after doing much good work, but Sir William MacGregor has been very active in opening up British New Guinea.

Reference was also made to the progress of the hydrographic surveys in different parts of the world.

In the evening the anniversary dinner of the Society took place at the Whitehall Rooms, Hôtel Métropole, and was attended by a large gathering of Fellows, with many of the leading scientific men and members of the Diplomatic Service as guests. The President occupied the chair. A clever speech was delivered by Mr. Whymper, in response to the toast of "The Medallists." Mr. Bryce, Colonel Maurice, Prof. Flower, Mr. W. T. Thiselton Dyer, and Mr. Norman Lockyer responded to the toast of "The Allied Sciences and Sister Departments."

TRANSFORMERS.[1]

ALTHOUGH transformers are in constant use for changing alternating currents of electricity from high to low or from low to high potential, exact calculations concerning them have hitherto been looked upon by scientific men as impossible because of the complicated law of magnetization which must subsist in iron. Calculations on the assumption of constant magnetic permeability were thought to be worthless, therefore, although these were the only ones which could be made. Certain graphical methods of representing what occurred were, however, based upon the constant permeability hypothesis, and although such graphical methods could only be useful in illustrative work, they were thought to be accurate enough when great accuracy was impossible. The absence of a theory was supplied by vague statements regarding the effects of hysteresis; and the cycle of magnetization being supposed to be exactly the same, however rapidly performed, and Foucault currents being ignored, it was possible for any writer to get his literature on this subject published and read and commented upon.

Prof. Perry has for a long time preached the doctrine that the only theory of the transformer that can be carefully worked out—namely, that in which hysteresis is ignored—ought to be worked out and compared with experimental results; and he insisted that when the known phenomena of magnetic leakage and slight saturation and Foucault currents are taken into account, the results of this theory explain all observed experimental results.

In the present paper he takes up the general case of a transformer with many primary and secondary circuits with magnetic leakage, Foucault currents, choking coils and condensers in series with or in parallel to any or all the circuits. He clears away much of the old difficulty by proving that, in all calculations except that of the idle current supplied to an unloaded transformer, in all practical cases, exactly the same answers are obtained, to four significant figures or more, whether we assume the most complicated of hysteresis cycles or whether we assume the very simplest, which is that of constant permeability. It is, for example, interesting to observe that a formula never hitherto published as correct, often enough used by manufacturers as sufficiently correct for practical purposes, is really a very correct formula. It is also shown that the mathematical difficulties introduced by condensers and magnetic leakage efface themselves completely now that the complete problem has been attacked, and that the numerical working out of the most complicated cases is a very simple matter.

The one problem on transformers in which it is necessary to consider the law of magnetization of the iron—namely, the calculation of the idle current when the transformer is unloaded—is solved by the author in general terms, and he gives a simpler solution, which in his opinion agrees with all experimental results, although it assumes that there is no hysteresis in the iron.

SCIENTIFIC SERIALS.

THE only important paper in the *Nuovo Giornale Botanico Italiano* for April is an elaborate one by Signor G. Paoletti on the movements of the leaves of *Porlieria hygrometrica*. The structure of the plant is described in detail, and especially the anatomy of the "motor nodes" of the leaves and of the leaflets. He distinguishes in them two kinds of tissue, a motor system and a passive system. The cause of the movements appears to reside in the protoplasm and in the osmotic properties of the cell-sap. The author is unable to find in the leaves any hygrometric properties, the supposed presence of which was the reason for the specific name of the plant. The paper is illustrated by four plates.

THE greater number of the papers in the 2nd, 3rd, and 4th numbers of the *Bullettino della Società Botanica Italiana* for 1892 are chiefly of local interest to Italian botanists. Among those of a wider scope are the following:—Signor L. Macchiati describes an appearance presented by *Navicula elliptica*, which he considers strongly to confirm Castracane's view of the occasional reproduction of diatoms by internal germs.—Signor P. Pichi gives the results of experiments on the power of the vine to absorp sulphate of copper through the roots as a specific against the attacks of *Peronospora*. Analysis of the ash showed the presence of copper in leaves taken from both the upper and the lower branches.—Signor L. Piccioli gives some details respecting the destruction of plants by different kinds of land and freshwater snails, with the amount which is devoured of different plants. This is generally greater in the spring than in the summer.

IN the *Botanical Gazette* for April, Mr. G. E. Stone describes and figures a self-registering auxanometer, which can be readily constructed, of much simpler construction than those at present in use in botanical laboratories.—Mr. Conway Macmillan offers suggestions as to the classification of the Metaphyta, *i.e.* of the higher forms of vegetable life.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 28.—"On some Phenomena connected with Cloudy Condensation." By John Aitken, F.R.S., F.R.S.E.

This paper is divided into two parts. In Part I. are described the different influences which cause the condensation of a jet of steam when mixing with ordinary air to become more dense than it generally is, and in Part II. certain colour phenomena are described which have been observed when cloudy condensation is made to take place under certain conditions.

PART I.

Steam Jets.

It had been previously shown that when a jet of steam is electrified the condensation suddenly becomes very dense. In addition to electrification, it is found that this change in the appearance of the jet may be produced by other four causes. These five influences are: 1st, electricity; 2nd, a large number of dust particles in the air; 3rd, cold or low temperature of the air; 4th, high pressure of the steam; and, 5th, obstructions in front of the nozzle, and rough or irregular nozzles.

1st. *Electrification.*

It is shown that the mere presence of an electrified body has no influence on the steam jet. In order to produce the increased density the water particles in the jet must be electrified, either by direct discharge, or by an inductive discharge, effected by means either of a point or a flame.

The increased density produced by electrification is due to an increase in the number of water particles in the jet, by the electrification preventing the small drops coming into contact by their mutual repulsions, in the same manner as the water drops in Lord Rayleigh's experiments with water jets, which scatter more when electrified than when not electrified. The coalescence of the drops in water jets takes place only under the disturbance produced by the presence of an electrified body, while such a disturbance produces no effect on steam jets.

Other experiments point to the conclusion that the increase in the density is due to an increase in the number, and not to an increase in the size, of the drops. For instance, if steam is blown into a receiver full of air in which there are many nuclei, the condensation is dense, and, if there are few nuclei, the clouding is thin. The same holds good for the clouding produced by expanding moist air. If many dust particles be present, the clouding is dense; if few, it is thin. The action of the electricity does not seem to be positive, as it has no effect on a mixture of hot moist air and cold air. It seems rather to

[1] Abstract of a paper read at the Royal Society, May 12, by Prof. Perry, D.Sc., F.R.S.

prevent something which takes place in the jet under ordinary conditions. The particles in a jet being in rapid movement, there are frequent collisions, and consequent coalescence of the drops, but when the particles are electrified they repel each other, and coalescence is prevented.

