Research Items.

A Hand-Axe from East Anglia.—Mr. J. Reid Moir, in *Man* for January, figures and describes a hand-axe found last November in the Upper Chalky Boulder Clay at Ipswich. It was dug out of solid clay at a depth of 2½ ft. It was in two pieces, which lay about 15 in. apart. The fracture was ancient and had been caused by thermal action along the line of a weakness in the flint, without doubt at the time of the deposition of the boulder clay. The specimen is typical of the implements found in the Upper Chalky Boulder Clay. In colour it is greyish-black, and shows no sign of patination or abrasion. There are a few ancient striations. The flaking is all of one period. Greatest length $4\frac{3}{16}$ in., greatest breadth $2\frac{15}{16}$ in., greatest thickness $1\frac{1}{16}$ in., and weight approximately 8½ oz. There is now a large body of evidence to show that the Upper Chalky Boulder Clay of East Anglia, representing the third glacial period of this part of the country, was laid down at the close of the Early Mousterian epoch. The flint implements found in the boulder clay have all been derived from other and older deposits torn up by the glacier in its advance. In certain parts of East Anglia sites have been discovered where these deposits have escaped destruction and they have been shown to contain artefacts such as occur in the boulder clay which overlies them. These pre-Upper Chalky Boulder Clay deposits are usually in the form of brick-earth such as have been excavated and studied at Ipswich, Hoxne, and High Lodge. In each of these cases the Upper Chalky Boulder Clay overlies the brick-earth, and in the latter deposit at Hoxne and High Lodge have been found hand-axes of precisely the same type and workmanship as that now described. One found by Mr. Reid Moir at Hoxne in an Early Mousterian floor at the base of the brick-earth under the glacial bed laid down by the Upper Chalky Boulder Clay glaciation is almost a duplicate of this specimen. It may now be said that the Early Mousterian period in East Anglia was succeeded by the third glaciation in that area, and that *in situ* in the Upper Chalky Boulder Clay, which was then laid down, derived flint implements of the Early Mousterian epoch have been unearthed.

Treatment of Trypanosomiasis.—Dr. Louise Pearce has written a critical review entitled "The Treatment of Human Trypanosomiasis with Tryparsamide" (Monograph No. 23 of the Rockefeller Institute for Medical Research). Tryparsamide is the name given to the sodium salt of *N*-phenylglycineamide-*p*-arsonic acid, a compound developed at the Rockefeller Institute for Medical Research during the course of chemotherapeutic investigations on certain protozoan infections. It has the advantage of being very soluble in water and may be administered intravenously, intramuscularly, or subcutaneously with satisfactory effects. The dose is usually 2 gm., and the amount required for the treatment varies from 15 gm. to 25 gm. for early cases up to perhaps 100 gm. for advanced cases. The only untoward effect noticed has been visual disturbances in some 5 per cent of the cases, which is more or less permanent in 1·8 per cent of the cases. The present analysis deals with the results obtained in 1197 cases of sleeping sickness with *Trypanosoma gambiense* infections, of which 96 were considered to be early cases and 1101 late ones. Of the early cases, some 96 per cent appear to have been cured by the drug. Of the 1101 advanced cases, 646 (58·7 per cent) appear to be cured, 272 (24·7 per cent) were improved, and 183 (16·6 per cent) were failures. The results obtained with tryparsamide appear to be vastly superior to those observed with any other drug. Several other papers which have appeared since this analysis was written are also reviewed, and a bibliography is appended.

Fresh-water Mussels Raised in the Laboratory.—The *Daily Science News Bulletin*, Science Service, Washington, D.C., of Nov. 21, announces that Dr. M. M. Ellis has discovered a method of speeding up the development of fresh-water mussels. In its natural environment the mussel spends the first four to six weeks of its life as a parasite on a fish. Dr. Ellis has found a nutrient medium to take the place of the fish, in which the mussel is able to develop. After spending a certain time in the medium, the mussels, important economically for the making of pearl buttons, may be planted out in the rivers which have been depleted by pollution. The raising of these molluscs will be undertaken at the University of Missouri in the new laboratory space just provided by the University for the use of the U.S. Bureau of Fisheries.

