THURSDAY, JUNE 7, 1883

WIEDEMANN'S "ELECTRICITY"

Die Lehre von der Electricität. Von Gustav Wiedemann. Vol. I., pp. xi. and 795 (1882); Vol. II., pp. vii. and 1002 (1883). (Braunschweig: Vieweg.)

FOR more than twenty years Prof. Wiedemann's "Lehre vom Galvanismus und Elektromagnetismus," first published in 1861, has been recognised without question as the leading authority and great storehouse of facts on the branch of science of which it treats. It is a practically exhaustive treatise, and each of the two editions (second edition, 1872 to 1874) marks with wonderful accuracy the high-water mark of knowledge of its subject up to the date of publication. It is safe to assume that any fact that is not to be found recorded in its pages had not been discovered, or at least had not been published, up to the date of completion of whichever edition is examined. The fulness and accuracy of the references to original authorities give to Prof. Wiedemann's book a unique value also as a classified index to the literature of galvanic electricity and electromagnetism.

The work which forms the subject of this notice, is in one sense a third edition of the "Lehre vom Galvanismus." It appears however under a new title, and is in fact to a great extent a new book. It is characteristic of the direction taken by the advance of electrical science during the last twenty years that, while Prof. Wiedemann found it practicable to confine himself in his first and second editions almost exclusively to the phenomena of current electricity and of magnetism, he has found it advisable in the present edition to enlarge the scope of his work so as to make it include the whole range of electrical science. It is true that the second edition contains an important chapter devoted to the discussion of a phenomenon that has usually been considered in connection with statical electricity, namely, the disruptive discharge in gases of different densities; but this is almost the only part of the book in which the considerations that have to be dealt with in treating of electrostatics occupy a prominent place. It is however becoming less and less possible to treat satisfactorily of one branch of electricity apart from the remainder. The terms frictional electricity and galvanic electricity have evidently an historical rather than a scientific origin. They do not refer to any logical classification of phenomena, but to two among the many processes by which electrical effects can be originated. It is not even by any means certain that electrification by friction is fundamentally a distinct phenomenon from electrification by contact as this occurs in a galvanic cell; on the contrary, various recent investigations tend to show that these actions are essentially similar, and that the friction which takes place in one case is of the nature of an accidental accompaniment. As a matter of fact, however, an electrical machine acting by friction serves (or at least did so until recently) as the readiest means of producing one large class of electrical phenomena; while a galvanic or voltaic battery serves (or at least did so until recently) as the readiest means of producing another large class of phenomena. Thus the division of electrical science for the purposes of study into frictional electricity and galvanic electricity originated in considerations of experimental convenience rather than in any strictly scientific distinction. So far as such a distinction can be drawn between these two branches, it may be said that the former includes the study of all those phenomena in which difference of potentials is the most characteristic factor; while the latter includes the study of phenomena characterised by the transfer of electricity. As examined by the instruments in use five-and-twenty years ago, the effects produced by the electrical machine seemed distinct enough from those due to the galvanic battery—indeed the difficulty rather was to establish their mutual connections; but with the galvanometers and electrometers that are now—thanks to Sir William Thomson—in the hands of every electrician, nothing is easier than to measure the current of an electrical machine or the difference of potentials of a galvanic cell. Moreover the recent rapid development of methods of converting mechanical into electrical energy, through the agency of magneto-electric induction, has made us familiar with the production of currents of great strength associated with great differences of potential. It is, however, not only the introduction of new instruments and apparatus, and the increased power over electrical phenomena that modern experimentalists have thereby acquired, that make it less possible now than formerly to treat of the laws of electric currents without reference to the principles of electrostatics. The conception that the immediate cause of the phenomena exhibited in either an electric or a magnetic field has its seat, not in electrified conductors, or in magnets or conducting wires, but in an impalpable medium existing throughout space, has completely shifted the scientific point of view as regards electrical effects. What is now demanded of electrical theory is an explanation of the conditions of the medium which are perceptible by us as the properties of an electric or magnetic field. The wider problem of the constitution of the electric medium, whether identical or not with the luminiferous ether, embraces in itself the phenomena of electrostatics, of electric currents, and of magnetism

There was thus every reason to wish that Prof. Wiedemann might be able to treat electrical science as a whole in the same complete way in which he had previously treated the portions included within the scope of his previous book. This is what he has now undertaken and in great part accomplished. The task is an enormous one, and probably, to any one except the man who has set himself to it, would have seemed overwhelming. Prof. Wiedemann's industry and care, however, never seem to fail before any mass of descriptive detail or complex mathematical discussion, and students of physics may therefore be congratulated upon the near prospect of having from his pen a complete treatise on electricity.

The first of the two volumes already published begins with a section on the General Properties of Electricity, including an historical sketch of early observations, the development of electricity by friction, &c., electrostatic attraction and repulsion, distribution on conductors, and a description of the various forms of electroscopes and electrometers. Then follows a section on the development of electricity by contact of heterogeneous bodies; next Ohm's law and its applications, the measurement of electrical resistance and of electromotive force, and a

description of various galvanic elements. These subjects occupy the first volume, consisting of close on 800 pages. The second volume begins with the electrical properties of dielectrics. The section devoted to this subject is perhaps the most interesting in the volume: it contains the mathematical theory of the behaviour of dielectrics, the experimental investigation of specific inductive capacity, the detailed study of electrical machines acting by friction and by induction, together with various allied matters. Next come thermoelectricity, pyroelectricity, and the thermal effects of the discharge of accumulated electricity and of continuous electric currents. After this follows the section devoted to electrochemical action: this occupies about five hundred pages, and concludes with a chapter on the theory of electrification by contact, which completes the volume. It is intended that the whole work should be finished in four volumes, and the manuscript of the two that still remain to be published is for the most part ready.

Prof. Wiedemann's great work has been so long known to physicists that it is needless for us to dwell upon its special qualities farther than to say that it fully retains in its new form all its old characteristics. It is true that it lacks the originality and unity of treatment of Clerk Maxwell's "Electricity and Magnetism," probably the most original systematic treatise on any great branch of physics that was ever written. Nor does it equal in the clearness and elegance of its mathematical discussions the treatise of Mascart and Joubert, a work which, while not laying claim to originality in respect of matter, exhibits in a remarkable degree consecutiveness and lucidity of exposition. Prof. Wiedemann's plan precludes his attaining to these particular excellences in an equal degree. Some sacrifice of unity and consecutiveness is inevitable in a work which aims not only at giving a complete account of what is known respecting a great branch of science, but also at showing what each author has contributed to the stock of knowledge and how he has presented it. From this point of view Prof. Wiedemann's book is without a rival in any language, and is indeed unapproached by any other work. G. C. F.

FLORA OF HAMPSHIRE

Flora of Hampshire, including the Isle of Wight, or a List of the Flowering Plants and Ferns found in the County of Southampton, with Localities of the Less Common Species. By Frederick Townsend, M.A., F.L.S., &c. Illustrated with Two Plates and a Map. (London: L. Reeve and Co., 1883.)

WE have here an important addition to the already large class of English local floras. To the general botanist, as to people who have made no study of botany, it would seem that the plants of so comparatively small a region as the British Islands must have been catalogued long since, and that there is little to be done in that direction which is worth doing. It certainly is remarkable that, besides facts connected with geographical distribution, which a more minute knowledge of the plants of a country must bring to light, there are actually new plants to be found—new, that is to say, not only to Britain, but to science. A Pondweed (*Potamogeton Griffithii*), new to science, has recently been described and figured by Mr. Arthur Bennett in the *Journal of Botany*, from specimens brought from a mountain lake in North Wales—the only place in the world where it is known to occur. Not that this is the only species peculiar to these islands. To take one example, there is a species of Centaury (*Erythræa latifolia*),[1] which has never been found anywhere in the world but on the Lancastrian sandhills; and there it is not known to have been seen more recently than 1865, if then. In Mr. Townsend's county, a Spearwort (*Ranunculus ophioglossifolius*), not hitherto found nearer these shores than Jersey, has been detected so lately as to appear only on the very last page of the book; *Spartina Townsendi* is another case in point; and another example of a plant having been long overlooked, and of which the distribution has quite recently been much extended, will be found in *Arum italicum*, which was detected in the Isle of Wight in 1854, and was afterwards found in West Cornwall and Sussex; this was recorded for Dorset last year, and its range has been extended during the present year to Kent (Folkestone). The volume now before us supplies a good illustration of the way in which novelties may turn up in the best known districts. Probably if there is one part of England which has been more thoroughly botanised than another it is the Isle of Wight; yet it was here, and in one of the best known parts—the Downs at Freshwater—that Mr. Townsend first distinguished in 1879 an *Erythræa* (*E. capitata*, var. *sphærocephala*), which is, as he says, "a peculiarly interesting addition to the British flora. It is," he continues, "a well-marked species, and is not known now to occur anywhere else in the world but in the Isle of Wight and in Sussex. The other form of it was found some fifty years ago somewhere in the neighbourhood of Berlin (the exact locality not being known), and though sought for diligently, it has never been found again."

It will doubtless seem strange to some to learn that a volume of more than 500 closely-printed pages can be occupied by an enumeration of the plants of one English county, especially when it is considered that the pages devoted to descriptions of species are very few. An interesting and instructive article might be written in which the history and development of the local flora should be traced. To undertake such is, however, not our present purpose; but we may note one or two of the more striking features of these later contributions to local botany, of which the "Flora of Hampshire" is the most recent. One thing to be noticed is their historical nature. Messrs. Trimen and Dyer, in their "Flora of Middlesex" (1869), were the first to develop this aspect of the work: their method of quoting the first authority for the occurrence of the species as a Middlesex plant has been followed by subsequent writers, and they also did good service by quoting the synonymy of the older (and pre-Linnean) authors—a work which has been very useful to their successors. When it is considered that a book of this kind is mainly undertaken by persons interested in the history of some particular locality, it seems natural that what has been called the antiquarian side of botany should be represented, although there are those who consider that

[1] The plant so named in Continental floras is certainly not the same as that of the Lancashire sandhills.

this line of action directs attention to persons rather than plants, and is thus out of place.

Another point to which much more attention is given now than was formerly the case is the division of a county into districts. Messrs. Webb and Coleman, in the "Flora Hertfordiensis" (1849), planned their divisions with reference to the river drainage; and this has been carried out in the best floras of later times. If it were generally adopted, and if our list of county floras were complete, we should arrive at a much greater knowledge of plant distribution than we have at present. The arbitrary boundaries of counties would give way to the natural divisions afforded by the various river-basins, and one county flora would fit into another, and form a harmonious whole. This subject has lately been worked out by Mr. Boulger in a careful paper "On the Origin and Distribution of the British Flora," published in the *Transactions of the Essex Field Club*. No one who has not tried it would suspect how greatly the floras of contiguous river-basins will be found to differ from each other.

It is time, however, to speak of Mr. Townsend's important contribution to our knowledge of local botany. As is well known, the work has occupied him during a large number of years: it has, we regret to say, been retarded by the ill-health of its author, or it would have been published two years since; but Mr. Townsend tells us that the delay has enabled him to improve the book in various details. The county is divided into twelve districts, two of which are in the Isle of Wight. A small but extremely clear and useful map showing the boundaries of these is given. The usual lists of books quoted and herbaria consulted are followed by a short sketch of the plan of the flora. The distribution of each species through the districts and subdistricts is then worked out at length. We confess to feeling some disappointment at the comparative fewness of the critical notes upon species. Mr. Townsend's extensive knowledge of British plants, especially in their relations to the Continental flora, had led us to expect that we should have had a good deal of additional light thrown upon some of our critical forms; but this, although not altogether wanting, occupies but a small portion of the volume. Mr. Townsend's notes are for the most part in the appendix—an arrangement which seems to us open to various objections, not the least being the fact that these notes and descriptions are often not mentioned in the index. Two or three varieties are described and named for the first time in these pages; and occasionally a specific name new to the British flora makes its appearance, as in the case of *Glyceria declinata* of Brébisson, with which Mr. Townsend identifies a plant which he had previously considered a dwarf variety of *G. plicata*.

One or two points seem to us open to criticism. "First record" in books of this kind is usually taken to mean first record in print; but this is not Mr. Townsend's view of the phrase. Thus under *Centaurea cyanus* we find, "First record: Herb. Reeves, 1837." It does not seem to us that the existence of a specimen in a private herbarium can be considered a record of its occurrence in the ordinary acceptation of the term. Sometimes we do not quite understand the author's meaning, as when he marks the curious and interesting *Spartina Townsendi* as "certainly introduced," although it has as yet been found nowhere else in the world. Equally puzzling is this sentence as to the specific rank of the same grass: "I believe this plant must take the rank of a sub-species; the characters which separate it from *S. stricta* being so important and distinctly marked. It is easily distinguished from *S. alterniflora*." This being so, surely it should be ranked as a full species? Mr. Townsend admits *Anthoxanthum Puelii* as indigenous, but its frequent substitution for *A. odoratum* by seed merchants throws much doubt upon its nativity: this plant, first found in Hampshire in 1874, had been collected in Cheshire two years previously, but Mr. Townsend cites the last-named county as one of those in which it "has since been found." We can, from observation of the two plants in several counties, confirm the statement of Mr. Pryor, which is doubted by Mr. Townsend, that *Viola Reichenbachiana* flowers about a fortnight earlier than the allied *V. Riviniana*. Some plants are included as natives of Hampshire on what seems to us insufficient evidence; *Silene noctiflora* is one of these, and *Orchis hircina* another. This latter, we do not hesitate to say, requires much confirmatory evidence before it can be accepted as a Hants plant; its occurrence rests solely on a manuscript note of the late Mr. Reeks, who stated that specimens had been found by a Mr. Lockart at St. Mary Bourne about 1866. The number of misprints is very considerable.

Such criticisms as these—and they might easily be extended—do not, however, prevent the "Flora of Hampshire" from taking a foremost rank among works of its class. A little more attention to uniformity would have improved the book, and, as we have shown, there is room for difference of opinion upon many of the points raised; but British botanists will be grateful to Mr. Townsend for giving them a handbook to the flora of one of the most interesting and beautiful of our English counties.

JAMES BRITTEN

LETTERS TO THE EDITOR

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

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

On Real and Pseudo-Reversals of Metallic Lines

I AM much indebted to the courtesy of Prof. Liveing for a copy of a paper extracted from the *Proceedings of the Cambridge Philosophical Society*, vol. iv. part 5, p. 256, on the circumstances producing the reversal of spectral lines of metals, by Professors Liveing and Dewar. In this communication the following paragraph occurs:—"Prof. Hartley has lately (*Proc. Roy. Soc.* xxxiv. p. 84) called attention to pseudo-reversals of this class, which may be produced in the case of a strong line by over-exposure. It is well known that over-exposure (solarisation, as we used to call it formerly) produces such an alteration in the sensitive preparation of the photographic plate that the over-exposed parts cease to be developable, so that a very strong line may appear white in the negative where it ought to be black, but with a dark border, and so give the appearance of a reversed line. Prof. Hartley finds it difficult to distinguish real reversals of the class we are now discussing from these pseudo-reversals. His difficulty has not occurred to us, first, because we have always been in the habit of taking photographs in series with varying exposure, in order to get impressions both of the feeble lines in some and of strong lines in others; and

secondly, because we almost always close part of the slit of the spectroscope with a shutter, so that the image is cut off sharply by the shadow of the shutter. Strong lines extend into the shadow more or less, and if there is a real reversal the extension of the reversed part into the shadow is trumpet shaped, whereas if it is only a pseudo-reversal it is closed."

I beg to be allowed to call attention to one or two points in the above quotation which I imagine may lead to a misconception of the phenomena observed, and of my remarks thereon.

First, as regards over-exposure, it is assumed that solarisation is an equivalent for this expression. This is the case only when speaking of the cause, but the word has been used by photographers for many years to describe the effect of over-exposure.

In all collodion processes, wet or dry, this effect is an undue intensity of the high lights and an overpowering of the intermediate tints and delicate shadows adjoining them. This appears to be due to the fact that from the intensity of the light not only the direct rays, but those reflected from the back of the glass plate, or even those which are scattered, have sufficient power to act upon the sensitive film. In photographs of spectra this is seen in the nimbus or halo surrounding the strongest metallic lines, which disguises their form. It is well illustrated by my photographs of the magnesium, cadmium, and other spectra, published in the *Journal of the Chemical Society*, vol. xli., *Transactions*, 1882, p. 90.

Although I have worked with dry plates of almost every description, and with some modifications prepared by myself which have never been described, I do not recollect having observed that over-exposure causes any other effect than a too dense deposit of silver, excepting when the vehicle for the sensitive salt is a film of gelatine. As far as my experience goes, it is a property peculiar to gelatine plates, that with such extreme facility they are incapable of development after too strong an action of light, and I carefully avoided the term solarisation, since it has been used to describe an effect so different from that to which I desired to call attention.

Secondly, with regard to difficulty in distinguishing reversals, the sentence above does not exactly represent my experience, and I think it may be seen by those who read my communication, that any want of distinction between real and pseudo-reversals had reference only to photographs which had been already taken with a fixed period of exposure, and that I advocated a method of comparative exposures as necessary in the study of spectra. It appears that this is one of the means whereby Professors Liveing and Dewar are able to draw distinctions between real and pseudo-reversals. The second method, namely, the use of a shutter, is extremely useful in observations on arc spectra, which have been so completely studied by them. I have been studying spark-spectra exclusively, and have not been giving special attention to reversals, in fact, endeavouring as far as possible to avoid them. The use of a shutter does not commend itself to me, since it would cut off a highly characteristic feature in spark-spectra which it is desirable to observe, namely, the extension of the lines, but I may here mention that a speck of dust on the slit, or a fine wire stretched across it, will answer the same purpose as a shutter, without obscuring any considerable portion of the spark, and may be conveniently employed. And now permit me to add one word: the same alteration in the intensity of the spark which results in real reversals also frequently causes pseudo-reversals. Sometimes simply a turn of the screw attached to the spring of the contact-breaker on the induction-coil is sufficient to effect this change.

W. N. HARTLEY

Royal College of Science, Dublin, May 18

The Northern Zoogeographical Regions

THE facts of zoogeography are so involved, and often apparently contradictory, that a skilful dialectician with the requisite knowledge can make a plausible argument for antithetical postulates. Prof. Heilprin, being a skilful dialectician and well informed, has submitted a pretty argument in favour of the union of the North American or "Nearctic" and Eurasiatic or "Palæarctic" regions (*Proc. Acad. Nat. Sc. Phila.*, 1882, pp. 316–334, and NATURE, vol. xxvii. p. 606), but Mr. Wallace has, with perfect justness it seems to me, objected to his proposition (NATURE, vol. xxvii. pp. 482, 483). As Prof. Heilprin's arguments have not been entirely met, however, permit me to submit some further objections to his views.

Prof. Heilprin has contended "(1) that by family, generic, and specific characters, as far as the Mammalia are concerned, the Nearctic and Palæarctic faunas taken collectively are more clearly defined from any or all of the other regions than either the Nearctic or Palæarctic taken individually; and (2) that by the community of family, generic, and specific characters the Nearctic region is indisputably united to the Palæarctic, of which it forms a lateral extension."

Prof. Heilprin has formulated these conclusions after a summary of the families and genera common and peculiar to the regions in question.

