, with contours in black.
(*b*) A black engraved map, with hill-shading either in black or in colour.
(*c*) A coloured map on thin paper, adapted to military purposes, but also on sale to the public.
(*d*) A cheap map by transfer to zinc or stone.

2. That the character of the roads on the 1 in. map be shown in four classes with distinct characteristics.

3. That parish boundaries be omitted from the 1 in. map.

4. That the contours of the sea bottom round the coast line and the depths of inland waters be shown.

5. That experiments be made in the practical application of heliogravure, and that, if results not inferior to an Austrian specimen map which we have seen be produced, that process be substituted for the existing method of engraving hills, and for so much of the country as is then uncompleted in its hill engraving.

6. That special arrangements be made to revise the 1 in. map within the next four years independently of the maps on the larger scales, and that subsequently this map be constantly revised within periods of fifteen years.

7. That the cadastral maps be revised and brought up to date in the next ten years, and that subsequently they be kept revised within periods of fifteen years.

8. That the publication of these revised maps be carried out by contract, if necessary.

9. That detail, such as single trees, footpaths in gardens, &c., be omitted.

10. That the skeleton and coloured forms of the 25 in. and town maps be abandoned, and the uses of both be combined in one edition having the houses cross-hatched.

11. That the reference numbers to parcels of land on the 25·344 in. plans be abandoned on revision.

12. That to a limited extent additional contour lines be added to the 6 in. map.

13. That on the 6 in. map the contours be always in black.

14. That certain of the engraved plates of the 6 in. map which are not now filled up beyond the county boundary be as soon as possible filled up to the margin of the plate with the detail of the adjoining county.

15. That the cost of the engraved sheets of the 6 in. map and that of the quarter-sheets of the photo-zincographed 6 in. map be equalised by a change of their respective selling prices.

16. That the Welsh names be gone over and corrected before the first revision of that map.

17. That the cadastral maps on the town scales be no longer entirely made or revised at the cost of the State, but that the town authorities be required by statute to maintain these maps.

18. That around towns and in tourist districts the existing sheets of the Ordnance Survey on the 6 in. and 1 in. scales be united so as to form special maps of such districts, and that advantage be taken of these maps to introduce any novelties in cartography that may be thought desirable, as these maps are not required to be joined to the general maps of the United Kingdom.

19. That certain authorities be placed under statutable

obligation to supply information to the Ordnance Survey Department in order to enable current revision to be better carried on.

20. That in future the term "revision" should be confined to the bringing up to date on its existing scale of a map already published, and that the term "resurvey" be applied to the operations necessary for the production of maps on a scale larger than that on which they were originally published.

21. That the Ordnance Survey Department be allowed to control its own supply of paper and printing material.

22. That the map on the scale of four miles to an inch be revised as soon as the 1 in. map is out of hand, and be completed with hill-shading.

23. That great freedom be allowed to private publishers desirous of bringing out other classes of maps than those specially published by the Survey Department, and that transfers of the maps on the 1 in. and smaller scales be supplied to publishers at cost price, a small sum being paid as an acknowledgment, and that all other reproduction of Ordnance Survey maps be prohibited.

24. That certain recommendations as to indices and catalogue be carried out.

25. That a book or pamphlet of information as to the Ordnance Survey be published, general in its main features and special for each county, containing the county indices or diagrams (on a reduced scale) and the information formerly contained in the parish area books, and also the table of parish areas now printed on the index of the 6 in. map, which table should in future be omitted from that map, and that copies of the small indices in this pamphlet be freely distributed for public information.

NOTES.

OWING to the large demand for tickets for the Croonian Lecture, which is to be delivered by Prof. Virchow before the Royal Society and their friends next Thursday, it has been decided to hold the meeting in the theatre of the London University, which has been lent for the occasion by the kind permission of the Senate.

THE public dinner which is to be given in honour of Prof. Virchow will be held on March 16, after the delivery of the Croonian lecture, at the Hôtel Métropole. Lord Kelvin will preside, and will be supported by the Presidents of the Royal Colleges of Physicians and Surgeons as vice-chairmen.

AT the Nottingham meeting of the British Association, over which Prof. Burdon Sanderson will preside, Lord Salisbury will be nominated president of the Association for the Oxford meeting in 1894. The following gentlemen have consented to act as presidents of sections at Nottingham:—Section A, Mathematical and Physical Science, Prof. Clifton, F.R.S.; Section B, Chemistry and Mineralogy, Prof. J. Emerson Reynolds, F.R.S.; Section C, Geology, Mr. J. J. H. Teall, F.R.S.; Section D, Biology, the Rev. Canon Tristram, F.R.S.; Section E, Geography, Mr. Henry Seebohm, Sec. R.G.S.; Section F, Economic Science and Statistics, Prof. J. S. Nicholson; Section G, Mechanical Science, Mr. Jeremiah Head; and Section H, Anthropology, Dr. Robert Munro.

AT the ordinary meeting of the Royal Meteorological Society, to be held at 25, Great George Street, Westminster, on Wednesday, the 15th instant, at 7 p.m., a lecture will be given by Mr. Shelford Bidwell, F.R.S., on some meteorological problems, which will be illustrated by experiments.

DR. R. THORNE THORNE, Medical Officer of the Local Government Board, and Mr. H. Farnall, of the Foreign Office, have gone to Dresden, the former as British delegate to the International Sanitary Conference in that city, the latter as assistant delegate.

THE students of the Royal College of Science propose to hold a conversazione in the South Kensington Museum on the evening of March 23 next. In the course of the evening Mr. Boys, F.R.S., will deliver a lecture on soap bubbles, illustrated by his own interesting experiments. The evening will be further enlivened by various public singers, and a selection of music will be played by the band of the Grenadier Guards.

IN reply to a question put by Sir Henry Roscoe in the House of Commons on Friday last with regard to the proposed new buildings for the Royal College of Science, Mr. Shaw Lefevre said:—"The accommodation at the Royal College of Science is now undoubtedly inadequate, and in my opinion new buildings must be undertaken at some early opportunity. Block plans were drawn up in 1891 by the professors of the Royal College of Science, showing a suggested appropriation of the land on the south side of the Imperial Institute Road, for the purposes both of the Royal College of Science and of the Science Museum, and these plans were submitted to the Office of Works; but that Department pointed out that it would be premature for them to consider the plans until the Science and Art Department had obtained the sanction of the Treasury to an organisation of their teaching and exhibition establishments on the scale contemplated in the plans. I understand that the Science and Art Department are now in communication with the Treasury in this sense." Sir H. Roscoe having asked when the report from the Science and Art Department would be issued, Mr. Shaw Lefevre said it was not in the nature of a report that could be issued to Parliament, but he should be happy to show it to the hon. member.