The jet on becoming dense emits a peculiar sound, which is the same whatever be the cause of the increased density. But, when electrified, along with this sound there is another, due to the discharge of the electricity, which causes the electrified jet to appear to make a louder noise. The jet, instead of changing suddenly in appearance when electrified, may be made to change very gradually, either by electrifying it by means of a very sharp point, or by aiding the discharge by a flame. Under these conditions, the jet emits only the sound produced when dense from any of the other causes.

2nd. *A Large Number of Dust Particles in the Air.*

Flame has not been found to have any influence on the steam jet, but on bringing the products of combustion to the jet, it at once becomes dense, and remains dense so long as the supply is kept up, and the jet has exactly the same appearance as if electrified. When in this condition electricity does not increase its density any further. The increased density is here due to the large number of dust nuclei, causing a great increase in the number of water drops, and these being very small, they will have less independent movement, and therefore fewer collisions, and the reduction in number from this cause will therefore be very slight.

3rd. *Low Temperature of the Air.*

When a steam jet condenses in air at ordinary temperatures it has but little density, but, if the open end of a metal tube cooled to 45° be held near the origin of the jet, the condensation at once becomes dense, and neither electrification nor an increased supply of nuclei makes it any denser. In a room at a temperature of 46° the jet is always dense, and neither electricity nor the products of combustion have any effect on it, but when the temperature rises to 47° the jet begins to get a little less dense, and electricity now increases its density slightly. At 50° the jet is much thinner, and both electricity and the products of combustion have a marked effect on it. The change produced by the cold air cannot be entirely due to the lower temperature causing more vapour to be condensed, as the fall of temperature is slight, while the increase in density is great. The increased density is shown to be due to a change which takes place in the films of the small drops with the fall of temperature. When the temperature is above a certain point, the films have no repulsive action, and the drops coalesce on collision; whereas when cooled below a certain temperature the well-known repulsion comes into play and prevents coalescence. This was proved by repeating Lord Rayleigh's experiments with water jets. When the temperature of the water was over 160°, the drops had no tendency to scatter, and the presence of an electrified body had no influence on the jet. It was only when the temperature fell that the scattering began, and the electrical disturbance produced coalescence. The effect of the low temperature is the same as that of electrification: both of them prevent the water drops coming into contact, one by electrical repulsion, and the other by the repulsive action of the water films, and the result is the same—namely, an increase, or rather a prevention of the decrease, in the number of the particles, and a consequent increase in the density of the clouding.

4th. *High Pressure of the Steam.*

Below a temperature of 46° the jet is dense at all pressures, and as the temperature rises the density decreases, but the density may be made to return by increasing the pressure. The increased density of the high-pressure steam jet is due to an increase in the number of drops produced, (1) by the jet being more cooled by the greater amount of air taken into it; (2) by a larger supply of dust nuclei; and (3) owing to the rate at which the condensation is made to take place, a larger number of dust particles are forced to become centres of condensation.

5th. *Rough Nozzles and Obstruction in Front of the Nozzles.*

Rough nozzles and obstruction in front of the nozzle are found to act in the same way as increase of pressure: they aid pressure in producing its effects with a less velocity of steam. They act by producing eddies, which mix more air with the steam, so lowering the temperature of the jet, increasing the number of dust nuclei, and quickening the rate of condensation.

The seat of sensitiveness to all these influences causing the condensation in the jet to become dense is near the nozzle. Both low temperature and obstructions have an effect only when they act very close to the nozzle; while electricity and increase in number of nuclei have a slight, but rapidly diminishing, influence to a distance of 3 or 4 cm. from the nozzle.

PART II.

Colour Phenomena connected with Cloudy Condensation.

The manner in which cloudy condensation changes after it is formed is pointed out, and it is also shown that the number of dust particles which become centres of condensation depends on the rate at which the condensation is made to take place, slow condensation producing few water particles and thin clouding, while quick condensation produces a large number of water particles and dense clouding. It is only when the dust particles are few that all of them become active centres of condensation.

Colour Phenomena in Steam Jets.

Colour has been seen by Principal Forbes and others in the steam escaping from engine boilers, but these colour phenomena have as yet been but little studied. For observing the colour in steam jets, the author has found it to be a great advantage to inclose the jet in a tube, and examine the effect through some length of condensing steam. Steam by itself has no colour in moderate lengths, but when mixed with a certain amount of cold air, and a certain quantity of dust, very beautiful colours are produced. A jet of steam is allowed to blow into the open end of a tube, and the amount of dusty air entering with it is regulated to the necessary amount. When the jet is condensing under ordinary conditions, the colour of the transmitted light varies from greens to blues of various depths, according to the conditions. The colour may be made very pale or extremely deep by varying the conditions. If the condensation in the jet be made to change and become dense by any of the influences already mentioned, the colour changes, and generally becomes of a yellowish-brown.

This yellow colour, seen through steam when the jet is electrified, has been previously observed. It was thought that the colour was due to the electricity, and that the experiment explained the lurid colour of thunder-clouds. There does not, however, seem to be any connection between the electrification and the colour, as the transmitted light becomes of the same lurid hue when the jet is made dense by any of the other influences.

The yellow colours seen through steam are not generally so fine as the greens and blues, but when the density is due to high-pressure steam the yellow is very fine.

Colours in Cloudy Condensation produced by Expansion.

No colours had been previously seen in the light transmitted directly through the clouded air produced by expanding saturated air in a receiver. It was thought this was due to the slowness with which this process is generally made to take place in the expansion experiments. On arranging an experiment to make the rate of condensation quick, beautiful colours were seen on looking through the clouded air. An air pump was connected with a metal tube provided with glass ends. The capacity of the tube was small compared with the capacity of the receivers usually used in these experiments. When the air in the tube was suddenly expanded, the light passing through it became beautifully coloured, and the colour, and the depth of the colour, varied with the conditions. With few dust particles in the air, a slight expansion made the transmitted light blue; a greater expansion changed it to green, and then to yellow; and when the expansion was still further increased the colour changed, and a second blue made its appearance, followed by a second green and yellow. But, if very many particles were present, the same amount of expansion which produced the second yellow only gave a very deep blue. When it is desired to produce these colour phenomena on a large scale a vacuum receiver is used. This receiver is connected with the experimental tube or flask by means of a pipe fitted with a stop-cock. After a partial vacuum has been made in the receiver, the connection between it and the flask or tube in which the colours are to be shown is suddenly opened, when the colour-producing condensation is produced. These colour phenomena fade rapidly, owing to the differentiation which takes place in the water drops.

The spectroscope shows that when the light is blue there is a general darkening of the whole spectrum, but the absorption is greatest in the red end, and the red end is also much shortened. When the transmitted light was yellow, the blue end was cut out, and the yellow part was much the brightest.

