THURSDAY, NOVEMBER 21, 1895.

HYDRODYNAMICS.

Hydrodynamics. By Horace Lamb, M.A., F.R.S., Professor of Mathematics in the Owens College, Manchester. (Cambridge: University Press, 1895.)

THE original edition of this work, published in 1879 under the title of a "Treatise on the Mathematical Theory of the Motion of Fluids," gave the first impulse to the cultivation in this country of the modern developments of Vortex and Cyclic Motion, with their Electromagnetic Analogues, the Discontinous Jets of Helmholtz and Kirchhoff, the Dynamical Theory of the motion of perforated solids through a liquid, and the examination, as far as possible, of the effects of Viscosity. Previous writers had confined themselves to simple applications of the principle of Parallel Sections, to the bodily rotation of liquid, especially of Ellipsoids, and to simple cases of Wave Motion and of Tidal Phenomena.

The analysis invented by Helmholtz for the special case of a discontinuous jet has led, in Schwartz's hands, to important developments in the Theory of Functions, which still receive their most convincing explanation by a return to the hydrodynamical analogue. A recent article in the *Math. Annalen*, 1895, by Réthy, on this subject deserves attention. So too, in the present treatise, the author introduces much of the modern Theory of Functions, guided by considerations of physical interest; but long analytical investigations, leading to results which cannot be interpreted, have, as far as possible, been avoided.

The author quotes Poinsot's warning, "Gardons nous croire qu'une science soit faite quand on l'a réduite à des formules analytiques," as especially applicable to the present branch of mathematical physics; so he has made the analytical results convincing and intelligible by numerical illustrations, and by the insertion of a number of diagrams, drawn carefully to scale and reduced by photography. The hope expressed by the author that the results of his numerical calculations will be found correct is a natural feeling to those mathematicians who find by experience that it is no small difficulty to make use of a formula by turning its results into numbers.

The so-called practical man can use a formula in this manner, without understanding the theory upon which it is based; on the other hand the mathematical student is apt to imagine that, after the formula has been demonstrated, it is an easy matter, hardly worthy of his attention, to turn the formula to account in a numerical application, until humiliating experience teaches him his error.

The subject is opened out in the initial chapters in much the same manner as in Basset's "Hydrodynamics." The method of Conjugate Functions, now more commonly called Harmonic Functions by continental writers, is a powerful machine for the construction of results of motion in two dimensions; it is unfortunate that the method cannot be extended to three dimensions, except when the motion is symmetrical about an axis, when Stokes's stream or current function presents a certain analogue.

The hydrodynamical questions which can be solved by the system of coordinates given by confocal quadrics are very fully explained in Chapter v.; for instance, the motion of liquid due to the presence of an ellipsoid. A very slight extension of the author's method enables us to dispense with an infinite extent of liquid, and to suppose it bounded externally by another confocal, useful when the oscillations of gravitating liquid between two confocal ellipsoids is to be considered; so also the author's own investigations in the preceding chapter of the motion due to an infinite elliptic cylinder can be completed and amplified in a similar manner. We miss, too, the special consideration of confocal paraboloids, where the liquid necessarily extends to infinite distance; also the discussion of the motion of the liquid filling a rectangular box. Mr. Basset's method of exhibiting the result by two symmetrical infinite series, due to Dr. Ferrers, can be illustrated by supposing each series to represent the effect of a shearing velocity in the shape of the box, the superposition of the conjugate shear producing the same effect as a rotation.

Prof. Lamb apparently does not approve of our insular plan of collections of examples interspersed in the Chapters; but many important results, for which room cannot be found without unduly swelling the book, can in this manner receive mention, as in Basset's treatise.

The plane motion of a solid through infinite liquid is worked out completely, with accurate diagrams, in Chapter vi., the error of supposing that the path of the body can be looped when there is no circulation, is corrected; but we notice incidentally that, among all the various functions employed by the author, the elliptic functions are conspicuous by their absence. Kirchhoff's equations for the general motion of a solid of revolution in space filled with liquid afford appropriate applications of elliptic functions, especially his curious equations giving the position of the centre of the body; but these are not given in Chapter vi.

It is always gratifying to be able to utilise some result out of the vast accumulation of analysis written on the elliptic functions; attempts are just beginning at the solution of new problems in Wave Motion em bodying the functions; for instance, by Willy Wien in the *Berlin Sitz.* in discussing the effect of wind, and by Korteweg and de Vries in the *Phil. Mag.*, May 1895 in extending theorems concerning the solitary wave, given (p. 420) by

$$y = h \sec h^2\left(x \sqrt{\frac{h}{4\sigma}}\right)$$

to the cnoidal wave

$$y = h \operatorname{cn}^2\left(x \sqrt{\frac{h+k}{4\sigma}}\right), \kappa = \sqrt{\frac{h}{h+k}};$$

reducing to the above when $k = 0$.

The author gives a complete though rather condensed account of Vortex Motion in Chapter vii., excusing himself on the ground that the recent investigations on this subject by Lord Kelvin, J. J. Thomson, Hicks, Larmor and Love, derive most of their interest from their bearing on kinetic theories of matter, theories which lie outside the province of a treatise like the present.

But Chapter viii. gives a complete and exhaustive investigation of Tidal Waves. In these cosmical problems the sailor's units are most appropriate, the sea mile or

sexagesimal minute of latitude and the hour ; the sailor's *knot* as unit of speed can now replace the circumlocution of *sea miles per hour* of p. 274, 449, and elsewhere ; but the author avoids at least the landsman's solecism of "knots an hour."

Interesting applications of Bessel functions are discussed in the chapter relating to the propagation of the tide in an estuary ; it may be mentioned here that the figure for $J_0(\sqrt{x})$ on p. 295 is easily realised by revolving with appropriate speed the upper end of a vertical chain ; this is the initial problem of Gray and Mathews's "Treatise on Bessel Functions."

Chapter ix. discusses the Surface Waves we are familiar with in vessels of various shapes, embodying all the results in this difficult subject which have so far been obtained. Here is a branch of Hydrodynamics which will repay the attention of young mathematicians, as every new problem solved constitutes a distinct advance in the subject ; thus the determination of a state of wave motion in a canal of circular section, or in a spherical bowl, such as we see every morning at the toilet, still await solution ; as also the wave motion in the gutters during a shower, when the viscosity takes a ruling part of the phenomenon.

The investigations of the effect on waves of a capillary film are easily extended to the case where the film possesses a certain superficial density, as a flag or sail, for instance, or

> "—the winning wave deserving note
> In the tempestuous petticoat,"—

and where the film possesses flexural rigidity, as a sheet of ice ; thus the results of Kelland, Kirchhoff, and others on waves in canals are but slightly modified when the free surface is supposed to be frozen. The minimum wave velocity, where the ripples change into waves, is now shown very elegantly by Mr. C. V. Boys on a logarithmic diagram (NATURE, July 18, p. 273).

Sir George Stokes's theory of Group Velocity of Waves, introduced modestly in a Smith's Prize Question, and developed subsequently by Osborne Reynolds, has cleared up much of the mystery of the turbulence of sea waves, and explained the reason of the sailor's adage that every ninth wave is a big one, or every third wave in crossing a bar ; for on this theory, if every mth wave is a big one, the motion is principally due to the superposition of two trains of waves, whose lengths are in the ratio of $(m-1)$ to $(m+1)$.

The author summarises very clearly the researches of Lord Kelvin and Lord Rayleigh on the wave-making due to the motion of a ship, and the complicated pattern produced in the wake of a steamer, of a duck, or even of a stick drawn through the water is illustrated in diagrams on pp. 402, 403. If the unpublished investigation referred to in the footnote of p. 403 relates to the explanation of the curious appearance of the echelon bow waves which form the fringe of the wake, where the wave fronts make an angle with the keel, the tangent of which is double the tangent of the angle between the wave fronts and the general direction of the echelon, the following extract from a letter by Lord Rayleigh will supply the deficiency :—

"A train of waves keeping up with a boat moving along Ox with velocity V_0, the crests making an angle θ with the keel, will be given by

$$a \cos k\,(Vt - x \sin\theta - y\cos\theta)$$

where

$$V = V_0 \sin\theta ;$$

and the groups are due to the combination of two such trains, defined by k, $k+\partial k$; V, $V+\partial V$; θ, $\theta+\partial\theta$; subject to $V \propto \lambda^{\frac{1}{2}} \propto k^{-\frac{1}{2}}$, or $k \propto V^{-2} \propto \mathrm{cosec}^2\theta$.

The resultant is thus given ultimately by

$$2a \cos k(Vt - x\sin\theta - y\cos\theta)$$
$$\cos\tfrac{1}{2}\{\delta(Vk)t - x\partial(k\sin\theta) - y\partial(k\cos\theta)\} ;$$

so that if the line of echelon makes an angle ϕ with the keel,

$$\tan\phi = \frac{\partial(k\sin\theta)}{\partial(k\cos\theta)} = \frac{\delta(\mathrm{cosec}\,\theta)}{\delta(\mathrm{cosec}^2\theta\cos\theta)} = \frac{\tan\theta}{2+\tan^2\theta}$$

or

$$\tan(\theta-\phi) = \tfrac{1}{2}\tan\theta."$$

("Progressive Waves." By Lord Rayleigh. *Proc. London Math. Society*, vol. ix.)

Chapter x. on Waves of Expansion discusses some problems, such as oscillations of the atmosphere, but passes over the applications which belong more properly to the Theory of Sound.

To account for many observed hydrodynamical phenomena, notably of the passage of a ship through the water, the hypothesis of perfect limpidity, postulated in Chapter i. must be abandoned, and the equations of motion, such as those employed by Osborne Reynolds in his investigations on turbulent motion and skin resistance, become complicated to a formidable extent. It is, however, in this direction that the most useful line of attack on new and practical problems must be directed.

The book concludes with Chapter xii. on the Equilibrium of rotating masses of liquid, such as the spheroid of Maclaurin and the ellipsoid of Jacobi, and with a slight sketch of Poincaré's investigation of the secular stability, and of the kindred researches of Bryan and Love.

Considering that the author has already developed the requisite Spherical Harmonic analysis, we think that a *résumé* of the theory of a Figure of the Earth would have occupied very little space, and would have been very welcome, as Prof. Adams's lectures on this subject are not yet generally available.

Prof. Adams led up to Laplace's general case of strata, varying continuously in density from one to the next, by an examination of the particular cases of a spheroid composed of two, three, or more strata of uniform density ; so, too, the examination of the possibility of a permanent distribution of the strata in the interior of an ellipsoidal shell which is rotating about any fixed diameter, is worthy of a careful examination by a young mathematician as an interesting research ; the oscillations of such a shell have already been considered by Mr. S. S. Hough (*Proc. R. S.*, February 7, 1895).

A comparison between the present treatise and Basset's Hydrodynamics is interesting from the different modes of presentation of parts of the theory ; we have reason to be proud of both as representing a branch of mathematical investigation in which foreign experts pay us the compliment of conceding that we are capable of teaching them something. A. G. GREENHILL.

GREEK TRIBAL SOCIETY.

On the Structure of Greek Tribal Society. An Essay. By H. E. Seebohm. (London: Macmillan and Co., 1895.)

IN this scholarly and modest essay, the author has collected some of the evidence relating to a certain stage in the development of Greek society, the existence of which runs some danger of being insufficiently recognised by students of ancient history. "Greek" society to most people means, in the first place, the society described in the Homeric poems; in the second, Athenian society from the fifth century downwards. These limitations of the field are the natural outcome of the paramount importance of Homeric and Athenian literature; information as to the structure of society in other parts of Greece and at other periods of Greek history can, with a few exceptions, only be gleaned from incidental references in Homer and the Attic writers, and from the data afforded by comparative anthropology. To a certain extent Mr. Seebohm's field of observation may still seem to be somewhat confined, and his work would have been more valuable had the few facts known of the life of the less civilised parts of ancient Greece been more extensively utilised. To this end we could, perhaps, have spared some of the detailed discussion of the better-known survivals of tribal institutions in Athenian society of the fourth century.

Within these limits, however, Mr. Seebohm's treatment of the subject merits little but praise. His employment of the comparative method is throughout judicious. Outside the Greek world, he has utilised three main sources of information—the Old Testament, the Ordinances of Manu (a code going back in its present form probably to the fifth or fourth century B.C.), and the Welsh law. The selection, as he admits, is arbitrary, particularly in the exclusion of the Roman system from the field of comparison. But the highly-organised character of the latter is a source of danger when it is used for comparison with the looser structure under consideration, and its exclusion is therefore somewhat of a relief.

Most investigations of the structure of ancient political systems must begin with Aristotle. His treatise on "Politics," however, deals with society in its highest stage, with man's activity τοῦ εὖ ζῆν, not merely τοῦ ζῆν ἕνεκα. It is with the previous stage that we are here concerned; in fact, with what he calls "village" life—the "village" being a convenient term for the union of families, whether living close together or not, just as the state, or political union, is the combination of "villages," whether within one city-wall or scattered about a district. This "village" life has four main characteristics. As society begins in the family, the first and most important, on which all the others depend, is the bond of kinship. Secondly, the body must be organised, and this necessitates a government. The permanence of the society is maintained in two ways—by the cultivation of the land, and by the worship of the gods; in the first place those of the family, in the second those of the community. As the village is merged in the state, which reproduces on a larger scale, and therefore in a less intense degree, the relations of early society, the order of things is reversed. But the old relations continue to exist within the larger group, and it is these still-existing tribal elements that we have to trace in the complex political society.

Mr. Seebohm's work falls into two main parts, dealing with the nature of kinship, and the relation of the family to the land, thus approaching the subject from the point of view of the first and third characteristics mentioned above. Undoubtedly this is a more scientific method than that (identified with the name of de Coulanges) which commences with the religious union, or that which lays most stress on the system of government. Primitive man is not in the first instance religious; his religion is only one of the forces which he brings into play to preserve his family or tribal unity; and government is another such force. The cultivation of the land, again, is of the first necessity, unless the tribe subsists on plunder. Any properly historical investigation should therefore begin with these two matters.

With regard to the nature of kinship, a great deal of information can be extracted from the private speeches of the Attic orators. Into this part of the subject, as we have already said, Mr. Seebohm has gone very fully. Two points seem to be of special importance, the supremacy of the head of the family, and the limitation of the "inner-circle" or ἀγχιστεία, the group of blood-relations, "responsible to each other for succession . . . for vengeance and purification after injury received by any member, and for all duties shared by kindred blood." As regards the nature of the government of the group, there is one feature which might perhaps have been dwelt upon a little more than it has been; that is, the limitation of the supremacy of the head of the family. Every household was ruled by its oldest member; but at the same time a passage from Plato, quoted by Mr. Seebohm himself (p. 60), shows that certain measures, such as the disinheritance of a member of the family, could not be undertaken without the consent of the kindred: "He who . . . has a mind . . . to expel from his family a son . . . shall collect together his own kinsmen, extending to (first) cousins, and in like manner his son's kinsmen by the mother's side, and in their presence he shall accuse his son, setting forth that he deserves *at the hands of them all* to be dismissed from the family." This family-council is an important factor in tribal life, particularly as being the prototype of the council of the city-state, which, as already remarked, only reproduces on a larger scale the relations of the previous stage of society.

In limiting the ἀγχιστεία to the degree of great-grandson, Mr. Seebohm seems to be quite right, although there are authorities who interpret παῖδες in the crucial expression ἀνεψιῶν παῖδες as meaning not merely children, but descendants. The evidence afforded by the litigation between the members of the family of Bouselos, which is excellently described on pp. 62 *ff.*, seems to make this clear.

The closeness of family relations in Greece gave rise to a curious state of things as regards the position of the illegitimate child. The position of the νόθος is perhaps not quite clearly stated by Mr. Seebohm. In one sense he had no place in the kindred. He could not be admitted to the phratria without the consent of the true son. The laws of Solon allowed no right of inheritance to the bastard, except in the case of failure of legitimate heirs. (It is true that the scholiast on the

passage of Aristophanes where this law is quoted thinks it is an invention of the poet's. But in any case the invention was probably founded on fact). In the text of the speech of Demosthenes against Makartatos is a law dating from Eukleides (403 B.C.), which seems to refuse to bastards even the limited right granted by Solon, as nothing is said of the case of legitimate children failing. But it is unwise to press the interpretation of the laws quoted in the speeches of Demosthenes, as they are notoriously in most cases interpolations of a later date. In any case it is clear that under ordinary circumstances the bastard could not be ἀγχιστής in his father's family. He could only claim as inheritance the νοθεῖα, which was a very limited sum. But this must not be interpreted in the sense that he was altogether an outcast. Politically he suffered little. Gilbert ("Greek Constitutional Antiquities," Eng. trans. p. 191, note 1) believes that νόθοι *ex cive Attica* were *ipso facto* citizens. When both parents were citizens, the bastard would probably belong to the Phyle of his mother, and when of age would be admitted to her Deme. The position of the bastard, however, brought into play the same device for evading the law as that suggested by our new death-duties, and wealth, as the scholiast already quoted informs us, was made over by the father by gift before his death. Greek society thus did something to alleviate the lot of the illegitimate son, whose position in the family, or rather out of it, might otherwise have been somewhat hard.

Mr. Seebohm is nervous lest, in ascribing to the structure of Athenian society a direct parentage amongst tribal institutions, he should meet with considerable criticism. It is improbable that any one will dispute his main conclusions. At any rate he is sensible of most of the difficulties attaching to his subject. There are many features in Greek society which seem foreign to the tribal system. The absence of Homeric evidence for regular ancestor-worship is not very satisfactorily explained by the suggestion that "the aristocratic tone of the poet did not permit him to bear witness to the intercourse with any deity besides the one great family of Olympic gods, less venerable than a river or other personification of nature." The Homeric poems, especially the Odyssey, are too full of the small details of daily life to permit us to accept this explanation—for Homer deals with swineherds as well as kings. Or take, again, the question of burial. De Coulanges ("La Cité Antique," p. 68) states roundly that the ancient custom was to bury the dead, not in cemeteries or by the way-side, but in the field belonging to each family. He adduces evidence for the survival of this custom even in the time of Demosthenes. But if this was the rule, what are we to say of the innumerable cemeteries dating from all periods, prehistoric downwards, which have been discovered all over Greece and on the islands and shores of the Aegean? In some parts, such as Lycia, we find the true tribal system of burial in use down to late times; but it is hardly an exaggeration to say that this is exceptional.

The essay before us touches on several questions of this kind, but space doubtless prevented the author from dealing with them at greater length. It is to be hoped that he will continue this line of study, and produce the volume dealing with Roman customs to which he alludes in his preface.

G. F. HILL.

A BIOLOGIST AS METAPHYSICIAN.

Mind and Motion and Monism. By the late George John Romanes, M.A., LL.D., F.R.S. Pp. vii. + 170. (London: Longmans, 1895.)

THIS little volume of Mr. Romanes' metaphysical writings possesses great interest. The type of philosophical theory which he represents has a singular fascination. He himself, it is plain, possessed genuine metaphysical powers, and he wrote at first hand, and with the acuteness and freshness of mind which are worth more than much learning. At the same time, he suffers for his disengagement from the work of other philosophers. The *naïveté* which forms the opening sentence of the book, that Hobbes is "the earliest writer who deserves to be called a psychologist," is a trifle. But there is no evidence that he had studied the father of monists, Spinoza; and though some points in his essay might have been modified if he had lived, it presents difficulties which, to a student of Spinoza, seem to be of the first magnitude. Yet, like the rest of his philosophical writing, even when it is unsatisfactory (and it seems to us unsatisfactory), it stimulates thought.

