Research Items.

THE CARRYING OF YOUNG BY MAMMALS.—In discussing the life history of the woodland deer mouse (*Peromyscus leucopus noveboracensis*) E. Raymond Hall makes a side observation of interest (*Jour. Mammalogy*, August). In a hunting cabin in Kansas he disturbed a female mouse with four young, which in her haste to seek shelter she scattered upon the floor. Within thirty seconds the mother reappeared and picked up with her teeth one of the young, and so on until she had carried all to safe places. In each case she deliberately turned the young belly up, grasped it on the under side with her incisors, and, adjusting it slightly with her fore feet, scampered away. Recalling that squirrels and some other rodents are known to carry their young belly up, rather than by the back of the neck, as cats and dogs do theirs, the author suggests that it may be a universal, or at least general, habit of rodents to carry their young belly up, and of carnivores to carry their young back up. The point is a curious one, and the experience of readers of NATURE might help to solve the question.

THE FAUNA OF HOT SPRINGS.—In the course of an investigation extending over several years, Charles T. Brues has examined the faunas of hot springs in the Yellowstone National Park, and in 1927 visited 34 hot springs or groups of springs in New Mexico, Nevada, California, and Utah (*Proc. Amer. Acad. Arts and Sci.*, vol. 63; 1928). His paper, containing careful records of the temperature, specific gravity, and *p*H of the waters, with a detailed list of the organisms found living in them, and references to other work of a similar kind, is a valuable contribution to knowledge. Of vertebrate animals he found only a cyprinoid fish (*Notropis lutrensis*) at 39·5° C., and a frog (*Hyla regilla*) at 35·8° C. Molluscs were occasionally found, but the vast majority of the population was composed of insects, of which aquatic coleoptera formed by far the most numerous section. The author discusses the nature of heat susceptibility, body temperature, the brackish water fauna in relation to that of thermal waters, and the temperature range of individual species. Unfortunately, none of the springs was suitable for following the changes in the composition of the thermal fauna over a considerable range of temperature in water from a single source, but the interesting discoveries of Blanchard and Seurat at the springs of Meskhoutine in northern Africa are quoted to illustrate the temperature stages at which fresh creatures invade the fauna.

VARIATION AND ITS ASSOCIATION WITH HABIT.—The American Fox-sparrow (*Passer iliaca*), though a bird of restricted habitat, has apparently developed a sensitiveness to environmental influences, for although in any one locality variation is slight, geographical variation is common, so that the species is split into sixteen races. A very thorough study of the variations which occur in these races has been made by Jean M. Linsdale (*Univ. California Pub. Zoo.*, vol. 30, p. 251; 1928). It is impossible to follow her into her analysis of the details of 465 specimens, but, in general, she found that significant geographic variation occurs in every part of the skeleton that was examined. Evidence was not forthcoming to show that the variations in every case were of any biological advantage. For example, races in which enlarged bills and skulls occurred were not found to use food different from their smaller-headed neighbours. One character, however, length of sternum, appeared to have a real functional value. The subspecies *iliaca* has the longest sternum in the species, and this is the race which in general breeds farthest north and migrates farthest south. Indeed, it may be said that the amount by which this race is set off from the others in respect of its sternum is roughly paralleled by the distance by which its migration route exceeds theirs. With this length of sternum goes, but to lesser extent, similar elongation of the limb bones associated with the sternum. In the other races similar behaviour of these characters can be correlated with the length of their respective migration routes. In short, every part of the skeleton used considerably in flight has been developed to a high degree as an accompaniment to a lengthened line of migration flight.

CAUSE OF HONEY FERMENTATION.—Spoilage of honey, due to fermentative changes, causes some loss to the bee-keeper and tradesman. Messrs. Fabian and Quinet investigating the subject (*Technical Bull.*, No. 92; Agricultural Experiment Station, Michigan State College of Agriculture, East Lansing, Michigan, U.S.A.), find that bacteria, yeasts, and moulds are present in many samples of spoiled honey. A number of these organisms were isolated and re-inoculated into honey to test their effects. Only the yeasts were found capable of causing honey fermentation; good honey frequently, perhaps always, contains yeasts, yet only some honey ferments. It is suggested in explanation of this anomaly that honey is capable of absorbing moisture—up to 30 per cent of its weight—and that when the moisture content rises to about 21 per cent and above the yeasts, the growth of which is inhibited in ordinary honey, are able to develop in the diluted honey.