LAST week a meeting, convened by the Duke of Westminster as president of the Royal Agricultural Society, was held at 12, Hanover Square, to consider the best means of commemorating the completion of the first half-century of the agricultural experiments which have been continuously carried on by Sir John Lawes at Rothamsted since the year 1843. The Prince of Wales presided. On taking the chair his Royal Highness stated the objects of the meeting. The Rothamsted experiments had from the commencement been entirely disconnected with any external organisation and had been maintained at the sole cost of Sir John Lawes. For the continuance of the investigations after his death Sir John had recently made the munificent endowment of £100,000, besides the famous laboratory and certain areas of land, and had nominated some of the most distinguished men of science of the day to administer the trust. In view of all these facts, and the great national importance of the Rothamsted experiments, it was only fitting that some public recognition should be made of the invaluable services rendered to agriculture by Sir John Lawes and his distinguished colleague, Dr. Gilbert. The Duke of Westminster said they all hoped that Sir John might live for many years to continue to carry on these experiments for the benefit of agriculture. He had great pleasure in proposing the following resolution:—"That, having regard to the great national importance of the series of experiments which have been carried on at Rothamsted during the last fifty years, it is desirable that some public recognition should be made of the invaluable services thus rendered to agriculture by Sir John Lawes, and also by Dr. Gilbert, who has been associated with the experiments during the whole period. That, with this object, subscriptions, to be limited to two guineas, be invited from all interested in agriculture, whether scientific or practical." Mr. Thiselton-Dyer, F.R.S., seconded the resolution—not as an agriculturist, but as one officially and all his life deeply interested in everything that was concerned with botanical science. The extraordinary merit of the work carried on at Rothamsted lay in the fact that those experiments had been continuously carried on under uniform conditions for so long a period. He ventured to say, as a scientific man, that he knew nothing in the whole records of scientific research more honourable to this country than those experiments which were being carried on at Rothamsted with such self-denying skill. The resolution was then put by the chairman, and carried unanimously. Sir John Evans moved :—" That, in the opinion of this meeting, the testimonial might advantageously take the form of —(1) a granite memorial, with a suitable inscription, to be erected at the head of the field where the experiments have taken place; (2) addresses to Sir John Lawes and Dr. Gilbert, accompanied (if funds permit) by a commemorative piece of plate." This was also carried, and it was unanimously resolved that the following should be requested to act as a committee for carrying the resolutions into effect :—The presidents of the Royal, Royal Agricultural, Linnean, and Chemical Societies, the Earl of Clarendon, Viscount Emlyn, Sir John Lubbock, Sir John Evans (hon. treasurer), and Mr. Ernest Clarke (hon. secretary), with power to add to their number. The Duke of Westminster moved a vote of thanks to the chairman, and the Prince of Wales said, in response, that nothing had given him greater pleasure and satisfaction than to take the chair on that occasion, and to testify, as an agriculturist, his own sense of gratitude for what Sir John Lawes had done for agriculture. Subscriptions to the fund may be sent to any member of the committee, to Sir John Evans, F.R.S., at Nash Mills, Hemel Hempstead, or to Mr. Ernest Clarke, at 12, Hanover Square, W.

LORD SALISBURY presided over a meeting held at Oxford last week, in aid of the building fund of the Radcliffe Infirmary. He delivered a most vigorous address, in the course of which he said that at Oxford the difficulty connected with medical education was the reverse of that felt in London. In London the practical opportunities of exercising medicine were abundant, and the only care, or the main care, which pressed upon those who had charge of education in that respect was lest the more scientific basis of that practice should be neglected or receive inadequate attention. At Oxford, on the contrary, they had abundant means of teaching the group of sciences which were the equipment of the physician. But, necessarily, unless they made a great effort to that end, they should not have the means of presenting those opportunities of practical inquiry which were essential to the formation of the professional ideal, and which in large populations necessarily occurred with so much greater frequency. This movement—for so he looked upon it—on the part of the rulers of the University, to draw somewhat closer to the science of medicine, was only part of a larger movement which had been going on for some time, which, if he might use the scientific language of the day, was part of the evolution of education in our time. He begged to assure the assembly that he had no traitorous views with respect to the study of Greek. In fact he was inclined to say that in recent controversies the advocates of the classical languages had been unduly frightened, and that there was not the slightest danger that the study of them would ever pass from the education of youth or the culture of men of intellect. The issue was not between science and languages, ancient or modern; the issue rather was between the science whose chief food was gathered from observation and the science whose chief food was gathered from reflection. This older science was slowly, very slowly, but still quite evidently, giving way to the sciences which relied upon observation. He always thought that the science of medicine had scarcely received among us all the tribute which it ought to receive among sciences which rest upon observation. It was a curious fact that the whole tendency of scientific thought appeared to be rapidly concentrating itself upon the fields in which medicine reigned supreme. Those infinitely minute beings which certainly for health or sickness deeply affected our existence, and which were so essential to us that some able scientific men said that we consisted of nothing else, that we were not only a Republic, but were in a permanent state of civil war—these bacilli were attracting more and more the attention of the scientific intellect in Europe. It was dangerous to prophesy, but he did not think that any one who had watched the course of science would doubt that for the generation to come the investigation of these creatures, which had been revealed by new methods of research and by singularly patient labour, and upon which the lives of millions of human beings depended, would figure more largely in the scientific field than any other study. This was the special domain and privilege of medicine. He felt, therefore, that in commending this appeal to their consideration he was doing more than preaching a charity sermon. He was asking them to help that which contained the most brilliant promise for the intellectnal future of science in a University by which science ought to be cultivated and where science ought to reign.

AFTER Lord Salisbury's address various resolutions were adopted, among which was one, moved by Prof. Dicey, to the effect that the Radcliffe Infirmary, being the chief hospital for Oxford and a large surrounding district, should be brought into a state of efficiency corresponding with the recent advances in hospital management. Another resolution, moved by the Master of University, expressed approval of the committee's scheme, consisting of the removal of the sick from the old building into more modern wards and the renovation of the old building.

ON Saturday and Sunday last much damage was done in Sandgate, near Folkestone, by remarkable disturbances of land. The first disturbance was felt on Saturday at 7.45 P.M., when a rocking motion was noticed. This soon stopped, but later disturbances were so alarming that many people took their furniture into the streets. According to a correspondent of the *Times*, houses "slipped away from each other, leaving gaping sections," while in other cases the walls bulged out, and great rifts appeared in the ground. In the area affected by the disturbances most, if not all, of the houses are out of line and show cracking. Many of the inhabitants have been brought to great distress by the calamity, and appeals to the public have been issued on their behalf. An inquiry into the cause of the disaster was held at Sandgate on Tuesday by Mr. Walton, Local Government Board Inspector. After hearing evidence the Inspector said that an official report would be sent to the Board. What he had seen led him to conclude that the catastrophe was due to the sudden release of impounded subsoil water, a thing which he believed was remediable by the institution of proper water drains. If that was attended to there was no reason to suppose that such a disaster would ever recur. The *strata* were full of water, which the recent abnormal rainfall had served to increase. That water being released had formed kinds of caverns. The remedies were proper storm drains and intercepting drains, with free outlets under the road to the sea.

THE death of Ludwig Lindenschmit, the well-known German archæologist, is announced. He died at Mainz on February 14 in his eighty-fourth year. He was the director and one of the founders of the fine Central Romano-German Museum at Mainz, and one of the editors of the "Archiv für Anthropologie." Among his works are "Die vaterländischen Altertümer der fürstlichen Hohenzollernschen Sammlungen" and his "Altertümer unserer heidnischen Vorzeit." He began a "Handbuch der deutschen Altertumskunde," but completed only the volume relating to the Merovingian period. Lindenschmit was an enthusiastic advocate of the theory that the Aryan race is of European origin.

THE temperature during the past week has been generally very high for the season, the daily maxima frequently exceeding

55°, and even reaching 59° in the eastern counties on Sunday; whereas the average maxima for the month, deduced from twenty years' observations at the telegraphic reporting stations of the Meteorological Office, range from about 45° in the north to 50° in the south and south-east. During the latter part of last week several depressions skirted our north-west coasts, and rain fell generally every day, although the amounts measured were not great; but on Sunday the type of weather changed, especially over the southern part of the kingdom. An anticyclone advanced over our south-west coasts from the Atlantic, while the air became dryer and conditions more settled, although there was little sunshine in any part of the kingdom. There was a deep depression over Norway on Tuesday, while secondary depressions in connection with it were approaching the north-west of Scotland, and occasioning a return of stormy weather in the northern parts of these islands. From the *Weekly Weather Report* it appears that for the week ending the 4th instant the rainfall was above the average in all districts except the north of Scotland and the south of Ireland. Over the northern parts of England and the east of Scotland the excess was large, owing chiefly to heavy snowfall at the beginning of the period.

