Mr. S. J. Dickson, says, "From the 9th to the 13th of October, the weather was unusually oppressive with threatening storms, and on the evening of the 13th a heavy storm was seen to be working up from the west accompanied by incessant lightning of every description, and about 8 p.m. it broke over the homestead in all its fury, the wind was from south-west and of terrific force, and the rain and hail were very severe. The hailstones were as large as hen-eggs, and in some of the paddocks, one particularly, it pounded the herbage completely out, so that not a vestige of it was left, although before the storm came on it was from six to twelve inches high, and in other places strong variegated thistles three to four feet high were beaten down. Trees some two feet thick, that the wind could not tear up by the roots, were snapped off short as if made of matchwood. In the storm the hail killed birds innumerable, and even domestic fowls roosting on the trees were killed by it, and after the storm a large snake was found cut into two pieces by the hail, so at least it appeared. On the open plain the hail laid four to six inches deep, and the whole country looked as if a heavy snowstorm had passed over it. Trees in the track of the hail were completely denuded of leaves, and the bark knocked off tree trunks and limbs. The storm wind carried away outstations, unroofed the hayshed, damaged the woolshed, and carried away two sides of the house-verandah, and the sheets of iron from it were found nearly half a mile (30 chains) away to the north-east, round wall plates in the hayshed six to eight inches thick were broken to pieces, and the iron roofing on all the buildings was battered by the hail as if some one had pounded it with a hammer all over. The storm track was only a mile to a mile and a half wide, at least the hail part. Between 7 and 8 p.m., as the storm came up, there seemed to be a white bow in the sky, like a white rainbow stretching from north to south. I have seen heavy storms before, but I never wish to see another like this. The shearers were completely terrified, and all say that they have never experienced a storm like it, in fact, it beggars description and can hardly be realised. It was an experience that we shall remember as long as we live."

North of Narrabri, and especially between Narrabri and Avondale, the storms were very severe. Midway between these places and at Terry-hi-hi and Berrigal Creek the wind worked great destruction in the forest. How violent it was may be gathered from the fact that great trees twelve feet in circumference at three feet from the ground, were snapped off short ten feet above the ground, or entirely stripped of their limbs.

SCIENTIFIC SERIAL.

