

## RESEARCH ITEMS

## Tongan Colour-Vision

DATA of colour-vision among Polynesian Tongans were collected by Ernest and Pearl Beaglehole in the course of a field trip to Tonga, employing the Ishihara test (seventh edition). Results are recorded in *Man* of November 1939. 135 Tongans were examined (male, 67; female, 68). Five males appeared to be red-green blind; but no case of female red-green blindness was detected. No cases of blue-yellow blindness, or of complete colour-blindness, were detected in either sex. A comparison of the percentage of red-green blindness in Tongan males (7.46) with comparable results in Whites (8.03), American Negroes (3.7), American Indians (1.7), taken in conjunction with the weight of evidence from all test results available, suggests a possible racial difference in the incidence in males of red-green colour-blindness. Of the five Tongan males with defective colour vision, two were completely green-blind. The proportion of green-blindness to red-blindness among Whites, Negroes, and American Indians as reported is also in the approximate ratio of three to one. Another peculiarity in Tongan subjects is the response of certain of them in the test to plates which can scarcely be read by normal subjects. These Tongans (10 male, 13 female) were otherwise normal. In regard to general colour discrimination a number of colour-names were collected—cream-white, skin-white, yellow or gold, yellow, red, black. There is no specific colour-name for blue, nor possibly for green either. Many descriptive colour-names are in use, as for example, colour-sea = blue; obscure, indistinct = brown; *kupesii*, stencil for marking bark cloth = dark brown; *loufusi*, banana leaf = deep green. Degree of saturation is expressed by such qualifying words as *mama*, light, *fakapo' opouli*, dark. The absence of certain terms, for example, for blue, does not imply a poor colour discrimination, but is due to a difficulty in finding words to describe them, and arises from a cultural origin.

## Pawnee Archæology

IN planning the work of the Nebraska Archæological Survey established in 1929, Dr. W. D. Strong suggested a line of attack which would establish a time sequence from known historic to unknown prehistoric. The Pawnee for various reasons offered the most suitable material for the first systematic attempt at isolating a historic archæological complex in Nebraska. During the nineteenth century, with two or three apparent exceptions, Pawnee villages centred about the confluence of the Loup with the Platte River, standing on terraces or second bottoms well out of reach of the floods. Beyond the tree-fringed water-courses are the dry, formerly grass-covered uplands suitable only for hunting; but it was the fertile river-bottoms, with abundance of wood, water, arable ground and shelter, which determined the location of their villages. The extreme limits of Pawnee settlement were on a 120-mile stretch of river valley, along which they shifted continually, but leaving it only for seasonal hunting. The sites show a somewhat decadent aboriginal culture, yielding also iron, copper, brass and glassware. Within this area but with more limited distribution are found sites with a more

abundant, superior culture and smaller quantities of white contact material. Generally the sites are large (50–100 acres or more), compact and selected with an eye to defence, some having earth-walls and ditches for protection. Excavation on these proto-historic sites has produced evidence which has been assigned to a 'Lower Loup focus', while another culture, possibly contemporary, has been revealed at Leary in south-west Nebraska, to which the name Oneota culture has been given. The relations of Lower Loup, Oneota and historic Pawnee have been discussed by Waldo R. Wedel (*Smithsonian Misc. Collect.*, 97, 7; 1938) in the light of analysis of material culture and examination of the documentary evidence of early travellers. By some it is maintained that Lower Loup is more closely related to Oneota than to historic Pawnee, but analysis of cultural traits points to the closer relation of Lower Loup and historic Pawnee, the probability that the former is ancestral to the latter, after a period of decadence, being rendered stronger by the absence of any evidence that settlements, of the size and importance indicated by the sites, were made here by a sedentary, horticultural people other than the Pawnee since the arrival of Europeans.