Among the various marine zoological stations which, on the initiative of that at Naples, have sprung up in recent years, the station at Trieste, on the Adriatic, holds an honourable place. It has been in existence nearly eighteen years. Dr. Claus states (*Naturw. Rdsch.*) that for its double function of instruction and investigation opportunity is afforded both to students and men of science. The students are, primarily, those of the professors of zoology at Vienna University, to whom the management is entrusted; also those of the Graz professor, who has a right to four places out of twelve. Students of other Austrian Universities are also freely admitted to work, and Austrian and foreign investigators. To each worker the ordinary reagents, besides the table, are supplied gratis; also the material, so far as it can be provided without special cost. The station further supplies living and preserved marine animals as specimens to the Zoological Institutes of the Vienna and Graz Universities, sending thither about 120 to 140 specimens annually. Other institutes are supplied on payment as arranged. The number of workers at the station has gone on increasing since it was opened in 1875. Of foreign investigators who have used it may be named Metschnikoff, Kowalevsky, A. Schneider, Selenka, R. and O. Hertwig, Keller, E. van Beneden, Fromann, Braun, and F. Cohn. The results of work carried on there are sometimes published independently, but they chiefly appear in the *Arbeiten* of the Zoological Institute of Vienna University, and the Zoological Station in Trieste, of which ten volumes have appeared. The *Denkschriften* and *Sitzungsberichte* of the Vienna Academy and the German zoological journals also witness to the activity of the station. The Austrian Government has liberally aided this useful institution.

The new number of the Journal of the Institution of Electrical Engineers contains a report of some very interesting speeches on a paper by Dr. Fleming on experimental researches on alternate-current transformers. The same number includes Mr. Preece's presidential address, from which we have given some extracts. The vote of thanks to the president for his address was proposed by Mr. Spagnolletti and seconded by Sir Henry Mance. Sir Henry said there was one point in the address which had struck him with dismay. That was the gradual increase of the teredo in the neighbourhood of our shores. This fact had been brought home to him that day by specimens of cable recently attacked by "the insect, or mollusc"; and it should teach them—what Mr. Preece had told them many years before—that they should not only survey the bottom of the sea for rocks and shoals, but should also examine it near the shores to find whether it was infested by that pest, which had damaged hundreds of thousands of pounds worth of cable.

The results of the solar, meteorological, and magnetical observations made during 1892 at the Stonyhurst College Observatory have just been issued by Father Sidgreaves. They take the commendable form of monthly and annual summaries, so that the most interesting results can be seen at a glance, and compared with the mean results of the last forty-five years. The range of barometer readings was only 1·724, or a quarter of an inch lower than the mean, while the range of the thermometer was seven degrees higher than the mean. The extreme range of the barometer recorded at this observatory is 3·13 inches. Sunshine was recorded for 207 hours in June, 202·1 in April, and only 172 in May. From January to April there is a regular increase, and from June to December a regular decrease, the falling-off in May being very conspicuous. 153 drawings of the sun have been added to the already splendid Stonyhurst series. An appendix contains the results of meteorological observations made at St. Ignatius College, Malta.

We learn from the *Botanical Gazette* that there are now as many as thirty-two botanical stations in the United States carried on by the various State Governments. The subject which receives most attention at these stations is that of the fungus and bacterial diseases of cultivated crops and of fruit-trees, and their treatment and cure. Some of them give attention to systematic botany, while others are investigating the life-history of certain fungi, or carrying on physiological work. A laboratory for the study of plant diseases has recently been fitted up in connection with the agricultural experiment station of the University of California at Berkeley. It has been arranged that a botanical survey of Nebraska shall be undertaken by the Botanical Seminar of the University of that State. The almost unknown flora of the north central portions of Idaho has recently been investigated, as we have already noted, by a commission acting under the auspices of the Botanical Division of the U.S. Department of Agriculture.

In the first part of Dr. Millspaugh's Preliminary Catalogue of the Flora of Western Virginia, published in the Bulletin of the Agricultural Experimental Station of Morgantown, a new feature has been introduced in a list of the rich fossil flora of the State.

Prof. Angelo Heilprin, of the Peary Relief Expedition, has presented to the Museum of the Academy of Natural Sciences, Philadelphia, the valuable collection of mollusks dredged by him in Greenland waters. They have not yet been studied, but the conservator of the conchological section, in his annual report, says he has ascertained the presence of a number of species not before in the collection of the Academy, of the genera *Margarita*, *Buccinum*, *Sipho*, and other Arctic groups. The specimens preserved in alcohol are in excellent condition for the examination of the soft parts.

Mr. J. W. Salter, writing to the *Zoologist* from University College, Aberystwith, says that on January 4 last he obtained a polecat about six miles south of Aberystwith. There is reason to believe, he says, that the species is by no means extinct in Cardiganshire.

The Pharmaceutical Society of Great Britain has issued a volume of papers, most of which describe the results of chemical investigations carried on at its Research Laboratory. The editor is Prof. W. R. Dunstan. The papers are reprinted from the Transactions of the societies to which they were communicated, namely, the Royal Society, the Chemical Society, the Pharmaceutical Society, and the Physical Society. Other volumes of a like kind are to follow.

THE new number of the Journal of the Royal Horticultural Society includes, besides papers on many other subjects, reports of conferences on the begonia and on apricots and plums. There is also a long series of extracts from the Proceedings of the society.

THE second part of the excellent "Canadian Guide Book," by Ernest Ingersoll, has been issued (W. Heinemann). It deals with western Canada, and the author has been at great pains not only to collect full and trustworthy information, but to present it in a clear and attractive style. There are maps and many illustrations.

THE results of an investigation concerning the nature and properties of metallic ruthenium, particularly with respect to the fusing point of this highly refractory rare metal, are contributed by M. Joly to the current number of the *Comptes Rendus*. M. Joly has accumulated no less than three kilograms of pure metallic ruthenium, and has consequently been enabled to carry out experiments upon it on a comparatively large scale. It will doubtless be remembered that ruthenium and osmium are the two most refractory of the metals of the platinum group. Deville and Debray only succeeded with great difficulty in obtaining a few minute globules of melted ruthenium with the aid of the oxyhydrogen blowpipe. The fusion of this metal is rendered very much more difficult owing to the readiness with which, at these high temperatures, it becomes converted into the volatile tetroxide RuO_4. It was apparent therefore that in order to attain success the temperature must be suddenly raised to a point considerably higher than the melting point of the metal; and in order to effect this a much more powerful source of heat than the oxyhydrogen blowpipe would be required. M. Joly has therefore employed the electric arc, which has recently been shown by M. Moissan to be so admirably adapted for the preparation of refractory metals. At the high temperature of a powerful arc ruthenium is melted in a few seconds, and without sensible loss by volatilisation in the form of tetroxide. Solid ingots of twenty to thirty grams of the metal have been obtained in this manner without difficulty. As the melted metal cools, however, it becomes covered with a coating of the blue sesquioxide Ru_2O_3 and the dioxide RuO_2. In order to remove this the ingot is placed first in aqua regia, which, however, has no action upon either the metal or the oxides, and subsequently in hydrofluoric acid; finally the ingot is heated in a stream of hydrogen, when it loses the last traces of oxide and the pure metal remains. Pure ruthenium thus obtained in tolerably large quantities after fusion is a greyish-white metal, more nearly resembling iron than platinum in appearance. Its hardness is about the same as that of iridium. It possesses a crystalline structure and is brittle. The density of the metal after fusion M. Joly gives as 12·063 at 0° compared with water at 4°. Employing the same electric arc and under equal conditions in all respects, the fusion of ruthenium appears to be attended with appreciably greater difficulty than that of rhodium and iridium, whose melting points are somewhat higher than the melting point of platinum. Moreover, under the conditions which suffice for the ready fusion of ruthenium, osmium merely sinters, traces of fusion being just apparent. Osmium therefore is the most infusible of the metals of the platinum group. M. Joly is now conducting experiments with the view of determinining the actual temperatures of these interesting high melting points.

NOTES from the Marine Biological Station, Plymouth:— The week's captures include the Lucernarian *Depastrum cyathiforme* and numbers of the Gephyrean *Petalostoma minutum*, Kef. Ephyræ of *Aurelia* have been abundant; Hydroid medusæ scarcer. Polychæte larvæ and *Nauplii* continue plentiful, and *Cyphonautes* (larva of the Polyzoan *Membranipora pilosa*) has considerably increased in numbers. Echinoderm larvæ (*Auricularia*, *Pluteus*) have made their first appearance in the season's townettings. The Nemertine *Nemertes Neesii* and a large eyeless mud-dwelling species of the Polychæte genus *Polydora* (*flava*, Clap. ?) are now breeding.