American Meteorological Journal, March.—Exploration of the free air, by Prof. M. W. Harrington. The author considers that the conclusions to be drawn from weather maps are nearly exhausted, and that the reason of the imperfection of meteorology is the want of knowledge of what is going on in the free air. Mountain observations give most important results, but they are still surface observations. We know what goes on at the base of a cyclone, but not what occurs at the top. Theories are deduced from cloud observations, but we lack actual knowledge of what is going on above, and the only means available at present is systematic balloon observations. Prof. Harrington thinks that such observations should be provided for by funds from private sources.—The general winds of the Atlantic Ocean, by Prof. W. M. Davis. The basis of this discussion is the "Sailing Directory of the Atlantic Ocean," published by the Deutsche Seewarte, and especially two generalised wind charts contained in the atlas accompanying that work. The author classifies the winds as planetary (due to the earth's rotation and the influence of the sun), terrestrial (the annual migration of the wind belts north and south, and the seasonal variations of velocity and direction), including the interruptions of continents and mountain ranges.—The colours of cloudy condensation, by Prof. C. Barus. The author considers the problems connected with the condensation of water from moist air, and reviews the labours of Mr. Aitken and Mr. Bidwell with reference to the particles of an opaque steam-jet. He also gives a minute description of the apparatus employed in his own investigations.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, March 24.—Prof. A. W. Rücker, F.R.S., President, in the chair.—Several excellent photographs of flying bullets and of the air waves produced by vibrating hammers, were exhibited, the originals of which had been taken by Prof. Mach.—A paper on the differential equation of electric flow was read by Mr. T. H. Blakesley. The object of the paper is to show that the ordinary mathematical expressions for electric flow fail to explain all known facts, and to point out that in order to interpret these facts certain properties of matter not usually recognised must be admitted. The subject is treated both algebraically and geometrically, in the latter case the magnitudes being represented by the projections of the sides of a triangle revolving in its own plane on a fixed line in that plane. Taking the ordinary differential equation for a simple circuit having resistance and self-induction, viz., $V - L\frac{dC}{dt} = RC$, it is shown that this takes no account of any energy except that spent in heating the conductor, and that where radiation into space is concerned, it is necessary to introduce another term λC, where λ is a quantity of the nature of resistance. It is further pointed out that if work be done outside the circuit, the line which geometrically represents the induced E.M.F. cannot be perpendicular to that indicating the current and "effective" E.M.F., the latter term being defined to mean the value of the quantity which is numerically equal to the product of the current into the resistance. A magnetic phase-lag must therefore exist. The author also shows that a magnetic field induced in phase with the magnetic induction would not result in a loss of energy, and no hysteresis could exist. Under the same circumstances there could be no radiation of energy from an alternating magnet. A Leyden jar discharging through a circuit having self-induction is next considered. Taking the ordinary premises, it is shown that no provision is there made for energy radiated into space, and that magnetic lag is necessary for the existence of such phenomena. The differential equations for the variables in condenser discharges according to ordinary assumptions are shown to be of the same form, and the variables can be represented by the projection of the sides of a triangle which is simultaneously undergoing uniform rotation and linear logarithmic shrinking. The rate of shrinking is the same as that of the radius vector of an equiangular spiral of characteristic angle β, where $\cos\beta = \sqrt{\frac{K}{L}\cdot\frac{R}{2}}$; K, L, and R representing capacity, self-induction, and resistance respectively. The equations and their consequences are considered at some length, and several important properties brought out. To allow for radiated energy, R must be virtually increased from R to $R+\lambda$, and the total energy is divided between the circuit and the field in the ratio of R to λ. If, therefore, the circumstances be such that λ is large compared with R, say by having high frequency, the heating of the circuit may only be a small part of the total energy. In this direction the author thinks the true explanation of some of Tesla's experiments is to be found, the energy being expended chiefly in radiation and not in current through the experimenter's body. Prof. Perry thought the C^2R term would not represent the heating of the wire when the oscillations were rapid, owing to the distribution of current not being uniform over the section of the conductor. Maxwell had shown that certain throttling terms had to be considered. In condenser discharges the complete equation would have many terms. Prof. O. J. Lodge said the best definition of R in such case was that derived from Joule's law rather than that of Ohms Frequency was very important in the radiation of energy, but even at ordinary frequencies of alternators some energy was radiated. Referring to Tesla's experiments, he said the reason why no serious consequences followed, was that there was not much energy behind them. High frequency might be instrumental in preventing injury, but this he thought remained to be proved. Dr. Sumpner pointed out that losses other than C^2R (R being the ordinary resistance of the conductor) had to be taken into account. In some cases, such as transformers on open circuit, the effective resistance might be 1000 times that of the coil. To discuss completely the problem taken up by Mr. Blakesley, it would be necessary to take account of non-uniform distribution of current, both across and along the conductor, as well as the character of the magnetic and electric fields surrounding the circuit. Mr. Swinburne thought there was a tendency to over-estimate the rate of high-frequency currents, for unless the coils of transformers were assumed geometrically coincident, calculations were difficult. Errors of hundreds per cent. were quite possible. In Tesla's experiments no great power was involved, for the transformer could not give out any large power. Mr. Blakesley, in reply, said the

term R was such that C^2R represented the whole waste loss in the conductor, whilst λ included everything wasted outside the conductor.—A paper on the viscosity of liquids, by Prof. J. Perry, F.R.S., assisted by J. Graham and C. W. Heath, was read by Prof. Perry. The viscosity was tested by suspending a hollow cylinder within an annular trough containing the liquid, and measuring the torque exerted on the cylinder when the trough rotated at various speeds about its axis. In the paper the equation of motion under the conditions of the experiment is discussed, the error introduced by assuming that the liquid moves in plane layers being shown to be about 0·5 per cent. By measuring the viscous torques exerted with different depths of liquid in the trough, the correction for the edge of the suspended cylinder was found to be 0·8 c.m. On plotting the results obtained with sperm oil at different temperatures and constant speed, a discontinuity was noticed about 40°. For a speed of nine revolutions a minute the viscosity (μ) could be very approximately calculated from the formula $\mu = 2{\cdot}06\ (\theta - 4{\cdot}2)^{-0{\cdot}656}$ below 40° C. and $\mu = 21{\cdot}67\ (\theta - 4{\cdot}2)^{-1{\cdot}349}$ above 40° C., θ being the temperature. Experiments on the change of density of sperm oil with temperature, made by Mr. J. B. Knight, indicated a minimum density about 40°. Subsequent experiments with other samples had not confirmed these observations. The paper contains several tables of the results obtained in various experiments. Those performed at constant temperatures show that for slow speeds the torque is strictly proportional to speed, but afterwards increases more rapidly, probably owing to the critical speed having been exceeded. After concluding the paper Prof. Perry read a letter he had received from Prof. Osborne Reynolds on the subject, who doubted whether the true critical velocities had been reached in the experiments. In the particular arrangement employed, he would expect no critical velocity in the outer ring of liquid, whilst in the inner ring the motion would be unstable from the first. Mr. Rogers pointed out that experiments which corroborated those of Prof. Perry had been made by M. Couette and published in *Ann. de Chim. et de Phys.* [6] xxi.