The volume consists of two essays, the Rede Lecture of 1885 on Mind and Motion, and a longer treatise on Monism, which amplifies and expounds the metaphysical ideas of the earlier essay, but makes many additions. Romanes holds with Clifford (who seems to have inspired his speculative thinking) that wherever there is matter there is mind in some form or other, and that mind and matter are everywhere but two aspects (two modes of apprehension he calls them) of one and the same reality. He makes admirably clear the truth that a physiological process which is accompanied by consciousness would not be what it is, if it were unaccompanied by consciousness, any more than we can separate the light and heat of an Edison burner. He shows that if we apply the idea of causality to mental action, we must apply it to the twofold reality, which is both physical and mental. But he throws no light on the difficulties raised by the phenomena of so-called unconsciousness. His disproof of spiritualism, as implying a creation of energy, is satisfactory; his disproof of materialism is less so. It is a shorter way with the materialists than even Berkeley's. To treat mind as a function of matter would be to treat it as a function of itself, since all that we know of the external world is our own mental modifications. Whereas Berkeley held matter to have no existence, save as an object of mind, Romanes goes further, and regards it as in some way mind itself. But if one fact is clearer than another, it is that we rarely have knowledge of our mental states, and that we primarily know objects. On the other hand, the simpler solution, that a physical process which is accompanied by consciousness cannot be merely physical, would afford no foundation for the theory of monism.

The most interesting portions of the essay are those in which he goes beyond Clifford. Clifford had stopped with attributing to each part of matter some portion of mind, mind-stuff, but said nothing of the universe itself. Romanes holds that we may regard the whole world of objects as itself an eject (*i.e.* an inferred subject), which we may regard as super-conscious. He founds himself on

the idea of a social consciousness working in the minds of members of a society. Though in his idea of an absolute mind he approaches most nearly to Spinoza, the argument is totally different, and the difficulties it raises are overwhelming. Is such a mind finite or infinite? If finite, where are the bounds of matter? If infinite, the analogy from the minds we know, which accompany a limited portion of matter, breaks down. Of a social mind we know nothing in fact; but so far as we conceive it clearly, we conceive it as animating the minds of individual persons. Yet if it is to supply a basis of inference to an absolute mind which animates the whole universe of physical and material things, we must suppose it to animate not merely ourselves, but our houses and all the material of our social life.

Romanes' thought reaches its highest flight where he identifies the principle of causality with volition. By this means he seeks to maintain the freedom of the will, and to find an explanation of morality and responsibility. It is an argument of much subtlety and ingenuity, in which elements are blended that remind us partly of Kant, partly of Green, but never of Spinoza. It culminates in an interesting theistic speculation, in which the absolute will is represented as assenting to the free volitions of all relative wills. The basis of the argument is a protest against regarding causality as in any sense prior to the mind, so that the mind should be subject to determination. The consciousness of causality is derived from volition, and therefore, so he seems to argue, volition is the primary cause. Hence the will as will is free to will anything whatever, even the impossible—it is limited only in its executive capacity through the restraints imposed on the body. On the other hand, though every will is free and might have willed otherwise, the moral or rational will is that which wills what is expedient under the circumstances in which actions have to be performed in the external world. This is no restriction of freedom, any more than a man is not free to marry, because to do so he must go through the marriage ceremony (a strange re-emergence this of the notion that moral action is simply self-consistent action). The questions raised by the argument are seductive. Every reason which Romanes alleges for the freedom of mind, as unaffected by causality, is equally an argument on the monistic theory against the causal necessity to which matter, he believes, is still subject. Instead of holding mind free and matter bond, he should have held them both equally bond or equally free, or should have declared causality to be an illusion. As it is, he has in reality reintroduced the notion of a mind which is not even affected by its own character. And this on the ground of what seems to be a confusion between two interpretations of will, as the process of which we are aware in volition, or as some supposed activity behind volition itself. If causation and volition are identical, as he says, and we become aware of causation by volition, the will must be the process known. But this may surely be subject to causality, like any other object of thought. If the will is understood in the other sense, how are we to understand the monistic identity of mental state and physiological process? Elsewhere Romanes urges that the mind is free, since whatever acts upon it is recognised by it as a motive. It would seem then natural to hold that while minds as well as bodies must be regarded as subject to determination, it is only minds which are conscious of their motives, and which therefore may have the consciousness of freedom.

S. A.

OUR BOOK SHELF.

Farm Foods: or, the Rational Feeding of Farm Animals. By Emil v. Wolff. Translated by Herbert H. Cousins, M.A. Pp. xvi. + 365. (London: Gurney and Jackson, 1895.)

THIS is a translation from the sixth edition of the well-known "Landwirtschaftliche Fütterungslehre" of Prof. v. Wolff, of Hohenheim. The book embraces three sections, dealing severally with the general laws of animal nutrition, the food of farm animals, and the feeding of farm animals. The most valuable part of the volume is the appendix, which consists of a series of six tables relating to (1) the average composition and digestibility of farm foods; (2) the digestibility of food-stuffs; (3) the nitrogen of foods expressed as albuminoids and amides; (4) feeding-stuffs for farm animals; (5) percentage composition of different parts of oxen, sheep, and pigs; (6) composition of carcase of oxen, sheep, and pigs. It is a coincidence that the volume should have appeared at about the time when the plaint went up at the meeting of the British Association at Ipswich, that for purposes of teaching or calculation we have to employ the results of German analyses relating to crops and food grown in a different climate, and under different conditions, from our own. In this way expression was given to the fact that the essential parts of Wolff's tables could be found in English books any time within the last eighteen or twenty years, so that agricultural students who were unable to read Wolff's work in the original were, nevertheless, not greatly handicapped. The circumstance that Wolff's investigations have in this way been so thoroughly "exploited" by English writers will no doubt impair the freshness and originality such as would have been associated with a translation of the treatise when it first appeared in 1874.

The examples that are given have a distinctly Teutonic flavour, and we may be pardoned for saying that, from our standpoint, they are somewhat academical. English farmers know nothing, for example, of potato slump, and Scotch farmers have to fatten their bullocks without mangel. Yet German beef is not to be mentioned in the same breath as the prime juicy joints of British growth, and German farmers have yet to bring their practice up to the level of turning out finished steers at three years old. A problem of far greater interest than any of those discussed would have been: Given a breeding flock of 500 or 1000 ewes to carry through such a season as either of the last two winters in Great Britain, with frosts severe and forage scarce, how would it best be done? English sheep-breeders solved this problem, and if they study this volume they will without doubt give due weight to the words (p. 105): "it is evident that our methods for the chemical analysis of food-stuffs, as well as our knowledge of the peculiar properties and proportions of different food-constituents, leave much to be desired."

The translator has done his work carefully, but he is not happy in his prefatory remarks, which show a lack of familiarity with English agricultural literature. When he refers to "the rather obtrusive fact that the book is simply the record of forty-two years' work by the experimental stations of the German Government on the feeding of farm animals," and further on says that "perhaps the most valuable feature of the book is that of the tables given in the appendix," he apparently overlooks the circumstance that at least two of the six tables are, as is acknowledged by Wolff himself, based principally on the results of Lawes and Gilbert, as published in the *Philosophical Transactions* in 1859 and 1883. But the reader will be prepared to overlook much when he sees

that even the name of Rothamsted is misspelt, both in the text and in the index. That Wolff's work, in English dress, will serve to increase the fame of its author cannot for a moment be doubted, and it is much to be hoped that many of the intelligent readers into whose hands it may fall will be qualified to read the volume critically.

Dog Stories from the "Spectator." With an Introduction by J. St. Loe Strachey. Pp. 264. (London: T. Fisher Unwin, 1895.)

A FEW of these stories record reasonable and well-observed instances of intelligent and deliberate acts of dogs, but most of them are anecdotes in which a modicum of fact is lost in a plenum of anthropomorphic fancies.

When an animal does anything remarkable, the average man (and more so the average woman) conceives that it is guided to its action by a train of *human* reasoning. It must, of course, be granted that dogs often behave with exceptional intelligence, and perform acts with distinct ends in view; we do not, indeed, venture to doubt any of these stories from the correspondence columns of the *Spectator*. But few people seem to be able to separate the "what" from the "why" when writing of animals' actions. Well-authenticated and trustworthy notes on canine intelligence are valuable; but when the narrators essay to explain the dog's motives, they get out of their depth. Here is the gist of a story of this kind: A dog jumped into a carriage at one of the stations on the District Railway; it remained under a seat of the compartment when the train stopped at two stations while the carriage door was opened, but when the door was opened the third time, the dog jumped out and slunk away. There is no evidence whatever that the dog's act was deliberate; and unless there were proofs to the contrary, it must be assumed that it was simply the result of impulse. Yet the anecdote fills nearly two pages of the book, the writer assuming that the dog recognised the station at which it alighted, and concluding with the words: "I suppose that he had been transferred to a new home, which had proved uncongenial, and was slipping away, in fear and trembling, to his old quarters." This is a fair example of the sentimental type of dog story—a type which predominates in the collection before us. A man who knows how to observe in a scientific manner, has no patience with the crude statements and unsupported assertions which make up most of these epistles; he will put his finger on weak points in nearly every page of this book. Many of the facts are the results of coincidences, but here and there among the chaff will be found grains of information of real importance to students of the instincts and habits of animals. The value of the stories is largely discounted from the scientific point of view, by the fact that the writers are often anonymous.

Science Readers. By Vincent T. Murché. Books v. and vi. (London: Macmillan and Co., 1895.)

THESE books are intended to be read by pupils in elementary schools, in conjunction with "object-lessons" given by the teacher. The text has been so carefully prepared, that juvenile readers will have no difficulty in understanding it, while the profuse illustrations add to its attractiveness. The apparently indiscriminate distribution of the subjects of the reading lessons is not one that commends itself to those who regard the orderly statement of facts as the cardinal principle of scientific instruction; but it must be remembered that pupils have to be interested as well as instructed, and Mr. Murché's practical knowledge of what interests the young people for whom he writes, has led him to depart from a strictly scientific arrangement. Putting this aside, however, the books contain a large amount of useful information, which the elementary scholars who read them will easily acquire.

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 November Meteors.

FROM various observations it would appear that the Leonids have not presented any unusual activity this year. The weather was tolerably favourable on the nights of November 12, 13 and 14, though there were occasional clouds and showers of rain; meteors were not, however, particularly numerous at any time.

At Bridgwater, on November 12, Mr. Corder watched the sky during the period from 14h. 5m. to 16h. 30m., and observed eighteen meteors, of which three or four only were Leonids.

At Bristol, on November 13, the writer counted ten meteors between 11h. and 13h. 30m., of which two only were Leonids. The sky was, however, partly overcast. At Bridgwater Mr. Corder maintained a look-out between 14h. and 16h. 10m., and recorded twenty-six ☄'s, including eleven Leonids with a well-defined radiant at 152°+23°.

At Bristol, on November 14, the writer saw very few meteors, and no Leonids before midnight. The observations were, therefore, relinquished as not likely to be productive.

During the nights following the 12th and 13th, and on the early part of that of the 14th, it is certain, from the above notes, that the Leonids were not numerously visible. If, therefore, the earth passed through a region of the stream much denser than usual, the *rencontre* must have occurred during daylight on the 14th. Observations in America will probably allow this point to be determined.

One of the best of the mid-November meteor showers has its radiant in Taurus, and it is a stream which furnishes an unusual proportion of fireballs. Several of them have been observed in the present year. About ten Taurids were seen at Bristol on the nights of the 13th and 14th, and Mr. Corder says that on the 12th and 13th he found them rather active and diverging from an accurately marked centre at 58°+22½°.

Fireballs appeared on November 9 at about 8h. and 10h. 45m. p.m., and on November 11 at 6h. 2m. p.m. Several conspicuous meteors were also remarked on the early evening of November 14. W. F. DENNING.

Bristol, November 17.

P.S.—A communication just received from Dr. A. Riggenbach, Professor of Astronomy at the University of Basle, Switzerland, contains the following:—"On November 13, after heavy rains the sky cleared up, and during the hours from 9h. 40m. to 13h. I perceived fourteen meteors, but only two of them appeared to be in connection with the Leonid swarm. From 1h. in the morning of the 14th, clouds impeded the observations. On November 14–15 the sky was overcast." Dr. Riggenbach's experience would therefore appear to corroborate the meagre results obtained at Bridgwater and Bristol.—W. F. D.

A Remarkable Daylight Meteor.

JUST before five in the afternoon of Wednesday, the 13th inst., a meteor of rare brilliancy, evidently one of the Leonids, was seen here. It was as large as Venus at its best. When flashing into view it lighted up the landscape with startling effect, though daylight had not faded. The meteor was followed by a dazzling golden-coloured train, which lasted for several seconds. The colour of the meteor by the waning daylight was of a peculiar greenish-blue tint.

Owing to the large size and intense brilliancy of the meteor, I expected that its grand appearance would have been observed in some other locality and noted in NATURE. Here this season the stream of the Leonids has been little in evidence.

Worcester. J. LLOYD BOZWARD.

The Feeding-Ground of the Herring.

IN your issue of October 24, Mr. Alexander Turbyne takes exception to the belief that copepods are most abundant between the Laminarian zone and the 20-fathom line. He gives his experience to prove that they congregate chiefly "in the deep water over the mud," and his contention is that herrings found with great numbers of copepods in their stomachs feed, for the

most part, at considerable depths, as in the depressions of 70 to 90 fathoms found in Loch Fyne.

I notice that this letter has now been reported in the *Fish Trades Gazette*, and, fearing lest the statement should go further unchallenged, I should like to suggest that the experiences of Brady, Herdman, and Scott cannot be set aside lightly. I in no way doubt the statement that copepods are abundant on the mud at 70 fathoms, but from the evidence given it is surely unnecessary to conclude that such depths are the natural feeding-ground of the herring. In Loch Fyne, after continued calms, I have seen congregations of *Calanus finmarchicus* floating in belts of dull opaque yellow, or left by the tide in such masses as made it possible to scoop them up in one's hand. It is far from probable, I fancy, that Mr. Turbyne's deep-water forms were more abundant, and yet the question is not merely one of the vertical range of copepoda. That herrings descend to a considerable depth seems true. That their eggs will hatch at as great a depth of 95 fathoms, the late Mr. George Brook and I proved in Loch Fyne. If at certain seasons they tend to congregate in deep areas, it is fortunate that, as Mr. Turbyne shows, a favourite food is to be had; yet when the copepods were as I describe, I saw the herrings being caught near the surface—I spent many nights off Skippness Point and in Kilbrennan Sound—and the fishermen told me that beneath such floating belts of copepods, closely packed shoals are usually to be met with. The fishes taken were gorged with *Calanus* and a few other species, such as *Temora longicornis* and *Dias longiremis*. The so-called disease of gut-pock was then prevalent. This I attributed, rightly or wrongly, to excess of oil brought into the intestinal tract by the copepods. The oil extruded plentifully from the anal openings. This, then, is evidence of herrings feeding freely on a plethora of copepods near or on the surface; evidence of a similar kind to that of Mr. Turbyne's, yet with an opposite deduction.

W. L. CALDERWOOD.

Napier-road, Edinburgh, November 11.

MacCullagh's Theory of Double Refraction.

IT is quite clear that Mr. Larmor has misapprehended the purport and object of the criticisms in my letter to NATURE of October 3.

I have not attempted to discuss the question whether or not "a gyrostatic ether may be constructed which will function (*sic*) according to MacCullagh's optical scheme." What I have said, is that the theory advocated by Mr. Larmor violates the principle of angular momentum, which is a totally different thing. I have also carefully avoided making use of any such phrases as "ordinary elastic matter," "elastic solid matter," and the like; for the employment of such expressions with reference to a quasi-fluid medium of extreme rarity, such as the ether is supposed to be, is altogether misleading, and is responsible for a good deal of misconception upon the subject.

Ever since the undulatory theory was accepted by the scientific world, the object of mathematicians has been to endeavour to form a conception of a medium whose properties are such, that optical phenomena may be deduced therefrom by dynamical principles and methods; and in order that any attempts should be successful, it is necessary for the medium to possess inertia, and also to be capable of resisting deformation. The latter condition requires that the forces on any right solid element, which are due to the action of contiguous parts of the medium, should consist of nine stresses. Now, whatever physical properties we may ascribe to the ether, or whatever the mathematical form of the equations may be which connect the nine stresses with the quantities upon which deformation depends, the principle of angular momentum requires that three relations should exist between the six conjugate stresses, except in the two special cases I have referred to in my former letter; that is to say, unless the medium is a gyrostatic one, or unless it is under the action of some system of forces (mutual or otherwise) whose action upon an element consists of a couple as well as a force.

Mr. Larmor appears to think that a satisfactory solution can be obtained by postulating an energy function, and deducing the equations of motion and the boundary conditions by the principle of least action; but this view is fallacious. For if some particular form of the energy function were assumed, and were found to lead to results which violate the principle of angular momentum, the theory would be dynamically unsound, and the results would represent some impossible form of motion. To write down certain mathematical expressions, and to perform certain mathematical operations, do not constitute a satisfactory theory, unless it can be shown that all the results furnish a consistent scheme in which none of the fundamental principles of dynamics are violated.

Mr. Larmor also suggests that possibly the energy function of a gyrostatic medium might be modified[1] in such a manner that MacCullagh's equations might be deduced therefrom by means of the principle of least action, and that it would be interesting and instructive to establish this in detail. But why has this not been done? If a mathematical investigation of this kind would be unsuitable for NATURE, the same objection would certainly not apply to the *Philosophical Transactions*.

I shall defer entering fully into the subject of magnetic action on the present occasion; but in the paragraph marked (2), Mr. Larmor has altogether failed to deal with the objection which I advanced, viz. that his theory is open to exactly the same defect as my own, inasmuch as it makes the tangential component of the E.M.F. discontinuous at an interface. What, according to Mr. Larmor's view, is the mathematical expression for the E.M.F. in a magnetised medium? What is the physical interpretation of the boundary condition referred to in my second letter? Does he propose to modify Maxwell's equations connecting the E.M.F. with the electric displacement? If he does, he ought to have stated the fact, explained the nature of the modifications he proposes, and his reasons for adopting them.

In conclusion, I fail to see that Mr. Larmor has made any adequate reply to my criticisms. To do this he must show (1) that his resuscitation of MacCullagh's theory does not violate the principle of angular momentum; (2) that his magnetic theory makes the tangential component of the E.M.F. continuous at an interface.

A. B. BASSET.

Fledborough Hall, Holyport, Berks, November 12.

The Nomenclature of Colours.

THE letter of Mr. Herbert Spencer in your issue of August 29, suggesting the use of a nomenclature to be used in connection with a scheme of colour standards, on a plan similar to that used by sailors in boxing the compass, is interesting, both because of its obvious appropriateness and because, as Mr. Spencer suggests may be the case, it has occurred to others. In a paper read before the American Association in 1890, I suggested the same idea, but at the same time stated that this would probably give more hues between the six standards than would be convenient in view of the uncertainty that will almost surely result in the mind of the common observer as to just which term should be applied in any one particular case. In view of this, I thought it wise to make the number of hues between the standards smaller than the compass chart would give. Those who have applied the standard colours to educational work have found this desirable.