THE additions to the Zoological Society's Gardens during the past week include a Black-faced Spider Monkey (*Ateles ater*) from Eastern Peru, presented by Miss Gertrude Farmer; a Macaque Monkey (*Macacus cynomolgus*, ♂) from Java, presented by Mrs. Frank Phillips; a Naked-footed Owlet (*Athene noctua*) European, presented by Mr. Albert Stevens; a Four-horned Antelope (*Tetraceros quadricornis*, ♂) from India, purchased; six Wild Swine (*Sus cristatus*), two Badgers (*Meles taxus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET BROOKS (NOVEMBER 19, 1892).—The following is a continuation of last week's ephemeris for this comet:—

12h. Berlin Mean Time.

1893.	R A. (app.) h. m. s.	Decl. (app.) ° ′	Log *r*.	Log Δ	Br.
Mar. 9	0 46 27	+20 46·1	0·1842	0·3563	0·47
10	47 22	34·4			
11	48 17	23·0			
12	49 11	12·1			
13	50 4	20 1·5	0·1946	0·3731	0·42
14	50 57	19 51·5			
15	51 49	19 41·0			
16	0 52 41	19 31·2			

This comet will soon be lost in the rays of the sun. The unit of brightness took place on November 21·5, 1892.

COMET HOLMES (1892, III.).—M. Schulhof gives the following ephemeris of this comet for the ensuing week:—

1893.	R.A. (app.) h. m. s.	Decl. (app.) ° ′ ″
March 9	2 43 7·1	35 8 11
10	44 52·2	10 58
11	46 37·2	13 46
12	48 23·4	16 35
13	50 9·4	19 24
14	51 55·7	22 14
15	53 42·2	25 3
16	2 55 29·0	27 53

UNIVERSAL TIME.—On February 6 last the Bill declaring the legal time for Germany to be that of the 15th meridian east of Greenwich, that is, one hour in advance of Greenwich time, passed the third reading. This law will be brought into force on April 1. The *Observatory* for March informs us that, in a letter addressed to the Astronomer Royal, it is stated by Dr. Schran that a similar Bill has been laid before the Austrian Government, and "it is hoped that the change will be made simultaneously with Germany." The draft of the latter Bill, which we take from the same number, provides:—

(1) That the legal time in Austria is the mean solar time of the meridian 15° east of Greenwich. The same to replace, on April 1, 1893, the present local times for legal, civil, and all other purposes.

(2) The Government is authorised to make the changes in the school and industrial hours which will become necessary in consequence of the adoption of the above.

THE BIELIDS, 1892.—M. Bredichin, in *Astronomischen Nachrichten*, 3154, has a short note on the Bielids, in which he says that the observations made in America on November 23 last show that the meeting of the densest part of this swarm with the earth has taken place almost four days earlier than in the year 1885, or, in other words, that the descending node of the stream has receded almost 4° to the west during the period between the end of 1885 and the end of 1892. The cause of this recession is, he says, due to Jupiter, the perturbations set up by this planet accounting for the mean daily motion which is nearly equal to that possessed by Biela's comet.

An approximate computation of the special perturbations for the whole period during which Jupiter had any influence gave for the recession of the node a little over 4°, the inclination decreasing about 0°·6.

THE WOLSINGHAM OBSERVATORY.—In the Report of this observatory for the year 1892 Mr. T. E. Espin tells us that although the zone work was interrupted by attention being given to Nova Aurigæ, yet one hundred and sixteen new Third-Type Stars were detected in zones + 55° and 56°. In the autumn, as the telescope was going to be devoted to the revision of double stars in connection with the new edition of "Celestial Objects for the Common Telescope," the driving clock was taken out and cleaned, and a new arrangement for letting the clock run for one and a half hours without rewinding was also added. Notwithstanding the pressure of work in this direction, as many as eight hundred and forty-seven measures were made in the autumn, "observing being carried on sometimes for twelve hours, and once for thirteen and a half at a stretch." With respect to the new edition of the work mentioned above, Mr. Espin gives a short description of the general scheme. The portions devoted to the planets and the sun (vol. i.) will have several foot-notes added to them, Mr. Denning will write a short chapter on comets and meteors, and chapters on celestial photography and spectroscopic work will also be inserted. The second volume will deal with double stars, &c., and will be entirely rewritten; the objects will be arranged in order of Right Ascension, and all double stars whose primaries are above 6·5 magnitude, and whose distance is less than 20″, will be included. The work of bringing the places up to 1900 was at the end of the year completed for the first twelve hours, and considerable progress has already been made in the next eight hours of Right Ascension. Mr. Espin refers to the death of Miss Compton, who took great interest in the work done at the Observatory, and who left a legacy for the purchase of a photographic telescope. This telescope is already in working order, its aperture being eight clear inches, and focal length forty-two inches, and will be devoted to the photography of the zones observed with the spectroscope for detecting variation in light. The Meteorological Department has also been increased by a hygroscope and solar radiation thermometer, the gifts of Miss Brooke.

UNITED STATES NAVAL OBSERVATORY.—From the report of the superintendent (Capt. F. C. McNair) of this observatory for the year ending June 30, 1892, we gather the following few notes. In October, 1891, owing to the retirement of Prof. Asaph Hall, the use of the 26-inch refractor was tendered to Mr. Asaph Hall, junior, the latter observing the satellite of Neptune, satellites of Saturn, and the two outer satellites of Uranus. During the period of opposition of Mars, in August, 1892, the instrument was employed by Prof. Hall for the purpose of securing measures of the satellites, as the superintendent thought that "it seemed fitting that Prof. Hall, the discoverer of these satellites, should have the privilege of observing them once more under such exceptionally favourable circumstances." With the transit circle practically no observations were made, as the instrument was under repairs previous to being set up in the new observing houses; the Meridian transit, on the other hand, was in constant use, chiefly in connection with the time service. The 9·6 inch equatorial was as usual employed in observing asteroids, occultations, &c., while two nights a week were set apart for the accommodation of visitors. The number of visitors at night is about 2500 per annum, the majority of whom are women. In the estimates of appropriations required for the service for the year ending June 30, 1894, we see that the superintendent asks for an expert elevator conductor, which is essential to prevent accident. Among the estimates for the new observatory is a request for three dwellings for observers, and this is accompanied by a note which we print here, and the truth of which every astronomer will endorse:—"In order that the work of a large observatory may be properly and economically done, it is absolutely necessary that the observers be within prompt call to their instruments throughout day and night. Very important observations can often be secured from the clearing of the sky for a few hours, or even in some cases for a few minutes, if the observer be within easy call by the watchman. This can only be accomplished, in the isolated situation of the new Observatory, by having dwellings upon the grounds for the observers. The Government erects dwellings at all its navy-yards, arsenals, forts, and schools for the officers on duty there. But no service requires such unremitting attention and constant presence at all hours as that of the astronomer, and no observatory can be regarded as economically managed which does not furnish dwellings for all its observers close by their instruments. It is estimated that with the observers living on the grounds of the new Observatory, not only will two or three times as much work be done as it will be possible to do otherwise, but the quality of this delicate work will be materially improved on account of the observers being in a proper physical condition to begin their labours, instead of with nerves unstrung from hurrying some miles from their homes immediately after meals, or at unreasonable hours of the night."

YALE ASTRONOMICAL OBSERVATORY.—Vol. i. Parts 3 and 4 of the publications of the Astronomical Observatory of Yale University contains (1) "A Triangulation of Stars in the Vicinity of the North Pole," by Prof. William L. Elkin; and (2) "Determination of the Orbit of the Comet 1847 VI.," by Miss Margaretta Palmer. With regard to the former paper, this was undertaken to determine the relative positions of some north polar stars to serve as fundamental points for a photographic survey of that region. Twenty-four stars, covering a considerable area, were selected for this work, and all the distances measured were large—that is, above 1000″. Out of 276 possible combinations of measuring the intermutual distances within the range of the heliometer, Prof. Elkin managed to employ 146, each combination undergoing three separate measurements. In the reduction of the measurements he gives full information as to the methods employed, showing the means of eliminating the systematic errors, &c., concluding with tables of the final results in Right Ascension and Declination and precessional tables. Miss Palmer prefaces her determination of the orbit of comet 1847 VI. with a short reference to its discovery and history, remarking that it is probably the only comet ever discovered independently by two women. Rümker in 1857 found the orbit to be of a distinctly hyperbolic nature, and the result of the present determination, by employing modern places for the sun and allowing for perturbations, &c., show that the observations can be best explained on the hypothesis of the hyperolic orbit, the new value for the elements differing slightly from the old ones.