Biology of the River Wharfe.—E. Percival and H. Whitehead have already done good work in connexion with Yorkshire streams and rivers. Their recent paper, "Biological Survey of the River Wharfe: Introduction and Report on the Invertebrate Fauna" (*Journal of Ecology*, vol. 18, No. 2, Aug. 1930), records investigations arising out of meetings of the research committee of the Yorkshire Naturalists' Union, in which the River Wharfe, being practically unpolluted, was decided on as a subject requiring detailed examination. Three stations, representing the three main physiographic regions through which the river flows, were worked monthly over a period of one and a half years, and in addition subsidiary collections and observations were made at other stations. A net with a mesh of 0·5 mm. was chiefly used, allowing a number of small creatures to escape. Therefore some groups, such as the Protozoa, Nematoda, and Rotifera, have been omitted. Insects are the most important and are dealt with fully. The station at Ulleskelf, where the river becomes affected by tides, is markedly different from the others. The great majority of the species from all the stations require water well charged with oxygen. The environmental conditions and dominant invertebrates are given for each station, and notes on the different groups show details of distribution, habitat, and breeding seasons. There seems to be little seasonal variation in the faunas except those related to breeding and life cycles. Most of the insects produce eggs from March to October. General conclusions of a preliminary nature are that the various types of stream bed can be approximately classified according to their structure and fauna: and that the variation in number of organisms is due in part, at any rate, to the nature of the life cycle, to the effect of temperature, and to the amount of rainfall both during the previous breeding season and at other times, and the amount of flooding, of erosion, and general disturbance of the river bed.

Genetics of Field Mice.—Dr. F. B. Summer has contributed a further account of his well-known investigations on the geographical sub-species of the field mouse, *Peromyscus* (*Jour. Genetics*, vol. 23, No. 2). It is unfortunate that these important researches, which he has carried on at the present Oceanographical Laboratory in Southern California for more than fifteen years, are now to be discontinued, for they represent the most extensive study yet made of the natural sub-species in any mammal. We have

received from Dr. Summer a request to point out two errata which occur on p. 307 of the present paper. In line ten, "$(4/5)'$" should read "$(4/5)^3$"; and in the nineteenth line, "$(5/6)^2$" should read "$(5/6^4)$". The present paper contains a mass of data, statistically treated, resulting from crosses between the three sub-species, *leucocephalus*, *albifrons*, and *polionotus*, and also from a fortunate cross between two species of *Peromyscus*. The results are too numerous to summarise here, but the paper is a searching inquiry into the conception of multiple genetic factors as applied to sub-specific crosses. Differences in depth and extent of pigmentation, the tail stripe, and other features are believed each to depend upon several multiple factors, but it is concluded that the formulæ of Castle and Wright for determining the number of such factors is not applicable. The tables of measurements of tail, foot, ear, etc., in the hybrids have also been analysed. Wide phenotypic variability and other conditions offer great difficulties, and it cannot be said that the multiple factor hypothesis as here applied is a great success, in spite of the great care and attenton to detail which has entered into the analysis. The author is inclined to favour the view that the genetic changes between sub-species have resulted in some direct way from the action of the environment, the colour mutations being selectively controlled by their value in concealment.

Mitogenetic Rays.—A monograph upon this subject was reviewed in NATURE of July 13, 1929. It will be remembered that Gurvitsch and his school suggest that a special type of short-wave length radiation promotes cell division; they thought to detect this radiation by pointing one growing root-tip at another at close range, when the number of cell divisions in the second root was said to be greater, as the result of 'irradiation' from the tip of the first root, on the side 'exposed' to the pointing tip. Around this conception a lively controversy has raged, and so long as the only tests applicable to mitogenetic radiation are the number of cells in a tissue in a state of division, or the number of buds produced in a growing yeast culture, conclusive critical evidence in support of the new radiation remains difficult to produce. Of considerable importance, therefore, is a paper by Stempell (*Biol. Zentralblatt*, **49**, Heft 10; 1929) in which he attributes to the radiant energy from such growing organs the power of destroying the Liesegang rings which are formed with beautiful regularity when a drop of silver salt is placed on the centre of a thin layer of gelatin containing ammonium bichromate. These experiments of Stempell have been repeated and confirmed by B. P. Tokin (*Biol. Zentralblatt*, **50**, Heft 11; 1930), but at the same time this worker makes it clear that this interesting result is due to the volatile substances, probably ethereal oils, which are given off from the crushed tissue of the onion, which has been the source of the 'mitogenetic' radiation in these experiments. Tokin's work seems to make it quite clear that this new experimental field has failed to produce any evidence for the existence of 'mitogenetic rays'.

