

Research Items

Control of Secondary Sexual Characters in Birds

MUCH information regarding the secondary sexual characters of birds, their alteration by experimental means and their bearing on the theory of evolution is given in a summary by Dr. Emil Witschi (*Scientia*, 60, No. 11). Many cases of male and female plumage in birds and their alteration by injections or castration are cited. The variety of conditions indicates that male and female plumage types are not necessarily always secondary sexual characters. In some species, plumage types are controlled by genetic factors, in others by hormones from different glands. Gonad hormones appear not to influence seasonal dimorphism. The hypophysis releases small quantities of gonadotropic hormones during sexual inactivity and large quantities in the breeding season. Ovarian hormone inhibits the development of cock plumage, but thyroid hormone appears to do the same. Ornamental plumages render the individual less fit for ordinary survival, but sexual selection cannot be considered the cause of the basic variations from which sex dimorphism has arisen; nor does it throw any light on the complicated hormonal and genetical control mechanisms. It is suggested that the change from hormonal to genic control may have happened through the hormones acting as messengers from soma to germ plasm.

Primitive Arthropods

THE Cawthron Lecture for 1935, delivered by the late Dr. R. J. Tillyard, has recently been published by the Cawthron Institute, Nelson, New Zealand. The subject of the lecture, "Tracing the Dawn of Life further Backwards", is one of special interest since it embodies the results of recent palaeontological discoveries among the ancient rocks of the Adelaide series. These were the outcome of many years of work by the late Sir T. W. Edgeworth David, and the rocks in question form the Proterozoic series of Australia. They are stratified deposits supposed to have been laid down in Pre-Cambrian times. Among the fossils disclosed, none is more remarkable than those described by David and Tillyard as belonging to the Arthrocephala. This name is given by them to a new Arthropod class which included creatures with four moveable head segments each bearing appendages. The address is accompanied by two plates which represent restorations of these creatures, and are taken from the original memoir lately published by the two writers mentioned.

Melanophores of the Paradise Fish

THE melanophores of the paradise fish, *Macropodus opercularis*, show two different phases in their reactions to light. The primary phase, according to G. Tomita (*J. Shanghai Sci. Inst.*, Sept. 1936), lasts from their first appearance in the embryo until the eyes have begun to function. In darkness the animals are pale, and in bright light they are dark. The expansion of the melanophores is related to the intensity of the light. The functioning of the eyes is followed by the secondary phase, in which in darkness or in light the fish are pale or dark to correspond

with their surroundings, but the reaction becomes slower with increasing age. The destruction of the eyes in the early larvæ has no effect on the reactions in the primary phase, but later larvæ in the secondary phase when so treated revert to the primary phase. Similar reversion is exhibited also by the newly born young of *Lebistes reticulatus*, *Gambusia affinis* and *Xiphophorus helleri*.

Pest and Plant

UNDER this title, Messrs. A. G. Bebbington (Empire Cotton Growing Corporation) and W. Allan (Department of Agriculture, Northern Rhodesia) have a very interesting discussion (*Empire Cotton Growing Rev.*, 14, Jan. 1937) of a thesis previously enunciated in the *Review* by Sir Albert Howard that "insects and fungi are not the real causes of plant diseases and only attack unsuitable varieties or crops improperly grown". Against this dictum, Messrs. Bebbington and Allan marshal convincing evidence, from their experience in Northern Rhodesia, of cotton crops in which the damage from bollworm and stainer attack is clearly the greater as the suitability of the locality for the crop increases, as also the care expended in its cultivation. They show also that with one stainer, *Dysdercus fasciatus*, the governing factor in determining its ravages on cotton is the extent of the fruit crop available on its chief host plant in that locality, the tree *Thespesia rogersii*. With the other stainer, *D. supersticiosus*, the story is more complicated, because it has a series of short-lived plants as its hosts and these vary in different regions, so that the incidence of attack varies in the same season from region to region. In all cases, however, both with bollworm and stainer, they produce remarkably strong evidence that, whilst neglected and poor crops of cotton struggle through to harvest with little damage from these pests, side by side with them well-grown plants, instead of yielding good crops, may be nearly ruined by their depredations.