GEOGRAPHICAL NOTES.

A COLONY only accessible through foreign territory is naturally unsatisfactory to its holders, and since the development of German South-west Africa, the inconvenience of having Walfish Bay as the only landing place for the interior has gradually increased. It is now announced that a new harbour has been found on German territory in the mouth of the Swartkop river. The stream is so small that it is marked on few general maps of Africa, and it may even turn out to be in the British sphere.

A PAPER for the next German Geographentag has been published in advance, by Prof. W. Köppen, under the title "Die Schreibung geographischer Namen." It deals in a very thorough manner with the principles which ought to regulate the orthography of place-names, and treats the whole matter of authoritatively published rules in a historical way from the first formulation of the Royal Geographical Society's Rules in 1885 to the new German rules (see NATURE, p. 89) adopted in 1892. Prof. Köppen has fully mastered his subject, and, from a thorough study of the phonetics of language, he has been able to formulate a scheme by which the Roman alphabet may be employed, with the aid of diacritical signs and groups of consonants, to represent almost every possible sound. The methods adopted in the official systems of the Royal Geographical Society and the German Colonial Office appear to the author of the pamphlet to be incomplete and unsatisfactory. The subject is one eminently adapted for full international discussion, and we hope that Prof. Köppen will not fail to bring the matter before the next international Geographical Congress.

POLAR exploration seems to have received a fresh stimulus, and we note with satisfaction the announcement in the American newspapers of Mr. Peary's new programme. He sails for Greenland in June, and will spend the winter not far from the site of his last winter's camp. A novelty in transport on the inland ice is to be the use of ponies shod with snow-shoes of a special pattern, experience in Alaska and Norway appearing to establish the practicability of the idea. The main object of the expedition is to survey the Arctic Archipelago immediately north of Greenland, and to determine the whole north coast of the mainland. Mr. Peary has no theories, and expects to have to modify his plans according to circumstances. He expects to reach higher latitudes than have previously been attained, but has no sentimental views as to reaching the pole. The whole of the expense of the expedition he hopes to defray by his lectures and the book describing his last year's experience, which will be published in June.

STROMBOLI.[1]

ON June 24, 1891, an earthquake and volcanic explosion took place, followed by another shock on June 30. Some days after, the authors spent three days at Stromboli, and subsequently studied at their homes the materials they collected.

The paper commences with a description of the island, which not only adds nothing to what has already been published, but is inferior to what has been described by others. Mention is made of many changes during the last century, but great care is taken not to mention several writers who have described and illustrated the changes during the last few years. The writer, who was the first to photograph the crater of Stromboli, and has since published new photographs, is not even referred to, yet those photos are the best so far published of the volcano. It is regretable to see the frequency with which Prof. Mercalli quotes himself to the exclusion of several of his own countrymen, and especially foreigners. Since 1887, the single crater has been replaced by a number of cones which, according to the authors, are the same as those of 1889. I myself visited the crater in 1889, and those in the plates of this paper are very different in situation, which I can confirm by photos in my possession. The matter is of little importance, but more care should be shown in such statements. Those who have a good practical experience of active volcanoes know how often, from day to day these central conettes change.

The shock of the present eruption was quite local and was unobserved at Lipari. It was much more violent on the upper part of the mountain than lower down, and the authors reasonably conclude that the explosion was limited to the actual crater. Several landslips occurred on the crumbling slopes of the island. A column of vapour and lumps of incandescent lava were ejected to a level with the summit of the island, that is for a height of 225 m. Dust and lapilli were spread over the island though not to any great amount. Lava immediately began to flow from a short rift.

On June 30, another shock occurred, sufficiently strong to disturb the Milne seismoscopes of Lipari. After the usual ejection of lava cakes, lapilli, stones, &c., another lava stream started from a point near the eastern mouths. By July 6, when the authors visited the crater, the excessive activity had so diminished that no more lapilli or dust was being ejected. Three currents of lava flowed down the Sciarra to the sea, and as one divided into two branches, four reefs were formed at the water-line which it appears are being rapidly swept away by the waves.

The microscopic and chemical examination of the lava shows it to be a basalt verging on an andesite with 50 per cent. of SiO_2, with a little more potash than soda. The scoria ejecta resemble the lava in composition, except so far as their different rate of cooling modifies them. Besides the *essential*, some *accessory* ejecta were thrown out, which were old fumarolised materials from the new crater walls. The dust, or ashes, as the authors call it, was partly composed of black vitreous particles and glass fibres mixed with a brownish powder from the trituration of older volcanic materials.

No relation was found to exist between the eruptive spasm of Stromboli with several earthquakes that occurred before and after. A list of known eruptions of Stromboli are given, but it is a most imperfect one; for example the eruption of 1768, which was actually figured by Sir William Hamilton in his masterly work, is not even referred to, although lava not only issued from the crater, but also from a lateral opening on the western side of the Stromboli, and also was the first recorded issue of lava from this volcano. This list is more complete of late years, there being no less than fourteen eruptions from 1879 to 1888. Prof. Mercalli thinks there is a sympathetic action between the outbursts of Stromboli and Etna, and also the seismic foci of South Italy. He likewise finds a faint relationship between the position of the sun and moon when in opposition and conjunction but not with barometric pressure, but says that the daily variation in activity may so be related, as stated by the inhabitants.

H. J. JOHNSTON-LAVIS.

[1] "Sopra il periodo eruttivo dello Stromboli cominciato il 24 Guigno, 1891." By A. Ricco and G. Mercalli. Con appendice dell' Ing. S. Arcidiacono. *Ann. d. Ufficio C. Met. e Geodinamico* ser. sec., pt. iii. vol. xi. 1889. (Paper printed 1892.)

FORTHCOMING SCIENTIFIC BOOKS.

MR. MURRAY has in preparation:—"The Life of Prof. Owen," based on his correspondence, his diaries, and those of his wife, by his grandson, the Rev. Richard Owen, with portraits and illustrations, 2 vols.; "Alone with the Hairy Ainu; or, 3,800 Miles on a Pack Saddle in Yezo and a Cruise to the Kurile Islands, by A. H. Savage Landor, with map and numerous illustrations by the author; "A Manual of Naval Architecture," for the use of officers of the navy, the mercantile marine, ship-owners, ship-builders, and yachtsmen, by W. H. White, F.R.S., third edition, thoroughly revised and in great part re-written, with 150 illustrations; "The Physiology of the Senses," by Prof. John McKendrick and Dr. Snodgrass, with illustrations (1) touch, taste, and smell (2) the sense of sight (3) sound and hearing; "Chapters in Modern Botany," by Prof. Patrick Geddes, with illustrations; "The Philosophy of the Beautiful, Pt. II.," by Prof. Knight; "Logic, Inductive and Deductive," by Prof. William Minto; "The Metallurgy of Iron and Steel," by the late Dr. John Percy, F.R.S., a new and revised edition, with the author's latest corrections, and brought down to the present time, by H. Bauerman, with illustrations.