The Cause of the Colour.

In the steam jet when condensing dense some of the yellow colour in the transmitted light is due to some of the particles being so small that they reflect and scatter the blue rays. This blue reflected light is polarized. The colours, however, seem in most cases to be produced in the same manner as the colours in thin plates; only a few of the colours of the first order or spectrum are visible, whilst those of the second and third orders are very distinct.

A "Green" or "Blue" Sun.

It is thought that these phenomena give the explanation of the "green" or "blue" sun seen in India and elsewhere in September, 1883, and also on other occasions. The eruption of Krakatão had taken place a few days before the green sun was observed in India. The volcano threw into our atmosphere a great quantity of water vapour, and a vast amount of dust, the very materials necessary for producing a green sun by small drops of water. Prof. C. Michie Smith's observations made in India show that there was a great amount of vapour present in our atmosphere at the time, and most observers frequently refer to a fine form of haze which covered the sky on the days the green sun was seen. It is therefore in the highest degree probable that, under the conditions existing at the time, this haze was greatly composed of water.

A New Instrument for Detecting Dust-polluted Air.

The colour phenomena produced when air is suddenly expanded has led to the construction of a new instrument for indicating roughly the amount of dusty pollution in the air. This instrument has been called a "koniscope," and it is hoped it will be found useful for studying sanitary questions. The instrument consists simply of an air pump and a tube provided with glass ends. The air to be tested is drawn into the tube, where it is moistened and expanded. The depth of colour seen on looking through the tube indicates the amount of impurity in the air. With about 80,000 particles of dust per cubic centimetre the colour is very faint; 1,500,000 gives a fine blue; while 4,000,000 gives an extremely dark blue. These colours are for an instrument having a tube half a metre long. By means of this instrument it is easy to trace the pollution taking place in our rooms by open flames and other causes. We can trace by means of it the pure and impure currents in the room, and note the rate at which the impurity varies.

May 5.—"The Potential of an Anchor Ring." By F. W. Dyson, Fellow of Trinity College, Cambridge. Communicated by Prof. J. J. Thomson, F.R.S.

In this paper the author develops a method of dealing with physical questions connected with anchor rings. He applies it

(1) To find the potential of a solid anchor ring at all external points. The result is obtained in a very convergent series of integrals, each of which may be reduced to elliptic functions. The equipotential surfaces are drawn, when the ratio of the radius of the generating circle to the mean circle of the ring is $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}, 1$.

(2) The density, at any point, of a ring charged with electricity is found; and the charge is calculated.

(3) The velocity potential of a ring moving in an infinite fluid is found, the kinetic energy calculated, and a few cases of motion discussed.

(4) The annular form of rotating fluid is considered, and the form of the cross-section determined. The cross-section even for large rings is, roughly, of an elliptic shape; the minor axis being parallel to the axis of revolution of the annulus.

May 12.—"On the Embryology of *Angiopteris evecta*, Hoffm." By J. Bretland Farmer, M.A., Fellow of Magdalen College, Oxford. Communicated by S. H. Vines, M.A., F.R.S.

The germination of the spore and the development of the prothallium have been described by Jonkman,[1] who also observed the formation of the sexual organs. The antheridium is formed from a superficial cell of the prothallium, which divides by a wall, parallel to the surface, into an outer shallow cell and an inner cubical cell. The former, by walls at right angles to the free surface, gives rise to the cover-cells; while the inner one, by successive bipartitions, originates the antherozoid mother-cells.

The antheridia are distributed both on the upper and lower surfaces of the prothallium, and apparently without any approach to regularity, though they are somewhat more frequent on the lower surface. I may observe, however, that an antheridium may often occur on the upper surface immediately above an archegonium which has been fertilized.

The archegonia occur exclusively on the lower surface. Their development has been described by Jonkman, who also noticed the division of the neck canal cell, by a transverse wall, into two cells. The division is not, however, invariable, and in one preparation in which the protoplasm had shrunk slightly from the wall, I observed that the cell plate had not extended so as to completely partition the neck passage into two cells.

The oospore, after fertilization, speedily forms an ovoid cellular body, and although I was not so fortunate, owing to scarcity of material, as to see the formation of the earliest cell walls, their succession could be determined with tolerable certainty in the youngest embryo that I met with, consisting as it did of about ten cells.

The basal wall is formed, as in *Isoëtes*, at right angles to the axis of the archegonium. The next one in order of occurrence I believe to be the median wall, which can easily be distinguished, even in advanced embryos, as a well-defined vertical line.

The tranverse wall is much more indefinite, and early loses its individuality owing to the unequal growth of the various parts of the young embryo. The further cell-division is irregular, and to a far greater extent than is the case with the leptosporangiate ferns as described by Hofmeister and Leitgeb.

The anterior epibasal octants together give rise to the cotyledon; the stem-apex is formed, not as in the leptosporangiate ferns, from *one* octant only, but from *both* of the posterior epibasal octants, though one of them contributes the greater portion. The truth of this statement is seen on examining vertical sections through the embryo cut at right angles to the median wall, when a few cells on each side are seen to be clearly marked out, by their dense protoplasmic contents and large nuclei, as meristem cells. There is no single apical cell in *Angiopteris* from which all the later stem tissue is derived, and this fact is, without doubt, to be connected with the character of the apical meristem just described. The root is formed from one of the octants beneath the cotyledon, *i.e.* from an anterior hypobasal one, and is at first indicated by a triangular apical cell, which, in one fortunate preparation, showed the first cap cell. The other octant, together with the two posterior hypobasal octants (which together form the rudimentary foot), round off the base of the embryo. The root presents considerable difficulty in tracing the course of its development, as the apical cell, at no time very clear, is early replaced by two cells. Moreover, the root grows in a somewhat sinuous manner in the embryo, and the cells of its apex may easily be confounded with other triangular cells which occur irregularly scattered in the lower portion of the embryo. It finally emerges, not immediately beneath, nor yet exactly opposite, the cotyledon, but at a distance from it of between one-third and one-half of the circumference of the embryo. The difficulties attending the exact following of its growth, added to the scarcity of the material, have prevented my elucidating completely the details of development, but the important point, that, even before its emergence from the embryo, its apex contains a *group* of initial cells, occupying the place of the single one characteristic of other orders of ferns, can be regarded as established with certainty.

When the embryo has reached a certain size, it bursts through the prothallium; the root boring through below, whilst the cotyledon and stem grow through the upper surface. This manner of issuing from the prothallium at once serves to distinguish *Angiopteris* from those other ferns whose embryogeny is known, and probably the peculiarity of its growth may be reasonably connected with the direction and position of the basal wall which separates the root and short portions of the embryo.