Geological Society, March 22.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—On the jaw of a new carnivorous dinosaur from the Oxford clay of Peterborough, by R. Lydekker. The author describes a fragment of the left side of a lower jaw of a carnivorous dinosaur from the Oxford clay of Peterborough, indicating a new genus and species, which he names *Sarcolestes Leedsi*. Some remarks were made on this paper by the President and Prof. Seeley.—On a mammalian incisor from the Wealden of Hastings, by R. Lydekker. In this paper a small rodent-like tooth from the Wealden of Hastings, belonging to Sir John Evans, K.C.B., is described. It is probably the front tooth of one of the mammalian genera found in the Purbeck Beds, as may be gathered from American specimens. The reading of this paper was followed by a discussion, in which the President, Sir John Evans, Mr. C. Dawson, Mr. Oldfield Thomas, Dr. Forsyth-Major, Dr. H. Woodward, and the author took part.—On an intrusion of Muscovite-biotite-gneiss in the south-eastern Highlands, and its accompanying thermo-metamorphism, by George Barrow, of the Geological Survey. (Communicated by permission of the Director-General of the Geological Survey.) The area to which this paper refers lies in the north-eastern part of Forfarshire, and is drained by the two Esks. The author first describes the distribution, mode of occurrence, and petrological characters of the intrusive masses. In the north-western portion of the area the intrusive rock is always a gneiss, and occurs in thin tongues which permeate the surrounding rocks. Towards the south-east these tongues amalgamate and form large masses, in which the foliation is less marked. Moreover, in this direction the large masses are often fringed with pegmatite, especially on their southern and eastern edges. Where the rock is a gneiss, it is composed of oligoclase, muscovite, biotite, and quartz, but contains no microcline. As the gneissose character becomes less marked, the oligoclase diminishes in amount, and microcline begins to appear, especially towards the margins of the masses. In the most south-easterly of these microcline is greatly in excess of oligoclase. The differences in structure and composition of these masses are believed by the author to be due to the straining off of the crystals of earlier consolidation during intrusion under great pressure. The still liquid potash-bearing portion of the magma was squeezed out and forced into every plane of weakness in the surrounding rocks; and that portion of it which contained the highest percentage of potash finally consolidated as pegmatite. Special attention is directed to the distribution of pegmatite. This rock is widely distributed in the Southern Highlands, and cuts across every known system of folding. It is consequently newer than any member of the metamorphic series. The surrounding metamorphic schists are next dealt with. These are remarkable for their highly crystalline condition, and also on account of the presence of many minerals known to occur in regions where thermo-metamorphism has taken place. The characters of the more important minerals are described in detail. The rocks of the metamorphoric area become less and less crystalline as they are followed towards the Highland border. Three zones, characterised respectively by the minerals sillimanite, cyanite, and staurolite, have been roughly mapped. The more important rocks found in these zones are described in detail, and evidence is given to show that the boundaries between the zones do not in all cases coincide with the strike of the rocks. Thus, a thin bed of quartzite, which retains its character in consequence of the simplicity of its chemical composition, may be followed through all the zones; whereas the bed adjacent to it is in the outer zone a staurolite-schist, in the intermediate zone a cyanite-gneiss, and near the contact with the igneous rock a coarse sillimanite-gneiss. Evidence is given to show that the original rocks formed a sedimentary series. The phenomena are compared with those of other areas where thermo-metamorphism has taken place; and the conclusion is reached that the differences are of *degree* rather than of *kind*. The special features of the area in question are attributed to the depth at which the change was produced. The paper is illustrated by a map of the district and a table of original analyses. This paper gave rise to a discussion, in which the president, Prof. Judd, Mr. Rutley, General McMahon, Dr. Hicks, Mr. Marr, Dr. Du Riche Preller, Mr. Teall, and the author took part.

