

Research Items

Bushmen and Hottentots

IN the course of an investigation of a quantity of skeletal material, adult and infant, from burials in the rock-shelter on Oakhurst Farm, George, Cape Province, South Africa, excavated by Mr. A. J. H. Goodwin (see page 1151), Prof. H. R. Drennan has found it necessary to define the characteristics by which the Bushman and Hottentot types are differentiated (*Trans. R. Soc. S. Africa*, 25, 3, 1938). A comparison of the skeletal material from Oakhurst and the Matjes cave, both associated with the Wilton stone age culture, leads to the conclusion that the Hottentot, instead of being a Bushman-Bantu cross, as has been held generally, may be the product of an evolution from a 'Wilton race', the larger head and greater stature in comparison with the Bushman being an inheritance from a Boskop or Boskopoid type. The Wilton race, it is generally recognized, has strong affinities with late palaeolithic man in Europe and northern Africa. As regards the special features of the Hottentot skull, as distinguished from that of the Bushman, it tends to be 5-15 mm. longer, but as there is no proportionate increase in breadth, and often a diminution, the majority are dolichocephalic, whereas a majority of the Bushman skulls are mesaticephalic. The Hottentot skull is consequently more an elongated oval than of the marked Bushman pentagonoid form. The vault is definitely higher, the breadth-height index bringing out the difference very strongly. The width of the face is only slightly greater than in the Bushman, in keeping with the narrowness of the cranium; but the length is definitely increased in relation to the length of the base of the skull, giving a downward extension of the jaw which has the appearance of prognathism, whereas it is really 'subgnathism'. The orbital index is usually lower than in the Bushman. Both races are platyrrhine. The mandible of the Hottentot is distinctive, being more massive and much longer, but it is not much wider, and therefore has a much higher mandibular index. The ramus is also more robust, and even wider in relation to the height than the Bushman ramus.

Study of Life and Climatic Relations

MISCELLANEOUS Publication No. 280 of the U.S. Department of Agriculture, dated January 1938, is a quarto brochure of 188 pages on "Bioclimatics. A Science of Life and Climatic Relations". Its author, Dr. A. D. Hopkins, was formerly an official entomologist but resigned in order to devote his time to research on this subject. The purpose of this publication is to give the results of prolonged studies made by the author on the principles of life and climatic relations, and their application to agriculture, with the hope that specialists in different sciences will adopt such as may be applicable to their own lines of work. The bioclimatic zone and zonal types of a place, area, or local region are the most reliable indexes to the species of animals and plants, and to the types of agriculture, that are best adapted to the local conditions. Under the requirements of the bioclimatic law, the phenomena of life and climate should be equal, under equal influences at the same level, across the continents along lines which depart from the parallels of latitude at the assumed constant rate

of 1° of latitude and 5° of longitude. These lines are termed isophanes. Since, however, the influences of local or other factors are never equal, departures or variations of the observed effects from the requirements of the law must occur. Such variation as determined by bioclimatic methods and expressed in units of time, temperature or distance serve (a) as measures of the relative intensity of the modifying influences and (b) as indexes to the interpretation of causes and factors and to the prediction of bioclimatic elements at any given geographical position. It is stated that the laws, principles, systems and methods as outlined in these pages, taken in conjunction with the tables, maps and test examples, enable the application of bioclimatic principles to be made to many branches of economic biology and agriculture.

Immature Stages of Aquatic Diptera

PROF. O. A. JOHANNSEN completes his study entitled "Aquatic Diptera" in Memoir 210 of the Cornell University Agricultural Experiment Station, which comprises Parts 4 and 5 of the series. Part 4 deals with the large subfamily Chironominae and Part 5 with the family Ceratopogonidae. Many additions to knowledge of these two groups have been made in recent years, especially by European workers. The results have made it evident that in the Chironominae the immature stages offer fewer and less sharply marked characters than do the adults, and considerable difficulty, therefore, attends the identification of these stages. In this connexion, the keys to the genera and species together with the accompanying figures of larval and pupal characters should prove a useful aid. In the Ceratopogonidae, it will be noted, the few terrestrial forms are also included in order to make the account more complete. The part dealing with this family is written by Miss Lilian C. Thomsen.