Fresh leaves and roots speedily arise on the young plantlet the second leaf appearing just above the place of exit of the first root—that is, not quite opposite the first leaf. The third leaf rises between the first and second ones, and nearer the first than the second. Their roots observe the same rule of divergence as

[1] "De geslachtsgeneratie der Marattiaceeën," door H. F. Jonkman.

that which obtains in the case of the first root. The stipular structures, so characteristic of the Marattiaceæ, are entirely absent from the first two leaves, but appear in a well-developed condition on the third and all succeeding leaves.

"On the Shoulder-girdle in Ichthyosauria and Sauropterygia." By J. W. Hulke, F.R.S.

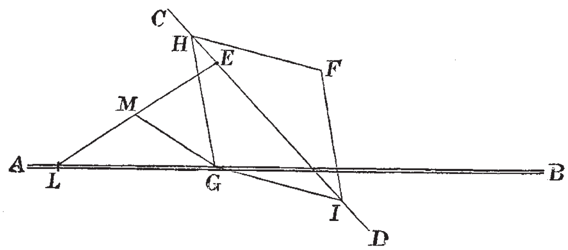
The author discusses the structure of the shoulder-girdle and the homologies of its several parts in these families. He shows that the alleged existence of a precoracoid in the Ichthyosauria rests on an insufficient foundation; offers proofs that in Plesiosauria the anterior ventral ray is not only theoretically but *actually* precoracoid; and also that the dorsal ray in the girdle *is* homologous with the shoulder-blade in Testudinata and other Reptilia.

"On the Development of the Stigmata in Ascidians." By Walter Garstang, M.A.

The author shows that the transverse rows of stigmata, which are present in all the fixed Ascidians, may arise in one or the other of two ways: either as independent perforations, distinct from the first (oozooid of *Clavelina*, buds of *Botryllus*); or as secondary formations, due to the subdivision of a series of primary transverse stigmata on each side (oozooid of *Botryllus*, *Styelinæ*). The former method of development is shown to be a modification of the latter.

The primary transverse stigmata (or "protostigmata") of *Botryllus* and the *Styelinæ* agree precisely with the definitive stigmata of *Pyrosoma* in structure, position, and order of formation. They are accordingly regarded as homologous formations; and the conclusion is drawn that *Pyrosoma* has not been derived from the fixed Ascidians, but represents an ancestral type of Caducichordate Tunicata, antecedent to the whole of the phylum Ascidiacea.

Physical Society, May 13.—Dr. E. Atkinson, Treasurer, in the chair.—Mr. R. Inwards read a paper on an instrument for drawing parabolas. It was designed for drawing curves of short focus such as are required for reflectors and for diagrams of the paths of comets and projectiles. Its construction is based on the fundamental property that every point on the curve is equidistant from the focus and the directrix. In the diagram below, AB is a slot representing the directrix, and FGHI



a rhombus jointed at the corners and pivoted at F, whilst CD indicates a bar capable of sliding through guides at H and I. A rod, LE, is coupled to G by a bar, GM, such that the lengths LM, ME, and MG are equal. As L and G slide along AB, the point E describes a parabola whose latus rectum depends on the distance of F from AB. In the instrument F is carried by a slotted arm so that its position is adjustable. GE is always perpendicular to AB and equal to EF. Prof. Boys inquired whether the instrument could be modified to draw any conic section by arranging that the ratio of EF to EG instead of being unity, might be greater or less than unity. Prof. Perry said an instrument for drawing curves represented by the equation $y = x^n$ was greatly needed for engineering work.—Mr. F. H. Nalder exhibited and described some electrical instruments. The first shown was a ballistic galvanometer with one pair of coils, the distinguishing features of which were accessibility, small damping, great sensitiveness, and the arrangement of the control. The control is effected by a "tail magnet" carried on a horizontal tube supported by a pillar outside the case, as suggested by Prof. R. M. Walmsley. A small magnet on the cover serves for zero adjustment. The suspended system consists of four bell magnets, two being in the middle of the coil and one at top and bottom respectively, arranged so as to be astatic. The sensitiveness of the instrument shown was such that $\frac{1}{4}$ of a microcoulomb gave 300 divisions (fortieths of an inch) when the periodic time was 10 seconds and scale distance about 3 feet. Resistance of galvanometer about 10,000 ohms. To bring the needle to rest quickly, a damping coil mounted on an adjustable stand, and a special reversing key with resistances in its base, are provided. The key has successive contacts arranged so that when pressed lightly, only a weak current passes round the damping coil, whilst when pressed further a much stronger current passes. The strong currents are used to check the large elongations, and the weak ones for finally bringing to zero. A lamp-stand with semi-transparent scale arranged for use with a glow lamp was next shown. Instead of reading by the image of the filament, as is ordinarily done, the lantern is arranged to give a bright disk of light with a black line across the middle. Mr. Blakesley asked if the galvanometer was astatic. For damping non-astatic ones he had found it useful to wind several turns of wire round the bobbin, and put them in series with a few thermo-electric junctions warmed by the hand and a key. In reply, Mr. Nalder said the galvanometer was astatic, but the damping coil could be placed so as to act on one pair of magnets more than on the other. A paper on a portable instrument for measuring magnetic fields, with some observations on the strength of the stray fields of dynamos, by Mr. E. Edgar and Mr. H. Stansfield, was then read. The instrument was described as an inversion of a d'Arsonval galvanometer, for the torque necessary to maintain a suspended coil conveying a constant current parallel to the field gives a measure of the strength of the field. The constant current is furnished by a Hellensen's dry cell which the authors found remarkably constant. The instrument consists of a coil of about fifty ohms, wound on mica and suspended by two German silver strips within a tube. A pointer is fixed to the mica, and a divided head, to which the outer end of one strip is attached, serves to measure the torsion. Within the head chamber is a commutator which automatically reverses the current in the coil when the head is turned in opposite directions from zero. Two readings may thus be taken to eliminate gravity errors due to want of perfect balance in the coil. Means are provided for adjusting and measuring the tension of the suspensions. The constant of the instrument was determined by placing the coil in the field of a Helmholtz galvanometer, and found to be 0·293 per 1°. Any other field is therefore given by $0·293\ (n + 1)\theta$, where θ is the angle of torsion in degrees, and n the multiple of 50 ohms in series with the coil. Fields from 2 or 3 C.G.S. lines upwards can be measured to about 2 per cent. by the instrument, and even the earth's field is appreciable. The authors have tested the fields of dynamos at the Crystal Palace Exhibition and elsewhere, and the results obtained are given in the paper. It is noted that the stray fields of multipolar machines fall off much more rapidly than those of two-pole dynamos as the distances are increased, and that near edges and corners of the magnets the fields are much stronger than near flat surfaces. The disturbing effect of armature reactions on the strength of the stray fields were measured, and the shapes of the fields observed in some cases. Experiments on magnetized watches are described in the paper. Mr. Whipple said the Kew Committee were to some extent responsible for the experiments described, for it was on their account that the investigations were commenced. In connection with the rating of so-called non-magnetic watches, it was necessary to know what strength of fields they were likely to be subjected to. The instrument devised for making the tests was a very interesting one, and the results obtained by it of great value. Mr. A. P. Trotter hoped the authors would supplement their work by tracing out the directions of the fields of dynamos, and he described a simple method of doing this by a test needle used as an india-rubber stamp. The question of watches, he thought, must be considered soon; even non-magnetic watches were stopped by being placed in strong fields, owing to Foucault currents generated in the moving parts. Mr. Blakesley inquired whether the instrument could be used in any position. He thought three observations would be necessary to completely determine any field. Mr. Stansfield, in reply, said they used a pilot needle for showing the directions of the fields, and then placed the coil accordingly. The instrument could be used in any position, for the weight of the coil was only about 2 grammes, and did not greatly alter the tension of the suspensions, which was usually about 300 grammes. A watch with a brass balance was not influenced by a field of 10 C.G.S. lines but seriously affected by one of 40.—Mr. Joseph W. Lovibond read a paper on a unit of measurement of light and colour. The paper was illustrated by many coloured charts, diagrams, and models, and several pieces of apparatus by which colour measurements could be made were shown. The principle of the measurements depends on the selective absorption of the constituents of normal white light by coloured glasses (red, yellow, and blue). The depths of tint of the glasses are carefully graduated to give absorptions in numerical proportions. For example, two equal glasses, each called one-unit red, give the same absorption as a two-unit red, and so on. The units of red, yellow, and blue are so chosen that a combination of one of each absorb white light without colouring the transmitted light. Such a combination is called a "neutral tint unit." By the use of successive neutral tint units, white light can be gradually absorbed without showing traces of colour, and the number of such units required to produce complete absorption is taken as a measure of the intensity or luminosity of the white light. Methods of representing colours by circles and charts were fully dealt with, and the influence of time of observation on the penetrability of different colours was illustrated by diagrams. The results of 151 experiments on colour mixture were explained, and represented diagrammatically. After the reading of the paper the methods used for colour matching and measurement were shown by Mr. and Miss Lovibond.—Mr. R. W. Paul exhibited his improved form of Wheatstone bridge, arranged to occupy the same space, and fulfil the same conditions, as the well-known Post Office pattern.