Zoological Society, March 28.—Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the chair.—A report was read, drawn up by Mr. A. Thomson, the Society's head-keeper, on the insects bred in the insect-house during the past season.—A communication was read from Mr. Herbert Druce, giving an account of some new species of Lepidoptera Heterocera, chiefly from Central and South America.—Mr. F. E. Beddard, F.R.S., read a paper on the brain of the African elephant. The author gave reasons for disagreeing with some of the conclusions of Dr. Krueg, but confirmed others. The outline is more like that of the carnivorous than the ungulate brain, but the principal furrows appear to be arranged on a plan characteristic of the elephantidæ.—Mr. W. T. Blanford showed that the various names hitherto employed in systematic works for the bird called by Jerdon the Himalayan cuckoo (*Cuculus himalayanus*, *C. striatus*, and *C. intermedius*) belonged to other species. He also gave reasons for not adopting S. Müller's *C. canoroides*, and accepted the term *C. saturatus*, Hodgson, as the correct scientific name.—A communication was read from Mr. F. M. Woodward, entitled "Further observations on the genitalia of British earthworms." This paper chiefly dealt with supplementary gonads which were found to be much more common than had been supposed; in one specimen an hermaphrodite gland was discovered in addition to testes and ovaries.

Entomological Society, March 29.—Henry John Elwes, President, in the chair.—Mr. G. C. Champion exhibited a living specimen of a luminous species of *Pyrophorus*, which had been found in an orchid house in Dorking. It was supposed to have emerged from the roots of a species of *Cattleya* from Colombia.—Mr. A. H. Jones exhibited living full-grown larvæ of *Charaxes jasius*, found by Mr. Frederic Raine, at Hyères, feeding on *Arbutus unedo*.—Surgeon-Captain Manders exhibited a series of *Lycæna theophrastus* from Rawal Pindi, showing climatal variations, the rainy-season form being of darker coloration, and larger than that occurring in the dry season. The ground colour of the former on the under surface was markedly white with deep black striæ; in the latter form the ground colour was distinctly reddish, and the marking reduced to reddish lines. He said that the latter form had been described as *L. alteratus*.—Mr. S. G. C. Russell exhibited a beautiful variety of *Argynnis selene*, taken near Fleet, Hants; two varieties of *A. selene* from Abbot's Wood, Sussex; typical specimens of *A. selene* and *A. euphrosyne* for comparison; and

a remarkable variety of *Pieris napi* from Woking.—Mr. C. J. Gahan exhibited a microscopic preparation of the antenna of the larva of a beetle (*Pterostichus*), for the purpose of demonstrating the sensory nature of the so-called "appendix" of the antenna. Since he wrote a note describing this structure, a short time ago, he found that Prof. Beauregard had already suggested its sensory character, and was inclined to believe that it was an auditory organ.—Mr. H. Goss exhibited a specimen of *Trogus lapidutor*, Grav., believed to have been bred from a larva of *Papilio machaon*, taken in Norfolk by Major-General Carden. Mr. Goss stated that he sent the specimen to the Rev. T. A. Marshall, who said it was a well-known parasite of *P. machaon* on the Continent, but not proved to exist in the United Kingdom.—Mr. F. Merrifield said he knew this parasite, and had bred several specimens of it from pupæ of *P. machaon* received from Spain.—Colonel Swinhoe read a paper, entitled "The Lepidoptera of the Khasia Hills. Part I." A long and interesting discussion ensued, in which Mr. Elwes, Mr. Hampson, Colonel Swinhoe and others took part.—Mr. W. Bartlett-Calvert communicated a paper entitled "New Chilian Lepidoptera."—Mr. J. W. Shipp communicated a paper entitled "On a New Species of the Genus *Phalacrognathus*."

PARIS.