The Milton Bradley Company, in their educational series of colour papers, have introduced only two hues between the standards. This makes the series R OR RO O YO OY Y GY YG G, &c. Mr. Louis Prang, of Boston, some two years since published a small pamphlet, proposing to make the series for common use R RRO ORO O OYO YO YYO Y, &c. On the whole, I think it wise to adopt the smaller number for ordinary use, and interpolate others for more delicate discriminations. A plan which seems to me a very practical one is the following, in which the hues represented by the symbols in capitals are for ordinary use, and those in small type for more careful discrimination: R orr ror OR oor rro RO oro roo O yoo oyo YO yyo ooy OY yoy oyy Y, &c. Translated into words, this would be RED, orange-red red, red orange-red, ORANGE RED, orange orange-red, red red-orange, RED ORANGE, orange red-orange, ORANGE, &c. Whatever method is used, however, does not in any way affect the value of the scheme of definitely determined standards of colour as proposed in my paper.

J. H. PILLSBURY.

Stoneham, Mass., U.S.A., November 7.

THE *Scientific American*, of New York City, in its issue of October 19, 1895, quotes from a letter to NATURE (vol. lii. p. 413), written by Mr. Herbert Spencer, suggesting that a

[1] The theory of the mixed transformation of Lagrange's equations, which leads to the energy function alluded to, was first given by myself in 1887. (See *Proc. Camb. Phil. Soc.*, vol. vi. p. 117, and "Hydrodynamics," vol. i. p. 173.)

system of colour nomenclature might be devised by indicating colours in a manner analogous to the accepted nomenclature of the points of the compass.

In this connection the enclosed circular, published by me during the summer of 1893, to explain briefly my system of colour standards, may be of interest to your readers. You will see that the system of colour nomemclature here described corresponds almost precisely to the idea in Mr. Spencer's mind.

October 24. LOUIS PRANG.

[WE have received, with Mr. Prang's letter, the circular descriptive of his system, which is essentially the same as that suggested by Mr. Spencer. As Mr. Spencer pointed out in his letter to us, the idea is a very obvious one, and had probably occurred to others; but this does not, of course, diminish its value. For ourselves, we are glad to see that the idea has been put into practice, and that, out of a chaos of colour-names, an intelligent system of nomenclature has been evolved. A series of standard coloured papers, harmoniously bound together, is published by the Prang Educational Company, Boston, for the use of teachers, designers, artists, and others.—ED. NATURE.]

RECENT IMPROVEMENTS IN LIGHTHOUSE ILLUMINATION.

PRIOR to the year 1822, the optical apparatus used in the best equipped lighthouses was silver-plated parabolic reflectors, having apertures, twenty-one inches for fixed, and twenty-five inches for revolving lights, their focal distance being four inches. These instruments, with a burner one inch diameter, and an initial power of eleven candles, condensed the light into a beam of 1304 and 2360 candles respectively. The power of a first order reflector light of sixteen reflectors, ranged on a frame having four faces, was equal to 9340 candles. These were the instruments (Fig. 1) which A. Fresnel,

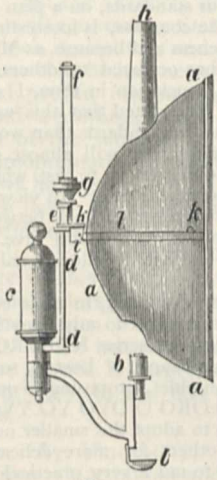


FIG. 1.

the celebrated physicist, replaced by optical apparatus of glass lenses and prisms acting by refraction and reflection in combination with a central lamp and multiple-wick burner of considerable power. In doing so he devised four optical agents: the annular lens, totally reflecting prisms, the cylindric refractor for small apparatus, and straight vertical reflecting prisms. These instruments he combined in different ways to form fixed and revolving apparatus suitable for lighthouse purposes. The annular lens subtended at the focus 45° vertically and horizontally, the focal distance being 920 m.m. (36·22 inches). Some of Fresnel's optical instruments in the hands of Mr. Alan Stevenson, underwent very notable alteration, extension, and improvement. The first order lens was extended to subtend 57° vertically, and reflecting prismatic rings were substituted below the lenses for silvered mirrors. The central portion of the first order fixed light apparatus (Fig. 2) was converted from a polygon formed of narrow lenses to a cylindrical drum, which drum was divided into sections having helical joints, and above and below the central belt reflecting prisms were introduced.

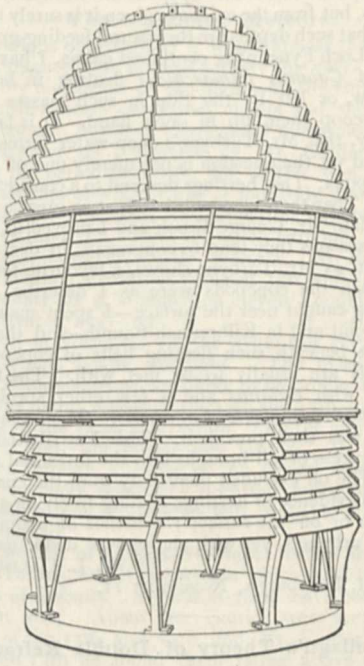


FIG. 2.

The next improvements were those of 1849–1850, by Mr. Thomas Stevenson, the main feature of which was that, for revolving lights, totally reflecting prisms generated round a horizontal axis were introduced above and below the lenses, lenticular action being thus extended throughout the whole height of the instrument (Fig. 3).

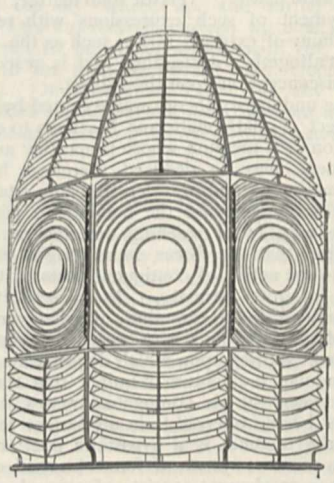


FIG. 3.

Then followed the dioptric spherical mirror, the dioptric holophote, the azimuthal condensing system, and its application to fixed, flashing, intermittent, and group flashing lights; the bivalve apparatus of 1859, which is really two holophotes ten feet in diameter, increased in power by a dioptric mirror, and numerous combinations of these and previously devised instruments.

One of the most notable of recent improvements is the hyper-radiant apparatus of 1330 m.m. or even greater radius, proposed by Messrs. Stevenson in 1869 (Fig. 4). This apparatus was designed to take advantage of the large and powerful flames of burners of greater diameter than five-wick ; the introduction of burners of increased size having been inaugurated by Mr. Wigham in connection with his gas burners, and rendered possible, on financial grounds, with oil burners, by the introduction of paraffin. With revolving apparatus of 920 m.m. radius, it was clearly demonstrated that with burners of large diameter, much of the light, being exfocal, escaped condensation, and hence the hyper-radiant apparatus was designed to utilise and condense the rays proceeding from the large radiant. The light from one of the lenses of a hyper-radiant apparatus is more intense with the same size of burner in the focus than that from two lenses of 920 m.m. The hyper-radiant is now largely used by all lighthouse authorities. In 1872, Mr. Wigham suggested a very obvious method of increasing the power of a lighthouse by superposing in the lantern two, three, or four lenses, each with its own burner. Such arrangements have been introduced at several lighthouses,

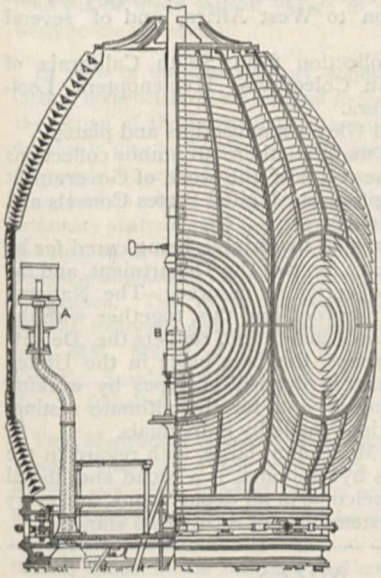
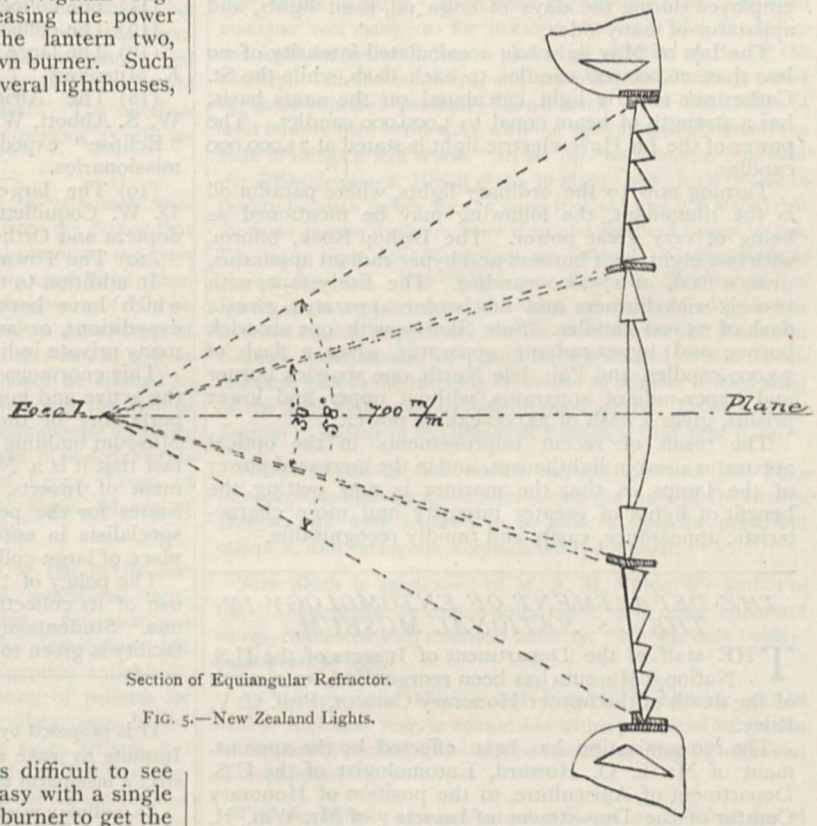


FIG. 4.

both in Ireland and England, but it is difficult to see what the advantage is, as it is quite easy with a single apparatus, properly designed, and single burner to get the same power and at a less cost. Mr. Charles A. Stevenson designed a form of refractor which is spherical in the horizontal and vertical planes, and this form was adopted in the apparatus of North Fair Isle lighthouse. The spherical refractor, if it has spherical profiles, loses in efficiency if carried beyond an angle subtending 20° at the focus, but when this design has combined with it Mr. C. A. Stevenson's equiangular prisms, as in the design for Sule Skerry lighthouse, there is less divergence, and hence less loss of light, than is the case with the Fresnel forms ; in the case of the spherical lens, from the fact of its greater radius, and in the equiangular, from the prisms being of profiles of minimum divergence for exfocal light. In the design for Rattray Head apparatus, the equiangular prisms have been adopted to enable the lens to be carried to 80° of a vertical angle, the prisms at this high angle of refraction still remaining of good efficiency ; whereas when lenses are carried to this high refracting angle by Fresnel's prisms, the lenses become very ineffective, owing to their great divergence for exfocal light. In recent designs by Messrs. Stevenson, of optical apparatus for New Zealand, lenses equiangular throughout have been introduced (Fig. 5).

The increased and ever-increasing speed of steamships has necessitated the adoption, for over-sea and prominent lighthouses, of revolving, flashing, and group flashing apparatus, having short periods of light and darkness. This is desirable in order that the sailor may be able, in a short space of time, without appeal to a watch, to tell the character of the light he sees. But long before the days of fast steamers, Mr. R. Stevenson recognised the desirability of shortening the periods of light and darkness, and in 1825 he introduced the "flashing" distinction on the coast of Scotland, having periods of 5″ light and 5″ darkness. Subsequent experience has fully proved the utility of this striking characteristic. In 1874, Dr. Hopkinson proposed the important group flashing characteristic, which has since been largely adopted.



Section of Equiangular Refractor.

FIG. 5.—New Zealand Lights.

The length of the duration of a flash to be effective has been lately much discussed by lighthouse engineers, and is a matter of great importance, for the shorter the flash can be made with efficiency, the stronger it can be made. Messrs. Stevenson have, in recent years, been gradually reducing the length of the flashes in apparatus designed by them, and in the case of the Isle of May electric light, installed in 1886, they reduced the flashes to half-second duration. They have not been followed in this by the lighthouse engineers of other countries, as, for example, in the case of St. Catherine's, lighted in 1888, where the flashes are 5″ duration. The French lighthouse engineers, however, have gone further, and within the last two years have designed lights, the duration of the flashes being only one-tenth second. This is going to the other extreme. M. Bourdelles and M. Blondel, in papers read before the International Maritime Congress, 1893, give the grounds on which they advocate such short flashes. They say, and say

truly, that physically even less than one-tenth second is sufficient to make the maximum impression on the eye, and conclude that a longer duration is therefore unnecessary. This would be a sound conclusion were the atmosphere always clear, but it is not so. Now it is physically true, as they admit, that the duration necessary for the full effect of a flash depends on the intensity of the light; a weaker flash must have a longer duration than a stronger one, to make the full effect on the retina. But by the time a powerful flash has pierced a few miles of hazy atmosphere, it is no longer powerful, and if it has not a duration suitable to its reduced power, it will not be seen so far. This is a question which cannot be settled on merely theoretical grounds, but must inevitably be a matter of experience. The following are a few figures showing the great power of some modern lighthouse apparatus now in use in the Trinity House and Northern Lighthouse Services, as compared with anything employed during the days of colza oil, fixed lights, and apparatus of many sides.

The Isle of May light has a calculated intensity of no less than 26,000,000 candles to each flash, while the St. Catherine's electric light, calculated on the same basis, has a strength of beam equal to 5,000,000 candles. The power of the La Heve electric light is stated at 23,000,000 candles.

Turning now to the ordinary lights, where paraffin oil is the illuminant, the following may be mentioned as being of very great power. The Bishop Rock, biform, with two eight-wick burners and hyper-radiant apparatus, gives a flash of 175,000 candles. The Eddystone, with two six-wick burners and first order apparatus, gives a flash of 75,000 candles. Sule Skerry, with one six-wick burner and hyper-radiant apparatus, gives a flash of 74,000 candles, and Fair Isle North, one six-wick burner and hyper-radiant apparatus, without upper and lower prisms, gives a flash of 72,000-candle power.

The result of recent improvements in the optical apparatus used in lighthouses, and in the increased power of the lamps, is that the mariner is now getting the benefit of lights of greater intensity and more characteristic appearance, easily and rapidly recognisable.

THE DEPARTMENT OF ENTOMOLOGY IN THE U.S. NATIONAL MUSEUM.

THE staff of the Department of Insects of the U.S. National Museum has been reorganised, as a result of the death of the former Honorary Curator, Prof. C. V. Riley.

The reorganisation has been effected by the appointment of Mr. L. O. Howard, Entomologist of the U.S. Department of Agriculture, to the position of Honorary Curator of the Department of Insects; of Mr. Wm. H. Ashmead to the position of Custodian of Hymenoptera; and Mr. D. W. Coquillett to the position of Custodian of Diptera. All Museum custodians are honorary officers. Mr. M. L. Linell will remain as general assistant to the Honorary Curator.

The Department is at present in excellent working condition. It contains a very great amount of material in all orders, and in many unusual directions surpasses any collection in the United States. Among others, the following are of especial interest:—

(1) The large collection, in all orders, of the late Prof. C. V. Riley.

(2) All of the material gathered during the past eighteen years by correspondents, field agents, and the office staff of the Division of Entomology, U.S. Department of Agriculture.

(3) The greater part of the collection of the late Asa Fitch.

(4) The large collection, in all orders, of the late G. W. Belfrage.

(5) The collections in Lepidoptera and Coleoptera made by Dr. John B. Smith down to 1889, together with the types of the Noctuidæ since described by Dr. Smith.

(6) The collection of Lepidoptera of the late O. Meske.

(7) The collection of Lepidoptera of G. Beyer.

(8) The collection of Coleoptera of M. L. Linell.

(9) The bulk of the collection, in all orders, of the late H. K. Morrison.

(10) The collection of Diptera of the late Edward Burgess.

(11) The type collection of Syrphidæ made by Dr. S. W. Williston.

(12) The collection of Ixodidæ of the late Dr. George Marx.

(13) The collection of Myriopoda of the late C. H. Bollman.

(14) Sets of the Neo-tropical collections of Herbert Smith.

(15) The collection of Hymenoptera of Wm. J. Fox.

(16) The collection of Tineina of Wm. Beutenmuller.

(17) The large Japanese collection, in all orders, of Dr. K. Mitsukuri.

(18) The African collections, in all orders, of Dr. W. S. Abbott, Wm. Astor Chanler, J. F. Brady, the last "Eclipse" expedition to West Africa, and of several missionaries.

(19) The large collection from South California of D. W. Coquillett, in Coleoptera, Hymenoptera, Lepidoptera and Orthoptera.

(20) The Townend Glover manuscripts and plates.

In addition to this material, there are minor collections which have been the result of the work of Government expeditions, or are gifts from United States Consuls and many private individuals.

This enormous mass of material is being cared for by the active and honorary force of the Department, and the perpetuity of the collection is assured. The National Museum building is fireproof, and this, together with the fact that it is a National institution, renders the Department of Insects, perhaps, the best place in the United States for the permanent deposit of types by working specialists in entomology, and for the ultimate resting-place of large collections made by individuals.

The policy of the Museum at large, with regard to the use of its collections by students, is a broad and liberal one. Students are welcome in all departments, and every facility is given to systematists of recognised standing.

NOTES.

IT is proposed by the Administrative Council of the Pasteur Institute to make an international appeal for subscriptions to erect a monument to the memory of Pasteur.

AN ordinary meeting of the Royal Society, for the reading of papers though not announced upon the printed list of arranged meetings, will be held on the 28th inst.

SIR ARCHIBALD GEIKIE and Prof. Story Maskelyne have been elected corresponding members of the Munich Academy of Sciences, in the Mathematical and Physical Section; and Dr. H. B. Swete, of Cambridge, has been elected a corresponding member in the Philosophical and Philological Section of the same Academy.

IN accordance with the arrangement mentioned in our last week's issue, Dr. A. G. Butler becomes Senior Assistant-Keeper of the Zoological Department of the British Museum, with special charge of the section of insects, and Mr. Edgar A. Smith and Dr. R. Bowdler Sharpe have been promoted to fill the two other assistant-keeperships. Mr. Vernon Herbert Blackman, of St. John's College, Cambridge, has been appointed, after competitive examination, an assistant in the Department of Botany, in the place rendered vacant by the promotions consequent upon the retirement of Mr. Carruthers.

WITH reference to the aurora briefly noted in our last number (p. 35), Mr. J. Shaw writes from Tynron, Dumfriesshire, as follows:—"At 11 p.m. November 9, I saw an aurora extending from the north-west to the north-east, where it began to break into long lines, one line lying above the planet Jupiter. It occupied about one-fourth of the distance from horizon to zenith at its widest. The luminosity was singularly free of tremulous motion, and between it and the spectator were ragged patches of black clouds, such as often portend rain, which began to fall in torrents four hours later."

FOR some years the need has been felt at the Harvard College Observatory, of some means of making a more prompt announcement of the results of its work. It is proposed therefore to issue a series of circulars, as required, to announce any matters of interest, such as discoveries made there, the results of recent observations, new plans of work, and gifts or bequests. It is not proposed to give these circulars a wide distribution, but rather to use them as a means of bringing new facts to the attention of the editors of astronomical and other periodicals, and thus secure the immediate publication of such portions as would be of interest to the readers of these periodicals. The distributions will be made without charge to such persons as will be likely to use the results.