As to families, Prof. Heilprin has presented the following figures:—

	All.	Peculiar.
Nearctic	26	1
Palæarctic	36	0
Oriental	36	3
Australian	22	8
Ethiopian	44	9
Neotropical	31	8

The proportions of peculiar genera to the entire Mammalian faunas of the several regions are stated to be as follows:—

	All.	Peculiar.	Percentage.
Nearctic	74	26	35
Palæarctic ...	100	35	35
Oriental	118	54	46
Australian ...	70	45	64
Ethiopian	142	90	63
Neotropical ...	131	103	78

The question may naturally recur why the line which separates "regions" from "subregions" should be drawn between 35 and 46 per cent. rather than between 46 and 63 or 64 per cent., or even between 64 and 78 per cent. Prof. Heilprin has not told us why, and I am unable to appreciate the reason therefor. Surely it is not sufficient to answer by simply asking the questions put in NATURE (p. 606).

But an analysis of more (but only approximately) correct figures and a more logical classification of mammals than that adopted by Prof. Heilprin reveal facts materially contravening the tabular statements of that gentleman.

First we must exclude the marine mammals, because their distribution and limitation are determined by other factors than those which regulate the terrestrial ones. A consideration then of the terrestrial forms leads to the following results:—

The Arctamerican or Nearctic region has 27 families, of which 11 are not shared with Eurasia and 4 are peculiar; it has 68 genera, of which 45 do not enter into Eurasia.

The Eurasiatic or Palæarctic region has 32[1] families, of which 17 are excluded from North America, and it possesses 89[1] genera, of which 60 have failed to become developed in America.

Such contrasts will more than compare generally with those existing between Eurasia and India, and even between the "Triarctic" or "Holarctic" and Indian "regions," and the same destructive process by which the northern regions are abrogated would entail the absorption of the Indian as well into a heterogeneous whole. The three can in fact be well united (as Cænogæa), and contrasted with a group (Eogæa) consisting of the African, South American, and Australian regions, as I long ago urged (*Ann. and Mag. Nat. Hist.* (4), xv. 251–255, 1875), but the claims of each to be considered as "regions" or realms is not thereby affected.

THEO. GILL

Smithsonian Institution, Washington, May 12

Deductive Biology

THOUGH no writer has yet afforded any remarks in criticism of Prof. Thiselton Dyer's "word of warning" to biologists, given in NATURE, vol. xxvii. p. 554, it does not, I think, follow that the objection raised by him is to be accepted as unanswerable. As no one of authority in such matters appears to be forthcoming, perhaps one who can lay no claim to being heard may still be permitted to venture to doubt the validity of the objection as given forth in such emphatic terms by Prof. Dyer, and to point out that most, if not all, of the scientific conclusions of importance, especially those accomplished during the present generation, have been arrived at mainly by means of the deductive method.

[1] These are the groups admitted by Prof. Heilprin, exclusive of the Pinnipeds.

The objection started is a serious one, for, if the deductive method is wrong at all, it is so absolutely, and must on no occasion be allowed a place in scientific reasoning, but—without any half-measure allowances—must be excluded altogether as a false and dangerous element of philosophy. If, on the other hand, we take exception, as I think we may do, to the exponent's opening expression,—"having formulated a few fundamental assumptions, to spin out from these explanations of what we see in the world about us . . . is merely a literary performance,"—as misleading in its main idea, we may still hold the method to be a perfectly scientific one.

The evolutionist, who has once ascertained by various careful experiments and extensive researches that there is a direct natural sequence of events in connection with certain phenomena, may be allowed to adopt set principles as recognised laws of action, fully as much as Euclid in the demonstration of problems from his formulated axioms. But perhaps Prof. Dyer's argument rests in reality upon his use of the word "assumptions," and thus his objection is merely urged against the false method assumed in his premise, rather than against deductive biology as a method of procedure, as he would have us believe. And so far, of course, every one will readily enough accept Prof. Dyer's remark as it stands.

But the conclusion that "the deductive method is a bad way of solving morphological problems" is opposed to all the evidence of Darwin himself, who constantly applied those well-tested principles which he had discovered even by this very method, and upon the bases of such fundamental *truths* it was that he reared his wonderful system. Are not the studies of comparative embryology and osteology, of comparative histology and biology, each founded entirely upon the method of deductive analogy?

As another sufficient witness, Mr. Wallace may be quoted as having adopted the same course with such remarkable results, and throughout his writings bears testimony to the value of deductive inference as a method of procedure, and I will deduce a couple of sentences taken from his work on "Island Life," bearing directly upon our point.

"On the theory of evolution," he says, "nothing can be more certain than that groups now broken up and detached were once continuous, and the fragmentary groups and isolated forms are but the relics of once widespread types which have been preserved in a few localities where physical conditions were especially favourable, or where organic competition was less severe. The true explanation of all such remote geographical affinities is that they date back to a time when the ancestral group of which they are the common descendants had a wider or a different distribution," &c., p. 296. And, in summary of the chapters on Madagascar, Mr. Wallace remarks: "The method we have followed in these investigations is to accept the results of geological and palæontological science, and the ascertained fact as to the powers of dispersal of the various animal groups; to take full account of the laws of evolution as affecting distribution, and of the various ocean depths as implying recent or remote union of islands with their adjacent continents; and the result is that wherever we possess a sufficient knowledge of various classes of evidence we find it possible to give a connected and intelligible explanation of all the most striking peculiarities of the organic world" ("Island Life," p. 419). We may then assuredly decide that the deductive system of logic,—the use without abuse of certain known factors,—instead of being in any way "bad," is (granting always that the general laws of Nature applied are sufficiently trustworthy) found to be even superior to the older and tardier processes of induction, to which the mere collectors of the facts dealt with have limited themselves, and has proved itself to be the *only* means of elucidating many of those abstruse problems, the solution of which has been conducive of such immense gain to the scientific philosophy of our day.

WILLIAM WHITE

Science and Art

As a rule it would be the extreme of absurdity for me to venture an adverse remark on the criticism of an art critic on paintings, yet there is one single exception regarding which I may perhaps be permitted to say a word or two.

In the very interesting critique on some pictures in the Royal Academy, written evidently by a master-hand, there is one picture—No. 764, "a snowstorm" (see NATURE, vol. xxviii. p. 76), not only somewhat severely, but I think unjustly or incorrectly, commented upon, because "there is not a single snowflake to be seen in the first twenty yards."

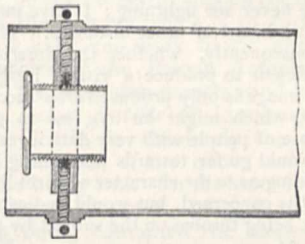
I have witnessed and been in the midst of many snowstorms in America, and some in Scotland. In a large proportion of these not a snowflake was to be seen, the snow being in very minute particles, so fine as to penetrate all openings in the clothing, however small. Snowstorms of this kind are the most dismal, bitter, and chilling of any.

On looking at Mr. Farquharson's picture, I was struck with its resemblance to a most unpleasant evening and night spent in the hills between the Coppermine River and Great Bear Lake, about 50 miles north of the Arctic circle. It being early winter, the weather was not very cold, but there was a combination of fog, fine snow (no snowflakes), and snowdrifts, which produced one of the most dismal and dreary scenes imaginable.

4, Addison Gardens, May 29 JOHN RAE

Transit Instrument

IN your issue of the 17th ult. (vol. xxviii. p. 51) you notice a cheap form of transit instrument introduced by me, and you point out the defect that no means are provided for placing the cross wires truly vertical. In all the most recent instruments which have been made this difficulty has been met by an arrangement which answers so effectively that I think it may interest others beyond those who are likely to use the instrument in question.



I employ the ordinary diaphragm with the usual four stretching screws, and the collimation is corrected in the usual manner by these screws. Into this diaphragm I insert a tube with a very fine screw, on the outside of which is fixed a plate carrying the cross hairs; by screwing this tube in or out the focus may be perfectly adjusted for objects at an infinite distance, while a slight additional movement to the right or left enables one at the same time to adjust the cross hairs truly vertical.

LATIMER CLARK

Sea-Shore Alluvion, Dungeness

REVERTING to an article in your journal of July 28, 1881, and a letter of mine in that for April 20, 1882, the following at the present time may be of interest:—

As regards the local wasting away in the bays east and west of Dungeness and the redistribution of the materials at Lighthouse Point;—on the west side the whole margin from Rye Bay to "Denge Marsh Gut," a distance of eight miles, has receded of late years; this is shown by the fact that the Denge Marsh authorities have recently erected a clay counter sea-wall at the back of the modern shingle "fulls" in front of the "Midrips" and "Wicks" (small land-locked pools of water) to check the overflow of the sea in south-west gales. This action is felt to the eastward in front of the "Holmstone," the Lydd coastguard station, and up to "Denge Marsh Gut," eastward of which we have modern "fulls,"—the resultant in part of this waste, overlapping and adding to the south-east outline of the "Ness" or extreme projection of this natural mole of shingle, and thence travelling northward until reaching "Great Stone End," which forms the southern boundary of Romney "Hoy" or Bay, northward of which Dymchurch Wall, an artificial stone-faced sea-wall three to four miles in length, is sufficient evidence of the modern local waste and necessity for sea-defences to the rich grazing district of Romney Marsh. Still further northward the sea-wall recently constructed by the municipal authorities of Hythe is equally suggestive of this recession. Going no further back than Cole's survey of 1617, we have a *status quo ante* very nearly, as regards outline from Rye Bay to within two miles of the lighthouse, and this accompanied by a local south-east increase and movement around the lighthouse,

involving towards the end of the last century the removal of the old and erection of the present tower, which, due to this increase, is now very much in the same relative position as its predecessor of 1792. This local accumulation runs northward to "Romney Hoy," but is accompanied beyond this again northward by a constant struggle to preserve the sea frontage right up to Hythe.

Take the Royal Military Canal, twenty miles long, as the base of a triangle running out ten miles seaward therefrom, with two inclined sides of ten miles and fourtee miles, or twenty-four miles of sea margin in all; of this we have on the west side eight miles of stationary or receding shore, thence two miles to the "Ness," and northward of it four miles, or six miles in all of local increase, and northward again ten miles of stationary or receding shore.

Now under these conditions who is to fix, and on what principle, the landward boundary of what may be termed the "live beach," and is it not this very material (not grass-grown or covered as it ultimately becomes by vegetation) that lies most te nptingly for removal?

A very tentative advertisement has recently been displayed at the Charing Cross terminal station of the South-Eastern Railway offering sea-beach or shingle for sale. J. B. REDMAN

6, Queen Anne's Gate, Westminster, S.W., May 28

Sheet Lightning

SOME people never see lightning; I have met one lady who cannot, and have heard of other instances. The question suggests itself, consequently, whether the duration of a flash of lightning is sufficient to produce a visible image on the retina or whether the image is only produced after successive reflections in the eye itself, which might be too few to produce such an image in the case of people with very dark eyes; if the latter is the case, this would go far towards accounting for the difficulty there is in deciding as to the character of sheet lightning as far as any optical test is concerned, but would indicate the possibility of further light being thrown on the subject by photography.

Ripon, May 24 N. W. TAYLOR

[WE *never* heard of any one (except blind people, of course) who could not see lightning, nor have we any idea how the colour of the iris (or reflection either) can have to do with it. As to the *duration* and visibility of a flash, see NATURE, vol. xxii. pp. 340-41. As to "summer lightning," the following statement from Prof. Tait's lecture on Thunderstorms (NATURE, vol. xxii. p. 438) may be of interest:—"I have said nothing of what is commonly called *summer lightning*, which is probably, at least in a great many cases, merely the faint effect of a distant thunderstorm, but which has also been observed when the sky appeared tolerably clear, and when it was certain that no thunderstorm of the ordinary kind had occurred within a hundred miles. In such cases it is probable that we see the lightning of a storm which is taking place in the upper strata of the atmosphere, at such a height that the thunder is inaudible, partly on account of the distance, partly on account of the fact that it takes its origin in air of small density." We know that Prof. Tait speaks from having himself seen what he here describes, which shows unquestionably that (*on some rare occasions*) its source is really above our heads, and not (as is the general rule) a thunderstorm of the ordinary kind several miles off.—ED.]

Curious Nest-building—"Scarecrows"

THERE is an old house at Whetstone at which a robin lately built its nest in a singular position. The gate in the garden wall, opposite the door, is opened from inside by a servant, when the bell rings. To do this she goes to a little hole in the wall close by the gate, and pushes along a small bell-pull handle in the line of the wall (the motion very slight). In the space behind this handle, and evidently scanty for the purpose, a robin built its nest, and it is now filled with little birds, which stretch out their yellow gaping beaks when one pushes the handle. The case is the more curious in that the master of the house, fearing inconvenience on both sides, had the nest twice removed when in course of building; but the robin persisted, and was ultimately allowed. A little way along from this gate is an old disused pump, the front of which opens on hinges. Round the vertical rod of this pump a tomtit has laboriously built up a pile of twigs and various scraps, quite filling the body of the pump for about a foot in depth; and on the top is the nest proper, with six or seven eggs. The handle is never moved by any one. The bird apparently enters at the hinge.

While on this topic I would ask, Has any systematic study been given to the question of scares for birds? I recently sowed some grass and clover seed on a lawn, and, to scare the sparrows, stuck up some bits of wood, with square pieces of paper, attached with string to flutter in the wind; but from the occasional position of sparrows on the lawn, I suspect the radius of action of these scares was decidedly limited. Are birds most scared by still effigies of persons, or by sight of movements apart from such imitation, or again by sounds, as in a scare I saw lately, where pieces of glass were hung so as to clink together?

Finchley, May 29 M.

Ground Ivy

I SHOULD like to know if a peculiarity I often see in the position of the stigmas in the pistillate form of this flower is generally observed. Instead of the stigmas opening up and down from the style as usual in Labiates, they often diverge to right and left across the flower, and the style also often curves forward, so as greatly to facilitate cross-fertilisation as it seems to me. If I am right this slight change may be of interest as a step towards diœciousness. I found this peculiarity in 291 out of 531 flowers with abortive stamens which I looked at; the stigmas opened in the usual way in 85, while in 141 one stigma was vertical and one horizontal; 14 cases were doubtful. In some unopened buds, the stigmas already diverged horizontally. For comparison I looked at 418 perfect flowers, and here, while the stigmas of 360 opened as usual, only 15 spread horizontally; 34 had one stigma vertical and one horizontal, and 9 cases were doubtful. S. S. DOWSON

Geldeston, May 22

Meteor

I HAVE just seen a very splendid meteor (at 10.40 p.m.). I watched it during about thirty seconds, in which time it traversed the heavens from about the point south-east nearly to that of north-west, where it burst. Its path was nearly parallel to the horizon, probably approaching it at an angle of about 5 degrees. When first seen it appeared nearly yellow as to colour, with a very fine tail, but just before it broke up the colour changed to white, and the fragments reminded me very much of some "magnesium stars" fired from a rocket. No doubt you will have a quantity of communications concerning this meteor. I wondered whether any one else had noticed this appearance.

Filston Hall, Shoreham, Kent, June 3 A. HALL

WASPS (L. C.).—Thanks; but there is nothing new in your observations.

MIMICRY (DR. KESTEVEN).—The occurrence is perfectly well known. It is probably *Urapteryx Sambucana*. You have mistaken the anterior for the posterior extremity.

RECENT ORNITHOLOGICAL WORKS [1]

TO those who imagine that British ornithology is worked out, and that there is nothing left to do in this well-worn field, we commend the study of the present book, as presenting us with a delightfully fresh view of an old and familiar subject. The author is already well known to the public from his admirable books of Siberian travel, but it is only his private friends who have been aware of the devotion to this favourite branch of science which has characterised Mr. Seebohm for many long years, when most people imagined him to be absorbed in business in the north of England. Brief excursions to points of interest on our own coasts, snatched in intervals of scanty leisure, succeeded in after years by more important expeditions to Greece and Asia Minor, the River Petchora, the Yenisei, &c., have given him an acquaintance with field-ornithology which is surpassed by few of his contemporaries, while the fact that the dry details of literary research have no terrors for him is proved by the

[1] "A History of British Birds, with Coloured Illustrations of their Eggs." By Henry Seebohm. Published by the Author, 1883.

masterly way in which he executed the fifth volume of the British Museum "Catalogue of Birds."

The present volume, however, will appeal to a class of readers very different from those who study the high and dry literature above-named, and even those accustomed to the well-written pages of Prof. Newton's edition of "Yarrell's British Birds," will find delight and instruction in the volume now issued by Mr. Seebohm.

The first part contains an account of the Birds of prey, and the Thrushes, and considerable novelty is introduced in the style of nomenclature of these two groups. First of all we notice that Mr. Seebohm gives up the idea of *Orders* in the class *Aves*. Although commencing with the Birds of prey, the time-honoured opening "Order Accipitres" is absent, and we are introduced to the family *Falconidæ* instead, and we consider that it is in the classification adopted and in certain points of the nomenclature that the weak spot lies in this otherwise admirable work.

Mr. Seebohm is the kind of man who would speak disrespectfully of the Equator! With unremitting energy he charges full tilt against what he considers the abuses of scientific nomenclature in the present day, and not content with heartily belabouring those who differ from him, he returns to the assault on every possible opportunity, "fights all his battles o'er again, and thrice he slays the slain." He is quite furious with the rules propounded by the Committee of the British Association, and rebukes the authors, promoters, and followers of these rules with unabated vigour, but with perfect sincerity, as is exemplified by the following sentence in his "Notice to Subscribers," where he writes :—"If I have criticised the work of any of my fellow ornithologists too severely, I ask their pardon, and hope that they will pay me back in my own coin by correcting my blunders with an unsparing hand. The object of all true scientific work is the elimination of error and the attainment of truth."

We can promise Mr. Seebohm that, as one of the authors most severely attacked in his volume, we shall accept the above challenge, and shall not hesitate to pay him back in his own coin when occasion arises, trusting to the strength of the late Marquis of Tweeddale's dictum, that it is "by the flails of disputation that the truth is threshed out." And yet this is not an easy book to criticise. There is so much that is elegant in the treatment of the subject, and the work is so evidently done *con amore*, that in reading it through one is apt to lose sight of the irritating attacks on one's own writings in the admiration which the general style of the book compels ; nevertheless there are several points on which it is impossible to agree with the author.

To drop the idea of *Accipitres* as an Order, and treat the Birds of prey as a simple family, suggests that the author has only a limited acquaintance with this group in its entirety, and this is a failing which appears throughout Mr. Seebohm's work, viz. that he is apt to judge of the classification of birds from a knowledge of Palæarctic forms alone, without any consideration of the mass of birds which are extra-Palæarctic in their habitat. This remark would be perhaps unnecessary did not the author aim at such a high standard. Thus his families are provided with "Keys to the genera," which, as Mr. Seebohm is nothing if not seeking after natural affinities, may be supposed to give the author's matured opinion on the relations of the genera. We can only wonder, therefore, at the importance attached to the characters which ally *Falco* with *Vultur* (in the same primary section of the *Falconidæ*), and place the Ospreys as intermediate between the Falcons and the Swallow-tailed Kite. The Falcons and the Honey-kites are united by such forms as the Neotropical *Harpagus*, the Indo-African genus *Baza*, and other forms, but what *Pandion* has to do with any of them we fail to see entirely, and so far we have not seen any reason to modify our opinion expressed in 1874, that the Ospreys are co-ordinate with the Falcons and the Owls, and form an intermediate group between these two. We should have thought, too, that at least as good characters could have been found to separate *Neophron* from *Vultur*, as some of those employed by Mr. Seebohm for distinguishing other genera of his family Falconidæ.