Messrs. Longmans announce:—"Theosophy or Psychological Religion," the Gifford lectures delivered before the University of Glasgow in 1892, by Prof. F. Max Müller; "Telephone Lines and their Properties," by Prof. W. J. Hopkins; "Essays on Rural Hygiene," by Dr. George Vivian Poore; "Abdominal Hernia," by John Langton, M.R.C.S.; "A Treatise on Electricity and Magnetism," by G. W. De Tunzelmann in 2 vols.; "Papers and Notes on the Glacial Geology of Great Britain and Ireland," by the late Prof. Henry Carvill Lewis, edited from his unpublished MSS., with an introduction by Dr. Henry W. Crosskey; "The Making of the Body, a Reading Book for Children on Anatomy and Physiology," with many illustrations and examples, by Mrs. S. A. Barnett; "A Manual of Machine Drawing and Design," by David Allan Low (Whitworth scholar) and Alfred William Bevis (Whitworth scholar), with over 700 illustrations; "Diseases and Injuries of the Teeth, including Pathology and Treatment," a manual of practical dentistry for students and practitioners, by Morton Smale, M.R.C.S., and J. F. Colyer, L.R.C.P.; "Cotton Weaving and Designing," by John J. Taylor; "Clinical Lectures on Abdominal Hernia," chiefly in relation to treatment, including the radical cure, by William H. Bennett, F.R.C.S., with twelve diagrams in the text; "The Elements of Bacteriology," a manual for practitioners and students, by Prof. S. L. Schenk, translated by Dr. W. R. Dawson, with 100 illustrations, some of which are coloured; "Esquimaux Life," by Fridtjof Nansen, translated by William Archer, with illustrations.

Among Messrs. Macmillan and Co.'s announcements are:—"William Kitchen Parker, F.R.S," a short memoir by his son, Prof. T. Jeffery Parker, F.R.S.; "Text-book of Pathology: Systematic and Practical," by Prof. D. J. Hamilton, Vol. II.; "A Uniform Edition of Prof. Huxley's Essays," in 6 vols., comprising Lay Sermons, Addresses and Reviews, Critiques and Addresses, Science and Culture, American Addresses, Man's place in Nature, &c.; "Lectures on Sanitary Law," by A. Wynter Blyth, M.R.C.S.; "A Text-book of the Physiological Chemistry of the Animal Body," including an account of the chemical changes occurring in disease, by Prof. Arthur Gamgee, F.R.S., with illustrations, Vol. II.; "Tables for the Determination of the Rock-forming Minerals," compiled by Prof. F. L. Loewinson-Lessing, translated from the Russian by J. W. Gregory, with a glossary added by Prof. G. A. J. Cole; "Text-book of Geology," by Sir Archibald Geikie, F.R.S., with illustrations, third edition, thoroughly revised; "Atlas of Classical Antiquities," by Th. Schreiber, edited for English use by Prof. W. C. F. Anderson; "The Soil in Relation to Health," by Henry A. Miers and Roger Crosskey; "Elementary Treatise on Modern Pure Geometry," by R. Lachlan;

"Exercises in Euclid," by William Weeks; "Utility of Quaternions in Physics," by Alexander McAulay.

In the Clarendon Press list are:—Locke's "Essay concerning Human Understanding," edited by Dr. A. C. Fraser; "Mathematical Papers of the late Prof. Henry J. S. Smith, with portrait and memoir, two volumes; "A Supplementary Volume to Prof. Clerk Maxwell's Treatise on Electricity and Magnetism," by Prof. J. J. Thomson, F.R.S.; "A Manual of Crystallography," by Prof. M. H. N. Story-Maskelyne, F.R.S.; "Analytical Geometry," by W. J. Johnston; "A Treatise on the Kinetic Theory of Gases," by Dr. H. W. Watson, new edition; "An Elementary Treatise on Pure Geometry," with numerous examples, by J. W. Russell; "Index Kewensis Nominum Omnium, Generum et Specierum, Plantarum Phanerogamarum,' '1735–1885, Part I.; "Hospital Construction," by Sir Douglas Galton, F.R.S.

Messrs. Swan Sonnenschein and Co.'s list contains:—"Philosophy and Political Economy in their Historical Relations," by Dr. James Bonar; "Appearance and Reality," by F. H. Bradley; "The Principles of Psychology," by G. F. Stout; "History of Philosophy," by Dr. Johann Eduard Erdmann, translated and edited by Prof. Williston S. Hough, third edition, revised, three volumes; "A Student's Text-Book on Botany," by Prof. Sidney H. Vines, F.R.S., copiously illustrated; "Text-book of Embryology: Invertebrates," by Drs. Korschelt and Heider, translated and edited by Dr. E. L. Mark and Dr. W. M. Woodworth, fully illustrated; "The Cell: its Anatomy and Physiology," by Dr. Oscar Hertwig, translated and edited by Dr. H. J. Campbell, fully illustrated; "Text-Book of Palæontology for Zoological Students," by Theodore T. Groom, fully illustrated; "Lectures on Human and Animal Psychology," by Prof. Wilhelm Wundt, translated and edited by James Edwin Creighton and Edward Bradford Titchener; "Hand-book of Systematic Botany," by Prof. E. Warming, translated and edited by M. C. Potter, fully illustrated; "An Elementary Treatise on Practical Botany," by Prof. E. Strasburger, translated and edited by Prof. W. Hillhouse, with 149 illustrations, third edition; "The Photographer's Pocket Book," by Dr. E. Vogel, translated by E. C. Conrad, with 63 illustrations; "How Nature Cures," by Dr. Emmet Densmore; "Beauty and Hygiene for Women and Girls," by a Specialist; "A Popular History of Medicine," by Edward Berdoe, M.R.C.S.; "Introduction to the Study of the Amphioxus," by Dr. B. Hatschek and James Tuckey, illustrated; "Practical Bacteriology," by Dr. Migula, translated and edited by Dr. H. J. Campbell, illustrated; "Geology," by Dr. Edward B. Aveling, illustrated with a Geological Map and numerous woodcuts; "Zoology," by B. Lindsay, illustrated; "Fishes," by the Rev. H. A. Macpherson; "Flowering Plants," by James Britten; "Grasses," by W. Hutchinson; "Mammalia," by the Rev. H. A. Macpherson.

Messrs. George Philip and Son will publish:—"Philip's Atlas Guide to the Continent of Europe," a series of 72 plates, with descriptive letter-press, by J. Bartholomew; "Philip's Systematic Atlas for Higher Schools and General Use," a series of physical and political maps, with diagrams and illustrations of astronomy and physical geography, by E. H. Ravenstein; "Philip's Anatomical Model of the Human Body," illustrating the construction of the Human Frame and the relative positions of its various organs by means of superimposed plates printed in colours; "The Celestium, or Patent Astronomical Calendar for recording and illustrating in miniature the daily and hourly positions of the heavenly bodies as they pass through the Sign of the Zodiac."

Messrs. Percival and Co. give notice of:—"The School Euclid," an edition of Euclid, Books III. to VI., with notes and exercises, by Daniel Brent; The Beginner's Text Books of Science: "Chemistry," by G. Stallard; "Geology," by C. L. Barnes; "Electricity and Magnetism," by L. Cumming; "Heat," by G. Stallard; "Light," by H. P. Highton; "Mechanics" (treated experimentally), by L. Cumming; "Physical Geography," by C. L. Barnes; "Practical Physics," an introductory handbook for the physical laboratory, in three parts, by Prof. W. F. Barrett; Part II. Heat, Sound, and Light. Part III. Electricity and Magnetism, Electrical Measurements; "Practical Lessons and Exercises in Heat for use in schools and Junior University classes, by A. D. Hall.

In Messrs. A. and C. Black's announcements we notice:—"Illustrated Text-Book of Invertebrate Zoology," by A. E. Shipley; "History of Astronomy during the Nineteenth Century," by Agnes M. Clerke, third edition, revised and enlarged; "Algebra, an Elementary Text-Book for the Higher Classes of Secondary Schools and Colleges," by Prof. George Chrystal, Part I., third edition.

Messrs. Crosby Lockwood and Son have in hand:—A new and enlarged edition (the third) of Prof. R. Wallace's "Farm Live Stock of Great Britain," containing additional phototype engravings of notable specimens of live stock; and a new volume by Prof. Sheldon on "British Dairying."

Mr. Walter Scott will issue in the "Contemporary Science Series":—"Modern Meteorology," by Dr. Frank Waldo, with 112 illustrations.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Two Radcliffe Travelling Fellowships, each of the value of £200 per annum, and tenable for three years, have been awarded this week. One, which has been gained by Mr. E. A. Minchin, of Keble College, was thrown open last year to candidates in all branches of science, and the usual declaration that the Fellow intends to graduate in medicine and to travel abroad with a view to his improvement in that study has been dispensed with. Mr. Minchin was placed in the first class in the Honour School of Natural Science (Morphology) in 1890. The other Fellow, Mr. W. Ramsden, of Keble College, is subject to the usual conditions attached to these Fellowships. Mr. Ramsden obtained a first class in Natural Science (Physiology) in 1892.