IN view of the unsatisfactory condition of veterinary anatomical nomenclature, we are glad to learn from the *Lancet* that the section of the recent sixth international veterinary congress detailed to give an opinion as to the necessary steps to be taken to remedy it, reported that the *Nomina Anatomica* of His be recognised as a basis for an international Latin nomenclature of veterinary anatomy, and that the work of adaptation, as well as the creation of new Latin denominations, should be allotted to certain anatomists of the countries represented, with the right of co-optation. This recommendation was unanimously adopted, and the following gentlemen were appointed to undertake this task, MM. Müller of Berlin, Arloing of Lyons, Lorge of Brussels, Sussdorf of Stuttgart, Schmalz of Berlin, Martin of Zürich, Rubeli of Bern, and Szakall of Pesth.

THE Manchester Museum was opened to the public last Sunday afternoon. The attendance was considered satisfactory, some five hundred visitors entering. Attention was pretty evenly distributed through the various departments, but a special attraction was the collection of Egyptian antiquities, recently added to the museum, and consisting of palettes for grinding metal tools, ceremonial and other flints, mace-heads, pottery (figured, polished, and rough), stone vases, art jars, &c. Objects arranged naturally, as specimens of the Porifera, also found favour. Arrangements are being made for demonstrations to be given upon the various classes of exhibits; and it is expected that this concession, rendered possible by the important pecuniary assistance from the Manchester Corporation, will be fully appreciated.

THE Executive Committee appointed to make the necessary local arrangements for the reception of the British Association in Liverpool, next year, held a meeting on Friday last, under the presidency of Sir Wm. Forwood. Among those present were the secretaries, Prof. Herdman, F.R.S., and Messrs. Isaac Thompson and Willink; the honorary treasurers, Mr. Reginald Bushell and Mr. C. Booth, jun.; Prof. O. Lodge, Drs. Hope and Forbes, and others. It was announced that the following gentlemen had been elected by the Council of the Association vice-presidents of the meeting, to be held from Wednesday, September 16, to September 23, 1896: The Lord Mayor (the Earl of Derby, K.G.), Lord Sefton, Sir W. B. Forwood, Mr. M. Rathbone, Mr. George Holt, Mr. T. H. Ismay, Principal Rendall, Sir Henry Roscoe, and Mr. W. Crookes. The President-elect is Sir Joseph Lister, Bart., F.R.S. A subcommittee was appointed to superintend the hospitable arrangements, which will be conducted on a liberal scale, and it was proposed to arrange for an excursion to the Isle of Man at the conclusion of the meeting. This excursion would occupy several days, and it was hoped that a local committee in the island would be appointed and facilitate arrangements. The honorary treasurers reported that they had received a large number of subscriptions; but as they had no reason to consider the list complete, they proposed to defer the publication of the list.

THE vagueness of the English names of our wild plants is one of the stumbling-blocks in the way of the student of botany. Those given in our text-books are, for the greater part, mere book-names—often simply translations of the Latin names—which are not, and never have been, applied to the plant in any part of the country. Even with regard to familiar names in common use, many—as for instance, eyebright and harebell—are used for quite different plants in different parts of the country. On the continent, and especially in Germany, where the more educated peasantry have a much better knowledge of wild flowers than is the case with our agricultural labourers, the state of things is still worse. In his *Internationales Wörterbuch der Pflanzennamen*, Ulrich gives, in many cases, from twelve to twenty German names for the same species; and it is stated that for some species there are more than one hundred names in use. We learn from *Die Natur* that an attempt is being made to correct this evil. The *Allgemeine Deutsche Sprachverein* of Berlin offers two prizes, of the value of six hundred and four hundred marks, respectively, for the best schemes for a uniform German nomenclature of plants for schools. It would be an immense gain to the teaching of botany in schools if something of the same kind could be done in this country. Could not the *Journal of Botany* or the Botanical Exchange Club take it up?

AFTER a part of last week's issue of NATURE had been printed off, containing a note announcing the death of Dr. George Dawson, we were rejoiced to be able to stop the press and cancel it, as a cablegram contradicted the rumour.

THE death is announced of M. A. M. Villon, the author of the "Dictionnaire de chimie industrielle" and other important works connected with chemical industry. He was only twenty-eight years of age.

AN International Marine and Fisheries Exhibition will be held at Kiel next year, in connection with a provincial exhibition for Schleswig-Holstein, and will be open from May 13 to the end of September.

THE earthquake which occurred at Rome on the first day of this month, and was noted in these columns (p. 12), was preceded by severe shocks, felt in parts of the United States, in the early morning of October 31. The shocks appear to have especially affected Ohio, Illinois, and Indiana.

ANOTHER important atmospheric disturbance approached our western coasts from the Atlantic on Friday last, 15th instant, causing further south-westerly gales and considerable damage; and before this disturbance had passed away a secondary depression reached St. George's Channel, on the following day. The rainfall which accompanied these storms was very considerable, amounting to nearly three inches in two days at Holyhead. In the storm of Saturday, the Bishop's lighthouse, off Pembroke, was struck by lightning.

THE Committee formed for the purpose of erecting a memorial to the late Dr. Valentine Ball, C.B., F.R.S., Director of the Science and Art Museum, Dublin, announce their desire to close the subscription list at an early date, and trust intending sub-

scribers will soon send their donations to the Treasurer, Dr. Samuel Gordon, Hume Street, Dublin. The subscription to the memorial is limited to one guinea. It is proposed to place a marble bust of Dr. Ball in the National Museum, the scene of his latest labours. It is further proposed, should there be sufficient funds, to have a portrait of Dr. Ball painted and placed in a position to be hereafter determined. About £120 has so far been subscribed.

THE first meeting of the one hundred and forty-second session of the Society of Arts was held on Wednesday evening, November 20. Previous to Christmas there will be four other ordinary meetings, as follows: November 27, locomotive carriages for common roads, by Mr. H. H. Cunynghame; December 4, on mural painting, with the aid of metallic oxides and soluble silicates, by Mrs. Anna Lea-Merritt and Prof. W. C. Roberts-Austen, C.B., F.R.S.; December 11, water purification by means of iron, by Mr. F. A. Anderson; December 18, machines for composing letter-press printing surfaces, by Mr. John Southward. The following papers will be read at meetings after Christmas: Dairy produce, by Mr. George Barham; the making of a great University for London, by Prof. Silvanus P. Thompson, F.R.S.; some native Irish industries, by Prof. Haddon; standards of light, by Mr. W. J. Dibden; ortho-chromatic photography, by Captain W. de W. Abney, C.B., F.R.S.; the garden in relation to the house, by Mr. F. Inigo Thomas; English book illustrations, 1860-70, by Mr. Joseph Pennell; Punjab irrigation, ancient and modern, by Sir James Broadwood Lyall, K.C.S.I.; the economic development of Kashmir, by Mr. Walter R. Lawrence. The following courses of Cantor lectures have been arranged: W. Worby Beaumont, on mechanical road carriages; Dr. J. A. Fleming, F.R.S., on alternate current transformers; Prof. J. M. Thomson, on the chemistry of metals and alloys employed for building and decorative purposes; Mr. H. Graham Harris, on refrigeration; Mr. Henry A. Miers, on precious stones; Mr. James Swinburne, on applied electro-chemistry. Two lectures, suitable for a juvenile audience, will be delivered on Wednesday evenings, January 1 and 8, 1896, by Prof. John Milne, F.R.S., on earthquakes, earth movements, and volcanoes.

A CONFERENCE, presided over by Sir Courtenay Boyle, and largely attended by representatives of municipal corporations, public companies, and others interested in the supply of electricity, was opened in the Westminster Town Hall yesterday, to consider the revised regulations made by the Board of Trade under the Electric Lighting Acts of 1882 and 1888. We summarise the report in the *Times*. The regulations were discussed seriatim, and a number of important changes were accepted. With reference to the Board of Trade definition of electrical pressure, Prof. Ayrton, who, with Mr. Compton, represented the Institution of Electrical Engineers, proposed that the expression "pressure" should mean "the difference of electrical potential between any part of any conductor and the earth, or between any two adjacent wires on the three or five-wire system." The Chairman promised that the proposal should receive careful consideration. He added, that he intended to advise the Board of Trade to raise the alternating current limit from 100 volts to a higher figure, say to 220 volts, or thereabouts. With regard to the low-pressure continuous current limit, he thought that it might be raised slightly above 300 volts. Discussion took place upon the regulation that "no high-pressure electric line shall be used for the transmission of more than 200,000 watts, and Mr. Compton suggested that the limit should be 500,000 watts." The Chairman said he intended to advise the Board of Trade not to adhere to the limit of 200,000 watts, but he thought that of 500,000 watts a little too high. He offered to make an important amendment in the clause referring to tests of insulation, the clause in its amended form reading: "Every electric main shall be tested for insulation after having been placed in position, the testing pressure being at least 200 volts, and the undertakers shall duly record the results of the tests of each line or section of a main." With reference to the clause requiring a test of insulation before a high-pressure circuit can be brought into use, the Chairman suggested the introduction of words providing that the test required in the case of electric lines should be twice the pressure to which the lines were to be subjected in use, and in the case of machines or apparatus intended to form part of a high-pressure circuit 50 per cent. more. As to the question of leakages from gas mains, and the accumulation of explosive mixtures in electrical conduits and street boxes, the Chairman said he would be prepared to recommend the Board of Trade to accept a clause based on that suggested by the Institution of Electrical Engineers, that is to say, imposing upon undertakers the obligation to take reasonable means to prevent the influx and accumulation of gas in boxes, and to give notice to the gas companies whenever an accumulation of gas therein was discovered. He accepted that clause on the understanding that there must be some further regulation with regard to the ventilation of street boxes.

A NOTE on the tinfoil grating as a detector for electric waves, by T. Mizuno, appears in the *Journal* of the College of Science of Tokyo. The author has been repeating and extending Aschkinass' most interesting experiments on this subject. The gratings employed are formed by coating a flat wooden block with tinfoil, and then cutting on it a number of fine parallel slits with a sharp knife. Two gratings have been used, one having a resistance of 130 ohms, and the other of 232 ohms. The wave-length of the electric radiation employed was about 60 cm. On exposure of these gratings to the electric radiation, the resistance fell in some cases as much as 11 ohms and 42 ohms respectively. Gentle tapping was sufficient to cause the resistance to increase to almost its former value. The experiments indicate that the angle which the plane of polarisation of the radiation makes with the strips of the grating influences the results to a certain extent, a greater decrease of resistance taking place when the strips are perpendicular to the plane in which the primary oscillations take place. The author has made some experiments with a view of determining whether the change in resistance is due to a molecular change in the tinfoil, or whether the change is a mechanical one. He has constructed gratings in which the spaces between the strips were much larger than in the above gratings. With this grating, however, no indication of a decrease of resistance under the action of electric radiation was observable. Gratings formed of fine german-silver wire and fine iron wire, also, showed no effect. The author concludes that the change is a mechanical one, and suggests that it may be due to small jagged points on the neighbouring strips coming into contact under the influence of the electric waves.

THE competition for mechanical carriages, which was arranged by the *Times-Herald* of Chicago to take place on November 1, has been postponed until the 28th inst., at the request of a number of the competitors who had entered for the competition, but were not prepared. According to the *Journal* of the Society of Arts, the *Times-Herald* thereupon offered a prize of £100, to be divided amongst those competitors who went over the course arranged for the race. This course extends over the line of boulevards which surround Chicago to a place named Waukegan on the lake shore, thirty miles to the north of the city. Several vehicles started, but only one completed the course—the carriage entered by A. Mueller, of Decatur, Illinois. The vehicle carries four persons, and is driven by a gasoline motor. The total distance covered was ninety-two miles, and the time taken 8 hours 44 minutes.

IF the Buchan Field Club succeeds in carrying out the ethnological survey sketched in its *Transactions* (1895) by Mr. T. Gray, who gives also the results of preliminary observations made by Mr. J. F. Tocher and himself, it will not only fill an important hiatus in the ethnographic chart of Great Britain, but also set an example which may be followed with advantage by similar societies all over the country. The observations referred to were made at the annual Buchan gathering, held this year at Mintlaw, and though no definite conclusions can be safely made from them, they show that a continuation of the survey will lead to interesting results, and help to settle a number of vexed questions in ethnology and history. The class of people at such gatherings as that at which the measures were made is very typical of the natives of the district, and the statistics obtained by Mr. Gray, and those working with him, should be of great value in determining the accurate anatomy of the typical native of Buchan.

A VALUABLE contribution to the existing literature of water-bacteriology has been recently made by M. N. van der Sleen. This monograph is a record of bacteriological investigations made during more than four years on the Amsterdam water-supply. The author has identified and described no less than 80 varieties of water microbes, some of which he regards as new, whilst others are identical with those already discovered by other investigators. A most helpful diagnostic aid is furnished by the 118 excellent photographic figures of microbes which accompany the text. No cholera bacilli were at any time found, and only one form which at all resembled them, although a careful search was made at a period when cholera had broken out in the vicinity of the intake of the water-supply, and when the river Vecht was declared contaminated by the authorities. M. van der Sleen has endeavoured to give water-bacteriologists fresh assistance in the difficult task of recognising the bacteria found in water, and the conscientious care with which he has accomplished this tedious piece of work deserves the highest praise.

THE well-known difficulty of obtaining instruments which will indicate rapid variations of temperature, has induced Mr. Paul Czermak, of Graz, to try thermo-elements with very fine wires for meteorological observations. These are better than thermometers with platinum bulbs, and much superior to glass-bulb thermometers, where rapid variations are to be measured. One of the instruments constructed consists of a thermo-couple of copper and constantane wire 0·1 m.m. thick. The ends are soldered to two hollow copper cylinders drawn into a point at the ends, and mounted side by side on a wooden support. The cylinders contain water, and hold ordinary thermometers indicating the average temperature. This instrument, when used in circuit with a strongly-damped aperiodic galvanometer, showed variations amounting to 2° C. within five minutes on a clear frosty Tirolese morning. The stratification of the air in layers of different temperatures was less in the afternoon. The paper describing these results, in *Wiedemann's Annalen*, also gives an account of a "relative actinometer" consisting of two concentric copper cylinders. The interior one is empty, and across one end of it are placed three thermo-couples in parallel, protected from draughts by a plate of rock-salt mounted obliquely to the axis of the cylinders. This instrument indicates the slightest variations of the intensity of solar radiation, such as those produced by different thicknesses of a filmy cloud.

SIR ROBERT BELL is said to have discovered a very large river flowing into James Bay. The river rises near the upper waters of the Ottawa, and drains a large area hitherto unexplored. The volume of water is so great as to make the river rank among the largest in Canada. It is navigable through the greater part of its course, but about one hundred miles from its mouth the descent becomes greater, and a series of rapids are formed. The name "Bell River" is proposed, in honour of its discoverer.

WE are indebted to the Vienna correspondent of the *Times* for the following information. At the beginning of this month the German Society for Geographical Discovery, and the special committee which has been organised for the purpose of promoting the exploration of the South Polar regions, held a joint sitting in Berlin, which Herr Julius von Payer, the well-known Austrian Arctic traveller, was requested to attend. In the course of the proceedings he was invited to modify the arrangements he had himself made in connection with the expedition to North-East Greenland, and, if possible, to co-operate with the Germans in undertaking an expedition to the South Pole. Herr von Payer replied that, although he was not adverse to the proposal, he could make no definite statement until he had ascertained the opinion of the Vienna committee, who had in hand the arrangements relative to the intended Austro-Hungarian expedition to Greenland. Within the next few days the Vienna committee will meet, under the presidency of Count Wilczek, with the object of considering the German proposals. The invitation to act in concert with Germany seems to be regarded with favour in Vienna. Herr von Payer has stated that, in view of the multitude of scientific and artistic opportunities afforded by a visit to Antarctic regions, he would have no objection to alter the destination of the contemplated Austro-Hungarian expedition. During the preliminary discussion, which took place in Berlin, it was decided that the expedition should consist of two steamers equipped on the most improved lines. The first landing would be effected on Kerguelen Island, whence it would be possible to proceed in two different directions—namely, either south or south-west, leading to a totally unknown region, or south-east towards the Magnetic Pole, in which direction a continent is supposed to exist. Geographical discovery, of course, would be the chief object of the expedition, but equally valuable results are expected to accrue to botany, zoology, and geology. About eighteen months would be required to prepare and organise the expedition, and the cost is estimated at about 1,000,000 marks. In order to achieve success the expedition would remain absent from two and a half to three years, it being considered essential that at least two winters should be spent in the Antarctic regions.

THE seventh number of the current volume of the *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* contains a discussion, by Hermann Moedebeck, of the project of reaching the North Pole by balloon, with the conclusion that, in our present ignorance of Arctic wind currents, it is impossible to decide as to the probabilities of success. Dr. Hedin continues an account of his journey across the Takla-Makan desert east of Yarkand. Wegener gives a summary of the papers read at the Geographical Congress in London. The volume refers to the departure of an expedition, under Humpelmayr and Sperhinger, from the Somali coast, in order to march southwards across the Galla country to Mombasa. The more important contributions offered to this Society are published in its *Zeitschrift*, of which we have received the fourth part of vol. xxx. This contains the third part of the report by the cousins Sarasin upon their travels in Celebes, describing the journey, in the winter of 1894, across the centre of the island from Boni to the Gulf of Tomini. The report is mainly narrative, but contains many notes on the zoology, anthropology, and geology of the district traversed. The monographs previously issued by the Sarasins, containing zoological and anthropological discoveries made during their visit to Ceylon, are well known, and encourage us to expect important results from their present journey.

THE principal article in the last number of the *Mittheilungen* of the Geographical Society of Vienna (Bd. xxxviii. Nos. 7 and 8) is a memoir, by R. Payer, on the districts of Eastern

Peru included in the Amazon basin. It consists mainly of an account of the various diseases. Dr. Gavazzi gives a short account of the hydrology of the lower part of the River Krka in Dalmatia. Among the smaller articles contributed is a biography of Huxley by Dr. Haas, an account of the German expedition of Lieut. von Carnap-Querheimb and Dr. Grüner in Togoland, and of Dr. Krüger up the Palena river in Chile. There is also a short notice of Glave, who did excellent work under Stanley on the Congo, and died there in May last. It also contains a report on the various expeditions engaged in work in Africa. From this we learn that Capt. Bottego is attempting to march from Barawa, on the Somali coast, to Logh, on the Juba; thence he is to cross to Lake Rudolf, and explore the course of the Omo, from its mouth to the point where Prince Ruspoli was killed. The King of Italy and the Italian Government have each contributed 40,000 lire for this expedition, Prince Boris, the well-known Russian sportsman, has been shooting in the Ogaden country in Somaliland, and has traced the Dachato river to its confluence with the Webi Schebeyli. Dr. Humpelmayr left Berbera in June in order to march across East Africa from north to south, as far as Mombasa.