In the much-vexed question of the Jer-Falcons Mr. Seebohm brings in his favourite theory of interbreeding, and accounts for the variation in plumage between the different races on this score with much ingenuity and some show of success, but we must totally dissent from his view of the Iceland Falcon being an intermediate form (*F. gyrfalco-candicans*). To our mind it is quite as good a race as the true Jer-Falcon of Scandinavia, and has a perfectly distinct habitat. In Greenland the case may be different, and it is by no means improbable that the resident Jer-Falcon of Southern Greenland, *Hierofalco hoelboelli*, Nob., sometimes crosses with the Arctic white Jer-Falcon (*H. candicans*), and that the result is seen in those specimens which are so numerous in collections, and whose exact specific position it is difficult to define ; nevertheless fully adult birds, both of *H. candicans* and *H. hoelboelli*, are very easily recognised, but Mr. Seebohm's theory of hybridisation carries a strong probability.

In the article on the Peregrine Falcon the author sounds the first note of the trumpet which is to carry the charge into the enemy's lines and work havoc and destruction among the followers of the British Association rules of nomenclature. Mr. Seebohm asserts (and he is probably right) that the *Falco gentilis* of Linnæus, founded on Albin's Falcon Gentle, is absolutely the oldest-known name for the Peregrine, if the above rules are to be carried out to the bitter end. In the year 1767, a posthumous work by Gerini, who cuts a great figure throughout Mr. Seebohm's book, contained the name *Falco peregrinus* for the species, and as this is also the best known one, it is adopted by Mr. Seebohm as being that "auctorum plurimorum." By the simple process of using that name which has been employed by the majority of standard ornithological writers, the author settles all vexed questions as to priority, and does away with the difficulties of nomenclature arising from the discovery of a prior name in some long-forgotten "musty tome" by some diligent bibliographer. In the present case Gerini's book cannot be invested with the authority which Mr. Seebohm claims for it, because, as Prof. Newton has lately shown, the work was the result of the labours of three *collaborateurs* who published it in 1767, Gerini himself having died in 1751. The work is generally quoted by authors as the "Storia degli Uccelli."

We must candidly confess that Mr. Seebohm's plan of selecting the best known names for a species of bird has much to recommend it, and in the present volume the result is in general satisfactory, as it restores to many of the common European species the names by which they are most familiar to the general public. At the same time this rule of adopting the nomenclature *auctorum plurimorum* requires great care in its application, and it will probably be found to work better in the case of European birds than in the less-studied species of other countries. The whole subject is deserving of earnest thought, but for our own part we cannot entirely free ourselves from the idea that a certain amount of injustice will be done to the labours of many of the early writers in ornithology whose names have been overlooked by their successors, but who scarcely deserve to be passed over entirely, as their work might be up to the standard of knowledge of the times in which they lived We cannot help seeing throughout Mr. Seebohm's volume that justice to the labours of the forerunners in ornithological science is *not* tempered with mercy to those who have endeavoured in all sincerity to fix the earliest recognisable names to the species of European birds. We must regret

that we have not space to give extracts from the many charming accounts of the habits of our English birds of prey, which have certainly not been surpassed by any modern writer. We have already alluded to the anomalous position given to the Osprey in Mr. Seebohm's classification, and we notice that in the characters which he assigns to the genus (p. 54) he does not refer to the skeleton, which is so essentially Owl-like in structure. The author calls attention to a very serious slip made by ourselves in the "Catalogue of Birds" with regard to the Rough-legged Buzzard (*Archibuteo lagopus*). We were certainly in error in placing this bird with the genus *Buteo*, and indeed the woodcut of the reticulated tarsus convicts us on the face of it; but we strongly doubt the correctness of Mr. Seebohm's relegation of the species to the genus *Aquila*, and we hardly think that Dr. Gadow's evidence as to the resemblance of certain points in the anatomy of the genera *Aquila* and *Archibuteo* was intended to suggest that they were closely enough allied to be considered inseparable. On p. 134 we are told that "ornithologists seem to have a fatality for making petty blunders." This probably accounts for Mr. Seebohm's admitting (p. 130) a woodcut of the nest of the Hen Harrier with the bird appearing in the background about the size of a Song Thrush. Perhaps Mr. Whymper, the artist who has drawn this otherwise pretty sketch, will, like Mr. Hanhart, who has done the plates of the eggs, "get better as he improves." (*Vide* the "Notice to Subscribers.")

Passing on to the family *Strigidæ* or Owls, we find with regret that Mr. Seebohm has once more ruthlessly destroyed the simplicity of nomenclature in the European species, and this on the authority of the "Storia degli Uccelli," whose fourfold authorship would surely be more than sufficient to place the book out of court. The genus *Aluco* is once more invoked for the Barn Owl, *Strix* is restored to the Tawny Owl as well as to the Long-eared Owl, Short-eared Owl, and Tengmalm's Owl, and the Snowy Owl and the Hawk Owl are placed in one genus, *Surnia*. This classification of the Owls is by far the most disappointing portion of Mr. Seebohm's book, and ornithologists will be inclined to view with suspicion the ideas of an author who, in endeavouring to upset the rules of the British Association, requires them to pin their faith to a system which would lead to such a result as is here offered to us. Gerini's "Ornithologia Methodice Digesta" may have gone down a hundred and forty years ago, but in the present day it appears to be "*Chaos, rudis indigestaque moles*," which the stomachs of the present generation of ornithologists will not be found strong enough to assimilate. A little woodcut is appropriately inserted as a tailpiece on p. 182, which represents the author coming to grief on a downhill path!

In the account of the *Passeridæ*, or Singing Birds, another suggestive tailpiece at once meets our eye at p. 199: it represents a peaceful scene on a river, and is probably placed there as emblematical of the joy of the author at finding himself once more in smooth waters. The rest of the volume is occupied with an account of the Thrushes and Warblers, Chats, Redstarts, and Fly-catchers, with which birds Mr. Seebohm possesses an acquaintance beyond that of any of his contemporaries; and no one who reads his book will find fault with this portion of the work, which appears to us to be in every way excellent. We unhesitatingly express our opinion that since the time of Macgillivray no such original book as Mr. Seebohm's has been published on British ornithology, and, in spite of a few less satisfactory illustrations, we think that the figures of the eggs are by far the best that have yet been given. We have ourselves too often run counter to the rules of the British Association Committee to allow of a suspicion of our complete sympathy with these rules, and Mr. Seebohm has done much to prove their unworkable character in many instances, but at the same time his strong expressions with regard to some of their most conscientious supporters seem to us likely to lessen the respect with which many of his incontrovertible strictures would otherwise have been received.

Another most useful ornithological work has also just made its appearance in Mr. Eugene Oates's "Handbook to the Birds of British Burmah."[1] Although less ambitious in its scope than Mr. Seebohm's work above noticed, it is nevertheless a very complete *résumé* of the ornithology of the country of which it treats, and it forms one of those useful volumes which appear from time to time from the pens of hardworking ornithologists, which bring into one focus the results of many scattered essays in various journals. It must not be supposed, however, that Mr. Oates's work has been confined to the incorporation of the labours of his predecessors, for although he has gathered together into one compass the results of the travels of Mr. Davison and Capt. Bingham in Tenasserim, and of Capt. Wardlaw Ramsay in Karennee, the book is also enriched with an account of his own personal experiences during a fourteen years' residence in Pegu. One great characteristic of this book is its conciseness. In the present volume of 430 pages, four hundred species are disposed of, and yet the principal references are given, as well as descriptions of all the species. In fact, the book quite comes up to our idea of what a model "handbook" should be, and there is no doubt that it will be simply invaluable to the collector in British Burmah, within whose reach it is placed by the exceedingly modest price at which it is published. All workers in the field of Indian and Indo-Malayan ornithology will not be able to do without this most useful volume.

R. BOWDLER SHARPE

THE AURORA BOREALIS[2]

III.

THE "Utströmnings" Apparatus.—On the top of a mountain, or in a spot situated so high that it commands the surrounding country within a radius of some 5 kilometres, the apparatus, which I have termed an "utströmnings" apparatus, should be erected. This instrument consists of a copper wire, at least 2 mm. in diameter, laid out on insulators fixed on poles 2 metres in height, along which points or nibs of copper or brass are attached at every half metre in such a way that they always point upwards. The wire is, I believe, arranged with most advantage as shown in the subjoined Fig. 1. If the wire begins at o, and the distance oo′ is = 18 metres, the total surface area of the apparatus will be = 324 square metres. The letter *i* indicates insulator.

The length of the wire is, therefore, 194 metres, and the number of insulators, if one insulator is attached in the centre of each outer coil, = 27.

The insulators should be of a peculiar construction, so that they would, under all conditions, even when covered by hoar frost, be perfectly efficient. The kind shown in Fig. 2, based on the principle of M. Mascart's insulator, appears to me to be the most serviceable.

This diagram shows the vertical section of the insulator attached to the pole. *ab* is a glass tube 7 mm. thick, 5 cm. in diameter, and 20 cm. in height. This tube is soldered to the bottom of the jar *cdef*, the outer diameter of which is 11 cm., and height 13·5 cm., and is, at the side, 10 cm. from the bottom, provided with an opening o (2 cm. in diameter), which can be closed with a cork. Above the tube, *ab*, the bell, *mnn′* is affixed, which is provided with arms for the coiling of the wire. In the cork, *o*, a U-shaped glass retort, with short arms pointed downwards, is inserted, and if the retort *fede* is filled

[1] "A Handbook to the Birds of British Burmah, including those found in the adjoining State of Karennee," by Eugene W. Oates, Executive Engineer, Public Works Department of India (British Burmah). London: R. H. Porter, 6, Tenderden Street, W., and Dulan and Co., 1883.

[2] Continued from p. 109.

with sulphuric acid, the outer surface of the glass tube, *ab*, will be kept dry, and almost completely insulated. The distance between the jar and the bell should be as great as possible, in order that the hoar-frost may not form a bridge across the intervening space.

From this apparatus a telegraph wire is led on poles

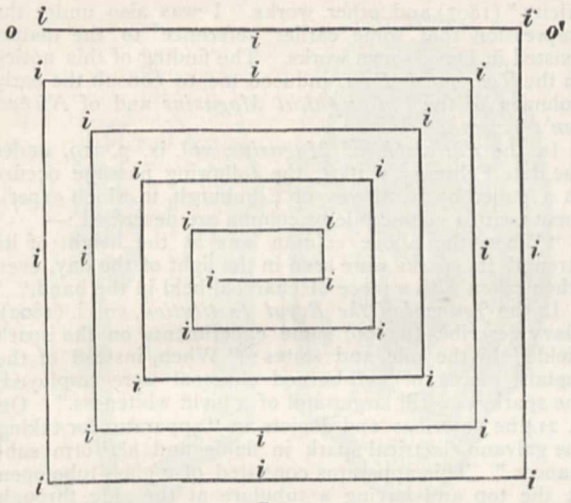


FIG. 1.

provided with insulators to a convenient chamber of observation. The conducting wire may, when the above-described kind of insulators is used, be an ordinary iron wire 2 mm. in diameter. The poles should be at most 40 metres apart.

The galvanometer should be constructed with a great

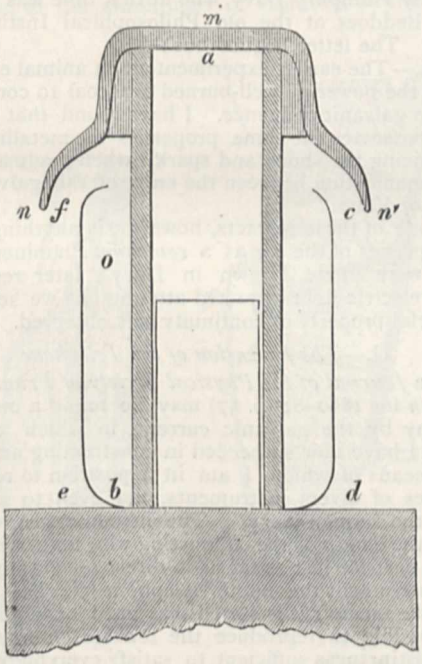


FIG. 2.

number (about 10,000) coils, and be provided with a pair of astatic needles, near which the mirror is affixed. In order to avoid too great oscillations, the needles should be hung side by side on fine threads of cocoon silk, the distance between the ends of the threads may be regulated according to circumstances. The readings should be made with a telescope and scale. It is besides clear that the conductive resistance of the galvanometer should be exactly measured, and that the readings of the instrument should be verified, as, for instance, with an inductor whose action on the galvanometer has been ascertained in absolute measure. For this purpose an ordinary Daniell's element may serve, and may in fact be the best, as a similar element should also be used for the actual measurements. If an iron wire is used it must of course be replaced with one of copper near the chamber of observation. The earth conductor of the current is a zinc disk about 4 square decimetres in area. The theory of the apparatus is this :—The entire quantity of electricity which is suffused in a certain part of the atmosphere which is situated above a certain horizontal plane, as that formed by the points in the "ütströmnings" apparatus, produces in each one of these points an *electromotive force*. And if the potential of these quantities of electricity on all the points be denominated as V_a, and the potential of the aggregate electricity on the zinc disk as V_z, the electromotive force E will be—

$$E = V_a - V_z,$$

and the strength of the current i

$$i = k\,\frac{V_a - V_z}{R},$$

where R denotes the whole conductive resistance, and k a constant dependent on the construction of the galvanometer, &c.

Generally, V_z is assumed $= 0$; but this is, in the present case, not correct; we therefore put—

$$i = k\,\frac{E}{R}.$$

If a constant element is introduced into the current, we have, if the electromotive force is denominated e, and the internal resistance of the element is not taken into account—

$$i_1 = k\,\frac{e}{R},$$

when i_1 means the intensity of the current which is created by the galvanic element.

If the positive pole is turned first against the "utströmnings" apparatus, we obtain—

$$i - i_1 = \delta,$$

and if the negative pole is turned against it—

$$i + i_1 = \delta',$$

i.e. if δ and δ' means the deflexion of the galvanometer in each case.

We obtain therefore in i a measure of $\frac{E}{R}$, and in i_1 a measure of $\frac{e}{R}$. If the deflexions are always reduced to the same value for $\frac{e}{R}$, which is easily done as e is constant, we obtain measures capable of being compared with E or $V_a - V_z$.

In the deflexions observed when a constant galvanic element is introduced into the circuit, one obtains, when the element is turned in the first instance with the positive pole against the "utströmnings" apparatus, and in the second against the earth-plate, a relative measure of the potential due to induction in the air on the particular occasion. From this it will appear that the observations should always be effected in the following manner :—

1. With the constant element in the current—
   (*a*) With the positive pole against the apparatus.
   (*b*) With the positive pole against the disk in the earth.
2. Without the element in the current—
   (*a*) First deflexion.
   (*b*) Constant deflexion.

3. With the constant element in the current—
   (*a*) With the positive pole against the apparatus.
   (*b*) With the positive pole against the disk in the earth.

The deflexions obtained will give the particulars required for an easy calculation of the strength of the current from the atmosphere to the earth.

I am fully aware that several details of this method may be open to discussion, but I do not deem others than the following of any great importance, viz. that as the intensity of the current is greatly dependent on the condition of the points, a gradual oxidation of the same will have the effect of causing an alteration in the current. This alteration also takes place in the strength of the current from the constant element, so that even the deflexions caused by the same will always be a measure of the aggregate potential due to induction, both through the points and in the air.

As it is not always possible to calculate the extent of the deflexions, an instrument permitting part of the current to be shunted should be employed. When the apparatus is erected care should be taken that the height between the disk in the earth and the apparatus is at least 180 metres; but experiments with disks at various elevations are of course of great interest.

From the account I have thus given of my experiments at Sodankylä, I think that all the subsidiary points which should be taken into account, as well as those questions which still await solution in connection with the aurora borealis, will be readily comprehended. It would, however, be of great advantage when making similar experiments to have two sets of apparatus; while thus measurements are being made with one, the variations in the current could be traced with the other, and thus the particulars requisite for a reduction to a fixed mean standard would be obtained.

SELIM LEMSTRÖM
Professor of the Helsingfors University

HISTORICAL NOTES IN PHYSICS

I.—*The Discovery of the Electric Light*

IN looking through an old volume of the *Journal de Paris*, I came across the following entry, for the date 22 Ventôse, An X. (March 12, 1802), which clearly relates to an exhibition of the electric arc light :—

"Le citoyen Robertson, auteur de la fantasmagorie, fait dans ce moment, des expériences intéressantes, et qui doivent sans doute avancer nos connoissances sur le *galvanisme*. Il vient de monter des piles métalliques, au nombre de 2500 plaques de zinc, et autant en cuivre rosette. Nous parlerons incessament de ses résultats, aussi que d'une expérience nouvelle qu'il a faite hier avec deux charbons ardens. Le premier étant placé à la base d'une colonne de 120 élémens de zinc et argent, et le second communiquant avec le sommet de la pile, ils ont donné, au moment de leur réunion, une étincelle brillante, d'une extrême blancheur, qui a été aperçue par toute la société. Le citoyen Robertson répétera cette expérience le 25."

The individual who thus came before the public was named Étienne Gaspard Robertson, a name suggestive of Scotch descent. He was better known for his "Phantasmagoria," exhibited a few years later in London. Of this invention a notice appears earlier in the volume from which the above passage is taken; and in an earlier volume of the *Journal de Paris* in the month "*Fructidor*, An viii.," there occurs a mention of some of his experiments on the *couronne de tasses* of Volta.

It is worthy of casual notice that in the number where Robertson's "Phantasmagoria" is advertised, the very next advertisement on the page is one of an exhibition to be given by Citoyen Martin at the Hôtel de Fermes, wherein as part of a "spectacle extraordinaire et amusant de physique," &c., was to be shown "l'expérience du télégraphie plus rapide que la lumière, d'un effet extraordinaire et amusant."

The usual date given for the invention of the electric light by Sir Humphry Davy is 1809; but I was aware that earlier notices existed both in Cuthbertson's "Electricity" (1807) and other works. I was also under the impression that some earlier reference to the matter existed in Davy's own works. The finding of this notice in the *Journal de Paris* induced me to consult the early volumes of the *Philosophical Magazine* and of *Nicholson's Journal*.

In the *Philosophical Magazine*, vol. ix. p. 219, under the date February 1, 1801, the following passage occurs in a paper by H. Moyes of Edinburgh, in which experiments with a voltaic pile or column are described :—

"When the above column was at the height of its strength its sparks were seen in the light of the day, even when taken with a piece of charcoal held in the hand."

In the *Journal of the Royal Institution*, vol. i. (1802), Davy describes (p. 106) some experiments on the spark yielded by the pile, and states: "When, instead of the metals, pieces of well-burned charcoal were employed, the spark was still larger and of a vivid whiteness." On p. 214 he describes and depicts an "apparatus for taking the galvano-electrical spark in fluids and aëriform substances." This apparatus consisted of a glass tube open at the top and having a tubulure at the side through which a wire tipped with charcoal was introduced, another wire, also tipped with charcoal, being cemented in a vertical position through the bottom.