Dermatophyte Fungi

A CASE of maduromycosis, a fungus disease affecting the legs of human beings, has recently been described from Canada by Drs. R. M. Shaw and J. W. Macgregor (*Canadian Med. Ass. J.*, 33, 23-28; 1935). A clinical history of the disease, which is known as 'madura foot', is given, and the causal fungus has been identified as *Monosporium apiospermum*. Dr. Eleanor S. Dowding also examined the fungus, and her account follows that cited above (*ibid.*, 28-32). The mycelium has the swellings and 'racquet hyphæ' typical of many dermatophytes, and its conidiophores are undifferentiated from the other hyphæ when submerged in the medium. They have a typical erect habit, often with tapering sterigmata, when borne aerially. A species of *Geomyces*, isolated from soil in Alberta, though similar to some of the fungi causing maduromycosis, was found to be non-pathogenic. Dr. Dowding and Dr. H. Orr have also studied the peculiar 'mosaic fungus' which appears in certain tissues parasitized by ringworm fungi. They consider that it is due to the breakdown of the dermatophyte fungus *Trichophyton gypsumum*.

The Sudbury Nickel Irruptive

IN his third paper on the life-history of the great Sudbury intrusion-complex, W. H. Collins describes the evidence bearing on the age relationships of the 'younger granites' to the 'nickel irruptive' (*Trans. Roy. Soc. Canada*, (4), 29; 1936). Dr. Collins and his co-workers have been unable to reach positive conclusions as to the relative ages of the rocks under investigation, though in the case of the Murray granite there are good grounds for the inference that it intruded the norite of the nickel irruptive. The Creighton granite, however, presents many puzzling features. Locally the norite becomes fine-grained against the granite and at one place stringers of a black chilled equivalent of the norite penetrate the granite for five feet. On the other hand, a stringer of granite was found extending from the main granite-mass into the chilled norite; moreover, a series of crooked and branching dykes of porphyritic granite, up to eight feet across where they leave the Creighton granite, has been traced for forty feet into the norite. After a careful discussion of all the possibilities, it is concluded that the apparent contradiction can be accounted for only by the hypothesis that the Creighton granite, though really older than the nickel irruptive, was mobilized by heat and pressure so that it was enabled to flow into cracks developed in the cooling norite. Collins is unable to support this hypothesis by many well-authenticated examples of the same phenomena. Reference may therefore be made to the fact that at the top of the Portrush Sill (near the Giant's Causeway) several occurrences have been found by N. Harris of veins of mobilized hornfelsed Lias which pass downwards into the chilled margin of the Sill from the roof. Other veins in the dolerite of the Sill consist of syntectonic rocks derived from the hornfelsed Lias by metasomatism and transfusion due to the action of magmatic emanations from the dolerite magma (*NATURE*, 138, 984, Dec. 5, 1936).

Recent Earthquakes at Helena (Montana)

THE destructive shocks of October 18 and 31, 1935, have directed attention to the earthquakes of the sparsely inhabited State of Montana. Mr. F. P. Ulrich has given (*Bull. Seis. Soc. America*, 26, 323; 1936) a brief description of these earthquakes, and has also compiled a list of all known shocks since 1805. Semi-destructive earthquakes occurred on December 10 and 11, 1872, and December 20, 1908, and a destructive earthquake, felt over about 300,000 square miles, on June 27, 1925. After a period of inactivity, the recent series began on October 3, 1935. On October 12, a semi-destructive earthquake was felt at least 200 miles from its centre. It was followed on October 18 and 31 by destructive earthquakes, between which 506 slight shocks were felt, the total number in the series up to the end of March 1936 being 1,794. The two great earthquakes were felt over an area of at least 200,000 square miles. Visible waves were reported by several observers. After each destructive earthquake, the ground at Helena was left crossed by stationary waves, the distance from crest to crest being 24-28 in. and the maximum depth 2-4 in.