THE Zoological Society have just issued the thirty-first volume of the *Zoological Record*, containing a summary of the zoological literature published in the year 1894. The various articles have been prepared by Messrs. J. A. Thomson, R. Lydekker, R. Bowdler Sharpe, G. A. Boulanger, W. A. Herdman, B. B. Woodward, D. Sharp, F. A. Bather, R. Hanitsch, and Miss Florence Buchanan. The whole volume has been edited by Dr. D. Sharp, F.R.S., of the Cambridge University Museum. Great credit is due to the Society and to the Editor for the early date at which this volume has been published. We observe that the corresponding *Record*, just finished in Wiegmann's *Archiv*, only relates to the year 1890, being thus *four years* behind that of its English rival. A very useful feature in the present volume is the newly revised list of abbreviations used in the *Record* for the titles of the *Journals* and *Transactions* that contain zoological papers. These periodicals are now, as is well known, exceedingly numerous, and increase in number every year. Some sixty or seventy new titles have been added to the present edition. The principal libraries in London and Cambridge, in which the various periodicals are to be found, are indicated by key-letters attached to each title, so that the recorder in each subject may always know where to go for his information. We observe that the present volume contains no records for the Crustacea, Arachnida, Myriopoda, and Cœlenterata, the naturalists to whom these subjects were assigned (Mr. R. I. Pocock and Dr. S. J. Hickson) not having delivered their manuscripts at the promised date. These deficiencies are much to be regretted; but the early appearance of a *Zoological Record* is a matter of so much importance, that we cannot but approve of the Editor refusing to wait for the convenience of his tardy coadjutors.

A FLORA of the Gramineæ of France, Belgium, and Switzerland is in preparation by M. T. Husnot, of Cahan, near Athis (Orne).

THE Christmas course of lectures, adapted to a juvenile auditory, at the Royal Institution, will be delivered this year by Prof. John Gray McKendrick, F.R.S. The subject will be "Sound, Hearing, and Speech," and the lectures will be experimentally illustrated.

A SKETCH of the life and personality of M. Berthelot, now Minister of Foreign Affairs, appears in the current number of the *Chemist and Druggist*. "The Republic has no use for chemists," is said to have been the remark made by the tribunal which condemned Lavoisier to the guillotine. The words are probably apocryphal, but, at any rate during this century, France has in many ways shown her appreciation of the abilities and work not only of chemists, but of all her scientific investigators.

IN our report of the opening of the Chingford Museum (p. 16), the writer inadvertently wrote "Dengey Hundred" in reference to Mr. Walter Crouch's collection of shells. He desires us to state that the collection was made in the Becontree Hundred, which comprises the Forest District.

THE Central Hydrographic Office of Vienna has published its first *Jahrbuch* containing daily or monthy rainfall values at 861 stations, and tidal observations at 493 stations, for the year 1893. The work occupies 562 large folio pages, and contains brief discussions of the observations, arranged according to the various river systems, and a map showing the yearly distribution of rainfall over the entire area. The publication is a valuable contribution to meteorological and hydrographical science.

THE additions to the Zoological Society's Gardens during the past week include a Blotched Genet (*Genetta tigrina*), two Crossed Snakes (*Psammophis crucifer*), a Smooth-bellied Snake (*Homalosoma lutrix*), a Rough-keeled Snake (*Dasypeltis scabra*), a Many-spotted Snake (*Coronella multimaculata*), a Hygian Snake (*Elaps hygiæ*) from South Africa, presented by Mr. J. E. Matcham; eight Great Tits (*Parus major*), British, presented by Mr. Brunsden; a Puffin (*Fratercula arctica*), British, presented by Dr. J. B. Johnson; two Lions (*Felis leo*, ♂ ♀) from Africa, deposited; a Black-faced Spider Monkey (*Ateles ater*) from Eastern Peru, purchased.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—A telegram, received from Kiel on November 18, announces the discovery of a new comet by Mr. Perrine at the Lick Observatory on the 16th inst. At the time of observation the comet was in R.A. 13h. 44m. and Decl. 1° 40′ N.; accordingly, it was nearly midway between ζ and τ Virginis, and would rise at London about 3.40 a.m. It is described as having a bright tail.

THE NEW MEROPE NEBULA.—The round bright nebula very close to Morope, in the Pleiades, which was discovered by Prof. Barnard in 1890, has recently been observed by him with special reference to its position (*Ast. Nach.* 3315, p. 42). With respect to Merope, its position angle for 1895·67 was 166°·6, and distance 33″·58; these figures agree remarkably well with the earlier measurements, and they indicate that the place of the nebula can be determined with such precision, that repeated observations may be expected to show whether it has any proper motion, or physical connection with the star. It is remarked that the nebula is only difficult in small telescopes because of its extreme closeness to the star, and that away from the star it would be an easy object in almost any telescope. The use of an occulting bar in the eyepiece of the telescope would probably facilitate observations of the nebula.

NUMBER OF NEBULÆ.—The number of known nebulæ has during the past few years been so largely increased by the labours of different observers, and the modes of publication have been so varied, that Dr. Dreyer's new index catalogue of the recent discoveries will be highly appreciated (*Mem. Roy. Ast. Soc.* vol. li. p. 185). This is a continuation of the well-known "New General Catalogue," which contained particulars of the 7840 nebulæ and clusters known up to the end of 1887, and brings the information to the beginning of the present year. The seven years' observations have resulted in the detection of 1529 new nebulæ, so that the general catalogue and the index together give the positions and descriptions of 9369 objects. More than half of the new discoveries are to be placed to the credit of M. Javelle, who has the advantage of employing the great refractor of the Nice Observatory. It is notable that only a very small proportion of new nebulæ has been discovered by the photographic method. Most of the objects included in the index are very small and faint, and it is remarked that they are probably only a small fraction of the total number visible in large telescopes. Dr. Dreyer considers it desirable that some of the possessors of large telescopes should turn their attention from the search for very faint nebulæ to "the less showy but more useful work of verifying the many old nebulæ which require re-observation."

A NEW STAR IN THE CONSTELLATION CARINA.—The first number of the Harvard College Observatory *Circular* contains a note to the effect that, from an examination of spectrum-photographs taken at the Arequipa Station of the Observatory, Mrs. Fleming has discovered that a new star appeared in the southern constellation Carina in the spring of this year. A photograph of a number of stars in the constellation contained a spectrum having bright hydrogen lines accompanied by dark ones of slightly shorter wave-length. Upon comparing this spectrum with those of Nova Aurigæ and Nova Normæ, it was seen that all three resembled one another, and were apparently identical in their essential features. A later photograph showed a slight change in the spectrum; a line at about wave-length 4700 being as bright as the hydrogen lines, though on the earlier photograph it was barely visible. These facts led to a close examination of all the sixty-two photographs of the region containing the star. Upon the first, taken in May 1889, no trace of the star could be made out, though stars of the fourteenth magnitude had recorded their existence. The star first appears on a negative taken on April 8 of this year, and last upon one obtained on July 1, its magnitude during the intervening period having diminished from the eighth to the eleventh. The approximate position of the star is R.A. 11h. 3·9m., Decl. −61° 24′.

CHOLERA IN GERMANY IN 1894.

THE part just issued of the *Arbeiten aus dem Kaiserlichen Gesundheitsamte* is devoted to a very elaborate report on all the cases of cholera which occurred in Germany during the past year. The inquiry has been so arranged that each district is responsible for its own report. Thus Prof. Dr. von Esmarch has drawn up the document relating to East Prussia, Prof. Dr. Flügge furnishes the statement for Schlesien, Prof. Dr. E. Fraenkel describes the outbreak which took place in the neighbourhood of Marburg, and so on, whilst a general introduction has been written by Regierungsrath Dr. Kübler.

In all 1004 cases of cholera occurred between May 23 and the middle of December, 1894, out of which 490 ended fatally. These figures, taking the population of the Empire at its official estimate of 49,429,470, represent 0·2 cases of cholera per 10,000, and a mortality from cholera equal to 0·1 per 10,000. The report is extensively illustrated, but one of the most instructive appendages is a map giving a graphic representation of localities in which cholera was notified. Here at a glance it may be seen how Germany suffers in this respect from her close proximity to Russia and Galicia in the eastern portions of her Empire, by far the greater number of outbreaks having taken place in East and West Prussia, whilst in the districts bordering on France, Belgium and Holland, hardly any cases of cholera occurred.

Dr. Kübler des not hesitate to assert that practically all the cases of cholera which took place were attributable to fresh infection imported into the country. West Prussia was last year at a particular disadvantage in this respect, for whilst cholera has invariably found its way from Russia along the water-ways, this part of Germany, being so intimately connected with Russia by the Vistula, in 1894 a specially alarming outbreak of cholera raged in these Russian and Galician districts, and thus every opportunity was afforded for its ingress into Germany.

The various reports seem to be almost unanimous in stating that cholera is disseminated throughout the Empire well-nigh exclusively by means of the traffic along the rivers or water-ways of the country, and that it is here that the greatest watchfulness has to be exercised. Such surveillance has, however, exerted a most salutary influence upon the hygienic conditions obtaining on ships, and although the interference was in the first instance opposed by the men, the latter are now most eager and active in carrying out the sanitary improvements, and the best results have ensued.

It is interesting to note that not a single case of cholera occurred in Hamburg,[1] and only six in the whole of the Elbe district.

There cannot be a doubt that these most satisfactory results are a direct consequence of the splendid way in which the regulations drawn up by the German Cholera Commission of 1893 were carried out, and that it is to the conscientious manner in which the various officials fulfilled their instructions, that Germany owes her comparative freedom from cholera and its restriction when an outbreak did occur.

Prof. Flügge cites an interesting table confirming the improvement which has taken place in combating cholera, in which the total number of cases of cholera which have occurred in Oberschlesien from the years 1831 to 1894 are given.

Year.	Cholera cases.	Year.	Cholera cases.
1831	1658	1855–56 ...	5498
1832	3270	1866	9069
1836	4324	1867	4438
1837	1159	1872–73 ...	2332
1848–49 ...	5903	1874	2499
1851	898	1893	7
1852–53 ...	3856	1894	346

This improved condition, which is so apparent within the past twenty years, Prof. Flügge ascribes to the achievements of Robert Koch, whose labours have revealed not only the nature of cholera, but also the most effective way of dealing with it and crippling its power.

But perhaps the most striking testimony to the effectiveness of the measures taken to stamp out cholera, is to be found in the fact that in spite of the prevalence of cholera in East and West Prussia, the army manœuvres were conducted on a large scale in this district, and no cases of cholera occurred amongst the troops. As an instance of the precautions taken, it may be interesting to read the following instructions which were issued, such instructions being by no means the most elaborate which were carried into execution.

During the mobilisation of troops on the Vistula, no eatables were allowed to be taken; to prevent the river water from being drunk, casks of boiled drinking water accompanied the soldiers, and every man was provided with an infusion of tea; further, it was ordered, and most strictly carried out, that all articles of clothing which had come in contact with Vistula water, were not to be returned to the barracks, but to be sent straight to the disinfecting station, and the men were further obliged to wash their hands with soap and pure spring water on the parade ground each time after the various drills had been gone through.

There seems to be no doubt that personal disposition to cholera, as in diphtheria and other zymotic diseases, varies with the individual, and members of a cholera-stricken household, although not themselves affected, may in cholera, as also in diphtheria, become the transmitters of the disease. This is an accepted fact in Germany, and Dr. Kübler states that last year this received fresh confirmation from the bacteriological evidence afforded by numerous investigations of perfectly healthy persons in cholera surroundings. The isolation of these suspects, Dr. Kübler regards as an important measure in helping to restrict cholera-infected areas.

This disposition to cholera, even in cholera-disposed individuals, appears to vary at different seasons of the year, and the consensus of opinion, derived from all parts of Europe, decrees the late summer and autumn as the period when the chances of infection are greatest. What the special circumstances are which determine this seasonable predisposition, no one rightly understands, and a great diversity of opinion on this question exists; but there can be no doubt as to the facts, and the following statistics of cholera cases per month, collected over a period of more than thirty years in Schlesien, bring out this point very clearly.

January ...	743	July ...	2029
February ...	515	August ...	7065
March ...	381	September ...	11065
April ...	591	October ...	10787
May ...	712	November ...	6949
June ...	1446	December ...	2648

The organisation and elaborate machinery necessary to combat effectively with cholera, and the discipline with which the sanitary precautions have been carried out in Germany, call for ungrudging admiration; it is, therefore, with the more surprise that we learn from Prof. Flügge's report how much remains yet to be accomplished in the management of so important a matter as disinfection. The most approved apparatus was frequently rendered useless by the ignorance of those to whom the work of disinfection was entrusted. "The modern practice and technique of disinfection is something," writes Prof. Flügge, "which every doctor does not *eo ipso* understand or can learn either from

[1] The fatal case of cholera, which occurred in the Hamburg Hygienic Institute, is not included, as this was due to accidental infection during the carrying out of some laboratory experiments on cholera.

books: it requires, of necessity, a thorough theoretical and practical training. The control of disinfection is in the majority of cases left in the hands of police officials who have no knowledge of the subject whatever, and thus numerous mistakes are made, and much unnecessary damage to property ensues. . . For cholera-disinfection, in my opinion, special courses of instruction should be provided for disinfectors in both the theoretical and practical application of the subject."

We cordially commend the perusal of this valuable report to our own public authorities, who might, thereby, possibly be stimulated to take some serious and effective steps in staying the ravages of, to us, a far more deadly enemy, *i.e.* diphtheria. The Hamburg cholera disaster has not been without its lesson to Germany; surely we need wait no longer for our authorities to be similarly roused to successfully combat diphtheria.

G. C. FRANKLAND.

A JAMAICA DRIFT-FRUIT.

THE dispersal of plants by oceanic currents is a subject full of interest, and no apology is needed in bringing it forward if thereby we stimulate those who have opportunities for observing the effects of this agency in various parts of the world. The valuable contribution made to the literature of the subject by Mr. W. B. Hemsley, F.R.S., in the "Botany of the *Challenger*," and since added to by himself, Mr. Guppy, and others, cannot fail to enlarge our knowledge in regard to the origin of plant-life on oceanic islands as well as on the littoral of much larger areas. Our first acquaintance with the fruit of the remarkable *Lodoicea* of the Seychelles, for instance, was as a waif floating on the surface of the sea, and hence one of its familiar names *Coco-de-mer*. In the West Indies the ripe fruits of a palm unknown in the Greater Antilles are continually brought by the Gulf Stream from the south, and washed ashore at Jamaica and other places. These are locally called "Sea apples" or "Sea cocoa-nuts." They are the fruits of the Bussu palm (*Manicaria saccifera*), found in Trinidad and the adjacent mainland of South America. The white kernel is sometimes fresh enough to be eaten after long immersion in salt water. This fruit was gathered by Sloane as long ago as 1687, and he remarked that it was frequently cast on the north-west islands of Scotland by the currents and the sea. The seeds of the Cocoon (*Entada scandens*), large brown beans about two inches in diameter, are so frequently cast ashore in various parts of the world, that they are commonly called "Sea-beans." Several plants have been raised at Kew from seeds picked up at the Azores. It is also mentioned by Robert Brown that a plant of *Cæsalpinia Bonduc* was raised from a seed found stranded on the west coast of Ireland. Linnæus also seems to have been acquainted with instances of germination having taken place in seeds thrown ashore on the coast of Norway. These are well-known and familiar examples of drift-fruits. The record might be considerably enlarged without more than touching on the fringe of the subject. It is hoped that botanists in suitable localities will give attention to this comparatively unworked field of investigation, and record the results of their observations.

In NATURE (vol. xxxix. p. 322), I gave an account, with woodcuts, of a drift-fruit that was collected on the shores of Jamaica. This had a very singular history. It had, in the first instance, been gathered nearly three hundred years ago, and presented by Jacob Plateau to Clusius. It was figured and described by many of the older botanists, but up to the time of writing in 1889 the plant bearing it had not been identified. The object I had in view in drawing attention to it in the columns of NATURE, was to enlist the interest of those likely to throw light upon its origin, and lead eventually to its identification.

FORMER HISTORY.

It is somewhat remarkable that a drift-fruit so plentifully brought by the Gulf Stream, and cast ashore in the West Indies and elsewhere, should have been so long a mystery.

The first notice, so far as I can gather, is given with a woodcut, by Clusius, in his "Exoticorum libri decem," lib. ii. cap. 19. This work bears the date of 1605. The following is Clusius' description, which is reproduced as it appears in the original, together with his representation of the fruit:—

Exotici fructus à Jacobo Plateau & aliis accepti.

Cap. xix.

Aliquot exoticos fructus mittebat ad me Jacobus Plateau, quum intelligeret me Exoticorum Historiam scribere, ut quantum posset meos conatus etiam in hac materia juvaret, sed quos, præter binos, jam antè videram & descripseram.

Binos igitur illos, quos dixi mihi antè non fuisse conspectos, cum binis aliis aliunde acceptis, in tabella exprimi curabam quam hîc subjicio. Primus illorum quos Plateau mutuo dabat, binas uncias cum semisse longus erat, quatuor in ambitu crassus, cine-

Drift-fruit (after Clusius).

racei coloris, quem aliquo operimento tectum fuisse arbitrabar: in quinque partes dividi posse, venæ per longitudinem ductæ indicabant; alioqui eminentibus aliquot tuberculis instar vesicularum obsitus erat, quæ aperta, inanes & inæquales lacunas ostendebant spadicei coloris & splendentes, quasi semen aliquod continuissent: valde durus autem erat is fructus, & adstringente facultate præditus.

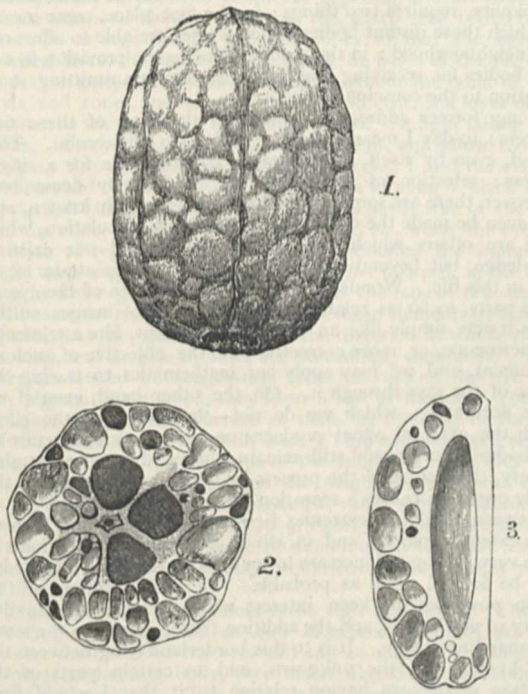
About sixty years afterwards, Johannes Jonston, in "Historia Naturalibus de Arboribus et Fructibus" (1662), p. 102, refers to the same fruit. In 1680 both the description and figure given by Clusius were reproduced by J. Bauhin in "Historia Plantarum," tom. i. lib. 3, cap. cxi. fig. 1. It is next mentioned in Sloane's "Catalogus Plantarum" (1696), p. 214, in the following words: "Fructum nunc saepissime collegi in Insulæ Jamaicæ littus ejectum cum aliis maris recrementis." The fruit itself was recognised in 1889 by Mr. E. G. Baker, as existing in the Sloane Collection in the British Museum (Natural History) where it is labelled "No. 1656." Further, in 1764, a small and somewhat unsatisfactory figure was given in "Petiveri Opera," t. lxxi., fig. 5, with the information: "It is a hard oval fruit with seed-holes round its surface. Cat. 605. Found on the shores of Jamaica." In all the cases enumerated above, it is represented in its water-worn condition as given in Fig. 1 below. It is a hard bony fruit, about an inch and a half to two inches long, marked externally with mammillated protuberances corresponding (as shown in Figs. 2 and 3) with numerous cavities or resin-cysts existing in its walls. In the transverse section, Fig. 2, it may be seen that the fruit is normally five-celled, but two are suppressed. The seeds are solitary, and contain abundant albumen. There is no doubt it was once a drupaceous fruit, but the fleshy outer layer or sarcocarp has decayed or worn away by the action of water. What is now left is, in many respects, so unlike the fruit in the fresh state, that its origin must always have been somewhat difficult to trace.