But earlier than any of these is a letter printed at p. 150 of *Nicholson's Journal* for October, 1800. This letter is entitled "Additional Experiments in Galvanic Electricity, in a Letter to Mr. Nicholson." It is dated "Dowry Square, Hotwells, September 22, 1800," and is signed by Humphry Davy, who at that time was assistant to Dr. Beddoes at the old Philosophical Institution in Bristol. The letter begins thus :—

"SIR,—The earlier experimenters on animal electricity noticed the power of well-burned charcoal to conduct the common galvanic influence. I have found that this substance possesses the same properties as metallic bodies in producing the shock and spark,[1] when made a medium of communication between the ends of the galvanic pile of Signor Volta."

In none of these extracts, however, is anything said of the properties of the *arc* as a *continuous* luminous spark. These were made known in Davy's later researches. Yet the electric light attracted attention as we see before the special property of continuity was observed.

II.—*The Invention of the Telephone*

In the *Journal of the Physical Society of Frankfort-on-the-Main* for 1860-61 (p. 57) may be found a memoir on telephony by the galvanic current, in which its writer says: "I have now succeeded in constructing an apparatus by means of which I am in a position to reproduce the tones of divers instruments, and even to a certain degree the human voice." The inventor further says: "Since the length of the conducting wire may be extended for this purpose just as far as in direct telegraphy, I give to my instrument the name 'telephone.'" Towards the end of the memoir it is stated that until now it had not been possible to reproduce the tones of human speech with a distinctness sufficient to satisfy everybody: "The consonants are for the most part tolerably distinctly reproduced, but the vowels not yet to an equal degree." The author of the memoir in which these remarkable statements occur was Philipp Reis. The paper from which the preceding quotations have been taken contains many other points of interest, and in particular a com-

[1] Here Davy adds a footnote: "The spark is most vivid when the charcoal is hot."

parison of the action of the transmitting part of the instrument with that of the human ear upon which it was founded. The author says: "How could a single instrument reproduce at once the total action of all the organs operated in human speech? This was ever the cardinal question. At last I came by accident to put this question another way. How does *our ear* perceive the total (or

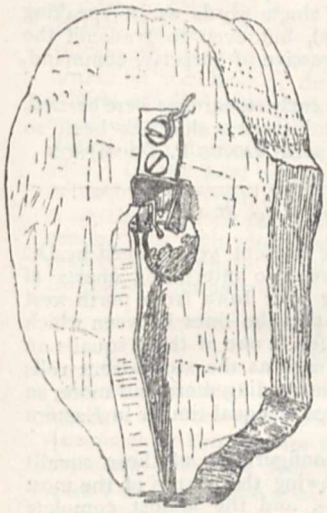


FIG. 1.

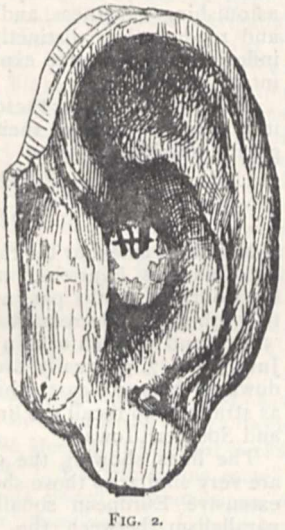


FIG. 2.

resultant) vibrations of all the simultaneously operant organs of speech?" He then goes on to describe the action of the auditory ossicles when made the recipients of sound-waves, and points out how they execute movements and exert forces upon one another in proportion to the condensations occurring in the sound-conducting medium and to the amplitudes of vibration of the tym-

FIG. 3.

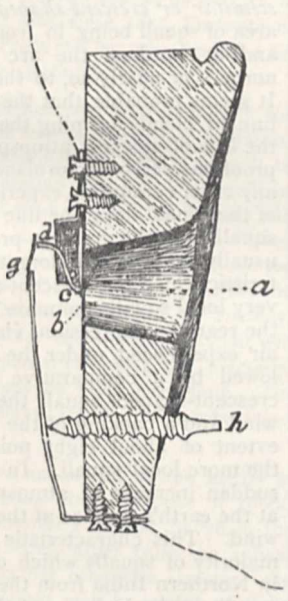


FIG. 4.

panum. Having stated this law of proportion between the cause and its effect, he goes on to speak of the graphic method of representing varying forces, such as those of sound-waves, by curves; and emphatically lays down that the ear is absolutely incapable of perceiving anything more than can be expressed by such a curve. After giving samples of undulatory curves corresponding to musical tones and to discordant sounds he makes the following significant remark: "So soon therefore as it is possible, at any place and in any manner, to set up vibrations whose curves are like those of any given tone or combination of tones, we shall then receive the same impression which the tone or combination of tones would have produced upon us. Taking my stand upon the preceding principles, I have succeeded in constructing an apparatus," &c. He concludes his paper by saying that the newly invented phonautograph of Duhamel may perhaps afford evidence as to the correctness of the views which he has asserted respecting the correspondence between sounds and their curves.

The actual apparatus figured in this memoir and exhibited to the Frankfort Society in October, 1861, is now in my possession; and I have also temporarily intrusted to me a still earlier experimental telephone made by Philipp Reis in the form of a model of the human ear.[1] This interesting instrument is depicted in its actual condition and size in Figs. 1, 2, and 3, and in section in Fig. 4. It is carved in oak-wood. Of the tympanic membrane only small fragments now exist. Against the centre of the tympanum rested the lower end of a little curved lever of platinum wire, which represented the "hammer"-bone of the human ear. This curved lever was attached to the membrane by a minute drop of sealing-wax, so that it moved in correspondence with

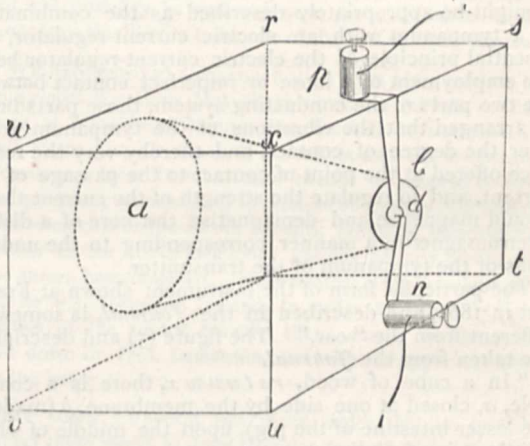


FIG. 5.

every movement of the tympanum. It was pivoted near its centre by being soldered to a short cross-wire serving as an axis. The upper end of the curved lever rested in loose contact against the upper end of a vertical spring, about 1 inch long, bearing at its summit a slender and resilient strip of platinum foil. An adjusting screw served to regulate the degree of contact between the vertical spring and the curved lever. Conducting wires, by means of which the current of electricity entered and left the apparatus were affixed to screws in connection respectively with the support of the pivoted lever and with the vertical spring.

If now any words or sounds of any kind were uttered in front of the ear, the membrane was thereby set into vibrations, as in the human ear. The little curved lever took up these motions precisely as the "hammer"-bone of the human ear does; and, like the "hammer"-bone, transferred them to that with which it was in contact. The result was that the contact between the upper end of the lever and the spring was caused to vary. With every rarefaction of the air the membrane moved forward, and the upper end of the little lever moved backward and pressed more firmly than before against the spring,

[1] The property of M. Léon Garnier, Director of Garnier's Institute at Fredrichsdorf, near Homburg, where Philipp Reiss was formerly Teacher of Natural Sciences.

making better contact, and allowing a stronger current to flow. At every condensation of the air the membrane moved backward, and the upper end of the lever moved forward, so as to press less strongly than before against the spring, thereby making a less complete contact than before, and by thus partially interrupting the passage of the current, caused the current to flow less freely. The sound-waves which entered the air would in this fashion throw the electric current, which flowed through the point of variable contact, into undulations in strength. Reis himself termed the contact-part of his telephone an interruptor. That it was not intended to operate as an abrupt make-and-break arrangement, as some persons have erroneously fancied, is evident; firstly, because the inventor introduced delicate springs to give a following-contact, and so prevent abrupt breaks from occurring; secondly, because abrupt breaks would have violated the fundamental principle to which he refers in the sentence immediately preceding his description of the instrument shown to the Frankfort Society, namely that of creating tones whose curves were like the undulatory curves imparted at the transmitting end of the instrument; thirdly, because (in another article) he described his instrument as opening and closing the circuit in proportion to the sound-wave, which obviously an abrupt "break-and-make" apparatus without a spring-contact could not possibly do. The mechanism which Reis thus invented —and which is substantially alike in all his instruments —might be appropriately described as the combination of a tympanum with an electric current-regulator, the essential principle of the electric current-regulator being the employment of a loose or imperfect contact between the two parts of the conducting system, those parts being so arranged that the vibrations of the tympanum would alter the degree of contact, and thereby vary the resistance offered at the point of contact to the passage of the current, and so regulate the strength of the current that it should magnetise and demagnetise the core of a distant electromagnet in a manner corresponding to the undulations of the tympanum of the transmitter.

The particular form of the instrument shown at Frankfort in 1861, and described in the *Journal*, is somewhat different from the "ear." The figure (5) and description are taken from the *Journal*.

"In a cube of wood, *r s t u v w x*, there is a conical hole, *a*, closed at one side by the membrane, *b* (made of the lesser intestine of the pig), upon the middle of which a little strip of platinum is cemented as a conductor of the current. This is united with the binding-screw, *p*. From the binding-screw, *n*, there passes likewise a thin strip of metal over the middle of the membrane, and terminates here in a little platinum wire, which stands at right angles to the length and breadth of the strip. From the binding-screw, *p*, a conducting-wire leads through the battery to a distant station."

In the original instrument there is also an adjusting-screw to regulate the contact, though this is not shown in the drawing.

The receiver used to reproduce the sounds transmitted by these telephones is also described in the memoir of Reis. It consisted of a steel needle surrounded by a coil of wire. This was at first set up for the purpose of increasing the sounds by resonance, upon the top of a violin; later it was mounted upon a pinewood box, to which still later a lid of thin pine was added against which the listener could press his ear. The sounds emitted by such a wire during magnetisation and demagnetisation were well known before, but to Reis is due the discovery that other tones than the natural vibration-tone of the wire could be electrically imposed upon it by the varying magnetising force of the current in the surrounding coil. Reis explained the reproduction of the transmitted sounds by supposing a magnetic attraction between the atoms of the steel wire to work synchronously with the fluctuations of the current. He later devised a different receiver in which an electromagnet was provided with an elastically mounted armature of iron which it threw into vibrations corresponding to those of the original sound-waves. With this apparatus and a transmitter with a small curved lever like that in the "ear," he was able (see Kuhn's "Handbuch der Angewandten Elektricitätslehre," 1866, p. 1021) not only to reproduce melodies with astonishing exactness, and single words as in speaking and reading (less distinctly), but even to transmit the inflexions of the voice expressive of surprise, command, interrogation, &c.

Considering how far these early researches were carried, it is remarkable that their historic value has been so greatly overlooked. SILVANUS P. THOMPSON

SQUALLS

IN a short calendar for the present year, issued by Dr. Gustavus Hinrichs,[1] are two interesting charts of the fronts of squalls passing over Iowa from north-west to south-east. He remarks that the lines between which ·5 inch and 1·0 inch of rain fell in one of these squalls on July 31, 1877, gradually diverge as the storm-front rolls down to the south-east, while bending more and more, so as strangely to recall the lines of equal timber in Eastern and Southern Iowa.

The lines showing the configuration of these squalls are very similar to those showing the shapes of the most extensive European squalls, and the almost complete parallelism between the chart of the squall above alluded to, and those[2] of the *Eurydice* squall, which traversed England on March 24, 1878, is worthy of the attention of meteorologists. Squalls of this description strictly deserve the name of "arched squalls" (apparently bestowed by English seamen on all squalls which are seen in perspective to rise as arches of cloud above the horizon), for when plotted out upon a chart they are found to be, at the period of their greatest development, *scimitar or crescent-shaped*, the central portion of the area of squall being in front of the right and left wings, and a chord of the arc so formed being commonly normal, or nearly so, to the isobars existing at the time. It seems probable that the most projecting portion of the line of clouds forming the front of the squall traverses the line of steepest atmospheric gradients, but of this no proof has yet been furnished. The strongest wind is, in any case, commonly experienced in the immediate front of the squall along the line traversed by the focus of the squall, and the greatest precipitation in the rear is also usually experienced along this line. There is one characteristic which the crescent-shaped squall shares with the very local squalls common in the temperate latitudes in the rear of a depression, viz. the violent down-rush of cold air experienced under the front of the squall-cloud, followed by a comparative calm in its wake. In the crescent-shaped squall there is a veering of the lower wind and a backing of the upper wind, sometimes to the extent of about eight points, which is not traceable in the more local squall. In the crescent-shaped squall a sudden increase of atmospheric pressure is experienced at the earth's surface at the time of the strongest rush of wind. This characteristic seems to be shared by the majority of squalls which occur in the Persian Gulf and in Northern India from the north-west, and also by many squalls in the Indian and China seas (which may possibly prove to be of the crescent-shaped type); and it is precisely analogous to the rise of barometer frequently noticed at inland localities in the temperate zones during a summer thunderstorm. It is, however, stated that in

[1] "Notes on the Cloud Forms and Climate of Iowa." Dr. G. Hinrichs, Director Iowa Weather Service.

[2] *Meteorological Magazine*, vol. xiii. p. 33; *Nautical Magazine*, vol. xlvii. 5.

the "tornadoes" of the Gold Coast (which are merely severe squalls) a fall of the barometer occurs. In some squalls, especially in the Indian and China seas, a change of wind occurs to nearly an opposite point of the compass, and in these instances there is sometimes a diminution of pressure [1] during the passage of the squall. These squalls I should regard as small typhoons.

The clouds which mark the front of an actual typhoon, as described by Dampier [2] and subsequent navigators, seem to be very similar to those which accompany the true squall, wherever observed. These consist of a dense curtain of ice-cloud in the higher regions of the atmosphere, usually permeated, except in the extreme rear, by mountainous cumuli from beneath, and having, when viewed at a distance, a very white and shining appearance. In the final stage of the squall, when it is diminishing in severity, these cumuli commonly disappear. A watchful outlook for these clouds, not least of all when coming off a high windward shore, may save many sailing vessels, as it might in all probability have saved the *Eurydice*, from destruction. W. CLEMENT LEY

NOTES

As we anticipated some weeks ago (p. 41), Prof. Lord Rayleigh has been nominated by the Council of the British Association as President for the Meeting at Montreal in 1884. The death of the late Prof. H. J. S. Smith having caused a vacancy among the vice-presidents elected at Southampton for the meeting at Southport in the present year, the Council have nominated Dr. J. M. Dawson, C.M.G., F.R.S., Principal of McGill College, Montreal, to be a vice-president.

PROF. HUXLEY'S Rede Lecture will have for its subject "The Origin of the Existing Forms of Animal Life: Construction or Evolution?" It will be delivered in the Senate House (Cambridge) on Tuesday next at noon.

THE death is announced of M. Charles Bresse, on May 22, at the age of sixty-one years. He was, since 1855, Professor of Mechanics in the School of the Ponts et Chaussées, and also for the last few years at the École Polytechnique.

A SERIES of conferences will be held in connection with the Fisheries Exhibition, in which the foreign commissioners, jurors, and others connected with or visiting the Exhibition, will be invited to take part. The first meeting of the Congress will be held on Monday, June 18, at 12 noon, when Prof. Huxley will deliver an introductory address. H.R.H. the Prince of Wales, K.G., has graciously consented to read a paper by H.R.H. the Duke of Edinburgh, K.G., entitled "Notes on the Sea Fisheries and Fishing Population of the United Kingdom," on Tuesday, June 19, at 12 o'clock. At all other conferences, the chair will be taken by the appointed chairman at 11 o'clock a.m. precisely. Papers will be read, and discussions on them will follow. The conferences will be held on Mondays, Tuesdays, Thursdays, and Fridays.

THE Company of Grocers have announced as the matter of competition for the first quadrennial discovery prize of 1000*l.* the following problem:—"To discover a method by which the vaccine contagium may be cultivated apart from the animal body, in some medium or media not otherwise zymotic: the method to be such that the contagium may by means of it be multiplied to an indefinite extent in successive generations, and that the product after any number of such generations shall (so far as can within the time be tested) prove itself of identical potency with standard vaccine lymph." The prize is open to universal competition, British and foreign. Competitors for the prize must submit their respective treatises on or before December 31, 1886, and the award will be made not later than May, 1887. In relation to this prize, as in relation to other parts of the Company's scheme in aid of sanitary science, the Court acts with the advice of a scientific committee which at present consists of the following members:—Messrs. John Simon, F.R.S., John Tyndall, F.R.S., John Burdon Sanderson, M.D., F.R.S., and George Buchanan, M.D., F.R.S.

A CORRESPONDENT in West Australia writes to us that the Exploring Expedition to Kimberly District, North-West Australia, to which Mr. E. T. Hardman, of the Geological Survey of Ireland, is attached as geologist, reached Roebuck Bay, Kimberly (lat. 18° 10′ S., long. 122° E.) on April 9, after a favourable voyage from Fremantle of ten days; all well, with the exception of a native who, in a fit of delirium, jumped overboard and was lost. Mr. Hardman proceeds with Mr. John Forrest, Surveyor-General, a well-known and experienced explorer, on a preliminary examination of the district for some months, and will then accompany the main party about to make a trigonometrical survey of the country along the Fitzroy River traced in 1879 by Mr. Alexander Forrest. The party, which consists of thirty-two, all told, with fifty horses, left Fremantle in the *Macedon*, on March 25, but were shipwrecked on Rottnest Island, and subsequently went on in the steamer *Rob Roy*. The field-work will be continued until the middle of next November, and will probably be resumed next year. Previous explorers pronounce this district to be one of the best in West Australia.

WE have received a communication from Herr Sophus Tromholt, dated Bossekop, May 18, in which he informs us that his work at Kautokeino having been finished he has paid a visit both to the Finnish station at Sodankylä and the Norwegian at Bossekop. Herr Tromholt now intends to proceed to Bergen, and promises, when settled, to send an account to NATURE of his final researches on the aurora borealis. He states, however, that at neither of the above-mentioned stations has any photograph of the aurora been obtained. Next winter, Herr Tromholt informs us, he will spend in Iceland, in order to proceed with his studies of the aurora borealis there, chiefly on the principle laid down by Prof. Lemström, and with the apparatus invented by the latter.

SIR JOHN LUBBOCK has given notice that he intends on Friday three weeks to draw attention to the fact that the Minister whose duty it is to bring forward the Educational Estimates has no power to appoint officers, and to move that it is desirable that there should be a separate department of education.

IT is stated that M. Jules Verne, the world-known novelist, will offer himself as a candidate to fill the chair vacated in the Académie Française by the recent death of M. Jules Sandeau.

AN Exhibition of Hygienic Dress and Sanitary Appliances, intended to illustrate as far as possible the aims and objects of the National Health Society, was opened by the Lord Mayor on Saturday afternoon, in Humphreys Hall, Knightsbridge. The Exhibition, which will continue for a fortnight, includes clothing, food products, everything connected with the sanitation of the house and hygienic decoration, appliances for the sick-room, home nursing, and home education, industrial dwelling and cottage hygiene, heating, lighting, and cooking apparatus, fuel, &c. Perhaps, however, the greatest attention will be devoted to the stands of the Rational Dress Society, and another close to it, where are shown examples of ladies' dresses made on purely hygienic principles.