## The House-Sparrow in Canada

THE house-sparrow (*Passer domesticus*) has been long established in Canada, and a recent investigation by Richard Lee Weaver suggests that it reached its peak of abundance several decades ago, and since then has in some parts declined in numbers (*Canadian Field-Nat.*, 53, 95; October 1939). In general, the northern limit appears to be determined by the limit of systematic cultivation, although occasional colonies persist beyond that boundary in the neighbourhood of settlements. Occasionally, too, specially favourable conditions induce a northward movement, such as established the birds at Churchill, on Hudson Bay, but in such cases the severe winters cause many deaths, and at Churchill the danger of extermination is circumvented only because the sparrows inhabit in winter the railroad roundhouse, where they get shelter and food from man. The change in locomotion from the horse-traffic of early days to the motor-car has made extraordinary differences in the sparrow population in towns, for the hordes of sparrows which once, according to a note by the Ornithological Editor, made sidewalks unusable and in another way interfered with church services, have disappeared with the disappearance of horses and the droppings which formed a main food supply in winter.

## Reproduction of the Spotted Hyæna

SOME unestablished peculiarity about the sexual anatomy and physiology of the spotted hyæna (*Crocota crocuta*) led writers of antiquity to assert that it was hermaphrodite. Scientific study of the subject has been meagre, but this statement no longer holds good in view of the investigation of L. Harrison Matthews, who travelled to East Africa to study the animal and records the results of the examination of 103 individuals (*Phil. Trans. Roy. Soc. Lond.*, Ser. B, No. 565, 230, July 1939). This random sample had a sex ratio of 61.1 per cent of males. The anatomical

puzzle arose from the peculiarity of the female genitalia, which possess a clitoris, perforated by the urinogenital canal, so similar to the penis of the male that male and non-parous females are indistinguishable externally. There is no annual breeding season for the female in Tanganyika Territory, all stages of sexual activity being found at the same time. In the absence of fertilization, a diœstrous cycle of about a fortnight occurs. Following fertilization, gestation lasts about 110 days, the lactation period extends over six months, and the complete sexual cycle lasts nearly a year. The author suggests that the peculiar male facies of the female may be produced by an excess of androgenic substances, accompanied probably by a deficiency of œstrogenic ones, derived from the ovary. The limit of life of the spotted hyæna appears to be about ten years.

#### Choice of Water by the Honey Bee

C. G. BUTLER of the Rothamsted Experimental Station has described the habit of bees collecting water from many undesirable sources that are often choked with decaying organic matter (*Bee World*, November 1939). It seemed, therefore, of interest and importance to discover what attracts bees to such sources of water. In his experiments most of the salts essential to animal life were tested in various concentrations against distilled water. Only in the case of very dilute sodium chloride and ammonium chloride were the bees attracted more than to distilled water. The optimum concentration was between 0.15 per cent and 0.07 per cent; with progressively stronger solutions the bees showed increasing preference for distilled water. Rain water, from a leaf-choked gutter, was next taken and tested against distilled water and the salt solutions. More than 90 per cent of the bees chose the rain water. Further experiments showed that bees were being attracted to this source of water by smell alone, and that their liking for very dilute salt solutions has little or nothing to do with their finding a source of drinking water. It is suggested that it is best to fill apiary drinking fountains with rain water to which is added sufficient sodium chloride to make it into a 0.1 per cent solution.

#### Water Movement and Radial Growth in Trees

W. R. C. HANDLEY has recently published some observations on the effect of prolonged chilling on these processes (*Ann. Bot.*, N.S., 3, No. 12, 803; 1939). By subjecting woody shoots of young saplings of ash and sycamore to continuous cooling to 2° C. during the season of growth, radial growth was almost completely inhibited, though not extension growth (which was, however, later in starting and proceeded more slowly). When cooling was extended to 0° C., leaf-wilt occurred owing to still further reduction in water conduction. Turgidity recovered on raising the temperature again to 2° C.