Chemical Society, April 21.—Prof. A. Crum Brown, F.R.S., President, in the chair.—The following paper was read:—Masrite, a new Egyptian mineral, and the possible occurrence of a new element therein, by H. D. Richmond and Hussein Off. Masrite is the name assigned by the authors to a variety of fibrous alum obtained in Egypt by S. E. Johnson Pasha. It contains from 1 to nearly 4 per cent. of cobalt. This being the first occasion on which cobalt has been met with in Egypt, the authors were led to inquire whether the blue colour used in the paintings on Egyptian monuments contained that element. The samples obtained, however, owed their colour to compounds of copper and iron. The mineral is principally interesting on account of the presence in it of a minute quantity of a substance, the properties of which appear to be unlike those of any known element, which the authors provisionally term masrium, from the Arabic name for Egypt. From an analysis of the oxalate, on the assumption that it is a bivalent element, the atomic weight of masrium is calculated to be 228. The authors point out that there is a vacant place in the glucinum-calcium group of the periodic system for an element having the atomic weight 225. In many of its properties masrium resembles glucinum, and the oxalate is analogous to that of calcium. Masrite has the composition

$$(Al,Fe)_2O_3, (Ms,Mn,Co,Fe)O, 4SO_3, 20OH_2.$$

May 5.—Prof. A. Crum Brown, F.R.S., President, in the chair.—An extract was read from a letter to Sir H. E. Roscoe, written by Prof. Kühne, of Heidelberg, at the request of Prof. Bunsen, expressing his thanks for the address presented to him by the Chemical Society.—The following papers were read:—The existence of two acetaldoximes, by W. R. Dunstan and T. S. Dymond. Acetaldoxime, $CH_3 . CH : NOH$, has hitherto been regarded as a liquid capable of existing in only one form, attempts to obtain evidence of the existence of an isomeride having failed; the authors, however, find that it can be crystallized by cooling. The crystals so obtained are often several inches in length, and melt at 46°·5. On heating them to 100°–150° no decomposition occurs, and the substance boils constantly at 114°·5. If this heated liquid be now cooled, it does not crystallize until nearly 35° below the melting-point of the original substance, and the crystals so obtained become liquid at ordinary temperatures. Many similar observations have been made, and it has been invariably found that on heating the aldoxime the freezing-point is lowered to a greater or less extent. Evidence has in this way been accumulated, showing that a change in the constitution of acetaldoxime occurs when it is heated, the original substance, melting at 46°·5, being gradually converted into a new modification, which melts at 12°. It is noteworthy that the acetaldoxime melting at 12° is slowly reconverted into that melting at 46°·5 on standing at ordinary temperatures. The authors term the substance melting at 46°·5 α-acetaldoxime, that melting at 12° being named β-acetaldoxime. —Sulphonic acids derived from anisoils (No. i.), by G. T. Moody. The author finds that contrary to the statement of Kekulé, and of Opl and Lippmann, anisoil and phenetoil afford only parasulphonic acids on sulphonation. Carefully purified anisoil was dissolved in concentrated sulphuric acid, and the product poured into water, when part of the anisoil was liberated, showing that as in the case of phenol an intermediate compound is formed before the sulphonic acid. The anisoil thus set free was treated with strong sulphuric acid at 80°, when complete sulphonation occurred. The solution yields a well-defined calcium salt; no indications of the presence of an isomeride were found. The calcium, potassium, and sodium salts of the anisoil parasulphonic acid obtained in this way are described, together with the sulphochloride and sulphonamide. Pure phenetoil similarly is shown to yield only the parasulphonic acid. The products of sulphonation, either with sulphuric acid or with chlorosulphonic acid, are in both cases the same, only one sulphonic acid resulting.—The formation of trithionate by the action of iodine on a mixture of sulphite and thiosulphate, by W. Spring. In his paper on the investigation of the change proceeding in an acidified solution of sodium thiosulphate, Colefax credits the author with having stated that trithionate of sodium is produced when iodine acts on a mixture of sodium sulphite and thiosulphate, and further denies that this is the case. The author used potassium salts, and not sodium salts, but, owing to an error in the abstract of Spring's original paper, Colefax was led to believe that sodium salts were used. The difference in the behaviour of the potassium and sodium salts is very striking, and arises from the greater instability of the sodium polythionates already pointed out by the author. Another difference between the two sets of experiments is found in the employment by Colefax of a larger proportion of iodine than that used by the author. The equation