Mica-Peridotites of India.—In his memoir on "The Jharia Coal Field" (*Geol. Surv. India*, vol. 56; 1930) C. S. Fox gives a valuable account of the remarkable peridotite intrusions associated with the faults and coal seams of the region. The coalfields of the Damuda valley represent a series of areas of Gondwana sediments set in a pavement of Archæan gneisses on which they lie and into which they have been faulted. The synclinal structures of the so-called basins result from tectonic movements. The peridotites are generally much altered. Many are characterised by an abundance of mica, but the most remarkable feature is the richness in apatite, as first disclosed by Sir Thomas Holland in 1894. The high phosphorus content in the coals of many of the Gondwana fields can be traced with tolerable certainty to the peridotite intrusions. A number of new analyses are presented and attention is directed to these because of their petrological and geochemical significance and because they might easily be overlooked in a memoir dealing mainly with coal. The peridotite magma appears to have been squeezed up through fault planes in the gneissic floor, but once it entered sedimentary rocks the bedding planes offered numerous channels for escape, mainly above or below coal seams, where the bedding planes appear to have been more easily separable than elsewhere in the series.

Comparative Study of Soil Profiles.—An exceptionally thorough investigation of soil profiles in Holland and Java has been made by A. Te Wechel, L. Möser, and C. Van Aggelen (*Mitt. Geol. Inst. Landbouwhoogeschool in Wageningen, Holland*, No. 16, 1930). The profile on Senonian limestone in Holland is compared with the profiles on loess in Holland and on Tertiary limestone in Java. The end products of soil formation are closely similar from the two contrasted types of parent rock in Holland, whereas they are widely different from the two similar rocks studied in Holland and Java (see table). The importance of climatic control is thus clearly demonstrated. The microscopic

Constituents.	Holland.		Java.
	Loess Soil.	Limestone Soils.	
$CaCO_3$	2·21	1·75	2·02
SiO_2	73·55	73·38	37·87
Al_2O_3	8·04	7·59	24·08
Fe_2O_3	2·89	2·63	8·95
Clay	41·40	40·50	37·80
Humus	5·14	4·42	4·31

(petrological), physical, and chemical character of the parent rocks and of four or five horizons in the profiles of each of the three examples investigated have been very fully determined. The memoir is well illustrated and constitutes one of the most illuminating studies of weathering and soil genesis yet issued.

The Constant of Gravitation.—A redetermination of the constant of gravitation (G), by P. R. Heyl, is described in the December number of the *Bureau of Standards Journal of Research*. The apparatus used was much the same as in the dynamical method of Braun, with, however, a considerable increase in the magnitude of the large attracting masses, and with the incorporation of the refinements possible to anyone working in a large institution. The attracting masses on the moving system were small spheres of gold, platinum, and optical glass, in each case of about 50 gm., but with the large stationary masses a radical change in shape was made, cylinders being substituted for the spherical form which had been previously almost universally employed: the mass of each was about 66 kgm. The reduction of the experimental data is thus enormously complicated, but it has been found that series which remained manageable could still be calculated fairly readily to express the forces due to the cylindrical masses; full details of these, which are probably of value in other connexions, are given. Other points in the experimental arrangements are the use of tungsten filament wires for the suspensions in place of quartz, with very satisfactory results, and the magnetic shielding

of the small paramagnetic and diamagnetic spheres which was found to be called for. The value finally adopted for the constant is $6 \cdot 670 \times 10^{-8}$ cm.^{3} gm.$^{-1}$ sec.$^{-2}$, with a precision of 0·005, as measured by the average departure from the mean. This result is in very good agreement with Boys' and Braun's value of $6 \cdot 66 \pm 0 \cdot 01$, in the same units. There is a curious outstanding discrepancy in the apparent dependence of the value on the material of the small masses, but it is considered that this is not due to the nature of the material.

Properties of Molecular Hydrogen.—In a paper in the January issue of the *Proceedings of the Royal Society*, on the chemical constant of hydrogen vapour and the entropy of crystalline hydrogen, T. E. Stern has extended some earlier calculations made by R. H. Fowler, essentially by introduction of the Einstein-Bose statistics in place of classical statistics. His results are important chiefly from the fact that they increase somewhat the accuracy of results predicted by Mr. Fowler, excellent agreement being obtained with Eucken's empirical values for the chemical constant. In addition, however, Mr. Stern has made some interesting remarks upon the nature of molecular motion in crystals. His analysis, like that of Mr. Fowler, assumes that the molecules of hydrogen rotate in the crystalline solid much as they do in the gas, and, as he points out, the reasonable nature of the predicted results furnishes good evidence for the validity of the assumption. It is not certain, all the same, that the moment of inertia remains unaffected by passage to the condensed phase, and an experiment is suggested by means of which any such change could be detected. There is possibly already evidence for a small diminution of the moment of inertia in formation of the liquid when liquid hydrogen is formed from the vapour from Prof. McLennan's investigation of the Raman effect. Rotation of molecules in crystals would appear not to be a universal phenomenon, as Mr. Stern refers to a theoretical investigation by Pauling as showing that in some crystals molecules cannot rotate at all, whilst in others they move in an irregular fashion which corresponds to wave-functions intermediate between those for pure rotation and for pure oscillation.