Crustacea and Pycnogonida of the John Murray Expedition

DR. M. RAMADAN describes the Astacura and Palinura and Dr. W. T. Calman the Pycnogonida of the John Murray Expedition 1933-34 (British Museum (Natural History). Scientific Reports, 5, No. 5 and No. 6; 1938). Only ten species of Astacura and Palinura were collected, one of which, *Puerulus sewelli*, is new. There are two appendixes to this part, one on the luminosity of Penaeidae, in which the photophores of *Hymenopenaeus debilis* are described, and the other on the structure of the ocular peduncles in deep- and shallow-water forms of the Penaeidae. Comparison of the ocular peduncles in deep- and shallow-water penaeids shows that the simplest form of peduncle is found in the deep-water forms, and as a rule the cornea is hemispherical, whilst a complex peduncle and reniform eye occur in the shallow-water forms. Fourteen species of Pycnogonida were obtained by the Expedition, no fewer than six of which are new. *Colossendeis angusta* from deep water in the Gulf of Aden has an extremely wide distribution, perhaps world-wide, always in cold water and (except in the Arctic) at great depths. Lieut.-Colonel Seymour Sewell is of the opinion that the two specimens captured without doubt came along with the Antarctic bottom drift up the east coast of Africa or else with the deep Atlantic water that enters the Indian Ocean round the Cape of Good Hope.

Autecology of *Zostera*

T. G. TUTIN has recently issued an interesting discussion of the growth and habitat of *Zostera* in connexion with its curious disappearance from many Atlantic localities, first from the American seaboard in 1931 and then a year or two later from its European localities (*New Phytol.*, 37, No. 1, 1938). The plant was so reduced in many cases as to affect seriously the distribution of other marine life, such as fishes and wild game birds; in Canada alone the annual financial loss from its reduction was conservatively estimated at some £30,000. Two parasites have been identified in the diseased patches in both America and Europe, a *Labyrinthula* and a fungus *Ophiobolus halimus*, but Mr. Tutin's conclusion is that these parasites have probably been generally present and cannot be assigned a major role in the widespread disappearance of the plant. He points out that the sunshine deficiency in the year 1931-32 in the British Isles amounted to some 20 per cent below normal, that no year in the previous ten years showed a deficiency approaching this and that the plant as a result was less vigorous and succumbed more readily to parasites that were always present. The widespread disappearance on the American seaboard at almost the same time is regarded rather as a coincidence than as evidence of the operation of a parasite the activities of which have spread a year later across the Atlantic. Recovery may depend upon seed propagation, as seedlings are free from the parasite and may be expected in that case to be slow in many localities where temperature conditions especially are not favourable to flowering, seed production and germination. The same causes might explain the fact that the plant still flourishes in its Mediterranean localities, for there the habitat is suitable to propagation by seed.

Growth-Promoting Substances in Horticultural Practice

A VERY useful paper by Dr. M. A. H. Tincker (*J. Roy. Hort. Soc.*, 63, Pt. 5, 210; May 1938) gives timely results of a number of growth-promoting substances upon the rooting of a wide variety of cuttings. β -indolyl acetic acid, α -naphthalene acetic acid, phenyl acetic acid, iso-indolinone and indolyl butyric acid have been used, and various methods of application have been tried. The most suitable treatment appeared to be the standard method of placing prepared cuttings with their bases in a solution of the substance for 24 or 48 hours. A certain amount of success was also obtained by the application of solutions to the rooting medium. The use of lanolin pastes containing the growth-promoting substances was deemed unsuitable for garden routine, though useful for unilateral application in experimental work. An interesting fact is that the polarity of root cuttings of *Anchusa italica* was influenced by treatment with α -indolyl acetic acid, and the results in general show a useful increase in facility or strength of rooting. Extensive though this paper is, the results require to be multiplied exceedingly. Dr. Tincker reports, for example, considerable success with ten varieties of *Pelargonium zonale*, following treatment; but the increasing experience of gardeners suggests that *Pelargonium* varieties respond somewhat irregularly to treatment with growth-promoting substances, and it is conceivable that with further varieties, or with other substances, Dr. Tincker would have had different results.