Negative Ion Formation

F. L. ARNOT has found that in mercury vapour negative ions are frequently formed by a positive ion extracting two electrons from any negatively

charged electrode to which they are driven. The resulting negative ion is repelled from the electrode. A new paper by Arnot (*Proc. Roy. Soc., A*, 158, 137) extends this work to hydrogen, nitrogen, oxygen and carbon dioxide. In all these cases negative ions were formed by the new process described above. Only monatomic ions were found in hydrogen and nitrogen, oxygen gave monatomic and diatomic ions, carbon dioxide gave CO_2^- , CO^- , O_2^- , O^- , and C^- . No negative ions produced by electron attachment could be observed, though this process has in the past been assumed to account for negative ion formation. The probability of conversion of positive to negative ions increases with the incident kinetic energy of the ion incident on the surface. For 180-volt ions it lies between 10^{-3} and 10^{-5} . The energy distribution of the positive ions rebounding as negative ions from a nickel surface has been measured, and the 'accommodation coefficient' defining the fraction of the kinetic energy of the ion lost on collision with the surface has been determined. This coefficient is not single valued, but has a most probable value such that the positive ion after reflection retains a few volts energy. In the case of hydrogen, there are two maximum values of the accommodation coefficient.

Scattering of Protons by Protons

M. A. TUVÉ, N. P. Heydenburg and L. R. Hafstad (*Phys. Rev.*, 50, 806) have made a careful study of the scattering of protons in hydrogen gas. The protons were obtained from a high-voltage accelerating tube driven by an electrostatic generator with special arrangements for steadying and measuring the accelerating voltage, which was varied from 600 to 900 kv. The scattered particles were counted by an ionization chamber and linear amplifier. The results are compared with Mott's formula, which assumes the inverse square law of force. At 600 kv. the numbers observed at all angles are about two thirds of the Mott values. At higher voltages, the angular distribution is markedly different from that given by the formula, and the authors were able to assure themselves that the anomaly was real and not instrumental. The field around the nucleus must differ strongly from the inverse square field at distances of the order 10^{-13} cm. A paper by G. Breit, E. U. Condon and R. D. Present (*Phys. Rev.*, 50, 825) investigates the nuclear field by wave mechanical methods, and shows that the observations agree with scattering by a 'potential wall' in which the symmetrical de Broglie wave is distorted in a way corresponding to an attractive force overpowering the Coulomb forces at short distances. The magnitude of the interaction determined agrees with that used by Bethe in the calculation of mass defects of light nuclei. It appears to be identical with the proton-neutron interaction as determined from the scattering and absorption of slow neutrons.

Absorption Bands in the Spectrum of ψ -Isocyanine Dyes

DR. E. E. JELLEY recently reported (*NATURE*, 138, 1009; 1936) that 1:1' diethyl- ψ -cyanine chloride exhibited a characteristic narrow absorption band and a fluorescence of wave-length very close to that of the absorption band, when it was precipitated from aqueous solution. This he considered to be due to the existence of the substance in a transitory molecular state, intermediate between the dissociated

and crystalline states. Scheibe, Kandler and Ecker (*Naturwiss.*, 25, 75; 1937) find such an absorption band and accompanying fluorescence in aqueous solutions of 1:1' diethyl- ψ -isocyanine chloride of certain concentrations, and believe it to be due to a reversible polymerization of ions of the dye. In support of this view they quote the fact that there is a considerable increase in the viscosity of the solution in the concentration range in which the narrow absorption and fluorescence occur. The polymerization is completely reversed by raising the temperature by about 30°. The phenomenon is much affected by dilution, when viscosity, absorption and fluorescence disappear together. In heavy water the position of the absorption band is the same as in ordinary water. The absorption spectrum of the dye when adsorbed on various surfaces such as glass, quartz, gypsum and mica has been examined, and whilst the narrow band is obtained in all cases, its position is slightly different from that of the band observed with aqueous solutions. The fluorescence is also slightly shifted. Freshly split fluorspar and polystyrol do not adsorb the dye.