TOURISTS with entomological proclivities who may be about to visit the Alps, Pyrenees, Norway, or other parts of Europe, will find Dr. H. C. Lang's "Butterflies of Europe" (L. Reeve

[1] Schück. *Annalen der Hydrographie*, March, 1877; *Quart. Journ. Met. Soc.* vol. iv. p. 78.

[2] "Voyages," ii. 36.

and Co.) very useful. So far as it has gone, indeed, it is the best book on the subject in the English language. Part xiii., just published, brings the work down to the larger Fritillaries, and is one of the most satisfactory so far as the plates are concerned.

THE Russian Chemical Society having established a competition for the best lamps for burning the intermediate oils of the Caucasian naphtha, which have a density from 0·860 to 0·875, has found that the four competing lamps satisfy the required conditions, the best of them being that of M. Kumberg. According to experiments made by Prof. Mendeléeff, the new lamps burn not only the intermediate oils but also a purified mixture of all distillations, the heavy greasy oils which have a density of 0·910 at 15° included. Like the American naphtha, the Baku naphtha would thus yield more than two-thirds (nearly three-quarters) of its weight of oils available for lamps, the oils from this last being far less dangerous than those of the former. It yields, besides, nearly 30 per cent. of greasy oils of great value.

M. YANKOVSKY mentions the disappearance of the spotted deer from the neighbourhood of Vladivostok. Before 1877 they were so numerous that flocks numbering forty and fifty were often seen, and their meat was cheaper than beef. Since the snowy winters of 1877 and 1878, however, during which they were hunted on a great scale, they have become very rare. It seems that other causes too have contributed towards diminishing their number. In 1878, after a great fire which consumed the whole of the depression around the lake of the Slavyansky peninsula, M. Yankovsky saw the valley dotted with the bodies of deer and antelopes. It will be a pity if a succession of mild winters does not give an opportunity to the spotted deer of multiplying again, as their number is already very limited, and the region they inhabit is very restricted, as it comprises only the sea-coast from Corea to the Bay of Olga.

NOTWITHSTANDING the active pursuit of the tigers in the South Usuri region, their number does not much diminish. In a communication to the Irkutsk branch of the Russian Geographical Society it is stated that in 1880 and 1881 no less than nine tigers were killed on the small space of thirty-five miles long, on the western coast of the Bay of Amur; and at the head of this bay five tigers were perceived at one time. The zoologist of the Society, M. Yankovsky, writes also that the South Usuri tigers do not seem to abstain from eating corpses and digging out graves as is generally believed.

ON May 19, at about 10 p.m., a remarkable aurora borealis was observed at Ludvika, in Sweden. It began as a faint band of light parallel with the horizon, which gradually grew broader and broader. The extraordinary feature of the phenomenon was, however, that this band had the appearance of an ice-covered lake on which the moon was shining. Promontories and shores covered with trees were seen, and also the faint outlines of farms. This phenomenon lasted about ten minutes, when the aurora changed into a suffused pink luminosity, like that of clouds near the setting sun.

A STRONG earthquake was felt throughout the state of Antioquoia at 6 p.m. on the 8th ult. Little damage was done in Medellin, although much alarm was caused and the walls of the cathedral were injured. In the town of Antioquoia the façade of the cathedral was thrown out of plumb, many of its columns were thrown down, and all the houses suffered more or less. In Santa Rosa the church steeple was injured and a number of houses rendered uninhabitable. In Aquadas the town hall was destroyed, and at Abejirral the church and a number of houses were injured. It was feared more disasters had occurred in districts which had not been heard from. The shock lasted more than two minutes, and appeared to move from the north to the south. This same shock was felt all over the isthmus, all along the Atlantic coast of Columbia, doing damage only at the mouth of the Atrato, so far as reported up to the present, and in the Magdalena Valley. It appears to have been the sharpest and most widely experienced since the great one of September 7 last year.

TELEGRAMS from Batavia state that Mount Karang in the Straits of Sunda is in full eruption. The shocks are heard several hundred miles away. It is now two hundred years since the last eruption of this volcano. The mountain is situated on the island of Krakatoa, near Anjer in the Straits of Sunda, and as it is in the path of sailing vessels from Europe to the East, which generally call at Anjer point for provisions and orders, we may shortly expect details of the eruption.

A CORRESPONDENT writes:—During the last ten years much has been written on the origin of the jade objects found in America and Europe, no raw materials of the stone having yet been discovered out of which the articles could have been manufactured. Prof. H. Fischer of Freiburg in Baden therefore brought forward the hypothesis, supported by several of his scientific brethren, that the jade objects of America had been transported thither from Asia in prehistoric times, when Mongolian tribes settled in the New World, and that the intercourse of trade had later acted in the same manner. For Europe, where thousands of those objects have been found, the Aryans had done this service, when wandering from the very heart of Asia to the west, the source of the jade objects of both continents being Asia, where deposits of the mineral are known to occur in Siberia, Turkestan, and Burmah. Recently Dr. Meyer of Dresden has energetically opposed these views in a large folio work containing many plates, and has come forward with the opinion that the jade sources of Europe and America yet remain to be discovered. As to America we are glad to hear that this much simpler and more reasonable explanation of the problem has now been verified, the Smithsonian Institution of Washington lately having received from Louisiana an immense number of objects of jade, among them implements, knives, and other articles, many having an admirably high finish, and with them a considerable quantity of the stone of which the objects were made. We do not doubt that similar discoveries may soon be expected in Europe, especially in Switzerland, and that we shall succeed in ascertaining the exact districts where the mineral is to be found.

WE are glad to see that there is at last some prospect of the immediate publication of Mr. W. Colenso's Maori-English Lexicon, which was submitted to the New Zealand Government nearly eight years ago. A specimen sheet of twenty folio pages has recently been printed and presented to both Houses of the General Assembly by command of the executive authorities. From this specimen it is evident that the work is of an encyclopædic character, embodying a vast amount of information collected from original sources on the languages, ethnology, traditions, religions, habits, and customs of the Polynesian races. The plan is at once simple and comprehensive. The various meanings of each word are first given in large type, and each meaning is then illustrated by one or more passages in small type from the native poems, myths, legends, proverbs, and colloquial usage. Thus nearly four pages are devoted to the different significations and grammatical applications of the single word *a*, which plays such an important part in all the Polynesian dialects. To the particle *atu* as many as thirty distinct meanings are assigned, and these meanings are illustrated by no less than seventy-two quotations from the various sources above indicated. In some cases the quotations are Englished, and it would certainly be satisfactory if this could be done uniformly. In the English-Maori part the same plan is adhered to, only here quotations

illustrating the different senses of the English words are omitted as unnecessary. Should the work be carried out on these lines it will enable the student to wait somewhat more patiently for the appearance of Mr. Whitmee's long-promised Comparative Dictionary of the Polynesian Languages.

THE Minister for Postal Telegraphy will ask from the French Parliament the credits required for connecting by a cable Saigon to Haïfong, the principal seaport of Tonquin, and Haïfong to Hanoi by another line laid down in the bed of the Red River.

AT the Polytechnic, which is now occupied by a Young Men's Christian Institute, there was recently an exhibition of drawings, and works of art and manufactures, executed wholly or in part by the members of the institute and the students at the numerous classes held there. Most of the exhibits show proofs of the usefulness and success of the institution. The exhibition included also many valuable works of art and a very costly and interesting collection of Japanese, Chinese, and Indian curiosities lent for the occasion by Mr. Quintin Hogg and other friends of the institute.

THE Oxford University Junior Scientific Club held a very successful *conversazione* in the University Museum on Friday evening last.

PROF. DEWAR, F.R.S., will give an experimental discourse on the Chemistry of the Electric Discharge at the last Friday evening meeting on June 8 at the Royal Institution.

THE additions to the Zoological Society's Gardens during the past week include two Pig-tailed Monkeys (*Macacus nemestrinus* ♂ ♀) from Sarawak, presented by His Highness the Rajah of Sarawak; an Egyptian Cat (*Felis chaus*) from India, presented by Mr. W. R. Glyn Griffiths; three Common Kingfishers (*Alcedo ispida*), British, presented by Mr. Frederic Houghton; a Barbary Ape (*Macacus inuus*) from North Africa, four Elliot's Pheasants (*Phasianus ellioti* ♂ ♂ ♀ ♀) from China, five Ceylon Terrapins (*Clemmys trijuga*) from Ceylon, four Bungoma River Turtle (*Emyda granosa*) from India, four Lacertine Snakes (*Cœlopeltis lacertina*), a Horseshoe Snake (*Zamenis hippocrepis*), a Pleurodele Newt (*Pleurodeles walti*), South European, a Red-legged Partridge (*Caccabis rufa*), European, deposited; a Buffon's Touracou (*Corythaix buffoni*) from West Africa, two Bronze-winged Parrots (*Pionus chalcopterus*) from South America, two Varied Hemipodes (*Turnix varia*) from Australia, two American Siskins (*Chrysomitris tristis*) from North America, two Black Larks (*Melanocorypha yeltonensis*) from Siberia, a Cerastes Viper (*Vipera cerastes*) from Egypt, purchased.

LOCAL SCIENTIFIC SOCIETIES

FOR some years past there has been a growing expression of desire of local scientific societies to be officially represented at the meetings of the British Association. The question is one of considerable difficulty and delicacy, and though it has been the subject of frequent discussion and some legislation, no measure has yet been carried that is satisfactory to all parties. Last year the subject was referred to the Council, who appointed a special committee, and this committee made on Tuesday its preliminary report. They asked in it for permission from the Council to circulate the report among the local societies in order to obtain from them that response which is needed before the committee can feel themselves in a position to report finally, and *a fortiori* before the Council can take their report into consideration. This permission has been granted, together with that of free publication. A copy of the report will consequently be shortly sent to the various societies by the secretary, Mr. H. George Fordham, Odsey Grange, Royston, Cambridgeshire, with the request that their replies will be forwarded to him. But as the subject presses, and as the season is advancing and the annual sessions of societies are drawing to a close, the best method of bringing the report before the members of those societies is through the columns of NATURE. I therefore forward it at once. FRANCIS GALTON

June 6

Preliminary Report of the "Local Scientific Societies' Committee, consisting of Mr. FRANCIS GALTON (*Chairman*), *the* Rev. Dr. CROSSKEY, Mr. C. E. DE RANCE, Mr. H. G. FORDHAM (*Secretary*), Mr. JOHN HOPKINSON, Mr. R. MELDOLA, Mr. A. RAMSAY, Prof. SOLLAS, Mr. G. J. SYMONS, *and* Mr. W. WHITAKER, *appointed by the Council in compliance with the following resolution referred to the Council by the General Committee:*

"That the Council be empowered to appoint a Committee, as recommended in their Report adopted by the General Committee on August 23, in order to draw up suggestions upon methods of more systematic observation and plans of operation for Local Societies, together with a more uniform mode of publication of the results of their work. It is recommended that this Committee should draw up a list of Local Societies which publish their proceedings."

The Committee have communicated with all the Societies known to them which appear to fall under the designation of "Local Societies which publish their proceedings," giving to this definition a somewhat liberal interpretation, and they submit a tabular list of the publications with other particulars of those which have furnished replies. These societies are about 170 in number, and seem from their rules and publications to be centres whence local scientific information may conveniently be obtained.

The Local Societies differ widely in character. Those which are established in large towns, and are not particularly well situated for carrying on systematic local investigations, are often of high scientific rank, and their affairs are administered in a business-like manner by a regular staff. On the other hand, there are numerous smaller societies and field clubs, scattered over the country, which are excellently placed for conducting local investigations, but whose organisation is so incomplete that it has often been difficult to discover their official addresses.

In some parts of the country the smaller societies either group themselves into what is practically a federation, or else affiliate themselves to some large society in their district, and the Committee think that if the Local Societies generally could be induced to group themselves round what might be described as local sub-centres, it would not be difficult to devise methods of uniting the representatives of those sub-centres in the performance of interesting and important duties during the meetings of the British Association, with the final effect of establishing systematic local investigation throughout the country, and uniformity in the modes of publishing the results. The recommendations the Committee are about to make will tend wholly in this direction, because, although they have considered many plans of fulfilling their instructions in a direct manner that perhaps look well on paper, no plan recommends itself to them as superior to this indirect method in its capacity of producing valuable and durable effects.

The Committee do not suggest any new topics for systematic investigation, but confine themselves to giving a few examples of what these topics are, taken from a circular printed last year by a committee appointed at a conference of delegates of scientific societies: (1) *Underground Waters* (to record the height of water in wells, and its variations in level in different parts of the country). (2) *Erratic Blocks* (to record their position, height above sea, lithological character, &c.). (3) *Underground Temperature* (to investigate the rate of its increase downwards in various localities). (4) *Rainfall* (its measurement). (5) *Periodical Natural Phenomena* (to record time of flowering of certain plants, arrival of certain migratory birds, appearance of certain insects). (6) *Injurious Insects* (to record their appearance in unusual numbers, the injuries they cause, and the degrees of success in preventing them). The first three of these investigations were set on foot by Committees of the British Association, and the last three by societies or private individuals.

It can hardly be doubted that numerous systematic investigations of a local character will from time to time be carried on, and that their successful prosecution would result in important gains to science. Neither does it appear doubtful

that the successful prosecution of such investigations by the smaller Local Societies would be greatly encouraged and facilitated by the general interest shown in their work by the more influential societies in their neighbourhood, by a watchful oversight, a readiness to discuss and publish results, and by the personal influence of their leading members. The Committee offer the recommendations they are about to make in the trust that, if the Council are pleased to publish them, they will serve to remind the more important Local Societies of the high and useful function they are able to perform by entering into friendly and helpful relations with the small and scattered societies of their respective districts, and by offering themselves as their scientific representatives wherever representation may be necessary.

The Committee recommend that they be empowered to print and circulate among the Local Societies the following draft of suggested rules, to give an opportunity to those societies of taking that initiative without which no action on the part of the Association is likely to produce much effect. After the Committee have been informed of the views of these societies, they will be in a better position than they are at the present moment for appreciating at its true value the desire for cooperation which they believe to exist. They will also perhaps receive useful suggestions from the societies that have not occurred to themselves, and they will probably be in a position to submit their final recommendations before the approaching annual meeting.

"SUGGESTED NEW RULES, THE EXISTING RULES BEING ALTERED ACCORDINGLY.

"*Corresponding Local Societies.*

"Application may be made by any society publishing scientific memoirs to be placed on the list of Corresponding Local Societies of the British Association. These applications must be addressed to the Secretary, and be made on or before the second day of the annual meeting, and they must be accompanied with a copy of the publications of the Society during the preceding year.

"The Secretary shall transmit these applications to a Committee appointed by the Council for the purpose of considering them, as well as for that of keeping themselves generally informed of the annual work of the Corresponding Local Societies. This Committee shall make an annual report to the Committee of Recommendations, and shall suggest such additions or changes in the list as they may think desirable; but the final determination of the list will rest with the Committee of Recommendations, subject only to the conditions—(1) That the number of Societies on the list shall not exceed that which is prescribed by the Council; (2) that the intended removal of any Society from the list shall not take effect until immediately before the commencement of the next annual meeting.

"The privileges of a Corresponding Local Society shall consist in—(*a*) The insertion in the Annual Report of the British Association of an index, in such abbreviated form as the Council may sanction, of the titles of the scientific memoirs published by the Society during the previous year; (*b*) the right to nominate any one of its members, who is also a member of the British Association, as its delegate to the annual meeting of the Association, who shall have for the time the rights of a member of the General Committee.

"Before the delegate can enter into his rights, he must transmit to the Secretary of the British Association a copy of the publications during the previous year of the Society he represents. He must also fill up a schedule, that will be furnished to him by the Secretary on application. This schedule will ask for—(*a*) The names of the President and chief executive officer of his Society; (*b*) a list of the institutions, if any, in its neighbourhood with which it has official relations and whose interests it represents; (*c*) a brief report on the character, number, and results of any systematic local observations carried on during the past year, either by itself or by any of the institutions on the foregoing list: (1) at the instance of Committees of the British Association, (2) at the instance of other Societies or private persons; (*d*) such other information as may be thought desirable.

"The delegates of the various Corresponding Local Societies shall constitute a Committee, which shall be summoned by the Secretary of the Association to hold one or more meetings during each annual meeting of the Association, under a Chairman and with a Secretary appointed by the Council. The Secretaries of each Section shall be instructed to transmit to the Secretary of the Committee of Delegates copies of any recommendations forwarded by the Presidents of Sections to the Committee of Recommendations bearing upon matters in which the cooperation of Local Societies is desired; and the Secretary to the Committee of Delegates shall invite the authors of those recommendations to attend the meeting of the Committee and give verbal explanations of their objects and of the precise way in which they would desire to have them carried into effect, and to discuss difficulties that may be raised by any member of the Committee, so that the Delegates may be qualified on their return to bring those recommendations clearly and favourably before the notice of their respective Societies."

The Committee believe that the distinction accorded to a Local Society through its selection and formal recognition by the British Association as one of its Corresponding Societies, the advantage of a widely-circulated notice of its work in so important a volume as the Report of the British Association, and the honourable and useful duties assigned to its delegate, would give considerable value to the title.

They also anticipate that a Local Society, which had asked for and received recognition as the representative centre for the time being of the institutions in its district, would be thereby stimulated to exercise that very creditable and important function with increased zeal and efficiency. The result would be to strengthen the mutual relations of the larger and the smaller Local Societies, to insure the encouragement of any disposition to engage in systematic investigations, and to establish a practice of printing the scattered results obtained by the smaller Local Societies of any district in a consolidated form in the publications of their leading Society.

Finally, the Committee believe that the annual meetings of the proposed Committee of Delegates, under the chairmanship of a distinguished member of the Association, would have large influence in harmonising the action of their several Societies, and that it would offer a facility that does not now exist for the natural and healthy growth of a federation between remote Societies which have no more direct bond of union than through the British Association.

THE ROYAL OBSERVATORY

THE following are the leading points referred to in the Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation on June 2.

On the subject of Astronomical Observations Mr. Christie says:—

"The regular subjects of observation are the sun, moon, planets, and fundamental stars, with other stars from a selected list. The working catalogue of 2500 stars down to the fifth magnitude having been cleared off, a new working list of 2600 stars, comprising all stars down to the sixth magnitude inclusive which had not been observed since 1860, has been prepared, and was brought into use at the beginning of March. About 1200 stars were observed in 1882, but amongst these there are nearly 500 single observations, necessitating careful comparison with catalogue place for the detection of any mistakes of observation or reduction. The labour thus entailed is considerable, and efforts will be made to obtain in this and each future year at least two observations of every star observed.

"The following statement shows the number of observations with the transit-circle made in the year ending 1883, May 20:—

Transits, the separate limbs being counted as separate observations	4488
Determinations of collimation error	354
Determinations of level error	323
Circle observations	4485
Determinations of nadir point (included in the number of circle observations)...	298
Reflection observations of stars (similarly included)	484

"Comet *a* 1882 has been observed seven times on the meridian since the date of the last Report, and Comet *b* 1882 has been observed three times.