A Smut Disease of Brassicaceous Crops

CABBAGES and allied plants are subject to several destructive diseases, but yet another pathogenic fungus has recently been added to the list. Dr. B. B. Mundkur describes (*Phytopath.*, 28, No. 2, 134, Feb. 1938) a new smut fungus from India. The species is *Urocystis brassicæ*, and although it is somewhat similar to *U. coralloides*, described by Mitra upon mustard, it is described as a new species by reason of its different spore size, and its dissimilar host range. Radish, turnip, cabbage and other related plants are attacked, and the fungus induces galls upon infected roots. The smut is soil borne, and brings about considerable reduction in yield.

Olivine-Fourchites from Antarctica

IN the course of an exploratory expedition from the base camp of the Byrd Antarctic Expedition II, an extinct volcano was discovered in the Raymond Fosdick Mountains. The specimens representing the lava flows, all of which are olivine-fourchite, have formed the subject of a petrological study by C. N. Fenner which is of exceptional interest and significance (*Bull. Geol. Soc. Amer.*, 49, 367-400; 1938). The physical and mineralogical structure of the rocks made possible the separation of the phenocrysts—olivine and pyroxene—from the ground-mass. Analyses of these three products have been made and with the resulting information it has been possible to compare the actual course of crystallization of the magma with what has been deduced from theoretical considerations. The ground-mass has been found to have an ultra-basic composition. This leads to the conclusion that, contrary to inferences reached in the theory of crystal fractionation, wholly liquid magmas of ultra-basic composition can exist. In this connexion it is of interest to note that in a recent presidential address N. L. Bowen has admitted that "difficulties accumulate for him who questions the existence of anchi-monominerale magmas" (*Amer. Min.*, 129; 1938). Fenner has also found that in passing from phenocrystic pyroxene to ground-mass pyroxene, there is decrease of SiO_2 and MgO accompanied by increase of Al_2O_3 , iron oxides and CaO . These results do not seem to be in accord with generalizations from experimental work on silicate systems, such as have been used to support the theory of crystallization differentiation. It is pointed out that the final test of conclusions regarding magmas lies in the behaviour and properties of the magmas themselves and of their actual minerals, and that this test should be applied in a more rigorous manner. Inferences from the behaviour of simple laboratory melts should not be generalized to cover conditions to which they may not be applicable.

Phosphors Without Metallic Activator

THE fluorescence of teeth suggests the existence of a type of fluorescent substance different from the more familiar phosphor resulting from firing a salt with a small amount of foreign metal as activator. W. H. Byler (*J. Amer. Chem. Soc.*, 60, 1247; 1938) has prepared phosphors from several inorganic compounds and mixtures without the use of metallic activators, for example, by treating calcium phosphate with phosphoric acid and firing at 400° . Pure basic and acid phosphates of calcium show fluorescent intensities of only 2 and 3 on an arbitrary scale after

optimum heat treatment at 400°, but a correct mixture of the two develops an intensity of 10 when similarly treated. Phosphors developed from mixtures of calcium phosphate with certain organic compounds such as tartrates were also studied. Since teeth are made up largely of calcium phosphate in the apatite structure and contain about 1 per cent of organic matter, it is considered that their fluorescence may be due to this type of complex. The general conclusion is reached that, in the absence of a specific metallic activator, fluorescence resulting from heat treatment of inorganic compounds is due to the formation of complexes of critical composition through partial decomposition, or of critical physical condition through modification of crystal structure.

Phenazine Derivatives

A NEW species of bacterium which has been named *Chromobacterium iodinum* isolated at the National Institute for Research in Dairying at Reading produces a violet, copper-glinting pigment outside the organism at the later stages of its growth. This pigment has been examined by G. R. Clemo and H. McIlwain of King's College, Newcastle-upon-Tyne (*J. Chem. Soc.*, 479; 1938), and found to be a phenazine derivative of formula $C_{12}H_8O_4N_2$. On reduction, it yielded a compound, $C_{12}H_{10}O_2N_2$, in which two atoms of oxygen in the original compound are replaced by hydrogen. Since no product of biological origin has yet been obtained with a nitro-group (NO_2 , which would reduce to NH_2) and the reduction product is readily converted on crystallization to $C_{12}H_8O_2N_2$, the interesting conclusion is reached that the pigment is 1:2-dihydroxyphenazine di-N-oxide, a derivative of the hitherto unknown phenazine di-N-oxide. Other derivatives of this have been prepared, and the synthesis of the purple pigment is to be attempted. The phenazine compounds which have been isolated from natural sources are now three in number, namely, pyocyanine, chloraphine and the present pigment. These are all bacterial pigments, but phenazine compounds have been shown to exhibit biological activity in a variety of organisms and enzyme systems, and it is anticipated that phenazine derivatives will be found much more widely distributed in Nature.