Secretions of Essential Oils in Plants

IN a report presented at the Annual Conference of the International Faculty of Sciences held in London on January 29-30, Prof. J. Politis discusses recent work in his department in the National University, Athens, on the morphology and physiology of certain plant glands. Glands on the leaves and, to a less extent, on the stems of the true artichoke (*Cynara Scolymus*) are responsible for the characteristic bitter taste. The gland originates from a single epidermal cell. The cell divisions taking place during development are described in detail, and the mature gland is figured. The characteristic bitterness of *Jurinea mollis* is found to be due to secretions from glands located on the stem, leaf and under-surface of exterior petals and bracts. Their origin, development and mature structure are also described and figured. Glands have also been found on the cardoon (*Cynara cardunculus*). Reference is made to the physiology of the secretive process, and micro- and macro-chemical tests of the substance secreted are given in detail. No further clues to their chemical nature have so far been obtained, however, but the author considers these bitter substances are essential oils which have been derived from glycosides by enzyme action.

Pure Oleic Acid

ALTHOUGH oleic acid is perhaps the most common of the naturally occurring fatty acids, the pure acid is still one of the rare chemicals. Oleic acid always occurs in fats and oils associated with saturated acids and usually with varying amounts of linoleic acid and acids of higher unsaturation. The methods of purification usually start with olive oil and proceed through the purification of the lead and barium soaps, and they are extremely tedious. J. B. Brown and G. Y. Shinowara (*J. Amer. Chem. Soc.*, 59, 6; 1937) show that oleic acid of high purity may be obtained by direct crystallization of the acids of olive oil from acetone. The saturated acids are removed by precipitation at -20°, and the remaining unsaturated acids are crystallized from acetone at -60° four or more times, this treatment being followed by a partial crystallization of the resulting

products from acetone at -35° to remove small amounts of palmitic acid not taken out in the original treatment at -20°. The three specimens obtained, distilled at 15 mm. pressure, all melted at 13.0°; the iodine numbers were 89.63-90.04, and refractive indices n^{20} 1.4585-1.4586.

'Marmite'

THE Marmite Food Extract Co., Ltd., London, E.C.3, has recently issued a booklet describing the medicinal uses of its well-known preparation, 'Marmite'. This autolysed yeast extract contains in 1 gram about 30 units of vitamin B₁ and is also a good source of vitamin B₂. Marmite has been found of value in diseases caused by a deficient intake of the B vitamins such as beriberi or pellagra, or when they are incompletely assimilated, as in alcoholic polyneuritis. Insufficiency of vitamin B is also associated with many vague conditions of ill-health, especially those accompanied by gastro-intestinal symptoms: whilst an increased intake is required during pregnancy and lactation. Sufficient evidence has accumulated during the last few years to demonstrate that Marmite possesses anti-anæmic properties. It has been found of value in tropical macrocytic anæmia, in the pernicious anæmia of pregnancy and in the anæmias associated with celiac disease, sprue, malaria and hookworm infestation. It has also been used successfully in the treatment of certain cases of Addison's pernicious anæmia, probably because it acts as a source of the 'extrinsic' factor: it does not contain a substance of the nature of the liver active principle. The booklet contains a table of the recommended dosage in the different conditions for which Marmite is indicated.

Shape of Road Aggregate

IN *Road Research Bulletin* No. 2 (London: H.M. Stationery Office. 6d.) a novel research is described to discover a method of classifying the shape and measuring the dimensions of the material that is placed as a covering on the surface of roads. Rightly or wrongly, surveyors and road engineers have thought that flaky and elongated material is undesirable for road construction. Although there are no records of actual failures that can be directly attributed to flaky material, there is a widespread unanimity of opinion that this material is unsatisfactory. In the British Standard Specifications for rolled asphalt, for example, it is stated that the stones have to be "angular and not flaky", thus hinting that flaky material is inferior. The Department of Scientific and Industrial Research and the Ministry of Transport have co-operated in preparing the bulletin under notice. The shape characteristics of broken stone and other similar materials have been measured and practical applications of the methods devised from the results have been considered. In view of the fact that the degree of flakiness permissible in an aggregate must depend at present on the judgment of the engineer, and since, in practice, deliveries will normally be compared with 'approved samples', no limits governing the maximum percentage of long and flaky material acceptable have been suggested. It is pointed out that flakiness in a crusher-run aggregate commonly varies with size. This fact, which is obviously of importance, is generally overlooked.