Academy of Sciences, April 4.—M. Lœwy in the chair.—On the construction of the chart of the heavens; numerical application of the method of attaching neighbouring negatives, by M. Maurice Lœwy.—Remarks on M. Joubin's note relating to the measurement of large differences of phase in white light, by M. A. Cornu.—On the approximate representation of experimental functions between given limits, by M. Vallier.—On the benzeneazocyanacetic ethers and their analogues, by MM. A. Haller and E. Brancovici.—Measurement of the parallel of 47° 30′ in Russia, by M. Venukoff. The parallel was measured from the meridian of Kichinev, near the Roumanian frontier, to that of Astrakhan, on the Lower Volga, the difference of longitude being 19° 11′ 55″·11. The measurements gave 1,446,462 m. for the length of the arc, or 75,336 m. per degree of longitude. But this mean value is not everywhere attained. Between Rostov-on-the-Don and Sarepta the geodetic arc exceeds the astronomical one by 15″·26, whilst between Sarepta and Astrakhan the astronomical arc is the larger by 9″·82. This deviation shows a remarkable agreement with that obtained in the measurement of the 52nd parallel and indicates that the plains of Eastern Russia are formed according to the same geometrical law over a vast area. A comparison of the results for the two arcs, with reference to the length of the meridian measured from the North Cape to Dorpat and the Lower Danube, indicates a polar depression of 1 in 299·65, which agrees closely with that found by Bessel for Germany in 1841 (1 in 299·26), but differs from that of Clarke (1 in 293·46).—Condensation experiments of the acetylcyanacetic acids with the phenols, by M. A. Held.—Synthesis of erythrite, by M. G. Griner.—Action of temperature upon the rotatory power of liquids, by M. A. Aignan. Reasoning from the fact that the oxide of isobutylamyl presents a rotatory power which changes its sign at −30°, M. Colson has concluded that "chemical constitution does not appear to be the preponderating factor in the value or the sign of the rotatory power." But the fact referred to can be explained as the effect of the mixture of a negative and a positive rotating substance respectively. A mixture of essence of terebenthine (left-handed) and camphor (right-handed) was dissolved in benzene, and observed through the 20 cm. tube of the polarimeter in different kinds of light. This mixture changed from negative to positive at a temperature between 61° and 73°C. for red light, between 13° and 33° C. for yellow light, and was positive for all the temperatures for green light, the angle of rotation being 2° 24′ at 13°, and 6° 43′ at 90° C. To explain M. Colson's observation, it is not even necessary to assume that the oxide contains two substances of rotatory powers of different signs. It suffices to admit, as has been done in the case of solutions of tartaric acid, that the molecules of isobutylamyl are susceptible of polymerisation in the liquid state, so that the sign of the rotatory power characterising the molecule of the substance is that observed at the higher temperatures.—Neolithic village of the Roche-au-Diable, near Tesnières, canton of Lorez-le-Bocage (Seine-et-Marne), by M. Armand Viré. In the course of excavations in the valley of Lunain a village was discovered of a type not met with up to now. It consists of a series of ground-works of square huts touching each other, and arranged in a line nearly east and west, forming a very regular street. At the end was a sort of square enclosure of stone, measuring about 2·5 by 3 m., with a door towards the south. Inside it presented a circular cavity, 30 cm. in diameter and 20 cm. deep, which still appeared to contain ashes, and whose clay walls were baked to a depth of about 4 cm. Similar hearths have been found among the Kabyles of Algiers. Near this structure was another, of circular form, built of rough blocks of limestone and sandstone, with a triangular door built of two enormous blocks of sandstone, joining at the top, and leaving a space of 50 cm. at the bottom. This hut also showed traces of cooking operations. A little further on came a series of seven similar huts, followed by two larger ones without hearths, and finally two more like the first. The total length of the village was 114 m. All the masonry consisted of blocks of limestone or sandstone, cemented with clay. A large number of stone and flint implements was found, including half a dozen sandstone hatchets, polished or prepared for polishing. The village is, curiously enough, situated at the very bottom of the valley.

BOOKS AND PAMPHLETS RECEIVED.

BOOKS.—Exercises in Euclid: W. Weeks (Macmillan).—Electrical Tables and Memoranda: S. P. Thompson and E. Thomas (Spon).—Popular Lectures on Scientific Subjects: H. von Helmholtz, 2 vols. new edition, translated by E. Atkinson (Longmans).—Aids to Biology: J. W. Williams (Baillière).—Statics and Dynamics: E. Geldard (Longmans).—Map of River Basins: C. E. De Rance (Manchester, J. E. Cornish).—Telephone Lines and their Properties: W. J. Hopkins (Longmans).—The Birds of Derbyshire: F. B. Whitlock (Bemrose).—Theory of Functions of a Complex Variable: Dr. A. R. Forsyth (Cambridge University Press).—Theory of Structures and Strength of Materials: H. T. Bovey (K. Paul).—Die Thermodynamik in der Chemie: J. J. Van Laar (Leipzig, Engelmann).—Polarisation Rotatoire: G. Foussereau (Paris, G. Carré).—Traité Pratique d'Analyse Chimique et de Recherches Toxicologiques: G. Guérin (Paris, G. Carré).—Forest Tithes, &c.: A Son of the Marshes (Smith, Elder).—Technology for Schools: J. Hassell (Blackie).—A Practical Treatise on Bridge Construction, 2 vols.: T. C. Fidler (Griffin).—The Steam-Engine, 2 vols: D. K. Clark (Blackie).

PAMPHLETS.—Sulla Distribuzione del Potenziale Nell'Aria Rarefatta percorsa dalla Corrente Elettrica: Prof. A. Righi (Bologna).—The Fundamental Theorems of Analysis Generalised for Space: Prof. A. Macfarlane (Boston).—The Imaginary of Algebra: Prof. A. Macfarlane (Salem).—Australian Museum, Sydney: Catalogue of Australian Mammals, &c. (Sydney).—Catalogue of the Michigan Mining School, Houghton, Michigan, 1891-92 (Houghton).

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