"As regards the computations—

Clock times of transit over the true meridian after all corrections for instrumental errors are prepared to 1883,	May 13
Clock errors and rates are determined to ...	May 5
Mean R.A.'s on 1883, January 1, are formed to...	April 25

"The investigation of personal equations has been completed for the year 1882, the results being very accordant with those found in the preceding year.

"The circle observations are completely reduced so as to form mean N.P.D. for 1883, January 1 to April 21, apparent Z.D.'s being formed to April 28.

"From the beginning of this year a correction of $-0''\cdot39$ has been applied to the results of the nadir observation to make them agree in the mean with the results of reflection observations of stars. This correction has been deduced from a comparison of the nadir results throughout 1822 with corresponding reflection results for stars north and south of the zenith. The discordance appears to be increasing, and its source has not yet been traced. It does not appear to originate on this occasion with the micro-scope-micrometer or telescope-micrometer, and it is not connected with the extension of the range of observation of stars by reflection. The discordance, which was insignificant in 1878, amounting only to $-0''\cdot03$, has gradually increased since, being $-0''\cdot10$ in 1879, $-0''\cdot29$ in 1880, $-0''\cdot30$ in 1881, $-0''\cdot39$ in 1882, and for the first four months of this year $-0''\cdot58$.

"Determinations of flexure have been made on 1882, December 30, and 1883, May 10 and 18, the resulting values being $-0''\cdot07$ and $-0''\cdot78$ and $-0''\cdot33$. The observations on May 18 were not altogether satisfactory, as the sun was shining during the second set of measures. The values resulting from the first and second sets respectively are $-0''\cdot72$ and $+0''\cdot05$. There is apparently nothing in the observations on May 10 to account for the exceptionally large value found on that day. No correction for flexure, as apart from the correction for R – D, has been applied to the observations.

"The correction for R – D, the error of assumed colatitude, and the position of the ecliptic have been investigated for 1882. For the planetary results, errors of R.A. and N.P.D. have been formed, but the heliocentric errors have not yet been computed.

"The reflection observations of stars available for investigation of the R – D discordance extend from Z.D. $71\frac{1}{2}^c$ north to Z.D. $70\frac{1}{2}^\circ$ south, and the discussion of these shows discordances steadily increasing from the zenith towards the horizon, and amounting to $-1''\cdot58$ for the group at Z.D. $68\frac{1}{4}^\circ$ north and to $+1''\cdot66$ at Z.D. 70° south, a correction of $+0''\cdot16$ sin Z.D. having been first applied to the reflection observations for inclination of the vertical at the mercury trough. It is quite evident that the discordances do not follow any such law, as $a + b \sin z \cdot \cos^2 z$, which was used from 1862 to 1880. Assuming the law $a + b \sin z$, which was adopted in the years preceding 1862 and in 1881, the R – D correction for 1882 would be $+0''\cdot07 + 0''\cdot42 \sin z$, and for the sake of continuity in the system of reductions this correction has been provisionally adopted for use in 1882. But the discordances between this formula and the observed quantities increase regularly from the zenith towards the horizon, amounting to half of the observed quantities at Z.D. 50° to 60°. The formula $+ 0''\cdot08 + 0''\cdot29 \tan z$ represents the observations better, though even this does not give sufficiently large results at large zenith distances. In this discussion corresponding reflection and direct observations made on the same day have alone been used.

"The value found for the colatitude from the observations of 1882 is 38° 31′ 21″·93, very slightly larger than the assumed value; the correction to the tabular obliquity of the ecliptic is $+ 0''\cdot44$; and the discordance between the results from the summer and winter solstices is $+ 0''\cdot37$.

"The mean error of the moon's tabular R.A. from observations with the transit-circle in 1882 is $+ 0^s\cdot82$.

"The following observations have been made with the altazimuth from 1882, May 20, to 1883, May 20:—

Azimuths of the moon and stars	317
Azimuths of the azimuth-mark	228
Azimuths of the collimating-mark	216
Zenith-distances of the moon	176
Zenith-distances of the collimating-mark	214

"Azimuths and zenith-distances of Comet *b* 1882 were observed on a single day.

"The altazimuth observations are completely reduced to May 6, so as to exhibit errors of moon's tabular R.A., N.P.D., longitude, and ecliptic N.P.D. The restriction of the observations, and the limitation of the computations to $0^s\cdot01$s. and $0''\cdot1$ have made these reductions comparatively light.

"The moon's diameter has been measured—

With the transit-circle, twice in R.A., 17 times in N.P.D.
With the altazimuth, 4 times in azimuth, 10 times in Z.D."

On the subject of Equatoreals Mr. Christie states:—"A very valuable addition has been made to the instruments of the Royal Observatory by the gift of the Lassell two-feet reflecting equatoreal, which has been generously presented by the Misses Lassell. The exceptional qualities of this fine telescope (with which Hyperion was discovered in 1848) are well known, and there could be no hesitation in accepting on the part of the Admiralty the offer of such a valuable gift. The instrument was removed from Maidenhead early in March, and has been erected in the south ground, where it commands a nearly unobstructed view of the sky to within about 5° of the horizon. A circular building 30 feet in diameter, has been erected for the Lassell telescope, and the construction of a suitable dome is authorised. There are two large mirrors available for use, and I contemplate taking advantage of the firm mounting and perfect clock movement of the south-east equatoreal to mount the spare mirror on this instrument, attaching it to the tube of the refractor, so as to have on the same mounting a refractor and reflector with their axes parallel. The former would be available for eye observation, whilst the latter could be used on the same object for physical work, spectroscopic or photographic. The Lassell telescope itself would be well suited for observation of faint satellites and comets which are beyond our present instrumental means.

"The observations of the solar eclipse of 1882, May 17, with the south-east equatoreal are completely reduced, and the final equations have been solved.

"The spectroscopic observations during the past twelve months have been somewhat restricted through the pressure of the photographic reductions at a time of maximum of sunspot frequency. The solar prominences have been observed with the half-prism spectroscope on eight days, and four sunspots have been examined on eight days with reference to the broadening of lines in their spectra. The spectrum of the great spot of 1882, November 12–25, showed some remarkable reversals of the lines of hydrogen and sodium, and an extraordinary displacement of the F line.

"As regards the determination of motions of stars in the line of sight, 142 measures have been made of the displacement of the F line in the spectra of 23 stars, and 26 measures of the b_1 line in 9 stars. The observations of Sirius during the past winter tend on the whole to confirm the impression that the rate of recession of this star has diminished progressively since 1877, and that the motion is now on the point of being converted into one of approach.

"The spectrum of Comet *a* 1882 was examined on three nights, that of the great Comet *b* 1882 on three nights, and that of Comet *a* 1883 on one night. The spectrum of the first-named object showed the yellow sodium lines with great brilliancy just before perihelion passage. The spectrum of the aurora of 1882, November 17, was also examined.

"The spectroscopic observations of all kinds have been completely reduced to 1883, May 20.

"In the year ending 1883, May 20, photographs of the sun have been taken on 200 days, and of these 339 have been selected for preservation. There were 7 days on which the sun's disk was observed to be free from spots. The number and size of spots and faculæ continued to increase in a marked way till last November, when a group of spots of very unusual size appeared. Since that date, however, the sun has become more quiescent.

"Since the beginning of December, gelatine dry plates have been used instead of the old wet-plate process. They are more convenient in use, and appear to give as good average results. The photographs on a scale of 8 inches to the sun's diameter recently obtained in India, under the auspices of the Solar Physics Committee, are so successful that the Committee have recommended the general adoption of this scale, and I propose, as soon as we have a spare photoheliograph returned from the Eclipse Expedition, to have it altered in the same manner as the Indian photoheliograph, so as to obtain eight-inch photographs of the sun instead of four-inch.

"It was suggested in the last Report that the measurement of such of the Indian and other photographs as were required to fill up gaps in the Greenwich series might with advantage be undertaken here. This proposal has now been carried out, and 111 photographs for the period from 1881, December 22, to 1882, October 19, have been received from the Solar Physics

Committee, so that a record of the condition of the sun on 279 out of the 302 days in that interval is now presented. From 1882 October 20, eight-inch photographs were taken in India, and for the measurement of these a special micrometer has been ordered of Messrs. Troughton and Simms by the Solar Physics Committee.

"All the photographs received from the Solar Physics Committee have been measured in duplicate, and the measures have been completely reduced so as to exhibit heliographic longitudes and latitudes of spots, and areas of spots and faculæ, from 1881, December 22, to 1882, October 19, the end of the series of four-inch photographs.

"Magnetical Observations :—

"The course of observation continues the same as in former years, changes in the magnetic declination, horizontal force, and vertical force being continuously recorded by photography with the three magnetometers, whilst absolute values of magnetic declination, dip, and horizontal force are found by eye observation. Earth-currents in two directions nearly at right angles to each other are also photographically registered.

"A great improvement has been made in the photographic registration by the substitution in June last of Morgan and Kidd's argentic-gelatino-bromide paper with ferrous oxalate development for the old photographic process.

"The large temperature correction of the vertical force magnet has been reduced to less than one-fourth of its former amount by some alterations which were carried out by Mr. Simms last autumn. The effect of these alterations has been to reduce the correction for change of 1° Fahrenheit from 0·00088 of the vertical force to about 0·00020. The coefficient, has, however, still the opposite sign to that which would result from mere loss of magnetic power with increase of temperature. It is intended to make an attempt to still further diminish the temperature correction by shifting the magnet in its carrier so as to reduce the horizontal stalk and balance weight.

"It was remarked in the last Report that the earth-current registers frequently showed abnormal disturbance during rain. By the kindness of Mr. Leonard (the successor to the late Mr. C. V. Walker, as telegraph engineer of the South-Eastern Railway), the wires were repaired in February, and the rain disturbance seems now to have disappeared.

"The following are the principal results for magnetic elements for 1882 :—

Approximate mean westerly declination	18° 22′.
Mean horizontal force ...	3·913 (in English units). 1·804 (in metric units).
Mean dip	67° 33′ 33″ (by 9-inch needles). 67 34 34 (by 6-inch needles). 67 34 14 (by 3-inch needles).

"There has been considerable magnetic activity during the year, the month of November, which was characterised by the appearance of a very large sunspot, being particularly disturbed with remarkable magnetic storms on November 17, 19, and 20, and many interesting cases of lesser disturbance. The magnetical changes in November are so interesting in relation to the accompanying outburst of sunspots that it seems desirable to have the registers for a great part of the month as well as for other days of magnetic disturbance in the year lithographed in the 'Greenwich Magnetical Results for 1882' on a reduced scale. The character of a disturbance would, I think, be much better shown by a reproduction of the curves traced on the photographic sheets than by tables of numerical values or ordinates. I am making inquiries as to the practicability of using some anastatic process, which would not be very expensive.

"The magnetic disturbances on October 2 and November 17 were accompanied by brilliant auroras.

"Particulars of magnetic disturbances are regularly communicated to the *Colliery Guardian* newspaper for the information of mining surveyors.

"Meteorological Observations :—

"On the occasion of the gale of 1882, October 24, a velocity of 64 miles an hour was registered with Robinson's anemometer for two successive hours, being greater than any velocity previously recorded here, but the greatest pressure registered with the chain was only 29 lbs. on the square foot, whilst on 1882, April 29, a pressure of 49½ lbs. was recorded with the copper wire at a time when the velocity was only 50 miles an hour.

"The observations of temperature of the Thames have recently been resumed under the charge of the Corporation of London, who have instructed Mr. G. J. Symons to arrange details. The observations are now made at the end of one of the jetties of the Foreign Cattle Market at Deptford, where a record is to be kept (by means of two Six's thermometers) of the daily maximum and minimum temperatures of the Thames at a depth of 2 feet below the surface, and also near the bottom of the river. Mr. Symons has arranged that these observations shall be regularly communicated to the Royal Observatory to be included in the meteorological table published weekly in the Registrar-General's Reports.

"The mean temperature of the year 1882 was 49°·6, being 0°·1 lower than the average. The highest air temperature was 81°·0 on August 6, and the lowest 22°·2 on December 11. The mean monthly temperature was above the average from January to May, then below until September. In October, November, and December it differed little from the average.

"The mean daily motion of the air in 1882 was 306 miles, being 27 miles greater than the average For the month of November the mean daily motion was 449 miles, being 159 miles above the average. The greatest daily motion was 758 miles on November 4, and the least 30 miles on December 11. As already mentioned, the greatest hourly velocity was 64 miles an hour, and the greatest pressure (with the chain) 29 lbs. on October 24.

"During the year 1882 Osler's anemometer showed an excess of 11 revolutions of the vane in the positive direction N., E., S., W., N., if all the turnings are counted (as has been the practice in former years); or of 23 revolutions in the positive direction if the turnings which are evidently accidental are excluded.

"The number of hours of bright sunshine recorded by Campbell's sunshine instrument during 1882 was 1245, which is more than 40 hours above the average of the 5 preceding years.

"The rainfall in 1882 was 25·2 inches, being very slightly above the average.

"The Westminster clock has maintained its high character, its errors having been under 1s. on 66 per cent. of the days of observation, between 1s. and 2s. on 25 per cent., between 2s. and 3s. on 6 per cent., and between 3s. and 4s. on 3 per cent. The error has never exceeded 4s.

Mr. Christie concludes as follows :—

"The changes suggested in the last Report have been carried out, and will, I trust, tend to increase the efficiency of the Observatory. The restriction of the altazimuth observations of the moon to the semi-lunation from last quarter to first quarter has enabled us to devote more attention to equatoreal observations, though the results hitherto obtained have been somewhat limited through the inadequacy of our instrumental means. The presentation of the Lassell telescope has now removed this difficulty, and when this fine instrument is in working order we may hope to be able to take up with success observations of comets, faint satellites, and other objects of interest. In regard to the spectroscopic observations we have now two observers available, and it may be expected that in the coming year we shall reap the full benefit of the arrangement by which Mr. Nash takes a share in this work.

"In solar photography we have undertaken the measurement and reduction of Indian photographs, supplementing those taken at Greenwich from the commencement of 1882. The Solar Physics Committee propose to undertake the arrears of this work for preceding years.

"In some slight degree the past year has been one of transition and of preparation for future work. Some administrative changes have been made, and the observers have been gaining experience in some new directions; but the regular course of observation and reduction has not been disturbed, and it has been my special endeavour to maintain the standard meridian observations in full vigour—a task in which I have received the hearty cooperation of all the staff.

"In regard to the coming year, I may mention one special work of meteorological reductions which it seems desirable to take in hand. The hourly ordinates of barometer and thermometer registers have been read out and tables of mean values formed for the 20 years of the meteorological reductions, and also year by year since 1877; but there is a gap of three years for the barometer (1874-1876), and of 8 years for the thermometer (1869-1876), for which the photographs have not been discussed. The continuity of the Greenwich series is thus broken, and the results are not available to their full extent. The dis-

cussion which I contemplate for the years in question would probably occupy one computer for a year and a half, involving an outlay of about 70*l*."

ON THE DARK PLANE WHICH IS FORMED OVER A HEATED WIRE IN DUSTY AIR[1]

IN the course of his examination of atmospheric dust as rendered evident by a convergent beam from the electric arc, Prof. Tyndall noticed the formation of streams of dust-free air rising from the summits of moderately heated solid bodies (*Proc. Roy. Inst.*, vol. vi. p. 3, 1870). "To study this effect a platinum wire was stretched across the beam, the two ends of the wire being connected with the two poles of a galvanic battery. To regulate the strength of the current a rheostat was placed in the circuit. Beginning with a feeble current, the temperature of the wire was gradually augmented; but before it reached the heat of ignition, a flat stream of air rose from it, which, when looked at edgeways, appeared darker and sharper than one of the blackest lines of Fraunhofer in the solar spectrum. Right and left of this dark vertical band the floating matter rose upwards, bounding definitely the non-luminous stream of air." . . .

"When the fire is white hot it sends up a band of intense darkness. This, I say, is due to the *destruction* of the floating matter. But even when its temperature does not exceed that of boiling water, the wire produces a dark ascending current. This, I say, is due to the *distribution* of the floating matter. Imagine the wire clasped by the mote-filled air. My idea is that it heats the air and lightens it, without in the same degree lightening the floating matter. The tendency, therefore, is to start a current of clean air through the mote-filled air. Figure the motion of the air all round the wire. Looking at its transverse section, we should see the air at the bottom of the wire bending round it right and left in two branch currents, ascending its sides, and turning to fill the partial vacuum created above the wire. Now as each new supply of air, filled with its motes, comes in contact with the hot wire, the clean air, as just stated, is first started through the inert motes. They are dragged after it, but there is a fringe of cleansed air in advance of the motes. The two purified fringes of the two branch currents unite above the wire, and, keeping the motes that once belonged to them right and left, they form by their union the dark band observed in the experiment. This process is incessant. Always, the moment the mote filled air touches the wire, the distribution is effected, a permanent dark band being thus produced. Could the air and the particles under the wire pass *through* its mass, we should have a vertical current of particles, but no dark band. For here, though the motes would be left behind at starting, they would hotly follow the ascending current, and thus abolish the darkness."

Prof. Frankland (*Proc. Roy. Soc.*, vol. xxv. p. 542), on the other hand, considers that what is proved by the above described observations is that "a very large proportion of the suspended particles in the London atmosphere consists of water and other volatile liquid or solid matter."

Last summer (1881) I repeated and extended Tyndall's beautiful experiment, not feeling satisfied with the explanation of the dark plane given by the discoverer. Too much stress, it appeared to me, is placed upon the relative lightening of the air by heat. The original density is probably not more than about 1/1000th part of that of the particles, and it is difficult to see how a slight further lightening could produce so much effect. In other respects, too, the explanation was not clear to me. At the same time I was not prepared to accept Prof. Frankland's view that the foreign matter is volatilised.

The atmosphere of smoke was confined within a box (of about the size of a cigar-box), three of the vertical sides of which were composed of plates of glass. A beam of sunlight reflected into the darkened room from a heliostat was rendered convergent by a large lens of somewhat long focus, and made to pass in its concentrated condition through the box. The third glass side allowed the observer to see what was going on inside. It could be removed when desired so as to facilitate the introduction of smoke. The advantages of the box are twofold. With its aid much thicker smoke may be used than would be convenient in an open room, and it is more easy to avoid draughts which interfere greatly with the regularity of the phenomena to be observed. Smouldering brown paper was generally used to produce the smoke, but other substances, such as sulphur and phosphorus, have been tried. The experiment was not commenced until the smoke was completely formed and had come nearly to rest. In some respects the most striking results were obtained from a copper blade about ¼-inch broad, formed by hammering flat one end of a stout copper rod. The plane of the blade was horizontal, and its length was in the line of sight. The unhammered end of the rod projected from the box, and could be warmed with a spirit-lamp. The dark plane was well developed. At a moderate distance above the blade it is narrow, sometimes so narrow as almost to render necessary a magnifying glass; but below, where it attaches itself to the blade, it widens out to the full width, as shown in the figure.

Whether the heated body be a thin blade or a cylindrical rod, the fluid passes round the obstacle according to the electrical law of flow, the stream-lines in the rear of the obstacle being of the same form as in front of it. This peculiarity of behaviour is due to the origin of the motion being at the obstacle itself, especially at its hinder surface. If a stream be formed by other means, and impinge upon the same obstacle without a difference of temperature, the motion is of a different character altogether, and eddies are formed in the shadow.