The new laboratories for the department of human anatomy are rapidly approaching completion, and will, when finished, add very much to the convenience and advantages of medical students. The buildings have been designed after the plans of Mr. Arthur Thompson, and include a large dissecting room and several additional laboratories and private rooms, a lecture theatre, and a large basement.

CAMBRIDGE.—The Council of the Senate report that the Royal Geographical Society have renewed their generous offer to provide £150 a year as part of the stipend of a geographical lecturer for the ensuing five years, and to award biennially exhibitions or prizes for the encouragement of geographical research in the University. The Council recommend that the proposals of the society be accepted, and that a lecturer be appointed, under the supervision of a joint committee of management, before the end of the Easter Term, 1893.

The Sedgwick Memorial Syndicate report that they have made certain alterations in the plans for the proposed Geological Museum in Downing Street, with a view to meeting objections that were raised and to reducing somewhat the cost of the building. The Syndicate ask to be authorised to obtain tenders for the immediate construction of the museum.

SCIENTIFIC SERIALS.

American Meteorological Journal, February.—Hot winds in Texas, May 29 and 30, 1892, by I. M. Cline. Hot winds occur to some extent every year, but rarely with sufficient intensity to injure vegetation. It was estimated that in the present case 10,000 acres of cotton were destroyed, and corn suffered severely. The temperatures reported ranged generally from 90° to 100°, and in some parts from 105° to 109°. These winds appear to have resulted from the same causes which produce the Föhn in Switzerland, the descent of dry air which has deposited its vapour during its ascent.—The electrification of the lower air during auroral displays, by A. McAdie. The author gives an account of some experiments made at Blue Hill observatory, for obtaining, by means of a kite flown during thunderstorms, a better record of the potential of the air than could be given by a collector near the ground, by which plan some remarkable results were obtained, and he suggests similar experiments for showing the electrification of the lower air during displays of aurora. He also proposes a new classification of the various auroral phenomena, distinguishing between the highly coloured displays, and those of less intensity which probably occur in the lower atmosphere.—Practical koniology, by Prof. Cleveland Abbe. He applies this term to the study of atmospheric dust and floating germs, and shows how their injurious effects on certain industries may be obviated.—The sling psychrometer, by Prof. H. A. Hazen, and the aspiration *versus* the sling psychrometer, by A. L. Rotch. Both papers deal with the comparative merits of the two instruments for balloon observations.

Wiedemann's Annalen der Physik und Chemie, No. 2.—Among the papers in this number are the following:—A modified astatic galvanometer, by H. E. J. G. du Bois and H. Rubens. To minimise the effects of disturbing vibrations as producing false oscillations about a vertical axis, the suspended system is given perfect "inertia symmetry" about the axis of the fibre, and all flat parts of it are distributed so as to have equal areas in two mutually perpendicular planes. Quartz fibres are used for suspension.—Bolometric investigations of the grating spectrum, by F. Paschen.—The fundamental law of complementary colours, by Paul Glan. To determine the amount of light absorbed by the pigment of the yellow spot during transmission to the optically sensitive nerves, two candles of equal luminosity were observed with one eye through glasses of various colours, the one direct, and the other at such an angle that its image fell outside the margin of the yellow spot. The candles were shifted till both appeared equally bright, and their respective distances were measured. Taking the coefficient of absorption for red light as = 1, that for yellow (5828) was 0·889, for wave-length 5222 it was 0·171, 4856 (blue) 0·269, and for white light 0·424. In this way the conclusion was arrived at that the intensities of complementary colours reaching the retina must be equal in order to give the impression of white.—Experiences with the self-acting mercury pump, by A. Raps. Several improvements are described, tending to make the working more rapid. It was found that the fear of contaminating the mercury by the use of black flexible india-rubber tubes was unfounded.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, February 22.—Mr. Henry John Elwes, President, in the chair.—Mr. F. J. Hanbury exhibited, on behalf of Mr. Percy H. Russ, of Sligo, several long and very variable series of *Agrotis tritici*, *A. valligera*, and *A. cursoria*, together with Irish forms of many other species, some of which we believe to be new to Ireland. Mr. W. H. B. Fletcher made some remarks on the species.—Mr. R. W. Lloyd exhibited specimens of a species of *Acarus* found in New Zealand wheat. He stated that Mr. A. D. Michael had examined the specimens, and pronounced them to belong to *Tyroglyphus farinæ*, a species which had been known for over a hundred years as a destroyer of corn, and was only too abundant all over Europe, and probably over the temperate regions of the world.—Mr. E. B. Poulton, F.R.S., exhibited, and made remarks on, a number of cocoons of *Halias prasinana*, in order to show the changes of colour produced in them by their surroundings; he also exhibited the coloured backgrounds employed by him in his recent experiments on the colours of larvæ and pupæ, and illustrated his remarks by numerous drawings on the blackboard.—Dr. T. A. Chapman exhibited by means of the oxy-hydrogen lantern, photographs of the larva of *Nemeobius lucina* in its first stage, showing the conjoined dorsal tubercles, each carrying two hairs, which are remarkable in being divided into two branches. For comparison he also showed, by means of the lantern, drawings of the young larva of *Papilio ajax*, after Scudder, and of a portion of a segment of *Smerinthus populi*, as the only instances known to him of similar dichotomous hair sin lepidopterous larvæ. Mr. Poulton pointed out that he had described the forked hairs of *Smerinthus* in the Society's "Transactions" for 1885, and that such hairs were even better developed in the genus *Hemaris* originally described, as he believed, by Curtis. Mr. Poulton, also said that he had noticed similar forked hairs covering the newly-hatched larvæ of *Geometra papilionaria*.—Dr. Chapman read a paper—which was illustrated by the oxy-hydrogen lantern—entitled "On some neglected points in the structure of the Pupa of Heterocerous Lepidoptera and their probable value in classification." A discussion ensued, in which Mr. Poulton, Mr. Champion, and Mr. Merrifield took part.—Dr. F. A. Dixey communicated a paper entitled "On the phylogenetic significance of the variations produced by differences of temperature on *Vanessa atalanta*." The President, Mr. Merrifield, Mr. Poulton, Dr. Chapman, and Mr. Tutt took part in the discussion which ensued.

Zoological Society, February 28.—Sir W. H. Flower, F.R.S., President, in the chair.—Mr. A. D. Michael exhibited some specimens of the *Ixodes*, known locally in the West Indies as the "St. Kitts" or "Gold Tick," received from Mr. C. A. Barber, of the Agricultural Department, Antigua.—A communication was read from M. A. Milne-Edwards respecting *Lemur nigerrimus*, Sclater, a species of lemur originally described from an example living in the Society's Gardens. It was pointed out that *Prosimia rufipes* of Gray had been based on a female of this species.—Mr. Howard Saunders exhibited and made remarks on a specimen of the American stint (*Tringa minutilla*), shot at Northam Burrows, North Devon, by Mr. Broughton Hawley, in August, 1892.—Mr. Sclater (on behalf of Mr. R. M. Barrington) exhibited a specimen of the Antarctic Sheathbill (*Chionis alba*), killed at the Carlingford Lighthouse, co. Down, Ireland, in December last.—Dr. C. J. Forsyth-Major read a memoir on some of the miocene squirrels, and added remarks on the dentition and classification of the *Sciuridæ* in general. The author proposed a new division of this family into three subfamilies—Sciurinæ, Pteromyinæ, and Nannosciurinæ. The genera *Spermophilus* and *Arctomys* and the allied forms were united to the Sciurinæ. The last part of the paper dealt with the primitive type of the Sciurine molar.—Mr. Henry O. Forbes read a paper entitled "Observations on the Development of the Rostrum in the Cetacean Genus *Mesoplodon*, with remarks on some of the Species." Mr. Forbes showed that in this genus the vomerine canal in the young animal is filled with cartilage, and in the adult with a dense petrosal mesorostral bone. From the examination of thirteen specimens of *Mesoplodon grayi* and four of *M. layardi*, of which he had made a large number of sections in various stages of growth, the author concluded that the mesorostral bone was not, as had been generally believed, an ossification of the cartilage, but an actual growth of the vomer and of the premaxillaries, with perhaps, in some cases, additions from the ossification of the cartilage of the vomerine spout. The cause of the growth in the vomer might be accounted for by the pressure communicated to it by the growth of the premaxillaries, induced, perhaps, by the movement, which appears to take place, of the maxillaries over the premaxillaries.