In passing, it may be noticed that it possesses ideal qualities as a drift-fruit. The numerous closed cavities contained in the walls render it very buoyant, and easily influenced by the action of the wind, while its hard texture and the presence of resin preserve it from becoming water-logged or decayed. There is no record that the seeds have germinated after long immersion in salt water, or that the plant has established itself in a new locality outside its present area. These are interesting points for further observation.

RECENT HISTORY.

The chapter in the recent history of the fruit opened in 1884. It was then collected, by the writer, with other drift-fruits on the sandy-spit of land known as the Palisadoes enclosing Kingston Harbour, Jamaica. On this land the Botanical Department had

established a cocal or cocoa-nut plantation with about 25,000 trees. Many of these are now in full bearing, and bring a regular revenue to the Government. The locality is exposed to the full force of the waves from the Caribbean Sea, and large quantities of wreckage, sea-weeds, and drift-fruit are thrown high up on the beach. The drift-fruits collected in 1884 were forwarded to Kew, and most of them were easily determined. The fruit under notice was, however, quite new, and it was placed in a cabinet with others until sufficient material had accumulated to lead to its identification. In November 1887, a further specimen was sent to Kew, by Mrs. Hubbard. This, singularly enough, had been picked up on the shore of Bigborough Bay, in the south of England. It is quite possible in this instance it may have been derived from a wreck, or thrown overboard from a passing ship, but, as Mrs. Hubbard aptly remarks, "such a fruit is not among the usual articles of import, and further, our south-west coasts are very likely to receive Gulf-stream waifs and strays." It was still, however, undetermined. The presence of the resin-cysts was always regarded as a character of some value. From the large collections in the Museums of Economic Botany at Kew a clue was at last obtained by the assistant, Mr. J. M. Hillier, in



Representation of a Jamaica drift-fruit (natural size). 1, external aspect; 2, cross-section; 3, longitudinal section.

the fruits of *Humiria gabonensis*, belonging to the natural order *Humiriaceæ*. These were somewhat smaller and more globular than the Jamaica drift-fruit, and, being covered with a brown fibrous epicarp, looked very different. The bony endocarp was, however, similar in character and plentifully furnished with resin-cysts. The natural order *Humiriaceæ* is a small one, and consists of plants entirely confined to tropical America, with the single exception of the species already mentioned. The theory was that the drift-fruit had been derived from tropical America, and not from Africa. The American genera of *Humiriaceæ* are *Vantanea*, *Humiria*, and *Sacoglottis*. The balance of probability at the time was in favour of *Humiria*, and possibly of *H. balsamifera*. The fruit of the latter was, however, unknown. After the publication of the note in NATURE special attention was given to the subject, with the result, as shown later, that the mystery connected with it was completely solved.

In 1887, Colonel Feilden, a member of the West India Exploration Committee stationed at Barbados, found a specimen on the beach of that island, while two years later Dr. H. A. Alford Nicholls, of Dominica, fished up a similar specimen off the island of Mustique, between St. Vincent and Grenada.

The most important result was, however, obtained from the island of Trinidad. In March 1889, Mr. J. H. Hart, Superintendent of the Botanic Garden at Trinidad, wrote as follows: "I am extremely pleased that you called my attention to the Jamaica drift-fruit. I remember the specimens well, and cut several of them in Jamaica at the time we were packing the set you sent to Kew for the *Botany* of the *Challenger* Expedition. As soon as I read your article in NATURE, I commenced a search among the material in the herbarium here, and found a drawing of *Sacoglottis*, by Crüger,[1] with dissections of the flower and fruit. These made it evident that the plant which produces the unknown fruit is a native of Trinidad. Feeling further interested in the matter, I communicated with Mr. Syl. Devenish, the friend and companion of Crüger on many of his excursions, and I learnt further particulars as follows. When travelling in the forest at Irois, in the south-eastern part of the island, they found on the beach specimens of the fruit in question. Following up the stream they came to the tree producing it, from which, I presume, the drawings were taken. In addition, Mr. Devenish gave me a fruit, which I now send, to show there can be no mistake in the matter. This was collected by himself on the spot, so that there can be no doubt of the identity of the species we are both discussing. Mr. Devenish states that the tree is very rare. He saw but two in all his travels through the island. It is known locally as *Cojon de Burro*. It is probable that a greater portion of the drift-fruits found in Jamaica and elsewhere are produced on the mainland of South America, and are brought down by the flood waters of the Orinoco and the Amazon." On receipt of Crüger's drawings, Prof. Oliver at once expressed the opinion that they afforded a satisfactory solution of the problem. He stated: "The fruit of *Sacoglottis amazonica* is unknown, but Crüger's drawings correspond well with the floral analysis of the plant given by Dr. Urban." The latter monographed the *Humiriaceæ* in Martius' "Flora Brasiliensis."

It may be mentioned, in passing, that Dr. Urban had already ventured an opinion that the fruit might belong to *Sacoglottis*, but there were no fruits available for comparison in the herbaria at Kew, Berlin, or Paris.

The *Humiriaceæ* consist of trees or shrubs mostly with balsamic juice. The Balsam of Unieri, possessing the properties of Peruvian and Copaiva, is the produce of *Humiria floribunda*. A preparation of the juice of this and *H. balsamifera* has the odour of Storax, and is made into ointment and used internally. Although very different in habit, the *Humiriaceæ* are not far removed from the Flax order, *Lineæ*.

Sacoglottis amazonica is a moderately large tree, thirty to forty feet high, with a stout stem of an ash-grey colour. The leaves are alternate, slightly crenulated along the margin, and with two small glands at the base. The flowers are arranged in lateral panicles, petals yellowish-green, the anthers are ten in number, five long, five short, joined at the base. There is an annular disk closely girding the base of the ovary; the latter is five-celled, with a solitary ovule in each cell. The fruit was unknown until recently. It is described for the first time below.

Crüger's drawings, so thoughtfully sent by Mr. Hart, consisted of two sheets of dissections, with descriptive notes, all apparently done on the spot. They are minutely drawn, and give characters that are omitted even in the elaborate drawings in the "Flora Brasiliensis." They remind one of the careful field notes and sketches made by Sir Joseph Hooker in the Himalaya, by the late Dr. Thwaites in Ceylon, by Sir John Kirk in tropical Africa, and Mr. C. B. Clarke in India. The more recent botanical explorers are in no way behind their predecessors in regard to the skill and energy shown in selecting and drying their plants; but it may be mentioned, without disparagement of their invaluable services to science, that they do not, as a rule, devote the same attention as the older botanists to field notes and dissections, and thus a large amount of very interesting and accurate information is lost. Such information can never be obtained from the specimens themselves, however well they are mounted, in our National herbaria. It is certain that but for Crüger's drawings in this instance we should not, even now, have had the means of determining the origin of the Jamaica drift-fruit.

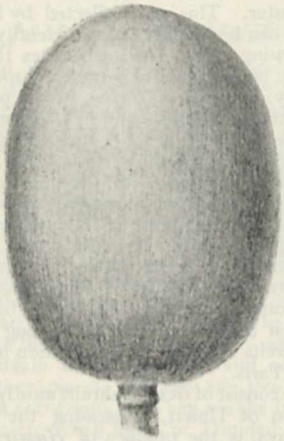
Since 1889 it has been sought to obtain fresh fruits of *Sacoglottis amazonica* from Trinidad or South America. These, so far, have not been received. There can, however, be no doubt of the identity of the plant. In order to obtain final evidence on the subject, my colleague, Dr. Stapf, the Assistant for India

[1] Dr. Herman Crüger, formerly Colonial Botanist and Superintendent of the Botanic Gardens, Trinidad.

in the Kew Herbarium, has been good enough to undertake a critical examination of Crüger's drawings, and compare them carefully with the description and plates of the species in the "Flora Brasiliensis." The result of the investigation is contained in the following note :—

"Crüger's drawings of *Sacoglottis*, Mart. 'Cojon de Burro,' October 13, 1861, agree perfectly with *Sacoglottis amazonica*, Mart. ('Flora Brasiliensis,' vol. xii. pt. 2, p. 449, tab. xcv.) The analyses are very carefully done. The sketch of the base of the leaf, for instance, shows the characteristic two glands which had been overlooked by Martius as well as Urban. As the fruit has not been previously described, it appears desirable to give a description of it drawn up from Crüger's drawings, as well as from the several specimens in the Kew Museum.

"Fructus subdrupaceus, ellipsoideus, 1½-1¾ poll. longus, 1-1¼ poll. latus, exocarpio vix 1 lin. crasso, endocarpio osseo, extus subbullato, cavernis resina impletis abundante, 5-loculari vel saepius ob ovula loculosque 1-4 aborta 4-1-loculari ineunte



Fruit of *Sacoglottis amazonica*, Mart. (after Crüger).

germinatione valvis 5-trigonis ab axi 5-alata semina inter alas in loculis late apertis exhibente sedentibus dehiscente. Semina cylindrica, pollicaria, testa tenui nigro-brunnea, albumine carnoso, embryone centrali, cotyledonibus lineari-oblongis planis, radicula brevi supera.

"The breaking up of the fruit, as described above, takes place also in water-worn specimens, as shown in the fruit collected by Dr. Nicholls. *Sacoglottis amazonica* was previously known only from Teffe or Egas, on the right bank of the middle Amazon, and from the banks of the Tagipurù, a channel in the delta of the Amazon, where it was collected by Martius. It is recorded from St. Vincent, on the authority of Guilding. Specimens from the latter are in the Kew Herbarium, but whether from wild or cultivated plants is not stated. It is also not certain whether they did not come, as many of Guilding's specimens, from Trinidad."—O. STAPF.

SUMMARY.

The story of this interesting drift-fruit is now told. The record of its occurrence has been traced from the year 1605, when it was first figured and described by Clusius, down to 1764, when it was redrawn by Petiver. For about one hundred and fifty years it was successively described by Clusius, Jonston, J. Bauhin, Hans Sloane, and Petiver. From 1764 until 1884, a period of one hundred and twenty years, it appears to have been entirely overlooked. It was, however, once more brought into notice in the latter year, and drifted specimens were obtained within a short period from Jamaica, the South of England, Barbados, the Grenadines (between St. Vincent and Grenada), and Trinidad. The specimen from the latter island was accompanied by careful drawings made by Crüger in 1861, giving particulars not only of the fruit itself, but also of the leaves and flowers. These when carefully compared with the description and plate in the "Flora Brasiliensis," and with specimens in the Kew Herbarium, left no doubt that the plant yielding the Jamaica drift-fruit is *Sacoglottis amazonica*, Mart. This grows very sparingly in the south-eastern portion of Trinidad, where it was collected by Crüger, but is more abundant in the delta of the Amazon, where it was collected by Martius and others. It is evident that from one or both of these localities the fruits are carried by the waters of the Gulf Stream into the Caribbean Sea, and either thrown ashore on the West Indian Islands, or carried still further, as in the case of many other similar fruits, across the North Atlantic, and cast on the shores of Western Europe. D. MORRIS.

THE PERCEPTION OF LIGHT.[1]

AT a former anniversary I brought before the members of the Institute the subject of the luminiferous ether. It is one of great and growing interest. I mentioned on that occasion how discoveries of very recent date have led us to attribute continually increasing importance, and a widening range of function, to that medium—substance can I call it?—the existence of which was originally assumed as a hypothesis in order to account for the phenomena of light. It is in connection with this last aspect that it relates to what I propose to bring before you to-day.

The wonderful sense of sight, which, to use an expression of Sir John Herschel's, confers upon us to some extent the character of ubiquity, requires two things: in the first place, some means by which those distant bodies which we see are able to affect our own neighbourhood; in the second place, some provision in our own bodies for receiving that influence, and transmitting some sensation to the conscious being.

In my former address I considered the first of these two subjects; to-day I mean to confine myself to the second. This second, even by itself, is, however, far too wide for a single address; selection of some kind is imperatively demanded. Moreover, there are some parts which are accurately known, and may even be made the object of mathematical calculation, while there are others which not merely lie beyond our existing knowledge, but beyond any that we can hope to attain to, at least in this life. Wonderful as is the construction of the eye in all its parts, so far as relates to the formation of images on the retina it acts simply like an optical instrument, like a telescope or microscope, or, more correctly, like the objective of such an instrument, and we may apply our mathematics to tracing the course of the rays through it. On the other hand, even if we knew accurately—which we do not—the nature of the effect which the external agent produces on the ultimate structure of our bodies, there would still remain, shrouded in impenetrable mystery, the nature of the process by which some change in the bodily organism causes a sensation to the conscious being.

Between these two extremes lies a region which has been to some extent explored, and in which a gradual and perhaps at last a very substantial increase to our existing scientific knowledge may be looked upon as probable. The investigation of this region possesses the keen interest which belongs to the discovery of new truths, and the addition thereby made to the stock of human knowledge. It is to this borderland lying between the well known and the unknown, and to certain parts of the structure of the eye having relation to it, that I would for a short time direct your attention to-day.

As I have already intimated, I propose to pass by entirely the functions of the eye acting as a simple optical instrument in forming images on the retina. The explanation of that may be found in all the ordinary text-books, and I will not weary you by repeating what is there to be found, and which is generally familiarly known.

The phenomena of vision show that distinctness of vision is dependent somehow or other in the first instance on the formation of distinct images of external objects on the retina. In that formation, as I have said, the transparent portion of the eye, the cornea, the aqueous humour, the crystalline lens and vitreous humour, plays the part of a lens in an optical instrument. I have said the "formation of the images on the retina"; but the retina is not a mere surface, it has a certain amount of thickness, although it is, on the whole, very thin. We may further inquire on what part of the retina, considered at different depths from the place where it first commences, on which of the various layers into which histologists have divided it, is it that we have reason to think that light first acts on the organism of our bodies in such a manner as ultimately to give us the sensation of vision?

I have said that the retina, as a whole, though very thin, is not a mere surface. If we go from the centre of the eye-ball

[1] Presidential Address delivered at the Victoria Institute by Sir G. G. Stokes, F.R.S.

outwards, *i.e.* towards the back of the body, we have first a plexus of very fine nerve-fibres which run along the front of the retina, and ultimately unite in the optic nerve, which runs into the brain. We have also minute blood-vessels, which are essential, apparently, for the growth from its original state, and for the nutrition of the eye-ball, and for the carrying on of the process for which it was designed, viz. that of enabling us to see. Then we have several layers of pulpy transparent substances which have been called ganglions, nuclei, and molecules, mixed with very fine fibres. Some of these are nerve-fibres, others are believed by anatomists to have relation to the fixing of the various parts of the structure to one another, so that they shall not fall to pieces in the rapid motions of the person using the eye.

Outside all, at the back surface of the retina, there is what is called the choroid coat; but between that and the coats I have spoken of is a very remarkable structure which I shall have to say more about. It is called the *bacillary* layer. In this part of the retina we have a vast number of elongated bodies placed closely, side by side. In the human eye, and in the eyes of most animals, they are of two shapes, and have been called accordingly rods and cones. The rods, as the name implies, are cylindrical, and the cones are tapering and are somewhat of the shape of slender peg-tops, the sharp side being turned inwards as regards the way you look, so that the light, in coming from the outside, first meets the bases of the peg-tops, and then goes on towards the point. About the point of these rods and cones, just close to the choroid coat, is a layer of pigment cells which absorb the greater part of the light falling upon them. The rods and cones are transparent, and allow the light to pass through them, passing lengthways. I said the extremities reached to the layer of pigment cells forming a black lining immediately inside the choroid coat. That is true of the rods, but the cones do not reach quite so far, *i.e.* when the eye is in a state of repose, as in darkness; but under the stimulus of light these pigment cells come down, *i.e.* forward, in the direction in which you look, so as to reach the tops of the cones as well as of the rods. I have said that these elements (remember, please, that they point radially in the direction in which you are looking, and lie side by side) are exceedingly numerous. When they are looked on lengthways from the back of the eye when the pigment is removed, they form a sort of mosaic. You may imagine the general structure of them by thinking of the head of the common sunflower in seed. They are arranged side by side, something like the seeds of the sunflower; but they lie so close that the distance between the neighbouring rods or cones, as the case may be, is only about (it varies somewhat from one part of the eye to another) $\frac{4}{10000}$th part of a millimetre, or say about $\frac{1}{60000}$th part of an inch. So numerous are they that a square with sides the tenth of an inch would cover nearly half a million of them.

Now something more about these rods and cones. They are found to be composed of two members or limbs, an inner (nearer the centre of the eye-ball) and an outer. The inner is a transparent-looking body, very much like the other bodies in the neighbourhood. The outer is transparent too; but it is found to be highly refractive. It is longer in the rods than in the cones. The outer segment of the cones may be represented to the mind's eye by thinking of the metallic point of a peg-top. These outer limbs are in both cases readily detached (when the eye is dissected) from the inner, and they separate after a little into laminæ, lying one on the top of the other, perpendicular to the axis of the rod or cone. At the outer end they do not appear to have any continuation, the structure stops. At the inner end (corresponding in the case of the cones with the bulbs of the peg-tops) there come nerve fibres from each of them. These pass through the various layers that I have spoken of; and although the course of them has not actually been traced the whole way, on account of the difficulty of examination of this pulpy structure, it is pretty certain that they join on to those nerve-fibres which line the front surface of the retina, and so pass on, through the optic nerve, to the brain. When I say "pass on" I mean of course as you trace them along; there is no motion in the case. This is a very remarkable structure. Has it any object? What is its object? Now we know by experience that if we have a single point of light exposed to us, the impression is that of a single point of light in the field of view. If there be two such points we have the impression of two luminous points occupying different positions in the field of view. Now two such points may be very close to one another, and yet we still see them as two. It is found that the limit of closeness, beyond which we are unable to distinguish two objects as two, is such that a line drawn between them subtends at the eye an angle of about one minute, or an angle of about $\frac{1}{3600}$th part of that subtended by the diameter of the moon. Yet although they exist as close as that, the impression of the two is distinct, and we might have a number of points, each giving a distinct impression. It appears, therefore, that for the purpose of vision it is necessary that stimulations coming from a vast number of independent points, having different bearings from the eye, should, somehow or other, give rise to distinct impressions.

Now if by calculation we trace inwards, to the retina, the course of the axes of two pencils coming respectively from two distant points not far from the centre of the field, it is found that those axes intersect, not exactly in the centre of the eye-ball, but in a point (called the optical centre) a little in front of it, the position of which we can calculate; and the place of either image may be found by joining the external point with the optical centre, and producing the joining line to meet the retina. It is an easy matter now to calculate the distance on the retina of the images of two external points which subtend at the eye a known angle; and it is found that when the external points are so close as only just to be seen as two, the distance of the two images is about the $\frac{1}{10000}$th of a millimetre, just about the distance apart of the cones and rods from one another, lying so closely as I have explained they do. Here, then, it would appear, in this remarkable layer of the retina, we have a provision enabling us to have distinct sensation of a vast number of distinct points in the field of view; and consequently we have reason to suppose that the effect of light, whatever it be, on one of these elements (be it cone or be it rod) gives rise to the sensation of a point; and that the position of that point in the field of view depends upon the position of the element of the bacillary layer which has been affected by the light coming from the point. Moreover in the nerve-fibres which come from the anterior ends of the rods and cones we appear to have a provision for communicating, through the optic nerve, to the brain, the influence, or an indication of the influence which light exerts on one of these elements.