FOREST NURSERY WORK IN GREAT BRITAIN.—In *Bulletin No. 11*, recently issued by the Forestry Commission, Mr. H. M. Steven discusses, under "Nursery Investigations," work upon which he and others have been engaged during the last few years in connexion with raising young stocks of trees for subsequent planting out to form woods. The investigations deal mainly with the chief coniferous species at present in use in Great Britain. The forest nursery has gradually increased in importance in British forestry since the beginning of the eighteenth century. But it is not pointed out that this factor is due mainly to the woods of the country having been privately owned; that continental practices were unknown; and, finally, that for the private owner wishing to grow coniferous plantations on comparatively short rotations, the nursery and artificial formation of woods by planting may be the best method at present available. Mr. Steven writes: "The purpose of this Act"—the allusion is to the Forestry Act of 1919—"was to increase the forest area by the creation of new forests. This could only be done by planting or direct sowing. To date, the percentage afforested by direct sowing has been less than five, and it will be contrary to the present tendency in European practice if direct sowing becomes the principal method of establishment." This allusion is to the afforestation work of the Forestry Commission. But the author is mistaken in his contention that "the present tendency in European practice" is against direct sowing. Some of the most important post-War mountain afforestation work with conifers is being undertaken by direct sowing over considerable areas in France. Even though netting against rabbits would not be necessary, as in Great Britain, the expense of raising plants in nurseries and afterwards planting them out is regarded as prohibitive, and is only resorted to in special circumstances. The Forestry Commission might consider the advisability of carrying out, over a series of years,

investigations into methods of raising coniferous woods by direct sowing.

YARN STRENGTH AND YARN EXTENSION.—*Bulletin No. 12* from the Indian Central Cotton Committee Technological Laboratory contains a survey by the Director, A. J. Turner, of the very intricate problem of relating yarn strength to the strength of the component fibres. The pioneer work of Bowman and Monie, which is freely quoted in the report, led to the conclusion that only about 10 per cent of the fibre strength is utilised in the yarn. This value is apparently too low on account of insufficient determinations of fibre strength, and corresponding data obtained for Indian cottons by Turner show that the percentage of fibre strength utilised in yarns of various kinds varied from 26·5 to 46·5 per cent (lea test). Such gross inefficiency in yarn structure gave rise to the impression that yarns must break by slippage rather than rupture of the constituent fibres. Turner has disagreed with this opinion in previous papers, and his views are adequately summarised in the present report, which includes photographs to demonstrate that while slippage does undoubtedly occur in the case of loosely twisted yarns, hard-twisted yarns break by fibre rupture. This position has been substantiated by the work of Miss Clegg, who, by employing Bright's technique, was able to determine the proportion of fibres broken when yarns of various kinds were fractured. But if yarn breakage occurs by fibre rupture as well as by slippage, it becomes even more important to explain the inefficiency in yarn strength. This is discussed in terms of ten factors, the most important of which are the transmission of tension by the component fibres; the boundary effect, *i.e.* the progressive decrease in compressional forces from the axis to the surface of the yarn; the effects of group testing; and imperfections of yarn structure such as irregular thickness and twist. The value of the analysis is diminished by the recent appearance of Dr. Lawrence Balls' more fundamental treatise, "Studies of Quality in Cotton."

FORMATION OF RAINFALL.—A recent paper by D. Brunt and C. K. M. Douglas (*Mem. Royal Met. Soc.*, vol. 3, No. 22) opens up a line of investigation which should help to explain the mode of formation of that large proportion of our rainfall which is not due to simple elevation of moist air currents by the interposition in their path of hills or mountains. It puts into mathematical form a relationship, hitherto only vaguely realised, between rainfall and change of barometric pressure. The work of Shaw and Gold on the relation between barometric gradient and wind force established many years ago the important fact that above the first few hundred feet in the atmosphere the motion of the air is such that there is balance between the accelerations brought into play by the motion of the air and the pressure gradient on occasions when the distribution of pressure is steady, and that a close approximation to this balance exists in a very large proportion of actual situations. In the paper under discussion, the difficult task of dealing mathematically with the case of a changing pressure distribution has been attempted, through a realisation of the fact that without a departure from 'balanced' motion convergence of air cannot take place, and consequently an upward current of air such as would give rise to steady rainfall cannot be maintained. An equation of motion is arrived at in which the effects of changing pressure gradient, curvature of the air's path and its acceleration, appear separately. Reasons are found for supposing that in certain cases the effect of changing pressure gradient is greater than that of the other terms. The wind is then made up of the geostrophic wind blowing along the isobars and a component blowing from rising towards falling pressure, this component being proportional to the gradient of barometric change. It is considered that the general tendency for rain to occur in regions of maximum fall, and for fine weather to occur in regions of maximum rise of pressure, may be attributed to convergence and divergence respectively of the 'unbalanced' component of the wind, that is to say, of the deviations from the 'geostrophic' wind. Observational evidence in support of this view is given.