$$K_2SO_3 + K_2S_2O_3 + I_2 = K_2S_3O_6 + 2 KI$$

requires less iodine than would be necessary to oxidize the sulphite to sulphate, and the hyposulphite to tetrathionate of sodium. The author does not, however, contend that the formation of trithionate takes place in accordance with the equation

$$Na_2S_2O_3 + Na_2SO_3 + I_2 = Na_2S_3O_6 + 2NaI.$$

He is convinced that sulphites have the property of desulphurising the tetrathionates, so as to convert them into trithionates. It would hence be more consistent to admit that the sodium sulphite which owes its existence to the employment of a reduced quantity of iodine decomposes the small quantity of sodium tetrathionate produced in the first instance, thus,

$$Na_2S_4O_6 + Na_2SO_3 = Na_2S_3O_6 + Na_2S_2O_3.$$

The statement erroneously ascribed by Colefax to the author seems, in consequence, to be really correct. It is, however, indispensable that the experiments should be performed under exactly the same conditions as those employed in the work on the potassium salts.—The determination of the temperature of steam arising from boiling salt solutions, by J. Sakurai. The evidence now on record as to the temperature of the steam arising from boiling salt solutions is exceedingly unsatisfactory and inconsistent. Such being the case, the author has devised a method for accurately measuring this temperature, and finds that the temperature of the steam escaping from a boiling salt solution is the same as that of the solution. The conditions for success are:—(1) The thermometer used must be kept from contact even with the smallest drops of the solution thrown up by ebullition. (2) The effect of cooling of the thermometer by radiation must be rendered insignificant in proportion to the heating up by the steam. This condition is readily fulfilled by the expedient of combining the introduction of steam from without with the ebullition by the lamp. (3) The walls of the chamber surrounding the thermometer must be sufficiently protected from external cooling, and yet, at the same time, must not be heated to the temperature of the steam. This is effected by jacketing the steam chamber with the vapour evolved from dilute acetic acid boiling at about 2° lower than the salt solution. The agreement between the numbers representing the temperature of the steam and that of the boiling salt solution is good.—Note on an observation by Gerlach of the boiling-point of a solution of Glauber's salt, by J. Sakurai. Some years ago Gerlach stated that the steam escaping from a boiling solution of Glauber's salt containing a crystalline magma of the anhydrous salt indicates a temperature of 100°, whilst the liquid is boiling at 82° or even 72°. The author finds that this is hardly true, for it is only a wet mass of sodium sulphate crystals that is heated. The steam, consequently, does not arise uniformly from the heated mass, but escapes from channels produced in those portions of it which are in contact with the sides of the vessel. The central portion of the magma therefore may be at a low temperature, whilst steam at 100° is issuing from the sides.—Chemistry of the thioureas, Part ii., by E. A. Werner. It is pointed out that the paper recently published by Bertram on the monophenylthioureas was evidently written in ignorance of the fact that the bulk of the work detailed therein has been already published by the author. A number of new derivatives of thiourea are now described.

Geological Society, May 11.—W. H. Hudleston, F.R.S., President, in the chair.—The President announced that a bust of the late Sir Charles Lyell had been kindly presented to the Society by Mrs. Katherine Lyell, through the intermediary of Prof. J. W. Judd, F.R.S.—The following communications were read:—On the so-called gneiss of Carboniferous age at Guttannen (Canton Berne, Switzerland), by Prof. T. G. Bonney, F.R.S. It is stated by Dr. Heim (*Quarterly Journal*, vol. xlvi. p. 237) that the stems of *Calamites* have been found at Guttannen in a variety of gneiss, *i.e.* in one of a group of rocks which exactly "resemble true crystalline schists in mode of occurrence. Petrographically they are related to them by passage rocks; at least the line of separation is not easily distinguished. . . . The Palæozoic formations mostly show an intimate tectonic relation to the crystalline schists, and have been converted petrographically into crystalline schists." The Author describes the result of a visit to the section at Guttannen in company with Mr. J. Eccles (to whom he is greatly indebted for kind assistance), and of his subsequent study of the specimens then collected. The belt of sericitic "phyllites and gneisses," presumably of Carboniferous age, represented on the Swiss geological map (Blatt xiii.) as infolded, at and above Guttannen, in true crystalline gneissoid rocks, is found on examination to consist partly of true gneisses, partly of detrital rocks. The boulder from which the stems in the Berne Museum were obtained belongs to the latter. These rocks sometimes present macroscopically, and occasionally even microscopically, considerable resemblance to true gneisses, but this proves on careful examination to be illusory. They are, like the Torridon Sandstone of Scotland, or the *Grès feldspathique* of Normandy, composed of the detritus of granitoid or gneissoid rock, which sometimes forms a mosaic resembling the original rock, and which has been generally more or less affected by subsequent pressure and the usual secondary mineral changes. Thus, if the term be employed in the ordinary sense, they are no more gneisses than the rocks of Carboniferous age at Vernayaz (Canton Valais) are mica-schists, but in some cases the imitation is unusually good, and, so far as the author saw, there are at Guttannen neither conglomerates nor slates to betray the imposition, as happens at the other locality. The reading of this paper was followed by a discussion, in which the President, Prof. Judd, Mr. Eccles, General McMahon, Mr. Rutley, Prof. Blake, Prof. Bonney, and Prof. Seeley took part.—On the lithophyses in the obsidian of the Rocche Rosse, Lipari, by Prof. Grenville A. J. Cole, and Gerard W. Butler. The rock described in this paper differs in no essential particular from that at Forgia Vecchia, or from the obsidian on the north flank of Vulcano; but the specimens show in a specially striking manner the passage through various stages of lithophysal structure, from indisputable steam-vesicles with glassy walls to typical solid spherulites. A full description is given of the formation of spherulites by a double process—firstly, divergent growth from the margins of vesicles outwards, and secondly, convergent growth inwards from the margins towards the centres of the hollows, until in the smallest cases the fibres from the opposite sides of the vesicle may meet in the centre, producing a spherulite, which, but for the occurrence of intermediate stages, might be supposed to have originated entirely by divergent growth. The authors give details of the appearances presented by intermediate stages of growth. The prevailing type of spherulite, both in Lipari and Vulcano, shows in section a dusky fibrous central area, which may possess concentric as well as radial structure, surrounded by an irregular brown cloudy zone of various width. The authors' studies lead them to the conclusion that this type owes its characters to the dual mode of growth, and therefore to the original presence of vesicles in the rock. Commonly the process of infilling does not go so far as this; on the ends of the felspar fibres plates of tridymite are deposited, and this seems to close the growth. It is clear that the lithophysal structure of the Lipari obsidians was formed during the cooling of the mass, and not by subsequent amygdaloidal infilling of vesicles. The authors discuss the effect of confined vapours on such rocks as those forming the subject of the paper, noting that these vapours may be kept at a high temperature for a considerable time, each vesicle thus becoming a sphere of hydrothermal action; so that if the surrounding glass remains at a temperature little below its fusion-point, crystallization will be promoted in it, and at the same time the action of the vapour in the vesicle will produce reactions on its walls. An appendix, by Prof. Cole, treats of the lithophyses and hollow spherulites of altered rocks. While admitting the presence of true lithophyses in many of the Welsh lavas, he is not prepared to abandon a former suggestion that the interspaces between successive coats of the Conway lithophyses result from alteration of a formerly solid mass. In the lavas of Esgair-felen and near the Wrekin he has no doubt as to the production of "hollow spherulites" by ordinary processes of decay. The typical Continental pyromerides are truly spherulitic, as is much of the Wrekin lava. In the latter case and that of the rocks of Bouley Bay it will be difficult to distinguish between infilled primary and secondary cavities. In the discussion which followed the reading of this paper Prof. Bonney, Prof. Judd, General McMahon, Mr. J. W. Gregory, Mr. Rutley, Prof. Cole, and Mr. G. W. Butler took part.