American Steam-Distilled Wood Turpentine

INTER-STATE regulations governing commerce in steam-distilled wood turpentine and gum spirits have emphasized the need for a satisfactory method of distinguishing these two products. Actually they are both derived from the same species of pine, though the former is prepared from stump oleoresin and the latter from fresh gum. Different methods are also employed for their preparation. Even so, continued improvement in the process of refining steam-distilled wood turpentine has made their distinction less and less easy. The United States Department of Agriculture has recently published a Bulletin (No. 596, December 1937) describing a suitable technique for the examination of such products and summarizing the chief differences between steam-distilled wood turpentine and gum spirits discovered by the application of this technique. In short, this process, which consists of systematic fractional distillation, has revealed that the hydrocarbon components of gum spirits consist practically entirely of dicyclic terpenes, whereas those of steam-distilled wood turpentine consist of appreciable proportions of

monocyclic terpenes. There is a considerably larger proportion of the dicyclic terpene α -pinene in steam-distilled wood turpentine than in gum spirits. The quantity of β -pinene present in gum spirits is substantial while that in steam-distilled wood turpentine is negligible.

Critical Phenomena in Gases

RECENTLY, three papers by Prof. J. E. Lennard-Jones and A. F. Devonshire have appeared dealing with critical phenomena in terms of interatomic forces (*Proc. Roy. Soc., A*, 163, 53 (1937); 165 (1938); *Physica*, iv, 10, 941 (1937)). An atom in a dense gas is assumed to be confined for the greatest part of its time to a cell, and consequently its average environment closely resembles that of an atom in a liquid or in a crystal. Instead of trying to calculate the properties of such a dense gas from binary encounters, the atom is considered to be subjected continually to multiple encounters. On this basis, by an application of the methods of classical statistical mechanics, an equation of state is derived and values of the critical temperatures of hydrogen, neon, argon and nitrogen are calculated; these values agree well with those observed. An extension of the method to liquids makes it possible to calculate boiling points in terms of interatomic forces; those calculated for neon, argon and nitrogen agree well with observed values. In addition, a theoretical interpretation is given to Trouton's rule and to the modified form of it suggested by Hildebrand. Calculations of the vapour pressures and heats of vaporization of the inert gases have also been made.

Wave Mechanics and Stellar Statistics

THIS is the subject of an interesting investigation by Dr. H. Jehle, University College, Southampton (*Z. Astrophys.*, 15, 182; 1938). Jehle deals with the statistics of an assembly of macroscopic mass-points by means of a generalized wave mechanics in ordinary space time. The wave equation differs from Schrödinger's equation only so far as h/mc is replaced by a macroscopic length σ which is characteristic for the assembly in question. Indeed, such a Schrödinger equation can be split into a continuity equation and in a Hamilton-Jacobi equation; and these on the other hand, can be identified with the continuity equation and the Hamilton-Jacobi partial differential equation for the streaming field of a statistical distribution of mass-points. Thus the classical laws of motion are not modified, unlike the case of a single particle in ordinary wave mechanics, but the assumption is introduced that in this assembly the product interval of position times interval of velocity is greater or equal to $\sigma.c$. This is in particular an assumption about the peculiar velocities. This theory has originally been designed for big stellar systems, and it offers an explanation of the following problems: the 180°-symmetry and the very slow development of the structure of spiral nebulae; the greatest possible flattening and the average mass density in nebulae. In the case of the solar system an application of the wave mechanical perturbation theory explains the distribution of the major axes of the planets that is, Bode's law, as well as the exceptions to it (Neptune), and the corresponding distributions in the systems of the moons. The well-known resonance relations between the periods of revolution are given by similar considerations, being in close correspondence to the classical theory of resonance.