NEW GEOLOGICAL MAP OF SOUTH AUSTRALIA.—The *Annual Report* of the Director of Mines and Government Geologist of South Australia for 1927 contains an account of the new geological map which has been issued by the Survey, together with a useful summary of the distribution and chief characters of the geological formations and references to the leading literature. The map has been printed in colours by photo-lithography, and is on the scale of 32 miles to an inch. Fossiliferous Cambrian rocks are now separated from the generalised Lower Palæozoic, and the oldest tillites have been grouped with Upper pre-Cambrian. The glacial deposits of Permo-Carboniferous age are now shown over a far wider area than was formerly possible. The age of the Leigh Creek coal measures is changed from Jurassic to Triassic as a consequence of recent palæobotanical work. The Cretaceous is divided into two divisions, a Lower marine series and an Upper freshwater series. More prominence is given to the mantle of Recent or Pleistocene material than formerly, mainly for economic reasons. Subterranean structure, however, is indicated by columns of figures showing in various places the downward succession of formations. A greatly reduced copy of the map in black and white patterns accompanies the *Report*, which, together with the colour-printed map, is obtainable from the office of the Geological Survey, Adelaide.

ORIGIN OF THE METAL IN METEORITES.—The peculiar and significant relations between the metallic and silicate portions of stony meteorites have been discussed by most investigators of these remarkable bodies. G. P. Merrill returns to the subject in a paper in which he reviews the divergent opinions of others, and gives the deductions which he has drawn from his own observations (*Proc. U.S. Nat. Museum*, vol. 73, Art. 21, 1928). By means of a series of cogent illustrations it is shewn that in the examples selected the metal was the *last* constituent to congeal and was probably wholly of secondary origin. Reduction of a ferriferous silicate by means of carbon or hydrogen is ruled out of consideration by the complete absence of residual products. Of all the other known constituents the ferrous chloride, lawrencite, seems best to meet the requirements of the case. In a hydrogen atmosphere it is reduced at temperatures not exceeding 400° C. Stony meteorites are certainly volcanic products, and it is possible to conceive the original chloride as one of the volcanic emanations. In terrestrial volcanoes the iron is oxidised almost at once, but in an atmosphere of reducing gases the iron would appear in metallic form. It is noteworthy that Sorby long ago suggested that the metallic constituents of meteorites were introduced into the interstices of the silicates in a state of vapour.

ATOMIC MAGNETISM.—In the September issue of the *Science Reports of the University of Sendai*, Prof. K. Honda gives an account of his theory of the origin of magnetism. He takes the atom to consist of a number of orbital electrons equal to the atomic

number of the element and a nucleus which contains additional electrons in number equal to the difference between the atomic weight and the atomic number, revolving with a high velocity. Just outside these electrons are a number of protons revolving in the opposite direction to the electrons. The outer electrons cannot be magnetised by an external field, but the processional motion produced gives rise to the diamagnetism of the atom. In ferromagnetic atoms the magnetic moment of the nuclear electrons and protons nearly cancel each other and the atom is easily turned by an external field. In paramagnetic atoms neutralisation is less complete and the external field has less effect. In diamagnetic atoms the magnetic moment is large and the field produces no effect on it, the diamagnetism being due to the outer electrons. The author shows that this theory explains many facts not covered by previous theories.

'RESIDUAL HEAT' OF METALS.—Two years ago Prof. Q. Majorana announced that iron, steel, lead, and copper placed, after a previous heating, in a thermostat at the temperature of the air, would retain for weeks a temperature about 0·01° C. higher than that of the thermostat. In the issue of the *Physikalische Zeitschrift* for Sept. 15, Miss M. A. Schirmann, of Vienna, gives an account of her measurements of this effect. Two similar specimens of the metal were used, one heated to redness before polishing, and the other unheated. They were placed in Dewar vacuum vessels immersed side by side in a water bath. The specimen previously heated showed a temperature 0·1° C. higher than the other, but the difference gradually decreased, and after several weeks disappeared. She ascribes the effect to the absorption and adsorption of air by the specimen previously heated, the effect of the heating having been to drive off the gases which the material contains in its normal state. She supports this opinion by showing that during the process of re-absorption the electrical resistance of the specimen increases. She points out that her explanation involves the disappearance of the effect when the metals are placed *in vacuo*.