The difference of temperature necessary to initiate these motions with this dark plane accompaniment is insignificant. On July 20, 1881, a glass rod, about ¼-inch in diameter, was employed. It was heated in a spirit-lamp, and then inserted in the smoke-box. The dark plane gradually became thinner as the rod cooled, but could be followed with a magnifier for a long time. While it was still quite distinct the experiment was stopped, and on opening the box the glass rod was found to be scarcely warmer than the fingers. It was almost impossible to believe that the smoky matter had been evaporated.

In order to test the matter more closely, smoke was slowly forced through a glass tube heated near the end pretty strongly by a spirit-lamp, and then allowed to emerge into the concentrated sunshine. No distinct attenuation of the smoke could be detected even under this treatment.

It is not necessary to dwell further upon these considerations, as the question may be regarded as settled by a decisive experiment tried a few days later. The glass rod before used was cooled in a mixture of salt and ice, and after wiping was placed in the box. In a short time a dark plane extending *downwards* from the rod, clearly developed itself and persisted for a long while. This result not merely shows that the dark plane is not due to evaporation, but also excludes any explanation depending upon an augmentation in the difference of densities of fluid and foreign matter.

The experiment was varied by using a U-tube through which cooled water could be made to flow. When the water was not very cold the appearances were much the same as with the solid rod; but when by means of salt and ice the tube was cooled still further, a curious complication presented itself. Along the borders of the dark plane the smoke appeared considerably brighter than elsewhere. Sometimes when the flow was not very regular it looked at first as if the dark plane had been replaced by a bright one, but on closer examination the dark plane could be detected inside. There seems no doubt but that the effect is caused by condensation of moisture upon the smoke due to the chilling which the damp air undergoes in passing close to the cold obstacle. Where the fog forms more light is scattered, hence the increased brightness. That the fog should not form within the smoke-free plane itself is what we might expect from the interesting observations of Aitken.

With respect to the cause of the formation of the dark plane, the most natural view would seem to be that the relatively dense particles are thrown outwards by centrifugal force as the mixture flows in curved lines round the obstacle. Even when the fluid is at rest a gradual subsidence must take place under the action of gravity; but this effect could at first only manifest itself at the top where the upper boundary of the gas prevents the

[1] Paper read at the Royal Society, December 21, 1882, by Lord Rayleigh, F.R.S., Professor of Experimental Physics in the University of Cambridge.

entrance of more dust from above. It is known that air in a closed space will gradually free itself from dust, but the observation of a thin dust-free stratum at the top of the vessel is difficult. If we conceive a vessel full of dusty air to be set into rapid rotation, the dust might be expected to pass outwards in all directions from the axis, along which a dust-free line would form itself. I have tried this experiment, but looking along the axis through the glass top of the vessel, I could see no sign of a dark line, so long as the rotation was uniform. When, however, the vessel was stopped, a column of comparatively smoke-free air developed itself along the axis. This I attributed to the formation of an inward flow along the top of the vessel, combined with a downward flow along the axis after the manner described and explained by Prof. James Thomson, so that the purified air had been in intimate proximity with the solid cover. It would almost seem as if this kind of contact was sufficient to purify the air without the aid of centrifugal force.

The experiments made hitherto in order to elucidate this question have given no decisive result. If the thin convex blade already spoken of be held in the smoke-box in a vertical instead of in a horizontal plane, the lines of motion are much less curved, and we might expect to eliminate the influence of centrifugal force. I have not succeeded in this way in getting rid of the dark plane; but since under the magnifier the curvature of the motion was still quite apparent, no absolute conclusion can be drawn.

ON THE MORPHOLOGY OF THE PITCHER OF "CEPHALOTUS FOLLICULARIS"[1]

THE brief, but most interesting, memoir on this subject read by Prof. Alexander Dickson before the Botanical Society of Edinburgh on March 10, 1881, was the first to throw any clear light upon the obscurity which had previously enveloped it. The conclusions at which he arrived seemed to be fully sustained by the facts which he then published; but since there are still botanists who do not fully accept those conclusions, any independent evidence bearing upon the problem of the morphology of these curious pitchers may be worth recording.

The publication of Prof. Dickson's memoir caused me to watch the growth of my plants of Cephalotus with increased interest. From time to time abnormal leaves have made their appearance, which seemed to afford more or less support to the views which the Professor entertained. This spring one of my plants has developed a leaf the growth of which I have watched. When this leaf first became visible it bore no indication of being other than an ordinary leaf of the plant, but its upper surface soon exhibited a somewhat shrivelled appearance, like that of a leaf distorted by the action of Aphides. It soon became evident that this disturbance was but the commencement of the process of pouching described by Prof. Dickson. That which at first appeared to be a mere distortion of the surface of the leaf soon deepened into a considerable depression, which became more considerable day by day until the leaf reached the condition represented in my figures 1, 2, and 3. Fig. 1 represents the upper, 2 the lateral, and 3 the inferior surface of this leaf.

From the beginning of its growth *a* was the unmistakable, somewhat cuspidate apex of the leaf, as it was also the distal end of the prominent ciliated ridge, *b*, the obvious precursor of the middle dorsal wing, which forms so conspicuous a feature of the normal pitcher. It will be seen in Fig. 2 that this ridge only extends downwards to the point *c*, whilst *d* was evidently the fundus of the enlarging pouch, relations which approximate closely to what characterise these portions of the perfect pitcher. On the under surface of the leaf (Fig. 3) we find this middle wing extending downwards from *a*, flanked on either side by a smaller, slightly curved ridge, also ciliated, the two unquestionably representing the lateral wings of the normal organism. It is perfectly clear that the peripheral outlines of the figures 1 and 3 represent the true primary margins of the leaf from the point *a* to the base of the petiole *e*. The upper half of this margin is abundantly ciliated, the hairs becoming more scanty as we approach the lower half of the leaf.

Figs. 1 and 2 show the form of what obviously represents the lid, *f*, of the true pitcher. In its essential features it accords with those figured by Prof. Dickson, who correctly recognised its true homology. As in his Fig. 5, this lid is two-lobed, its central indentation, *g*, separating two triangular lobes. This arrangement corresponds substantially with what exists in the normal pitcher, only in the latter the lobes are large and rounded instead of being small and triangular. The free margin of this rudimentary lid is abundantly ciliated, as in the perfect pitchers.

Thus far my specimen only confirms and illustrates the conclusions arrived at by Prof. Dickson, viz. that the pitcher is merely a depression in the upper surface of the leaf, of which the petiole *e* is identical morphologically with the terete petiole of the true pitcher, whilst the lid, *f*, is an outgrowth of the

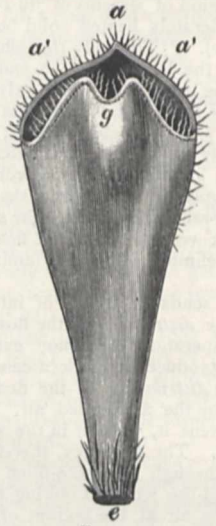


FIG. 1.

FIG. 2.

upper surface of the leaf from the proximal margin of that depression.

Prof. Dickson was not able to decide with absolute certainty which part of the matured normal pitcher represented the primary apex of the leaf. In his abnormal specimens, as in mine, that apex coincided with the apex *a* of the middle dorsal wing. As is well known, in the perfect pitcher the entrance into the pitcher is bounded by a thick, involuted, toothed rim, to which the apical point of the dorsal wing is external. The Professor

FIG. 3.

was uncertain whether the apex *a* of the wing coincided with the true apex of the leaf, or whether that apex is hidden in the involuted margin of the pitcher. He inclines, however, towards the former view, and I have the conviction that he is right. The two *ciliated* margins, *a' a'*, of Fig. 1, are obviously the two lateral margins of the anterior portion of the normal leaf, demonstrating clearly that the point *a* is its apex. In the true pitcher these margins have lost their ciliæ, a few prominent teeth being substituted for them, and become thickened at their inner side

[1] By W. C. Williamson, LL.D., F.R.S., Professor of Botany in the Victoria University, Manchester.

by the development of the rounded and ribbed involuted border. It appears clear to me that this thick involuted structure is an outgrowth from the upper surface of the leaf, and which crossed the base of the cuspidate apex, *a*, without materially modifying it; and as it developed in a similar manner round the base of the distal surface of the lid *fg*, it contracted that base so as to reduce the attachment of the lid to the pitcher to very small dimensions. If the explanation is as correct as I believe it to be, the apex *a* of the middle dorsal wing is also the true apex of the leaf, whilst the involuted margin of the pitcher and the whole of its lid are equally outgrowths from its upper surface.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—In a Convocation to be held in the Sheldonian Theatre on Wednesday, June 13, at twelve o'clock, it will be proposed to confer the degree of D.C.L. *honoris causâ* upon Lord Rayleigh, M.A., F.R.S., Professor of Experimental Physics and Honorary Fellow of Trinity College, Cambridge, and Sir Frederick A. Abel, K.C.B., F.R.S.

In a Convocation held on June 5 the following decree was submitted to the House:—"That the Curators of the University chest be authorised to expend a sum not exceeding 10,000*l.* in the erection of a laboratory, working-room, and lecture-room for the Waynflete Professor of Physiology, and in providing fixtures, warming apparatus, and gas for the same," which was carried by 88 to 85.

CAMBRIDGE.—The Geological Museum Syndicate recommend the combination of a new chemical laboratory with the Sedgwick Geological Museum, and believe that no better site will be available than the Downing Street frontage. They have asked permission to obtain plans and estimates in accordance with this proposal.

The Special Board for Medicine recommend the combination of the subjects of botany and comparative anatomy, now taken in the 1st and 2nd M.B. respectively, into one—elementary biology, which is to include much less than the two separate subjects. They propose that chemistry and physics in the 1st M.B. may be taken at a distinct period from the elementary biology, if candidates prefer it, and also that human anatomy and physiology in the 2nd M.B. may be taken at a distinct time from pharmacy and pharmaceutical chemistry. They also propose to discontinue classifying candidates, which has only been adopted of late years, and to publish merely alphabetical lists.

The university Local Lectures in populous centres have during the past winter, as usual, included numerous courses on science subjects, including chemistry and electricity, by Messrs. C. M. Thompson and S. L. Hart; Europe in Prehistoric Times, by Mr. J. E. Marr; Geology and Physical Geography, by Mr. W. W. Watts; Physics of the Earth, by Prof. Teall, &c.

LONDON.—On Tuesday afternoon last a large number of the friends of the medical education of women met at the Ladies' Medical College in Brunswick Square at the ceremony of presenting the prizes to the successful students of that institution. Countess Granville presided, and in the course of the proceedings Mr. Stansfeld, M.P., referred to the financial condition of the college as satisfactory. Two gentlemen from India spoke on the recent movement in Bombay to secure qualified medical women for that country, and referred to the immense value of a knowledge of medicine as an adjunct to missionary effort. Mrs. Garrett-Anderson, M.D., as Dean of the College, supplied some statistics of its progress, and Mrs. Fawcett, in proposing a vote of thanks to Countess Granville, dwelt on the assistance which the movement for placing a medical training within reach of women had received from Earl Granville in his capacity as Chancellor of the University of London.

WITH a view to encourage the study of veterinary science, the Lieutenant-Governor of Bengal has resolved to offer two prizes—one of 50*l.* and the other of 20*l.*—for competition by holders of Agricultural Scholarships from Bengal, studying in the Royal Agricultural College, Cirencester.

SCIENTIFIC SERIALS

THE *American Journal of Science*, No. 149, May, 1883.—Observations of the transit of Venus, December 6, 1882, at Princeton, New Jersey, and South Hadley, Massachusetts, by Prof. C. A. Young. Two sets of measurements of the planet's diameter, and some spectroscopic observations were made by the author and Mr. McNeill. During the transit 191 photographs were taken by Prof. Brackett and assistants. Of these 40 were first class, 30 worthless, the rest of all grades of excellence. The planet's atmosphere was seen by all observers at Princeton. But no satellite, spots, or marks were detected upon the planet's disk.—Notes on the occurrence of certain minerals in Amelia County, Virginia, by Wm. F. Fontaine. These have been brought to light during the excavations carried on for some years past for the purpose of obtaining mica. They are chiefly feldspar, beryl, fluorite, columbite, garnet, orthite, microlite, monazite, and helvite.—On the surface limit or thickness of the continental glacier in New Jersey and the adjacent States, by J. C. Smock.—Contributions to the geological chemistry of Yellowstone National Park, by F. Leffmann and W. Beam.—Notes on American earthquakes, with records from June, 1879, to end of December, 1882, by Prof. C. G. Rockwood.—A four years' record of earthquakes in Japan, studied in their relation to the weather and seasons, by Dr. Thos. H. Streets, U.S. Navy. The shocks are tabulated, with remarks on the state of the barometer and temperature. Three charts show the relation between the height of the barometer and the earthquakes.—Observations on the fossils of the metamorphic rocks of Bernardston, Mass., by R. P. Whitfield.—On De Candolle's "Origin of Cultivated Plants," with annotations upon certain American species, by Asa Gray and J. Hammond Trumbull (part ii.).

Annalen der Physik und Chemie, 1883, No. 5.—Experimental researches on the elliptical polarisation of light by reflection from surface-coloured bodies, with ten illustrations, by Julius Merkel.—A new radiometer, described and figured by C. Bauer.—The radiation of rock-salt under various temperatures, by the same author.—On the generation of heat in the absorption of gases by solids and fluids, with illustration, by P. Chappuis.—Some remarks on the action of air condensed on glass surfaces, by W. Voigt.—On the theory of the longitudinal impact of cylindrical rods, by the same author.—Observations on the action of quicksilver drops falling in thermometrical tubes, by Paul Volkmann.—On the galvanic resisting-power of psilomelan, by Hugo Meyer.—Remarks on W. Siemens' theory of luminosity, by W. Hittorf.—On a hitherto unrecorded phenomenon acccompanying electric discharges, with three illustrations, by Heinrich Hertz.—On the action of platinum, palladium, gold, coal, and aluminium in nitro-muriatic acid, by Carl Fromme.—On the dynamometrical method of determining the ohm, by J. Fröhlich.—On the measurement of local variations in terrestrial magnetic horizontal intensity, by F. Kohlrausch.—Researches in the electromagnetic phenomena of rotation, with three illustrations, by Friedrich Koch.—Experiments in connection with the theory of the Nobili-Guébhard rings, by W. Voigt.—Measurement of the diminution of sound in the telephone, by K. Vierordt.—On electric undulatory movements, with illustration, by A. Overbeck.—On the selective absorption of solar energy, with two plates, by S. P. Langley.—Remarks on C. Bohn's treatise on "Absolute Dimensions," by Paul Volkmann.—An account of Foucault's experiment with the pendulum, by A. Schuller.

No. 6.—On the measurement of the refractive relations of coloured fluids, with four illustrations, by C. Christiansen.—On the determination of the power of emission and absorption of heat in bodies, by the same author.—Observations on Norman Lockyer's theory of dissociation, by Hermann W. Vogel.—Researches on the variation of temperature in the pole-plates of a voltameter during the transmission of electric currents, with two illustrations, by E. Edlund.—Carl Fromme's electrical investigations (continued): Experiments on the condensation and absorption of hydrogen by platinum and palladium; *résumé* and further explanation of the results contained in the two previous sections.—Remarks on A. Kundt's treatise on "The Optical Action of Quartz in the Electric Field," by W. C. Röntgen.—On some experiments with static electricity, with numerous illustrations, by V. Dvorák.—Some remarks on the unipolar conduction of solid bodies, by F. Braun.—On the elliptical polarisation of the heat rays reflected by metals, by H. Knoblauch.—On the fluorescence of the vapour of iodine, by E. Lommel.—On the thermodynamic equilibrium of vapour mixtures, by Max Planck.—On some modifications of the pyknometer, by G. W. A. Kahlbaum.—On the selective absorption of solar energy (continued), with fresh observations on the invisible prismatic spectrum, by S. P. Langley.

THE *Beiblätter* to part 4 contains papers on the necessity of introducing certain modifications into the study of mechanics, and eliminating diverse problems from them, by Yvon Villarceau.—On the influence of temperature on manifestations of molecular energy, by A. Millar.—On the inner pressure and energy of superheated vapours, by G. Schmidt.

Journal de Physique Théorique et Appliquée, April, 1883.—Methods for determining the ohm, by Marcel Brillouin.—On the solidification of phosphorus and other substances in superfusion, by M. D. Gernez.—On the theory of colourless curves in double refractive crystals, by J. Macé de Lépinay.—A new hygrometer condensing internally, described and figured by A. Crova.—A new electrocapillary translator, described and figured by E. Debrun.—On the reading of a system of two electrodynamic machines, by A. Potier.

Revue Internationale des Sciences, February, 1883, contains articles:—On the contagiousness of tubercle.—On the Khouds, by Élie Reclus.—On the dangerous properties of finely-divided coal-dust, by Prof. Abel.—On the adulteration of food in Paris, by M. Egasse.—Medical anthropometry from the point of view of aptitude for military service, by M. Jansen.—Proceedings of the Academy of Sciences, Paris.

Journal of the Asiatic Society of Bengal, Vol. li. Part 11, No. 4, 1882, contains:—On a new species of Hipparchia from the North-West Himalayas, by Major G F. L. Marshall.—Notes and drawings of the animals of various Indian land mollusca, by Lieut.-Col. H. H. Godwin-Austin (Pl. 5).—Some further results of sun-thermometer observations, with reference to atmospheric absorption and the supposed variation of solar heat, by H. F. Blanford.

THE *Archives des Sciences Physique et Naturelles* for March contains papers by M. Schneebeli, on the determination of the absolute capacity of some condensers in electromagnetic measurement; by Raoul Gautier, on the great comet of September, 1882; by Dr. Julius Maurer, on the theory of the atmospheric absorption of solar radiation.—M. Casimir de Candolle has an interesting biographical notice of the eminent naturalist Emile Plantamour.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 19.—"On the Limiting Thickness of Liquid Films." By A. W. Reinold, M.A., Professor of Physics in the Royal Naval College, Greenwich, and A. W. Rücker, M.A., Professor of Physics in the Yorkshire College, Leeds.

The previous investigations of the authors have shown that the specific electrical resistance of a soap film thicker than 374×10^{-6} mm. is independent of the thickness, and that the composition of films formed of M. Plateau's "liquide glycérique" may be largely altered by the absorption or evaporation of aqueous vapour which attends even slight changes in the temperature or hygrometric state of the air (*Phil. Trans.* Part II. 1881, p. 447).

In the present paper they describe a modified form of the apparatus which they previously employed. The glass case in which the films are produced is surrounded by water, and additional precautions are adopted for maintaining the aqueous vapour within it at the tension proper to the liquid of which the films are formed. These changes have entailed considerable alterations in details, but the main features of the apparatus remain unaltered. The new form, however, possesses the important advantage that the temperature and hygrometric state of the air in contact with the films can be kept perfectly constant during the progress of the experiments. With this apparatus a number of measures have been made of the electrical resistance of films which have thinned sufficiently to show the black of the first order of Newton's rings. To deduce the thickness from the resistance, it is necessary to assume that the specific resistance of the films is the same as that of the liquid in mass. The authors' previous experiments do not enable them to assert the truth of this assumption for such thin films, and it was therefore important to ascertain by an independent method whether it might be taken as approximately true.