Royal Meteorological Society, May 18.—Dr. C. Theodore Williams, President, in the chair.—The following papers were read:—Raindrops, by Mr. E. J. Lowe, F.R.S. The author has made over 300 sketches of raindrops, and has gathered some interesting facts respecting their variation in size, form, and distribution. Sheets of slate in a book form, which could be instantly closed, were employed; these were ruled in inch squares, and after exposure the drops were copied on sheets of paper ruled like the slates. Some drops produce a wet circular spot, whilst others, falling with greater force, have splashes around the drops. The same sized drop varies considerably in the amount of water it contains. The size of the drop ranges from an almost invisible point to that of at least 2 inches in diameter. Occasionally large drops fall that must be more or less hollow, as they fail to wet the whole surface inclosed within the drop. Besides the ordinary raindrops, the author exhibited diagrams, showing the drops produced by a mist floating along the ground, and also the manner in which snow-flakes, on melting, wet the slates.—Results of a comparison of Richard's anémo-cinémographe with the standard Beckley anemograph at the Kew Observatory, by Mr. G. M. Whipple. This instrument is a windmill vane anemometer, and is formed by six small wings or vanes of aluminium, 4 inches in diameter, inclined at 45°, rivetted on very light steel arms, the diameter of which is so calculated that the vane should make exactly one turn for a metre of wind. Its running is always verified by means of a whirling frame fitted up in an experimental room, where the air is absolutely calm, and, if necessary, a table of corrections is supplied. The recording part of the apparatus differs entirely from any other anemometer, and is called the anémo-cinémographe, and in principle is as follows:—The pen, recording on a movable paper, is wound up at a constant rate by means of a conical pendulum acting as a train of wheel links, whilst a second train, driven by the fan, is always tending to force it down to the lower edge of the paper; its position, therefore, is governed by the relative difference in the velocity of the two trains of wheel-work, being at zero when the air is calm, but at other times it records the rate of the fan in metres per second. The author has made a comparison of this instrument with the standard anemometer at the Kew Observatory, and finds that it gives exceedingly good results.—Levels of the River Vaal at Kimberley, South Africa, with remarks on the rainfall of the watershed, by Mr. W. B. Tripp. Measurements of the height of the River Vaal have for several years past been made at the Kimberley Waterworks. These gaugings having been placed at the disposal of the Society, the author has compared them with the rainfall of the watershed. There is a marked period of floods and fluctuations at a comparatively high level from about the end of October to the latter part of April, and a period of quiescence during which the river steadily falls, with very slight fluctuations from about April 19 to October 31. The highest flood (525 feet) occurred in 1880, the next highest being 503 feet on January 24, 1891.

OXFORD.

University Junior Scientific Club, May 4.—The meeting was held in the University Museum. In private, business regulations about the "Robert Boyle Lecture" were passed by the Club.—Papers were read on the action of light on metallic iodides, by Mr. Douglas Berridge; on the colours of birds, by Mr. F. Finn; and on Caliche, by Mr. P. Elford.

May 13.—At an open meeting Mr. E. F. im Thurn (Exeter) delivered a lecture on "Primitive Games of the Red Men of Guiana." Prof. Tylor afterwards addressed the Club.—The inaugural "Robert Boyle Lecture" will be given at a *conversazione* on May 27. All old members of the Club are cordially invited.

PARIS.

Academy of Sciences, May 16.—M. d'Abbadie in the chair.—Contribution to the history of silico-carbon compounds, by M. P. Schutzenberger. The compound, SiC, has been produced by long heating of silicium diluted with silica in carbon crucibles. The friable mass is broken up, heated with potash solution, which dissolves out the silicium, and some silica, and then boiled with moderately concentrated hydrofluoric acid, by which all the silica is taken up and silicium nitride is converted into silicium fluoride and ammonium fluoride. The clear green pulverulent residue of SiC is not attacked by potash or by boiling HF; it is infusible, and at a white heat forms SiCO.—On the determination of the density of liquefied gases and their saturated vapours; elements of the critical point of carbonic acid, by M. E H. Amagat. The critical constants for carbonic acid are given as—temp. = 31°·35 C., pressure = 72·9 atmos., density = 0·464.—Observation of the partial eclipse of the moon on May 11–12, 1892, by MM. Codde, Guérin, Nègre, Zielke, Valette, and Léotard.—On the theory of *fonctions fuchsiennes*, by M. L. Schlesinger.—On the relations existing between the infinitesimal elements of two reciprocal polar surfaces, by M. Alphonse Demoulin.—On transformations in mechanics, by M. Paul Painlevé.—The physiological scale of distinct vision, applications to photometry and *photo-esthésiométrie*, by M. W. Nicati.—On a method of separation of xylenes, by M. J. M. Crafts.—Calculation of boiling-points of compounds with simple terminal substitution, by M. G. Hinrichs.—Method for the proximate analysis of chlorophyll extracts; nature of chlorophyllane, by M. A. Étard.—Influence of the nature of the soil on vegetation, by M. J. Raulin.—Presence of fumarine in one of the Papaveraceæ, by M. J. A. Battandier.—On some muscular anomalies in man, by M. Fernand Delisle.—On the apparently teratological origin of two species of *Triclades*, by M. P. Hallez.—On the theory of gills and the parablast, by M. F. Houssay.—The origins of the wing nerve among the Coleoptera, by M. Alfred Binet.—The nervous system of *Nerita polita*, by M. L. Boutan.—On the origin and formation of the chitinous coat of the larvæ of *Libellules*, by M. Joannes Chatin.—On the microscopic structure of ooliths from the *bathonien* and *bajocien* of Lorraine, by M. Bleicher.—The odoriferous properties of alcohols of the fatty series, by M. Jacques Passy. The odoriferous power, as measured by the inverse of the millionths of a gram present in one litre of air when the odour can be just distinguished, increases regularly with the molecular weight.—On the lack of movement of the deep oceanic waters, by M. J. Thoulet.