WIND PRESSURE ON WIRES.—Many researches have been made on the connexion between wind pressure and the velocity of the wind. The construction of the English grid of overhead electric wires has brought the question prominently to the front, and the B.E.R.A. (British Electrical Research Association) have had many researches made in connexion with this subject at the National Physical Laboratory. In a paper read to the Institution of Electrical Engineers on Nov. 8, W. B. Woodhouse gave an interesting account of the work and the definite results that have been obtained. So far as smooth cylinders are concerned, it is now possible to predict with certainty the pressures corresponding to any wind velocities likely to be met with in practice. From theoretical considerations it was known that the ratio of the pressure on the cylinder to the product of the wind speed and the projected area should be a constant, provided that the product of the wind speed and the diameter of the wire remain the same. This has been directly verified by experiment. It has been found that if the diameter of the wire or the velocity of the wind vary, this ratio alters in a definite way. If the pressure is in pounds per square foot and the velocity of the wind in miles per hour, then for large wires the ratio is 0·003, and this is the number generally taken hitherto by engineers. For smaller wires, however, this ratio may be so small as 0·00246, and for very minute wires it may be 0·00360. Experiment shows that this law does not apply to stranded cables, the law derived from dynamic similarity being no longer applicable. Tests made on wooden poles disclosed that the usual design could be greatly improved by suitably modifying it. It has been found that the wind pressure on a strut of circular cross section can be considerably reduced by the addition of a similar strut in its wake. At certain speeds the pressure on a sphere can be reduced by roughening its surface. It has also been shown that the wind pressures on two struts of equal mechanical strength may be in the ratio of 6 to 1, depending on the shape of their sections.

MICRO-IDENTIFICATION OF ISOMERS.—A recent number (vol. 3, No. 8) of the *Bulletin of the Chemical Society of Japan* contains a paper by M. Migita on the micro-identification of the three isomeric xylenes in their mixture. Xylene is present in most samples of petroleum and wood-spirit and it is an important constituent of solvent naphtha, but the identification of *o*-, *m*- and *p*-xylenes in small quantities is a matter of considerable difficulty. From this paper it appears that traces of *m*- and *p*-xylene can be identified by the colour reactions given by their trinitro-derivatives in alcohol or acetone solution on the addition of alkali, while *o*-xylene can be detected as the sodium sulphonate by microscopic examination of the crystals.

REACTION BETWEEN ZINC AND CARBON MONOXIDE.—The *Journal of the American Chemical Society* for October contains a note by R. W. Millar on the reaction between liquid and gaseous zinc and carbon monoxide. From thermodynamical considerations it appears that, except at very low partial pressures, zinc vapour and carbon monoxide should react to give zinc oxide and carbon at about 700°, which is the temperature of the condenser used in zinc smelting. Experiments were carried out in order to ascertain whether the rate of direct reduction of carbon monoxide by zinc was appreciable, but the results indicated that, in the absence of a catalyst, the reaction $CO + Zn = ZnO + C$ is very slow at 600°-700°. It was found, however, that zinc reduces carbon dioxide rapidly at this temperature. The production of zinc oxide in the condenser seems to be due, therefore, to the oxidation of the zinc by carbon dioxide or by water vapour, both of which are present in considerable quantities during the smelting operations. Zinc may be safely distilled in carbon monoxide provided that the apparatus is free from iron.

ACCELERATED TESTS OF ORGANIC PROTECTIVE COATINGS.—The *Bureau of Standards of the U.S.A.* has recently issued Research Paper No. 1, which consists of an account by P. H. Walker and E. F. Hickson of the accelerated tests applied by the Bureau to paints, varnishes, lacquers, etc. The most important causes of the decay of such protective coatings are light, moisture, and temperature changes. An enclosed carbon arc is used as the source of light for test purposes in preference to a mercury arc, since the latter emits a considerable amount of radiation not present in sunlight. Test panels are also exposed to a spray of warm water, to low temperatures, and to various gases such as ozonised air. The extent of disintegration is determined by measuring the permeability to air and water vapour, and by testing the insulating properties of the film. The apparatus used for these purposes is also described. So far as can be judged by visual observation, the nature of the breakdown of a coating by artificial means is similar to that of a breakdown caused by weathering, but it is not easy to know the time of weathering equivalent to given standard tests owing to the variations of the weather.