Now I have mentioned one argument for believing that this remarkable bacillary layer is that in which light, which previously merely passed through the eye as it would through an optical instrument, acts in some manner on the organism so as to give rise to stimulation of the nerves which convey to us the sensation of vision. The argument, so far, is a sort of *à priori* one, but it has been remarkably confirmed by an experiment of H. Müller's, made by means of Purkinje's figures.

When in a room which is not quite dark we look with one eye towards a moderately illuminated wall with uniform surface, and holding a candle to one side of the eye move it up and down, there is seen in the field of view a figure branching like seaweed. This is the shadow of the blood-vessels of the retina. That the candle requires to be moved in order to show the figure, is explained by the consideration that the shadow is not black, but only darker than its neighbourhood, and when the light is steady the exhaustion of the eye for that part of the field which lies beside the shadow tends to equalise the apparent illumination of the parts in and out of shadow; whereas when the candle is moved the shadow falls on a new place which had been in full light and therefore partially exhausted, and the previous exhaustion and the new partial interception of light falling on that place contribute to make the shadow sensible.

The existence of a shadow shows already that the percipient layer of the retina must lie behind the blood-vessels. But we may go a step further. By suitable methods of illumination we may cause two spots on the surface of the eye-ball, whose positions can be determined from the circumstances of the experiment, to be alternately virtually the sources of the light which casts the shadow, and the places in the field of view of the shadows of the same vessel in the two positions of the illuminating source can be marked. It is then only a question of similar triangles to determine how far behind the blood-vessels lies the percipient layer, and the distance thus calculated is found to agree, within the limits of errors of observation, with the distance of the bacillary layer as determined by microscopic examination of a dissected eye.

I have said as you go backward from the centre of the eye-ball, you have, in front of the rest of the retina, a plexus, as it is called, of nerve-fibres lying side by side, something like the threads in a skein of silk, but gradually leading onwards to the

optic nerve. Light passes across these, but it does not excite the nerves in passing through them. The nerves are transparent, and the light produces no effect upon them directly. If it did, your whole field of view would be confused, because it is known that when a nerve is excited the sensation is referred to a particular part no matter where the nerve may be affected. Suppose you could isolate, say in the thigh, a particular nerve leading to the great toe, and pinch it without hurting its neighbours, you would feel the pinch not where the nerve is pinched, but in the great toe. So, here, if these nerve-fibres were excited by the passage of light through them, then the sensation corresponding to the excitement of a particular nerve-fibre, which would be that of a definite point in the field of view, would be excited by an external luminous point lying anywhere in the curve in which the surface generated by a straight line passing through the optical centre and intersecting the fibre in question would cut what we may call the celestial sphere, and the correspondence between the subjective points in the field of view and objective external points would be lost. And the fact that the visual nerves are not affected by light which passes across them is further shown by the well-known experiment of the blind spot, where the optic axis passes out of the eye-ball, not in the axis of vision but to one side, towards the nose, so that an object whose image falls on the blind spot of one eye is seen by means of the other.

But now comes a question, and here we enter on uncertain and debated ground—How is it that the nerves are stimulated by the light at all?

We have reason to believe that these rods and cones form the means by which the light, acting on them, causes the stimulation of the nerve. As I have said, they consist of two elements, an inner and outer; the outer from the centre of the eye, *i.e.* the inner as regards the body, being of that remarkable structure which I have described. It has been questioned which of these two elements it is that you are to regard as the percipient organ. I do not know that physiologists have decided that question. I have looked into a paper of Max Schultze's—in fact I have it on the table—and he inclines to the opinion that it is the outer element. Now is there anything in the outer element which can conceivably form a means of stimulation of the nerve, when that element is acted on by light?

I have spoken of the way in which it is composed of laminæ which come to pieces when dissected, after a certain amount of maceration. I do not know whether it may not be rash to say what I am about to say, because I do not know that physiologists have suggested it—it is merely an idea which occurred to myself, so you must take it for what it is worth. I was reading an account of the electric organ of electrical fishes, such as the torpedo. It is a very remarkable organ, occupying a considerable space in these fishes. It has a columnar structure, and the column again consists of laminæ placed one over the other. It has a structure which may roughly be compared to that of the basaltic columns in the Giant's Causeway, only here you must think of laminæ as more numerous and not having that curved surface shown in the Giant's Causeway. Now nobody questions that somehow or other this is an organ by means of which these fishes are enabled to give a shock, and the idea, of course, is suggested, are not these laminæ like the plates of a battery? Is not one of these columns, roughly speaking, something like a galvanic battery? But how the battery is charged and discharged we do not know. In this case it depends, no doubt, on the will of the animal as to what he does, and nobody knows how he brings that about.

Now it strikes me that there is a remarkable apparent analogy between the outer member of the rods and cones, and these columns in electrical fishes. This gives rise to the suspicion that possibly these outer members may act the part of a microscopic battery, being charged somehow or other. But how are they to be charged? Well, before I go on to enter into any speculation on that I may mention that some years ago Prof. Dewar and Mr. McKendrick made some remarkable experiments, the results of which are given in a paper published in the *Transactions* of the Royal Society of Edinburgh. When an eye is dissected out, and the cornea is connected through a wire with non-polarising electrodes to the middle of the section of the optic nerve, the wire being led through a delicate galvanometer, it is found that there is a certain amount of electric current passing. Now it was found that when the eye (having been in darkness) was allowed to have light shining upon it, there was a change in this current, and a change again when the light was cut off. It is true that the total change was only a small fraction of the whole; but still that there should be any change at all produced by the action of light is a remarkable thing. It looks very much as if the stimulation of the nerve had something or other to do with the production of electric currents; but those, if they are produced, we must suppose to be produced in some way by the action of light. How may we imagine light to act so as to produce them? It has been discovered that in the layer of pigment cells in the retina there is a substance, called visual purple, of a purple colour, which is acted on by light, and is made first yellow and then nearly colourless. We have thus a substance that is capable of being acted upon by light, as very many substances are. I do not say that it is by any means proved that that is the substance, or even that there is any substance, which is acted upon by light in the way demanded; yet it seems very probable that the change produced by the action of light, whether it be on visual purple, or some other substance associated with it, may give rise to something which may, so to speak, charge this microscopic battery and stimulate the nerve-fibre which is attached to it. We know the rate of the vibrations of light of various kinds; and the rapidity of vibrations is so enormous, ranging about 400 millions of millions of vibrations in a second, that we can hardly imagine that the organism of our bodies is calculated to be set in vibration in a corresponding period. In that respect the sense of sight differs notably from the sense of hearing. In hearing the tympanum of the ear is thrown into vibration, and the vibrations are not so enormous in number in such a time as one second but that the corresponding nerves may actually be mechanically agitated, and thereby in some way stimulated. We can hardly imagine that the visual nerves are acted upon in this sort of way directly by the luminous vibrations, but they may be indirectly. Here, again, I may throw out a possible conjecture, though I am less disposed to receive it myself than that which I have just mentioned. We know there are substances which when acted upon by light continue to shine in the dark. In some cases the action ceases almost instantly after the exciting light is cut off; for instance, a solution of the salts of quinine, where the rapidity of cessation of the effect is amply sufficient to tally with the rapidity of cessation of visual sensation when light is cut off.

There are various other matters connected with the perception of light which are of great importance to our well-being and to our enjoyment which I have not ventured to touch upon at all. It would take a great deal too long to go into two which I will only just mention. One is the provision in the two eyes, and in the muscles which move them, which enables us to obtain single vision notwithstanding that the two eyes are at work. Nothing is easier than to obtain double vision in which the images seen by means of two eyes occupy different positions in the field of view. There are very remarkable contrivances for bringing about singleness of vision in the habitual use of both eyes.

Then, again, we do not see light merely as light, but we see a great variety of colour. We can distinguish one light from another light by its colour, and not by its intensity only. It would take me a great deal too long to give you any idea of what is known (which after all is not much) as to the way in which that is effected.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Woodwardian Museum has been greatly enriched by the generosity of Prof. T. Wiltshire, Treasurer of the Geological Society and Secretary of the Palæontographical Society, who has presented to the University a large collection of Cretaceous fossils. The collection includes nearly all the known British species, as well as many not yet described. This addition will probably make the Woodwardian collection of Cretaceous fossils the finest in the country. The thanks of the University have been voted to Prof. Wiltshire, who is himself a Cambridge graduate.

Sir William Turner, F.R.S., of Edinburgh, has been appointed an Elector to the chair of Anatomy, and Lord Walsingham, F.R.S., an Elector to the chair of Zoology and Comparative Anatomy, in place of the late Right Hon. T. H. Huxley.

The Vice-Chancellor, Mr. C. Smith, Master of Sidney Sussex College, is suffering from the shock of a fall from his bicycle last week, and will probably be unable to resume his duties for some

time to come. We learn, however, that he is making satisfactory progress towards recovery. The Provost of King's College, late Vice-Chancellor, is acting for him.

DR. A. WEISMANN has been granted the degree of Doctor *honoris causâ* by the University of Utrecht.

Science states that at the annual meeting of the Chicago Alumni of Mount Holyoke College, on October 24, Dr. D. K. Pearson offered to give £30,000 to the College, provided the alumni would raise an additional £10,000.

A MEMORIAL from the London School of Medicine for Women was considered at a meeting of the Council of the Royal College of Surgeons of England, last week, and it was resolved that—"The Council of the Royal College of Surgeons of England, although in favour of granting the petition of the officers and teachers of the London School of Medicine for Women, do not see their way to admit women to the Conjoint Examination in face of the adverse vote of the meeting of the Fellows and Members of this College and the expressed opinion of the Royal College of Physicians."

AT a meeting of the Council of University College, Dundee, on Monday, the question of the relations of the college to St. Andrews University was considered. It was decided to address a letter to her Majesty's Commissioners expressing the willingness of the Council to consider carefully any suggestion from the Commissioners with a view to removing the difficulties in which, by recent events, the University and the college had been placed, and in particular to meet the Commissioners and the University Court to discuss anew any proposals which might form the basis of a new agreement between the two institutions and secure to each the advantages provided for in the Universities Bill of 1889.

THE following are among recent appointments:—Prof. S. L. Barton to be professor of mathematics in the University of the South, Seewanee, Tennessee; Dr. A. Macfarland to be lecturer in physics in Lehigh University; Dr. G. B. van Vleck to be associate professor of mathematics in Wesleyan University; Prof. C. A. Waldo to be professor of mathematics at Purdue University; Prof. K. Zickler to be professor of technical electricity in the Technische Hochschule at Brünn; Dr. R. Dzieslewski to be professor of the same subject at Lemberg Technische Hochschule; Dr. F. Mehres, extraordinary professor of physiology in the Bohemian University at Prague, to be professor; Dr. F. R. von Höhnel to be professor of botany and technical microscopy in the Technische Hochschule at Vienna; Dr. H. Klinger to be professor of chemistry at Königsberg; Dr. E. Waelsch to be extraordinary professor of mathematics in the German Technische Hochschule at Brünn.

A CONFERENCE of the leading teaching and examining bodies of the kingdom and of representative County Councils which are in a position, under the County Councils Act, to contribute funds for the purpose of technical instruction, was held last week, under the auspices of the London Chamber of Commerce, at Drapers' Hall, Sir Albert K. Rollit (President of the Chamber) presiding. The conference agreed to a resolution approving the principle of the co-ordination and simplification of the present system of examinations in commercial subjects, and the matter was referred to the Commercial Education Committee of the London Chamber of Commerce to consider details and formulate a scheme to carry this resolution with effect, it being understood that the Chamber would enlarge its Committee for this purpose by the addition of some members of the conference. Perhaps now that the Chamber of Commerce has taken steps to organise commercial education, it may go on, and, in the course of time, do something for instruction in science.

FROM statistics in the *Deutscher Universitäts Kalender* it appears that the number of persons attending lectures in German universities during the winter semester of 1894–95 was 33,021, of whom 8755 were in attendance at Berlin, 1587 at Bonn, 1350 at Breslau, 1168 at Erlangen, 1216 at Freiburg, 556 at Giessen, 843 at Göttingen, 775 at Greifswald, 1643 at Halle, 1230 at Heidelberg, 667 at Jena, 532 at Kiel, 737 at Königsberg, 3112 at Leipzig, 852 at Marburg, 3561 at Munich, 421 at Münster, 420 at Rostock, 980 at Strassburg, 1184 at Tübingen, and 1492 at Würzburg. At Berlin, however, the matriculated students numbered only 5631, the remaining 3724 being persons who had received permission to attend lectures without being enrolled as *cives academici*; at Leipzig there were 127 of such students, and at Munich only 86. In the law department (including cameralistics and forestry) there were at Berlin 1667, at Leipzig 985, and at Munich 1230 students; in the medical department (including surgery and pharmacy) at Berlin 1220, at Leipzig 752, and at Munich 1168; in the philosophical department (including philology, mathematics, &c.) at Berlin 1660, at Leipzig 856, and at Munich 700.

SEVERAL noteworthy points are referred to in the Report of the City and Guilds Technical College, Finsbury, for the session 1894–95, in addition to the usual statistics and statements as to the number and quality of the students and the work of the different departments. During the session a number of students entered the College with scholarships from various County Councils and other bodies. A few of these were able to obtain the full benefit from the instruction given, but some of them had gained their scholarships when too childish to benefit properly by the College system. Others suffered from imperfect preliminary training, having been crammed to pass examinations rather than trained how to learn. And the result of it all is that the Principal points out that care must be exercised in future, and influence brought to bear upon the educational advisers of the various County Councils as to their selection of scholarship holders. As a step towards the better selection of qualified candidates, it is proposed to introduce a slight modification into the entrance examination of the College. As with other Colleges on the same status, it appears that amongst the newly-admitted students every year there are a number who have never been taught to take notes, to write original descriptions, or even to use indices or books of reference. The presence of these students has been found greatly to retard the general course of teaching, and causes much waste of time. The time of lecturers and demonstrators is taken away from their proper work to teach the new students things which they ought to have learned at school. As a step toward remedying this matter, it is proposed in future to lay more stress upon the English subjects in the entrance examination, by giving them greater prominence, and by assigning higher marks for such as *précis writing* and composition. In concluding his report, Prof. Thompson has something to say about the future of the College. The large Technical Institutes which have sprung up during the past few years, in various parts of London, have affected the trade-classes at the College to a certain extent, and have also diminished the numbers of students attending the elementary classes. But these Institutes have only affected the elementary part of the work, and the indications are that the more advanced students from the elementary work of the Institutes should pass to the Technical College to carry it on. No institution in London is attempting to give in its evening classes instruction of so thoroughly scientific a character as is given at that College; the instruction is, indeed, admirably suited to supplement the work of the various Polytechnics. It is therefore proposed to develop the courses of special lectures given at Finsbury, and to raise the scientific standard of the evening class work, so as to make the College a focus for the higher branches of study, and for more specialised classes than those of the Technical Institutes.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, vol. ii. No. 1, October 1895.—The number opens with accounts of the proceedings at the second summer meeting of the American Mathematical Society, held at Springfield, Mass., on August 27 and 28, and of the proceedings at the meeting of Section A of the American Association, held at the same place, from August 29 to September 4. The papers at each meeting are given in abstract, and two of them are printed in full, viz. on the differential equations of certain systems of conics, by R. A. Roberts, and asymptotic lines on a circular ring, by Prof. Maschke. The results in the former paper are principally deduced by means of elliptic integrals and the first class of hyper-elliptic integrals, and from these are derived theorems concerning doubly infinite porisms of curvilinear polygons. The latter paper contains an application of elliptic functions to curves drawn on the surface of a circular ring.—Prof. F. Morley communicates a short note on a generalisation of Weierstrass's equation with three terms.—The notes contain various items of interest, and the list of publications is unusually full.

The Mathematical Gazette, No. 6, October 1895.—The conics of Apollonius, by the Rev. J. J. Milne, is the paper read by that gentleman at the annual meeting in January last. It contains a full and careful analysis of Apollonius' treatise, putting in evidence what the great geometer says on the subject, and also stating what properties he does not touch upon. The result arrived at is that the ground covered by Apollonius "is very extensive, and many parts of the subject are very thoroughly treated which are passed over in silence in modern text-books."—Proof of Horner's method of approximation to a numerical root of an equation by the properties of algebraical quotients and remainders, by Mr. M. Jenkins, is supplementary to papers read before the Association by Messrs. Langley and Hayward.—Dr. J. S. Mackay gives a further short note on Greek geometers before Euclid. Amongst the geometers slightly noticed are Œnopides of Chios, Anaxagoras, Democritus of Abdera, Hippocrates of Chios and Antiphon.—The notes contain some suggestions in mathematical terminology, by R. F. Muirhead; some trigonometrical identities, by the editor and J. H. Hooker; on Simpson's rule, by Prof. A. Lodge; and on division into classes and homogeneous products, by P. J. Harding.—A few questions and reviews complete a number which is quite up to the previous high standard of the *Gazette*. If this journal were better known, we feel sure it would be more heartily supported than it is by mathematical teachers.

Bulletin de l'Académie Royale de Belgique, No. 8.—On a hydrate of arsenic trisulphide and its decomposition by pressure, by W. Spring. If the specific volume of a compound is greater than the sum of those of its constituents, it should be decomposed by pressure. This has already been verified with cupric-calcic acetate. It is also shown by the hexahydrate of arsenic trisulphide, which decomposes on compression in water or orpiment, and does not require very great pressure. This phenomenon is the converse of the combination of bodies by pressure when the resulting specific volume is smaller.—On a spot recently observed on the surface of Venus, and on the period of rotation of this planet, by M. Schiaparelli. This spot is near the south pole of the planet, and had at the time of writing remained the same for four weeks, so that the period of about twenty-three hours is out of the question.—On the attraction sphere in the fixed cells of the conjunctive tissue, by C. de Bruyne. The author investigates the attraction sphere in the conjunctive cellules fixed in position in the interstitial of the liver and the genital glands of *Paludina vivipara*. He describes its constitution, its shape, its continuity with the cytoplasmic filaments, the character of the medullary zone and that of the centrosomes, which vary in number, dimensions and shape. He then describes the situation of the sphere and its relations to the nucleus, and the constitution of the radial fibres. He concludes, against the views of O. Hertwig and others, that the centrosomes rest in the cytoplasm during the stage of repose of the cellule. The drawings reproduced are a conclusive proof of their presence in the conjunctive cellules at rest.