Constitution of Coal.—Two of the methods for studying the constitution of coal are the use of solvents for fractional extraction and the examination of the products of oxidation. At a meeting of the Royal Society of Arts on Nov. 26, Prof. W. A. Bone summarised the results of his experience with these two methods (*Jour. Roy. Soc. Arts*, **79**, 77). By means of benzene under pressure, material can be extracted from coals which is divisible into four fractions. Prof. Bone has adduced from this evidence that the solid fraction is really the material which imparts to a coal the property of forming a coke. By controlled oxidation of the extracted residue he has not only confirmed the view that the main product is a mixture of benzene carboxylic acids, but also accounted quantitatively for the material of the reaction. The same sort of product was obtained from coal in all stages of formation and in the carbonisation products, indicating that the benzenoid structure is present throughout. He advanced the view that coal is of the nature of a 'bakelite'.

Energy Distribution in an Oil Circuit-Breaker.—One of the most difficult problems which electrical engineers have to solve is to devise switches capable of breaking circuits in which large currents at high voltages are circulating. If the switch is incorrectly designed, the limit of rupturing capacity is low, and if used for large currents a short circuit results and the switch is destroyed. Automatic oil switches are now in general use, as they have been found both efficient and trustworthy. An arc drawn out between the separating contacts underneath the oil is rapidly cooled and compressed by the surrounding oil. The special feature of the switch seems to depend on the squeezing effect of the oil on the arc. In a paper read to the Institution of Electrical Engineers on Jan. 8 by C. E. R. Bruce, an elaborate study is made of the distribution of energy in an oil circuit-breaker. The paper is the latest of the reports on the subject made by the British Electrical and Allied Industries Research Association. It deals in considerable detail with the energy dissipated by large oil circuit-breakers at a pressure of 5500 volts. Rough but satisfactory measurements have been made of the various ways in which the energy liberated is dissipated. The energy dissipated at the contact surfaces and radiated from the arc was measured experimentally. That required to heat, vaporise, and break up the oil was calculated. The rest of the energy used for raising the arc to the gas temperature and in dissociating the hydrogen present could then be found and the temperature of the arc calculated. The temperature found in this way was about 3500° K. (3227° C.). This value is nearly double the value (1750° C.) which has previously been used. Tests were made with both open and closed tanks and with copper and aluminium electrodes. Interesting theoretical calculations are also given.

Electric Incubators.—In his recent address to the Scottish centre of the Institution of Electrical Engineers, E. Seddon gave an example of how electrical power is enabling the struggling industry of poultry farming to compete with imported products. It is a good illustration of the gradual mechanisation of farming. The Buttercup Dairy Co. has an electrical poultry farm near Edinburgh stocked with 200,000 laying hens. There have been installed nine incubators, each capable of holding 16,000 eggs. The eggs are placed end-downwards in special trays and packed tightly to prevent movement. The trays are then placed in the incubators at an angle of 45°. The eggs require to be turned during the process of incubation; by an ingenious device the trays are turned about a horizontal axis until they are perpendicular to their former position. The motion is reversed every six hours. Each incubator has an electric heater taking 2400 watts, which maintains the temperature between the limits of 99·5° and 100° F. The heat is controlled thermostatically and if the temperature varies by so much as 1° a bell rings. On the eighteenth day the trays of eggs are tested by being placed over high candle-power lamps. The unfertile eggs are quickly removed and the trays placed in the hatching compartments. The chicks hatch regularly on the twenty-first day. The average number of infertile eggs is 21 per cent, and 9 per cent contain dead germs. The chicks pass from the incubator rooms in cardboard boxes to the brooding rooms. The essential requirements are a constant supply of fresh air, protection from draughts, uniform temperature, and a moist atmosphere. Air drawn in by electric fans is steam-warmed and then drawn upwards through the cages containing the chicks to the exhaust fan in the roof. A complete change of air is effected every five minutes. All windows are of blue glass and the electric lamps are tinted blue. It is found that the chickens thrive under these conditions. Special lighting is arranged in the laying sheds to ensure egg-laying in the winter months. Electrically-driven conveyors convey the food to the bins, the consumption being about 150 tons of meal per week.