For this purpose between fifty and sixty plane films were formed in a glass tube 400 mm. long and 18 mm. in internal diameter. The tube was closed by pieces of plate glass and placed in the path of one of the interfering rays in a Jamin's "interferential refractometer." When the films had become black, a known number were broken by bringing an electromagnet near to the tube and thus moving some sewing needles which had been inclosed along with the films. The mean thickness of the films was deduced from the displacement of the interference "fringes" caused by their rupture.

Two liquids were observed, viz. M. Plateau's "liquide glycérique," and a soap solution containing no glycerine. The following are the means of the various groups of observations:—

Liquid.	Method.	Mean thickness in terms of 10^{-6} mm.
"Liquide glycérique" ...	Electrical... ...	11·9
	Optical	10·7
Soap solution	Electrical... ...	11·7
	Optical	12·1

The agreement between these numbers is sufficiently close to make the fact that they are approximately correct unquestionable, and to prove that the mean thickness of a black film is nearly the same for both liquids.

The electrical observations afford a means of comparing the thicknesses of different black films and observing whether or not the thickness of the black portion of any particular film alters as its area increases. The results obtained in the paper and in a previous preliminary investigation on the same subject (*Proc. Roy. Soc.*, 1877, No. 182, p. 334) are summed up by the authors as follows:—

(1.) Persistent soap films which thin sufficiently to exhibit the black of the first order of Newton's rings invariably display an apparent discontinuity in their thickness at the boundary of the black and coloured portions.

(2.) The whole of the black region, at the time of or very soon after its formation, is of uniform thickness.

(3.) This thickness remains unaltered in any film, whether the coloured parts of the film are thinning or thickening, increasing or diminishing in extent.

(4.) It is different for different films, but no connection has been traced between its magnitude and the time which elapses between the first formation of the film and the first appearance of the black, or between either of these and the time of observation.

(5.) The mean values of this thickness are the same to within a fraction of a millionth of a millimetre, whether the films are plane or cylindrical, in contact with metal or with glass, formed of soap solution alone, or with the addition of more than two-fifths of its volume of glycerine.

(6.) Two totally independent methods of measuring the thickness of the black portions of the films give completely concordant results.

(7.) The mean value of the thickness calculated by giving equal weight to the results of the electrical and optical experiments is $11{\cdot}6 \times 10^{-6}$ mm. The extreme values formed were $7{\cdot}2 \times 10^{-6}$ and $14{\cdot}5 \times 10^{-6}$ mm.

The smaller of these quantities is therefore a limiting thickness to which a soap film in air saturated with the vapour of the liquid from which it is formed rarely attains, and below which none of the films observed by us have thinned.

Linnean Society, May 24.—Anniversary Meeting.—Sir John Lubbock, Bart., president, in the chair.—Mr. R. McLachlan read for the Audit Committee the statement of receipts and payments for the year; 750*l.* had been invested, and a balance at banker's (April 30) remained of 514*l.* 8*s.* 7*d.*—The Secretary (Mr. B. D. Jackson) read his annual Report. Since the last anniversary 11 Fellows and 1 foreign member had died and 11 withdrawn, while 54 new Fellows had been elected. Between purchase, exchange, and donations, 407 volumes and 442 separate parts had been added to the library.—Mr. G. J. Romanes, on behalf of the subscribers, formally handed over the portrait of Charles Darwin, painted by Mr. J. Collier, its exhibition at the Royal Academy last year having then prevented its presentation.—A bust of the late Prof. Louis Agassiz by the American sculptor, Mr. Hiram Power, was handed over by Prof. Allman to the Society as a present from the sculptor's son, Mr. H. Power of Florence.—An engraving from Gainsborough's painting of the old English naturalist, Mr. Thomas Pennant, was presented by Mr. Howard Saunders in the name of Mrs. Alston, as a bequest from her son, the Society's late secretary, Mr. E. R. Alston.—The President then delivered his anniversary address, commenting generally on the events of the past year, with special reference to their bearing upon the Society; in congratulating

the Society on its annual balance-sheet, he reminded the Fellows that, besides investments, the property of the Society might be valued at 25,000*l.*, or a total of 30,000*l.*; he alluded to colonial Fellows and the good work they are doing, incidentally referring to the British Association meeting in Canada in 1884. Reference was also made to the progress of rearrangement of the Biological Collections in the Natural History Museum at South Kensington; this was followed by reports on the various botanical and zoological publications issued at home and abroad during the last twelvemonth. Remarks were made on the stock of the Society's Journals and Transactions, also on the purchase of a portrait of Jacob Bobart (1598–1679), and the President himself presented a valuable portrait of Linnæus painted from life, by the Swedish Magnus Hollman.—A resolution was unanimously accorded by the Society, at the instance of the Chair, to Mr. G. Bentham and Sir J. D. Hooker on the completion of their great work, the "Genera Plantarum."—The scrutineers having examined the ballot, then reported that Mr. Thomas Christy, Mr. H. E. Dresser, Mr. G. Murray, Mr. H. Saunders, and Mr. H. T. Stainton had been elected into the Council in the room of Mr. H. W. Bates, Mr. G. Busk, Mr. C. B. Clarke, Sir John Kirk, and Mr. R. McLachlan, who retired; and for officers, Sir J. Lubbock as president, Mr. Frank Crisp as treasurer, and Mr. B. Daydon Jackson and Mr. G. J. Romanes as secretaries.

Physical Society, May 26.—Prof. Clifton in the chair.—Mr. G. Griffith read a paper on the graphical representation of musical intervals, in which he gave an account of previous attempts to represent musical intervals in a graphical manner, and exhibited an enlargement of a diagram published by Dr. Pole in Sir F. Ouseley's "Treatise on Harmony." In this diagram the musical intervals contained in one octave are represented by the differences between the logarithms of the vibration-numbers forming them. Mr. Griffith proposes to apply this principle to the whole musical scale. Retaining the lines used in ordinary music he inserts a faint line between these at unequal distances to represent the tones and semitones. Several diagrams were exhibited, in which the principle was applied to the representation of intervals to the sequence of the keys in the major diatomic scale, and to actual music. Mr. W. G. Blakely and Dr. Coffin considered that it would be a great help to students to have the method proposed. Mr. Blakely considered that it combined the advantages of the tonic solfa and ordinary notations. Dr. Coffin thought that it might become generally used.—A paper by Dr. J. Fleming on a phenomenon of molecular radiation in incandescent lamps. When the carbon filament in an Edison lamp volatilises, the vapour is condensed on the glass in a cloud. When the copper electrode is volatilised, the copper is likewise deposited, but there is a bare space or line left on the glass in the plane of the filament, forming as it were a shadow of the filament. Dr. Fleming explains this on the supposition that the copper particles are thrown off in straight lines, as in a Crooke's vacuum. This shadow is not noticed in the carbon deposits. Dr. Fleming also remarks that the colour of a thin copper couch is the same as a thin layer of gold in transmitted light.—Mr. W. Baily read a paper on an illustration on the crossing of rays. He took the case of three rays of homogeneous light of the same intensity, and parallel to one plane, and polarised so that the vibrations were also parallel to the plane, and he exhibited and explained diagrams showing the motion which would occur under the circumstances.—Prof. F. Guthrie exhibited one of Chladin's plates bearing a striking re-emblance to one of these figures. Mr. Baily thought the analogy might be a real one.—Prof. Clifton described an improvement which he had made in the glass insulating stem he had exhibited to the Society on a former occasion. This stem had a glass cup encircling it, and of a piece with the stem. Sulphuric acid was put into the cup. The new pattern had a hole formed into the bottom of the cup, and the upper part of the stem fitted into this hole like a stopper. It could thus be removed at will and the acid renewed. Prof. Ayrton stated that he had used a similar arrangement for nearly two years, a narrow necked glass bottle taking the place of the cup.—[In the report of the Physical Society for April 28 (p. 47), Mr. H. R. Droop's name was written *Troop*.]

Entomological Society, May 2.—J. W. Dunning, M.A., F.L.S., &c., president, in the chair.—The President said: "You scarcely need to be reminded that we this day complete the fiftieth year of our existence. It was on May 3, 1833, that nine gentlemen—Messrs. Children, J. E. Gray, G. R. Gray, Hope, Horsfield, Rudd, Stephens, Vigors, and Yarrell—met and resolved to found the Entomological Society of London. No time was lost; for on the 22nd of the same month the first general meeting was held at the Thatched House Tavern, the Rev. Wm. Kirby was chosen Honorary President, 103 Members were enrolled, and a Council of thirteen were chosen to complete the organisation of the Society and prepare rules for its government. Rooms were taken at No. 17, Old Bond Street, and on November 4, 1833, under the presidency of Mr. Children, the then Secretary of the Royal Society, a code of by laws was adopted and our first scientific meeting was held. Of the original Members six, and six only, still survive—Prof. C. C. Babington, the Rev. Leonard Jenyns (now Blomefield), Sir Sidney S. Saunders, Mr. W. B. Spence, Mr. G. R. Waterhouse, and Prof. Westwood. Of these Mr. Waterhouse has the additional distinction of having been one of the original Council, and the first Curator of the Society. Our meetings continued to be held at 17, Old Bond Street, from 1833 until 1852, when we removed to No. 12, Bedford Row; during nine sessions commencing in 1866, by the kindness of the Linnean Society, we assembled in Burlington House, but our library remained in Bedford Row. In 1875 the library and place of meeting were again united in this house; and though the building operations now in progress have prevented us from indulging in any celebration of our jubilee, we shall soon be in the enjoyment of improved accommodation, and I hope it may be long before the Society has again to change its quarters. At the present moment we have 33 Subscribers and 205 Ordinary Members, making a total of 238 contributing Members. Three years ago I ventured to express from this chair a hope that we might be able to publish a jubilee list of not less than 300 Members. It is not yet too late. And I appeal to each and all of you, gentlemen, to be active in striving to attain this object. 'The Entomological Society of London is instituted for the improvement and diffusion of entomological science.' From first to last this has been our only object. To bring fellow-workers into friendly communication and facilitate the interchange of ideas, to extract the hidden knowledge of secluded students, to provide a library for consultation, to encourage observation and experiment, and to publish the results for the benefit of all whom they may concern—such is our aim, the very reason of our being. And I venture to assert that the Society has succeeded in its object. If any be inclined to doubt, I refer him to the thirty volumes of our *Transactions*, to the *Record of Proceedings* at our more than 600 meetings, as proof of our activity and of the unfailing ardour with which the Society has now for half a century devoted itself to the diffusion of entomological science. I can only regret that by the irony of fate it has fallen to *my* lot to fill the presidential chair on this occasion, when, of all others, it ought to have been occupied by one of the fathers of British entomology. But you have willed it otherwise, and I will bury my regret; nay, it is already swallowed up in the delight I feel at the commission with which I have been intrusted by the unanimous voice of the Council, and I am sure that the proposition I have now to make will meet with your approval, and be carried by acclamation. I have to suggest that Prof. Westwood be made titular Life-President of the Society. There is no man to whom we as a body owe so much. An Original Member, he has never failed us; during the crucial period of our childhood he was the motive power, the life and soul of the Society; for fourteen consecutive years he was Secretary, and for part of that time he was Curator also. The Council has seldom been complete without him; he has been vice-president times without number, and during six years (1851–52, 72–73, 76–77) he was our president. Whilst he resided in or near London he rarely missed one of our meetings; even Oxford cannot keep him away from us; and there is not a single year from first to last that he has not been a contributor to our *Transactions*. From 1827 to the present time his pen and his pencil have never been idle; his papers are scattered broadcast over the scientific publications of this and other countries. Scientific bodies, both at home and abroad, have delighted to do him honour. I do not propose to abdicate the function with which your kindness has invested me. But if it be your pleasure to adopt the suggestion that has been made, I shall be proud to recognise Prof. Westwood as my titular chief, and to yield the chair to him at any of our scientific meetings when we are favoured with his presence. I know no better way of showing that our constancy is equal to his, and that our gratitude is enduring and lifelong. It is a barren title and an empty honour, but it is all that we as a Society can bestow. He has grown gray in our service, and in recognition of his

services, to us in particular and to our science in general, I ask you to confer upon him a title which will be a standing record of the esteem in which we hold him, and which throughout the evening of his days shall assure him of our affectionate respect." The proposal was carried by acclamation, and Prof. Westwood was declared honorary life-pre ident of the Society.

Anthropological Institute, May 22.—Mr. Hyde Clarke, vice-president, in the chair.—Mr. G. P. Rathbone exhibited and described a collection of ethnological objects from Bolivia. —Major H. W. Feilden read a paper on stone implements from South Africa. The specimens exhibited form part of a collection made by the author in Natal, the Transvaal, and Zululand during the years 1881 and 1882. Out of the large number of worked stones and implements that have passed through the author's hands he had seen scarcely any with water-worn edges. It would appear, therefore, that these implements, chiefly made of comparatively soft materials, must have been used and lost in the immediate vicinity where they are now found, and the large numbers found in certain spots seem to indicate settlements on stations at such spots; moreover, the most prolific spots are generally just those which would be most advantageous for procuring game. On the summit range of the Drakensberg and in its rocky kloofs, where game must always have been scarce, stone implements are scarce, if not altogether absent, whilst on the lower levels of the Newcastle district, which even in the memory of middle-aged colonists swarmed with countless herds of antelope, we find abundant traces of the Stone period. The conclusion at which the author arrived was that the users of the stone implements found in the more recent of the superficial alluviums were not separated from the present day by any great lapse of time. On several occasions crystals of quartz were found in company with stone implements in the alluviums, and the author believed that the Stone age people had carried these crystals either as charms or ornaments. Possibly the Stone age existed for a lengthened term in South Africa, and may resolve itself into Palæolithic and Neolithic periods, but at present we have hardly sufficient data at command to enable us to arrive at definite conclusions.—The Rev. C. T. Price read a paper by the Rev. James Sibree on relics of the sign and gesture language among the Malagasy.

Institution of Civil Engineers, May 22.—Mr. Brunlees, president, in the chair. The first paper read was on the Edinburgh Waterworks, by Mr. Alexander Leslie, M.Inst.C.E.—The second paper read was on the waterworks of Port Elizabeth, South Africa, by Mr. J. G. Gamble, M.A., M.Inst.C.E.—The third paper was on the water-supply of Peterborough, by Mr. John Addy, M.Inst.C.E.

PARIS

Academy of Sciences, May 28.—M. E. Blanchard, president, in the chair.—The following papers were read:—General considerations on scientific methods with special reference to the *a posteriori* method of Newton and the *a priori* of Leibnitz, by M. E. Chevreul. The author concludes that the experimental inductive method, as practised by Newton and his successors, is unquestionably the cause of the progress of the physico-chemical sciences, while the absolute *a priori* method, as conceived by Leibnitz, barred the way to all further progress. While Newton sought the proximate cause in order gradually to ascend to a possible first cause, Leibnitz started from the first cause, which for him was everything. The study of the material world accessible to the senses led, according to the German philosopher, to nothing real, while the spiritual world, without parts or dimensions, as represented by monads, numerical unities endowed from their creation with motion, was the object of pure knowledge, that is, of God Himself.—An account of the meteorological station of Aigoual in the Cevennes, where an observatory for the systematic study of atmospheric phenomena is about to be erected, by F. Perrier.—Remarks on the violet sulphate of iridium in the heated state, due apparently to oxidation, by M. Lecoq de Boisbaudran. —On the physical and chemical constitution of the vine-growing lands treated by the method of submersion in the lower Rhone valley and Languedoc, by M. P. de Gasparin.—Experimental researches on the action of various alcohols applied slowly and continuously to the pig, by MM. Dujardin-Beaumetz and Audigé. The alcohols invariably produced sleep, prostration, lassitude, while absinthe gave rise to phenomena of excitation somewhat analogous to epilepsy. During the experiments, begun in June, 1879, and concluded in July, 1882, some of the animals died from the effects of the alcoholic poison, and others were sacrificed in order to study its action on the vital functions. This was in all cases found to be injurious.—Observations on the great comet of September, 1882, made at the Paris Observatory, by M. G. Bigourdan.—On the relations existing between the covariants and invariants of the binary form of the sixth order, by C. Stephanos.—On the relations existing between solar eclipses and terrestrial magnetism, by P. Denza.—Note on the hydrates of baryta, by H. Lescœur.—Constituents of the Montrond (Loire) mineral water, by M. Terreil.—On some combinations peculiar to the kreatine and kreatinine groups of substances, by E. Duvillier.—On the fermentation of bread-stuffs, by M. Chicandard. —On some features in the structure of the placenta of the rabbit, by M. Laulanié.—On the origin of the follicular cells and of the ovula in Ascidians and other animals, by M. H. Fol. The author considers that these cells are genetically the strict homologues of the spermatoblasts in zoosperms, while the ovula itself corresponds to the polyblast or male ovula of Duval.—On the formation of the cystoliths and their reabsorption in plants, by M. Chareyre.—On the shingle, sand, and mud formations along the beach of geological seas, by M. Stan. Meunier.—Fresh observations on the dimorphism of the foraminifera, with four illustrations, by MM. Munier-Chalmas and Schlumberger.—On a saccharine substance extracted from the lungs and phlegm of consumptive patients, by M. A. G. Pouchet.—On condiments, especially salt and vinegar, studied from the point of view of their influence on the digestion, by C. Husson. The author's experiments confirm the conclusions of Wurtz, Dumas, Béclard, Claude Bernard, and others, that taken moderately these condiments are useful, especially in stimulating the formation of the gastric juice. In excess they render the food more indigestible, and are irritating to the coats of the stomach. The proportion of salt should not exceed 5 or 10 grams to 0·5 kilograms of meat; of acids 1 to 4 per 1000.

CONTENTS

	PAGE
Wiedemann's "Electricity"	121
Flora of Hampshire. By James Britten	122
Letters to the Editor:—	
On Real and Pseudo-Reversals of Metallic Lines.—Prof. W. N. Hartley	123
The Northern Zoogeographical Regions.—Prof. Theo. Gill	124
Deductive Biology.—William White	124
Science and Art.—Dr. John Rae, F.R.S.	125
Transit Instrument.—Latimer Clark (*With Diagram*)	125
Sea-Shore Alluvion, Dungeness.—J. B. Redman	125
Sheet Lightning.—N. W. Taylor	126
Curious Nest-building—"Scarecrows.—M.	126
Ground Ivy.—S. S. Dowson	126
Meteor.—A. Hall	126
Recent Ornithological Works. By R. Bowdler Sharpe	126
The Aurora Borealis, III. By Prof. Selim Lemström (*With Diagrams*)	128
Historical Notes in Physics. By Prof. Silvanus P. Thompson (*With Illustrations*)	130
Squalls. By Rev. W. Clement Ley	132
Notes	133
Local Scientific Societies. By Francis Galton, F.R.S.	135
The Royal Observatory	136
On the Dark Plane which is Formed over a Heated Wire in Dusty Air. By Lord Rayleigh, F.R.S. (*With Diagram*)	139
On the Morphology of the Pitcher of "Cephalotus follicularis." By Prof. W. C. Williamson, LL.D., F.R.S. (*With Illustrations*)	140
University and Educational Intelligence	141
Scientific Serials	141
Societies and Academies	142