THE papers in the *Bullettino della Società Botanica Italiana* for July belong exclusively to the departments of descriptive and geographical botany, most of them having special reference to the Flora of Italy.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, November 6.—The Right Hon. Lord Walsingham, F.R.S., Vice-President, in the chair.—Lord Walsingham announced the death of M. E. L. Ragonot, President of the Entomological Society of France, and, since 1887, a Foreign Fellow of the Entomological Society of London. He remarked that M. Ragonot was especially distinguished by his knowledge of the *Phycidæ*, a monograph on which group he had brought out in Russia, and for his amiable persona qualities and the readiness he showed to assist other workers in the identification of species. He said that the loss of M. Ragonot would be greatly felt not only by the Entomological Society of France, but by entomologists all over the world, and that the Council had that evening passed a resolution to the effect that the Secretary should write a letter of condolence to the French Entomological Society on the death of their distinguished President. Colonel Swinhoe also spoke as to the great loss sustained by the death of M. Ragonot, and of the kindness and generosity of the deceased, which he had personally experienced.—Mr. Goss read a letter from Mr. Waterhouse, calling attention to the prospectus of a monograph by Mr. Ernest Green on the *Coccidæ* of Ceylon. A copy of the prospectus and specimen plates were shown, and Lord Walsingham and Mr. McLachlan commented on the importance of the proposed work and the beauty of the plates.—Mr. Stevens exhibited two larvæ, supposed to be those of a species of *Anobium*, which had been damaging oil paintings in his possession; also two specimens of a luminous species of *Pyrophorus*, which he had received alive from the West Indies.—Mr. Adkin exhibited a portion of a collection of Lepidoptera made in Hoy, Orkney, in 1895, including the following species, viz. *Agrotis vestigialis*, *A. tritici*, and *A. cursoria*, not previously recorded from Orkney; *Nemeophila plantaginis*, having the usual yellow ground-colour of the hindwings replaced by red in many of the females; *Hepialus humuli*, males of the ordinary white form, bearing no resemblance to the Unst (Shetland) form; *Triphæna comes*, all very dark, the forewings almost black, the yellow of the hindwings of many of the specimens much obscured by blackish scales; *Noctua festiva*, showing forms of variation ranging between the pale southern and the dark *conflua* forms; *Epunda lutulenta*, some almost uniformly black, others pale grey with dark markings; *Hadena adusta*, one almost black, others much variegated; *Thera juniperata*, many having the central fascia and apical streak very dark brown; and *Hysipetes sordidata*, varying from blackish-brown to pale green.—Mr. Tutt exhibited a series of *Emydia cribrum*, var. *candida*, which he had bred from eggs obtained from a specimen caught by Mr. Merrifield in May 1895, in Northern Italy. He stated that being unable to obtain *Calluna vulgaris*, the ordinary food-plant, he had tried them with Knot Grass (*Polygonum aviculare*), and had no difficulty in rearing them.—The Rev. Canon Fowler exhibited, on behalf of Prof. Poulton, F.R.S., living *Diapheromera femorata* bred from eggs received from Prof. E. B. Titchener, of New York. He stated that the young larvæ had emerged from the eggs in July and August last, and fed on lime. Several pairs had arrived at maturity, and were feeding in cases in the Oxford Museum.—The Rev. J. H. Hocking exhibited a specimen of *Xylina zinckenii*, taken by him at sugar on the trunk of an oak tree, at Copdock, near Ipswich, on September 30 last. It was in beautiful condition, and had apparently only recently emerged from the chrysalis. He also exhibited two specimens of *Xanthia ocellaris* taken at the same time. Mr. Barrett referred to the few recorded chapters of *X. zinckenii* in this country.—Mr. R. W. Lloyd exhibited male and female specimens of *Amara alpina* from Garvell, Perthshire.—Colonel Swinhoe stated that he had, during the past summer, captured four specimens of *Pieris daplidice* at Deal. They were worn, and had probably been blown over from France. Mr. Tutt remarked that he had collected at Deal for many years, but had never met with *Pieris daplidice*.—Mr. Tutt read a paper by Prof. A. Radcliffe Grote, entitled "Notes on the genus *Cidaria*."—Dr. T. A. Chapman read a paper entitled "Notes on Pupæ; *Orneodes*, *Epermenia*, *Chrysocorys*, and *Pterophorns*." Lord Walsingham, Mr. Blandford, and Mr. Tutt took part in the discussion which ensued.

Geological Society, November 6.—Dr. Henry Woodward, F.R.S., President in the chair.—The Serpentine, Gneissoid and Hornblendic Rocks of the Lizard District, by Prof. T. G. Bonney, F.R.S. The author states that in company with the Rev. E. Hill, and in consequence of their work in Sark, he had again investigated the question of the genesis of the hornblende-schists at the Lizard, and was able to overcome the difficulties which formerly withheld him from attributing an igneous origin to the schists themselves, and their banded structure to fluxional movements during consolidation. There also, as in Sark, he found some evidence of this banding being the result, at any rate in places, of a mixture of a less and a more basic material. Additional evidence was given as to the genesis of the granulitic group and its relations to the hornblende-schist. The author maintained that the relations of the serpentine to the granulitic and the hornblendic groups are inexplicable on the hypothesis of an igneous complex, so far as he understood the meaning of that term, or of a folding in a solid condition or any other form of dynamometamorphism, and he maintained his original opinion that the serpentine (*i.e.* the original peridotite) was intrusive in the other rocks. The paper also dealt with some minor points in the geology of the Lizard. In the discussion that followed, Mr. Teall, speaking as to the origin of hornblende-schists, reaffirmed his belief in the theory that both gabbros and basic

dykes had been converted into rocks of this character by dynamic metamorphism; and Sir Archibald Geikie said that though he would not venture to offer an opinion upon most of the disputed questions in the geological structure of that area, he had seen evidence sufficient to convince him that in the Potstone Point part of the coast the serpentine and horblende-schist formed, as Mr. Teall maintained, the great complex which presented a marked coincidence of banding and had been plicated by one common series of movements. He could see no indication of the serpentine being intrusive in the schists.—The "schistes lustrés" of Mont Jovet (Savoy), by Dr. J. W. Gregory. The author gave a history of the controversy as to the age of the "schistes lustrés" of the Western Alps, making special reference to the views of Zaccagna and Bertrand concerning the schists of Mont Jovet. Of these writers, the former maintained that the rocks of the summit of the mountain are old rocks on which the Carboniferous and Triassic strata were deposited unconformably; while, according to the latter author, the rocks forming the top of the mountain were laid down after those which flank it. In his paper the present author gave the results of an examination of the rocks of Mont Jovet recently made by him. He contended that Lory and Zaccagna were correct in identifying the central rocks of Mont Jovet as "schistes lustrés," for this conclusion is supported by their lithological characters and the occurrence of basic igneous rocks of the "pietre-verdi" type associated with them, and is not opposed to their stratigraphical relations. It was further maintained, as the results of the evidence collected by the author, that the schists in question were older than the Trias. The probabilities were in favour of the schists occupying the same relation to the Carboniferous as they do to the Trias; while the close approximation of the schists to the former shows that the schists are not the altered representatives of the neighbouring Carboniferous beds, and it was therefore concluded that the "schistes lustrés" are pre-Carboniferous, but evidence by which finally to assign them to any exact horizon before this date is still wanting.

Linnean Society, November 7.—Mr. C. B. Clarke, President, in the chair.—Several volumes of Cryptogamic exsiccata, recently received from Madame Weddell as a bequest from her late husband, a foreign member of the Society, were shown, and some remarks made thereon by the Botanical Secretary.—A portrait of the French naturalist Guillaume Rondelet, Professor of Anatomy and Chancellor of the University of Montpellier 1545, recently presented to the Society by Dr. H. Woodward, F.R.S., was exhibited by the Zoological Secretary, who gave an account of his life and work, supplemented by remarks from the President.—Mr. C. T. Druery exhibited and made remarks on a *Scolopendrium* raised by Mr. E. J. Lowe, bearing archegonia and antheridia upon the fronds, constituting a more advanced phase of apospory than any previously noted. Some remarks thereon were made by Mr. George Murray.—Dr. Maxwell T. Masters exhibited specimens of the fruit of *Pyrus sorbus*, *Aberia caffra*, and small *Cocos australis*, from the gardens of Mr. Thomas Hanbury at La Mortola, Mentone, and some palm fruits of *Cocos australis* from Naudin's garden at Antibes, Alpes Maritimes.—Mr. J. E. Harting exhibited a specimen of the American yellow-billed cuckoo, which had been picked up dead in a garden at Bridport, Dorsetshire, on October 5, and gave some account of the species and previous occurrence in the British Islands.—A paper was read by Colonel Swinhoe on mimicry in butterflies of the genus *Hypolimnas*, Hübner. By means of a series of beautifully coloured lantern slides, he showed the changes in mimetic forms in a single genus of Nymphalid butterflies, from India through Arabia to Africa, and from India through the Malay Archipelago to Australia, commenting upon the resemblance they always bear in colour and pattern to different forms of *Danaïs* and *Euplœa*, insects well known to be distasteful to birds and reptiles.—Mr. G. F. Scott Elliot communicated a paper entitled "A revision of the genus *Pentas*," in which some account was given of the distribution of these plants in Africa, with a rectification of the synonymy, and descriptions of five new species. The genus as a whole showed in a remarkable manner the way in which local species occur whenever a different climate restricts the distribution of a wide-ranging form, and several examples of this were mentioned. A discussion followed, in which the President and Mr. W. P. Hiern took part.—On behalf of Dr. A. G. Butler, an abstract was read of a paper on butterflies of the genus *Charaxes*, of which 159 species were recognised, nearly all of which are represented in the National collection. Five species—*Charaxes princeps*, *C. repetitus*, *C. layardi*, *C. fervens*, and *C. coniger*—were described as new.

PARIS.

Academy of Sciences, November 11.—M. Marey in the chair.—The following memoirs have been submitted to Committees: "Comparison of the French, English, and German races by means of mortality tables," by M. Delauney. A note concerning the weight of the atmosphere, by M. F. Delmas. "On the formation of curved refractors and reflectors by means of plane mirrors and transparent plane surfaces," by M. Moret de Montjou. "The defence of the vine against phylloxera," by M. Leroux (Tenès, Algeria). "A contribution to the study of ferments," by MM. G. Nivière and A. Hubert. "The Cartesian planimeter with tangential registration. A new mechanical integrator of great precision," by M. José Ruiz-Castizo.—On a problem concerning the determination of the integrals of an equation to the derived partials, by M. E. Goursat.—On the unicursal types of two dimensions, by M. Léon Autonne.—On the homogeneous differential linear equations of which the general integral is uniform, by M. G. Floquet.—On the construction of new magnetic maps of the globe, undertaken under the direction of the Bureau des Longitudes, by M. de Bernardières. Seven survey expeditions have been equipped with the most modern appliances, and sent, under competent observers, to ascertain accurately the magnetic elements at numerous stations, and an eighth will be started as soon as the necessary instruments are obtained. The observing stations are grouped broadly round the great oceans.—Some effects of the synodic revolution of the moon on the distribution of pressures in the season of summer, by M. A. Poincaré.—On the hardening of extra-hard steels, by M. F. Osmond. With steels containing 0·35 to about 1·3 per cent. of carbon there is a gradual increase of hardness with increase of carbon contents, beyond 1·3 per cent. the steel becomes softer. A description is given of the method of investigating the structure of steel by abrasion with a sewing needle and microscopic examination of the scratch, and it is shown that the structure thus investigated leads to the conclusion that hard steels consist of two interpenetrating types of steel, of which one is much harder than the other. The same conclusion may be drawn by examination of etching figures, using iodine tincture or dilute nitric acid for the attack.—On the silicides of nickel and cobalt, by M. Vigouroux. These compounds of silicon and nickel or cobalt are produced in similar ways to the chromium and iron silicides. They have the composition $SiNi_2$, $SiCo_2$. They have a steel-grey metallic appearance, a specific gravity of about 7·1, and are more fusible than either of the constituents. Their properties in relation to halogens, halogen acids, oxygen, alkalies, and potassium nitrate are given in detail.—On crystallised normal calcium chromite, by M. E. Dufau. At a sufficiently high temperature, chromic oxide combines directly with lime to give a chromite of the composition $CaO.Cr_2O_3$. This compound is stable at the highest temperatures. It forms prismatic needles of metallic lustre, transparent in thin crystals, and of a fine green colour. Its hardness is 6, and specific gravity 4·8 at 18°.—On the alcoholates, by M. H. Lescœur. Sodium ethoxide forms no stable alcoholate, sodium hydrate appears to give the compounds $NaOH.3C_2H_6O$ and $NaOH.C_2H_6O$.—On the properties of emulsin from mushrooms, by MM. Em. Bourquelot and H. Hérissey. Emulsin from different fungi of the mushroom type appears always to be the same, and it cannot be affirmed to differ from the emulsin of almonds.—Constancy of the freezing point of some liquids of the organism. Application to the analysis of milk, by M. J. Winter. The author establishes the isotonism of body-fluids, more particularly of milk and blood-serum. "These liquids are equimolecular, and their molecular concentration is the same among the diverse animal species examined." The constancy of the freezing point of milk may be used as a means of detecting adulteration with water. Blood-corpuscles, along with their other functions, serve the purpose of regulating the concentration of the blood serum.—On fermentations caused by Friedländer's pneumobacillus, by M. L. Grimbert. There exist two types of Friedländer's pneumobacillus which are morphologically alike, but differ in their fermentative action. The pneumobacillus studied by Frankland has no action on glycerol and dulcitol, whereas that from the Pasteur Institute attacks these substances.—On the direct fixation, by vegetable fibres, of certain metallic oxides, by M. A. Bonnet.—On the detached crystalline rocks, probably of Tertiary age, in the Briançon Alps, by M. P. Termier.

NEW SOUTH WALES.

Linnean Society, September 25.—Mr. Henry Deane, President, in the chair.—Notes on Cicadas, by W. W. Froggatt.—Description of a tree creeper presumably new, by C. W. De Vis, *Climacteris animosa*, n.sp. Several examples were obtained in clearings in the Mulga Scrubs, at Charleville.—On the dates of publication of the early volumes of the Society's Proceedings, by J. J. Fletcher.—The President exhibited a number of botanical specimens from the Tweed River.—Mr. Froggatt exhibited his collection of Sydney Cicadas.—Mr. Steel showed a Gecko (*Gehyra vorax*, Gir.) from the Rewa River, Fiji.—Mr. Fletcher showed some English humble bees, the defunct portion of a consignment from New Zealand, recently imported by the Department of Agriculture in the hope of the successful acclimatisation of the insects. Of the remainder, some were liberated in the Botanic Gardens, and some in the Society's arden.

BERLIN

Meteorological Society, October 15.—Prof. Hellmann, President, in the chair.—Dr. Kassner spoke on the influence of weather on the growth of sugar-beets. He had compared the beet-root crops in the provinces of Saxony and Silesia, with the temperatures, rainfall, and intensity of rain during fifteen years, for the yearly period from October 1 to September 30. The curves of temperature corresponded to those of the crops in both provinces, except in 1887. On the other hand, the curves of rainfall in Silesia showed no such correspondence, although they were in somewhat greater harmony in Saxony. The curves of intensity of rain were in somewhat closer accordance with those of the crops, than were the curves of rainfall. The speaker came to the conclusion that the relationship of weather to crops requires a much more thorough investigation than is possible with the scanty data as yet available.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, NOVEMBER 21.

ROYAL SOCIETY, at 4.30.—(1) On the Gases obtained from the Mineral Eliasite. (2) On the New Gases obtained from Uraninite. Sixth Note. (3) On the Variable Stars of the δ Cephei Class: J. Norman Lockyer, C.B., F.R.S.—Microscopic and Systematic Study of Madreporarian Types of Corals: Miss Maria M. Ogilvie.—On the Calibrationof the Capillary Electrometer: G. J. Burch.—An Experimental Investigation of the Laws of Attrition: F. T. Trouton.—Experiments on Fluid Viscosity: A. Mallock.

LINNEAN SOCIETY, at 8.—Development of a Single Seed in the Fruit of the Cocoanut Palm (Cocos nucifera): D. Morris, C.M.G.—Assimilation in Plants under Abnormal Conditions: A. J. Ewart.—On a New Species of Pinites from Wealden (England): A. C. Seward.

CHEMICAL SOCIETY, at 8.—The Evolution of Carbon Monoxide by Alkaline Pyrogallol Solution during Absorption of Oxygen: Prof. Clowes.—The Composition of the Limiting Explosive Mixtures of various Combustible Gases with Air: Prof. Clowes.—Barium Butyrate and the Estimation of Butyric Acid: W. H. Willcox.—And other Papers.

LONDON INSTITUTION, at 6.—Relation of Ants to Plants: Prof. F. E. Weiss.

CAMERA CLUB, at 8.15—Mechanical Carriages: J. H. Knight.

SOCIETY OF ANTIQUARIES, at 8.30.

NUMISMATIC SOCIETY, at 7.

FRIDAY, NOVEMBER 22.

PHYSICAL SOCIETY, at 5.—An Exhibition of Photographs of Spectra: G. Johnstone Stoney.—A Direct Reading Platinum Thermometer: R. Appleyard.—Historical Note on Resistance and its Change with Temperature: R. Appleyard.

CLINICAL SOCIETY, at 8.30.

SATURDAY, NOVEMBER 23.

ROYAL BOTANIC SOCIETY, at 3.45.

MONDAY, NOVEMBER 25.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Faëroe Islands: Dr. Karl Grossmann.

INSTITUTE OF ACTUARIES, at 7.—Address by the President, Mr. Alex. J. Finlaison, C.B., on the Recent International Congress of Actuaries at Brussels.

MEDICAL SOCIETY, at 8.30.

CAMERA CLUB, at 8.15.—Daylight Enlarging: F. Seyton Scott.

TUESDAY, NOVEMBER 26.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Photo-ceramics. A Demonstration will be given by Mr. W. Ethelbert Henry.—A Method of Carbon-printing without Transfer: Valentine Blanchard.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Discussion on Subaqueous Tunnelling by Shield and Compressed Air.

ROYAL VICTORIA HALL, at 8.30.—The Land of the Midnight Sun: Prof. Clowes.

ROYAL MEDICAL AND CHIRURGICAL SOCIETY, at 8.30.

WEDNESDAY, NOVEMBER 27.

SOCIETY OF ARTS, at 8.—Locomotive Carriages for Common Roads: H. H. Cunynghame.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, NOVEMBER 28.

ROYAL SOCIETY, at 4.30 (Extra Meeting).—The following Papers will *probably* be read:—Mathematical Contributions to the Theory of Evolution. III. Regression, Heredity, and Panmixia: Prof. Karl Pearson.—The Expansion of Argon and of Helium as compared with that of Air and Hydrogen: J. P. Kuenen and W. W. Randall.—On the Percentage of Argon in Respired Air: A. Kellas.—Examination of Gases from certain Mineral Waters: A. Kellas and Prof. Ramsay, F.R.S.—On the Granular Leucocytes: G. L. Gulland.—On the Development of Lichenopora verrucaria, Fabr.: S. F. Harmer.

LONDON INSTITUTION, at 6.—A Forest Primeval: Prof. W. Boys Dawkins, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electric Wiring Question: F. Bathurst.—Concentric Wiring: Sam Mavor.

SOCIETY OF ANTIQUARIES, at 8.30.

SATURDAY, NOVEMBER 30.

ROYAL SOCIETY, at 4.—Anniversary Meeting.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—British Birds' Nests: R. Kearton (Cassell).—Text-Book of the Embryology of Invertebrates: Drs. Korschelt and Heider, translated, Part 1 (Sonnenschein).—Royal Natural History, Vol. 4 (Warne).—A Laboratory Course in Experimental Physics: W. J. Loudon and J. C. McLennan (Macmillan).—Outlines of Psychology: Prof. O. Külpe, translated by Prof. E. B. Titchener (Sonnenschein).—Recettes de l'Electricien: E. Hospitalier (Paris, Masson).—Evolution in Art: Prof. A. C. Haddon (Scott).

PAMPHLETS.—Manchester Museum, Owens College, Museum Handbooks: Catalogue of the Hadfield Collection of Shells from the Loyalty Islands: J. C. Melvill and R. Standen (Manchester, Cornish).—The Ethnology of Buchan (Peterhead).

SERIALS.—Strand Magazine, November (Newnes).—Records of the Australian Museum, Vol. 2, No. 6 (Sydney).—Psychological Review, November (Macmillan).—Transactions of the Rochdale Literary and Scientific Society, Vol. 4 (Rochdale).—Journal of Conchology, January, April, July, October (Dulau).—Synoptical Flora of North America, Vol. 1, Part 1, Fasc. 1: Gray, Watson, and Robinson (Wesley).—Himmel und Erde, November (Berlin).—Royal Natural History, Part 25 (Warne).

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