#### Wound Hormones in Plants

J. English, J. Bonner and A. J. Haagen-Smit (*Proc. Nat. Acad. Sci.*, 25, 323-329; 1939) have isolated a crystalline substance of composition  $C_{12}H_{20}O_4$  which is capable of inducing renewed cell division and cell extension in parenchymatous cells. This substance was isolated from fresh bean pods. The activity of the substance is about a hundred times that of the original material, but this varies considerably. This variation is probably due to the

fluctuation in the amount of co-factors in the test material. Such co-factors have been identified during the chemical preparation, while sucrose and glutamic acid were found to increase greatly the activity of the di-basic acid  $C_{12}H_{20}O_4$ .

#### Aphid Vectors of Sugar-cane Mosaic

THE aphid *Aphis maidis* has been recognized for a considerable time as a transmitting agent for the sugar-cane mosaic virus. H. D. Tate and S. R. Vandenberg have shown, however (*J. Agric. Res.*, 59, No. 1, 73-80, July 1939), that two other aphids, *Carolinaia cyperi* and *Hysteroneura setariae*, which may occur on the crop in Porto Rico, are also vectors of this particular disease. These insects inhabit the weeds *Cyperus rotundifolia* and *Eleusine indica* (goosegrass), which are common in sugar-cane plantations, and doubtless play a considerable part in the spread of mosaic under field conditions. A fourth kind of aphid, *Sipha flava*, was unable to transmit the virus. The results supply yet another instance of the close relation between a virus and its insect vector.

#### Indirect Damage by Narcissus Leaf Diseases

RESULTS of several recent investigations into the damage caused by fungi the general attack of which upon their host plants appears to be slight have often revealed more extensive indirect damage. Such a state of affairs has now been demonstrated by P. H. Gregory for several leaf diseases of the narcissus ("R.H.S. Daffodil Year Book", pp. 49-53, 1939). Leaf scorch, caused by the fungus *Stagonospora Curtisii*, white mould, which results from the parasite *Ramularia vallisumbrosae*, grey mould (*Botrytis narcissicola*) and fire (*Sclerotinia polyblastis*) are widespread in the commercial bulb districts of the south-west of England; but it is not certain whether they invariably cause substantial loss of the crop. Dr. Gregory has shown that their indirect effects, at any rate, are quite substantial. The leaf spotting fungi spread upon the foliage after the time of flowering, and often curtail photosynthesis, so that subsequent flower crops are affected. Spraying the foliage with Bordeaux mixture resulted in increased bulb weight, enhanced flower quality, and, most important of all, considerably greater flower crop. Gains in flower production as high as 70 per cent over unsprayed foliage have, in fact, been recorded. Further measures of plant hygiene, such as the removal of infected foliage and flowers, are recommended, whilst routine lifting and replanting of the bulbs usually eradicates the diseases if fresh foliar infection does not occur.

#### Structure of Complex Fluorides

AMONG compounds of the type  $R_2MX_6$  ( $R = K, NH_4$ ;  $M = Si, Ge, Sn, Ti, Zr, Mn$ ) only the fluosilicates have been prepared in crystalline modifications possessing the fluorite-like arrangement of  $R^+$  and  $MF_6^{--}$  ions known as the ammonium chloroplatinate type. J. L. Hoard and W. B. Vincent (*J. Amer. Chem. Soc.*, 61, 2849; 1939) have examined by the X-rays the atomic arrangement in crystals of ammonium and potassium fluogermanates. The crystals possess one-molecule hexagonal units of structure, and the crystal structure is an aggregate of univalent cations ( $K^+, NH_4^+$ ) and nearly regular octahedral anions ( $GeF_6^{--2}$ ) with  $Ge - F = 1.77 \text{ \AA}$ . Each cation is surrounded by nine nearly equidistant

fluorine atoms and three others at somewhat greater distances. The structure is of the same general type as that of the hexagonal modification of ammonium fluosilicate; it is found only in the case of complex fluorides, for which at ordinary temperature it is usually preferred to the cubic ammonium chloroplatinate structural type.