BERLIN.

Physiological Society, April 27.—Prof. du Bois-Reymond, President, in the chair.—Dr. Boruttau gave an account of experiments made to determine the cause of the difference in latent period observed during the direct and indirect stimulation of muscles, being, as is well-known, greater (with maximal and supra-maximal stimuli) in the latter mode of stimulation. According to some observers the difference is due to the resistance offered by the end-plates, whereas some regard it as due rather to a summation of stimuli during direct stimulation. The speaker had satisfied himself by a careful repetition of the experiments under many varying conditions that the difference is due solely to the resistance of the end-plates. In connection with the above, Prof. Gad pointed out the possible important bearing of the results obtained on the processes which go on in other organs. Thus recent anatomical research has shown that in the central nervous system there is no complete continuity between the axis-cylinders and ganglia, hence the existence of some intermediate structure must be assumed, and a portion at least of the slowing which impulses experience in the central nervous system may be due to the resistance offered by this structure.—Prof. Wolff exhibited a patient in whom the larynx had been completely extirpated some seven months previously, and who was now able, by means of an artificial larynx, to speak quite loud and clearly. Prof. Gad gave an historical account of the construction of artificial larynxes, of the requirements which these instruments must satisfy, and of recent improvements in the cannulæ employed by patients.

Physical Society, May 6.—Prof. Kundt, President, in the chair.—Dr. Gross spoke on the principle of entropy, and criticised several formulæ of Clausius and Zeuner.

[In the reports of the Berlin Scientific Societies, NATURE, vol. xlv. p. 599, *for* Schumbert *read* Schubert, and *for* Lammer and Brodhan *read* Lummer and Brodhun.]

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Genesis I. and Modern Science; Dr. C. B. Warring (New York, Hunt and Eaton).—Analyse des Vins: Dr. L. Magnier de la Source (Paris, Gauthier-Villars).—Tiroirs et Distributeurs de Vapeur: A. Madamet (Gauthier-Villars).—Studies in South American Native Languages: Dr. D. G. Brinton (Philadelphia)—Die Eibe in Westpreussen: H. Conwentz (Danzig, Bertling).—Wood-Notes Wild. Notations of Bird Music: S. P. Cheney (Boston, Lee and Shepard).—Lehrbuch der Botanik, Erster Band: Dr. A. B. Frank (Leipzig, Engelmann)—The Theory of Substitutions and its Applications to Algebra: Dr. F. Netto, translated by Dr. F. N. Cole (Ann Arbor, Michigan, *Register* Publishing Company).—Results of the Meteorological Observations made at the Government Observatory, Madras, during the Years 1851–90, edited by C. M Smith (Madras).—Watts's Dictionary of Chemistry, vol iii, revised, &c., by H. F. Morley and M. M. P. Muir (Longmans).—Practical Enlarging: J. A. Hodges (Iliffe).—The First Principles of Photography: C. I. Leaper (Iliffe).—Smithsonian Report, U.S. National Museum, 1889 (Washington).—Key to J B. Lock's Elementary Dynamics: G. H. Lock (Macmillan).—The Anatomy, &c., of the Blow-Fly, Part 3: B. T. Lowne (Porter).

PAMPHLETS.—On the Organization of Science: A Free Lance (Williams and Norgate).—The Nitrate Fields of Chile: C. M. Aikman.—Sadducee *versus* Pharisee: G. M. McCrie (Bickers).

SERIALS.—Quarterly Journal of the Geological Society, vol. xlviii. Part 2, No. 190 (Longmans).—Engineering Magazine, May (New York).—Himmel und Erde, May (Berlin, Paetel).—Transactions of the Royal Irish Academy, vol. xxix. Part 19 (Williams and Norgate).—Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande, &c.—Achtundvierzigster Jahrgang Fünfte Folge, 8 Jahrg., Zweite Hälfte (Bonn, Cohen).—Bulletins de la Société d'Anthropologie de Paris, tome 2 (1891). 3e. Fasc. (Paris, Masson).—Journal of the Chemical Society, May (Gurney and Jackson).—Institute of Jamaica, Bulletin No. 1, A Provisional List of the Fishes of Jamaica: T. D. A. Cockerell (Kingston).—Rapport Annuel sur l'État de l'Observatoire de Paris, 1891, le Contre-Amiral Mouchez (Paris, Gauthier-Villars).—Indian Museum Notes, vol. ii. No. 5 (Calcutta).—Journal of the Institution of Electrical Engineers, No. 98, vol. xxi. (Spon).—Mémoires de la Société de Physique et d'Histoire Naturelle de Genève, Vol. Supplémentaire, Centenaire de la Fondation de la Société (Genève).

CONTENTS.

	PAGE
Mathematics used in Physics	73
Phases of Animal Life. By **F. E. B.**	74
Our Book Shelf:—	
Hurst: "Silk Dyeing, Printing, and Finishing"	75
Murray: "Phycological Memoirs."—**A. W. B.**	75
Wrightson: "Live Stock"	76
Letters to the Editor:—	
Lord Kelvin's Test Case on the Maxwell-Boltzmann Law.—**Edw. B. Culverwell**	76
Poincaré's Thermodynamics.—**Prof. Poincaré; P. G. T.**	76
Land and Freshwater Shells Peculiar to the British Isles.—**T. D. A. Cockerell**	76
The Former Connection of Southern Continents.—**T. Mellard Reade**	77
The Lesser Spotted Woodpecker.—**Albert C. Mott**	77
The God of the Ethiopians.—**W. Hammond Tooke**	78
Aurora Borealis.—**Warington Stock**	79
The New Element, Masrium. By **A. E. Tutton**	79
On a New Method of viewing Newton's Rings. (*Illustrated.*) By **T. C. Porter**	80
Jean Servais Stas	81
Notes	83
Our Astronomical Column:—	
Paris Observatory Report	86
Stars with Remarkable Spectra	86
Comet 1892 Swift (March 6)	87
Light Variations of Y Cygni	87
Nebulæ	87
Anniversary Meeting of the Royal Geographical Society	87
Transformers. By **Prof. Perry, F.R.S.**	90
Scientific Serials	90
Societies and Academies	90
Books, Pamphlets, and Serials Received	96