Linnean Society, March 2.—Prof. Stewart, President, in the chair.—Mr. Miller Christy exhibited some photographs of the American bison taken from living wild animals, and gave some account of the present restricted distribution of the species. Mr. A. G. Renshaw and Mr. W. Carruthers detailed what they had been able to learn respecting it while travelling in its former haunts.—Mr. J. M. Macoun gave an account of the flora of the Behring's Sea Islands from personal exploration.—On behalf of Mr. H. N. Ridley the Secretary read a paper on the flora of the eastern coast of the Malay archipelago.—The meeting then adjourned to March 16.

Anthropological Institute, February 21.—Prof. A. Macalister, F.R.S., President, in the chair.—A paper, by Mr. E. H. Man, on Nicobar pottery was read. He stated that the little island of Chowra has held for generations a monopoly of the manufacture. Preparing the clay, and moulding and firing the finished utensil, devolves on the females. The value of trade marks is recognised, the device of its maker being affixed to each vessel. Experience having taught them that pots are more serviceable if allowed to harden gradually, they store newly-made utensils on a lattice platform in the roofs of their huts. In a year the heat and smoke render them hard and durable. Indian pots and jars are readily purchased from the traders, who occasionally visit the islands; but they are deemed unsuitable for certain culinary operations. There are no special vessels made for funeral purposes; but, in accordance with the almost universal custom of uncivilised races, cooking pots are among the personal and household requisites which are laid on a grave after an interment.—A paper, by Lieut. Boyle, T. Somerville, R.N., on some islands of the New Hebrides was read. The habits of the natives of adjacent islands sometimes vary exceedingly, and in this paper reference was made only to a small portion of the group, including the Efate Islands, the Shepherd Islands, and the East Coast of Malekula. A child calls all his uncles on both sides, "father," all his aunts, "mother," and his first cousins on both sides, "sister" or "brother." A man cannot marry a woman of his own tribe, and the children belong to their mother's tribe; the property of their father going, at his death, to his sister's children. It sometimes happens that a man will call a small girl much younger than himself "mother." Circumcision takes place between the ages of five and ten. Till then a boy goes naked; but afterwards he is costumed like the men. When a Malekulan is old and decrepit, he has nothing to look forward to but burial alive. Should an old person become bedridden, or a burden, he or she is told quite simply that his or her burial will occur on such a day. Invitations to the funeral feast are then sent out, and, dead or not dead, on that date the unhappy person is buried.

Paris.

Academy of Sciences, February 27.—M. de Lacaze-Duthiers in the chair.—On the attempt at oyster culture in the Roscoff laboratory, by M. de Lacaze-Duthiers. In April, 1890, a set of seed oysters were introduced into a tank in the grounds of the observatory, which lies opposite Batz Island, in the Channel. They were always submerged, but exposed to tidal changes of level. In a year they had acquired a considerable size, but had not yet "fattened." Last November they had a size and flavour which, in M. Chatin's opinion, surpassed the qualities attained in any other locality along the coast, although in the warmer months preceding (the months without R) they had shared the decline common to all oysters at that period. It was also found that the oysters in the tank acquired longer "beards," and also increased in length, whilst others cultivated on the shores of Batz Island, and often left dry at low water, were more developed in the direction of thickness. As regards reproduction, the results have been fairly favourable, although definite data have not yet been obtained. In one case, where part of the tank water had been pumped into a reservoir used for supplying an aquarium, some embryos were drawn up through the pipes, and fixed themselves on the wooden level-ball, where a colony of about a dozen well-developed oysters was subsequently found, some of which now measure 6 cm. across.—On the exact determination of the pepto-saccharifiant action of the organs, by MM. R. Lépine and Metroz.—On the photographs of the moon enlarged by Prof. Weinek, by M. Faye. These photographs are enlargements by twenty times of some of the Lick photographs of the moon, obtained by an exposure lasting several days. On their being exhibited, several members expressed their opinion that they had been retouched.—On the urea contained in the blood in cases of eclampsia, by M. L. Butte. It is found that in cases terminating fatally the amount of urea contained in the blood is less than in cases of recovery, owing to hepatic alterations, which in the former cases impair the secretion of urea. From the point of view of prognostication, therefore, recovery can be anticipated if the amount of urea is two or two and a half times the normal amount, but a fatal issue if the amount closely approximates to the physiological figure.—On the general problem of integration, by M. Riquier.—On certain differential equations of the first order, by M. Vessiot. — Remarks concerning a preceding note on a generalisation of Lagrange's series, by M. E. Amigues. — Physical properties of fused ruthenium, by M. A. Joly (see Notes).—On Stas's determination of the atomic weight of lead, by M. G. Hinrichs. In Stas's determinations of the atomic weight from the sulphate and the nitrate the weight of substance taken, according to M. Hinrichs, enters as a continuously changing element into the result, owing to a systematic error in Stas's arrangement. In plotting the atomic weights in terms of weight of substance taken, curves are obtained showing a minimum at about 150 gr. The method of averages is therefore inadmissible, and a new method is promised in a forthcoming communication.—On the aldehydes of the terpenes, by M. A. Étard.—On the constitution of hydrated alkaline phenates, by M. de Forcrand.—On the alkaloids of cod-liver oil, their origin and therapeutic effects, by M. J. Bouillot.—On a pathogenic microbe of blennorhagic orchitis, by MM. L. Hugounenq and J. Eraud.—Crustacea and cirrhipeds commensal with the Mediterranean turtles, by MM. E. Chevreux and J. de Guerne.—On a terrestrial leech of Chili, by M. Raphael Blanchard. This animal, which has been named *Mesobdella brevis*, forms a link between the Glossiphonidæ and the Hirudinidæ. Among the latter it approaches most closely the Hemadipsinæ by its mode of living and its ten large black eyes, but differs from the whole family by the great condensation of its somites.—Mineralogical and lithological examination of the meteorite of Kiowa county, Kansas, by M. Stanislas Meunier. The metallic portion presents two principal alloys of iron and nickel, which an attentive study has succeeded in characterising: Tænite (Fe_6Ni) and plessite ($Fe_{10}Ni$). In composition it agrees closely with the entirely metallic type called jewellite, but it differs from the latter in structure. Apart from the peridotic portions the mass consists of lamellæ of tænite arranged in bundles which frequently intersect at the angles of the octahedron. The intervals are filled up with plessite which may be distinguished at once by its dark-grey colour, contrasting with the polished steel tint of the other alloy. Some specimens of the meteorite show quite exceptional characters. With the usual structure and cohesion they are formed of opaque black mineral grains cemented by a network of oxidised iron. These have probably been produced by an alteration of the normal specimens, in which the metallic skeleton has been oxidised.

Göttingen.

Royal Society of Sciences.—From July 27 to December 28, 1892, the following papers of scientific interest have appeared in the *Nachrichten*:—

July.—Drude: Current theories of light practically tested.—Ehlers: On *Arenicola marina*, L. (five pages).—Rhumbler: The so-called germ-spherules (Max Schultze) of *Foraminifera* (these are stated to be merely deposits of iron silicates).—Nernst: The change of free energy in the mixture of concentrated solutions.—Hilbert: Third note on algebraical invariants.

September.—Fricke: A general arithmetical principle in the theory of automorphic functions.—Kohlrausch: On the influence of time upon solutions of sodium silicates.

November.—Peter: Botanical work in the summer of 1892.—Voigt: On a problem in fluid motion.—Sella and Voigt: The rupture coefficient of rock salt.—Kallius: The neuroglia-cells of peripheral nerves.

December.—Wagner: The third (Peter Apian's) map of the world (1530).

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