#### Structure of Water in Ionic Solutions

THE effect of the presence of ions on the structure of water molecules has long been the subject of investigation and discussion. In a recent article (*J. Chem. Phys.*, 10, 869; 1939), G. W. Stewart reports data on the variation of the X-ray diffraction pattern of water with concentration of dissolved electrolytes ( $\text{NH}_4\text{Cl}$ ,  $\text{LiCl}$ ,  $\text{NaCl}$ ,  $\text{KCl}$ , and  $\text{MgCl}_2$ ), and draws the following direct conclusions from a consideration of the displacements of the major and minor diffraction peaks: (i) the increase in concentration of ions causes the amount of 4-co-ordinated water structure to decrease and produces a more closely-packed arrangement, with a consequent increase in density; (ii) the effect of the ion on the water structure is not confined to that shell immediately adjacent to the ion; and (iii) the alteration in structure is apparently similar to that produced by increasing the temperature of water. Further, from measurements on the alteration of the minor diffraction peak by fifteen strong electrolytes, selected because of their wide variation in type and in apparent molal ionic volume, he shows that the liquid structure of water varies with ionic concentration at a rate comparable with the rate of variation of the apparent molal ionic volume. It seems, in fact, that the alteration in liquid structure has an effect on the apparent molal ionic volume much more important than has the electrostatic effect based on the Debye-Hückel theory. On the basis of these interesting data the author draws a picture of the solvent and its alteration in density by the ion solute which agrees with the conception of Bernal and Fowler (*ibid.*, 1, 515; 1933). Water at temperatures just above the melting point has a co-ordination number greater than that in ice, and the packing is correspondingly closer in the liquid. This difference explains the latent heat of fusion, and the increase in density of water on melting. The structure of liquid water is not rigid, as in a crystal, and the relation of any molecule to its neighbours is constantly changing. Co-ordination bonds are broken and re-made. The water is homogeneous only if a representative group of molecules is considered. The effect of ions is not to contract the structure but to increase the co-ordination number, and thus change the closeness of packing.

#### Stellar Structure and Stellar Energy

AN interesting paper with the above title has been published by W. H. McCrea (*Occas. Notes, Roy. Astro. Soc.*, No. 6; October 1939). He gives a short summary of the present position on attempts to utilize known physical laws to explain the mechanism of energy-generation responsible for the maintenance of stellar luminosity. The problem is to discover a mechanism of energy-generation that will be consistent with the physical conditions prevailing in the star. The problem of stellar structure can be stated in its generality as follows: given in some region of space a quantity of matter of known chemical composition and given its initial physical state, what will be its subsequent history? The problem would be soluble

in principle if the physicist knew how the material components can interact with each other and with radiation, including the various ways in which the interaction could generate energy. The following points seem to be fairly well established. In the brighter stars of the main sequence, the energy-generation is provided by the formation of helium from hydrogen, and these stars have a large hydrogen content, their central temperatures being about 20 million degrees. While there is no evidence that the synthesis of heavier nuclei in stars occurs, it is certain that some of these nuclei have an essential role as catalysts in the synthesis of helium. Stars of the main sequence, the masses of which are not too great, ultimately contract and become white dwarfs. The giant stars present a difficulty if, as is predicted by the theory of stellar structure, they have relatively low central densities and temperatures. Gamow's suggestion of processes in which there is resonance between an energy level of a nucleus and the energy of a penetrating particle has not been substantiated, and it seems certain that there is an essential distinction between the structure or mode of energy-generation or both in the giants and main-sequence stars. Among the problems awaiting solution are the ultimate fate of massive stars, the mechanism of energy-production in giants, and the origin of heavier nuclei in stellar material.

#### Sunspots and Magnetic Disturbances

H. G. ARCHENHOLD has recently published a paper on the influence of the variability of the mean latitude of sunspots on the recurrence tendency of magnetic disturbances (*Mon. Not. Roy. Astro. Soc.*, 99, 9; October 1939). As is well known, the rotation of the sun varies with the latitude; also, the mean latitude of sunspots changes systematically during a sunspot cycle. In the first years, that is, after a sunspot minimum, the mean equator distance of the spots is about  $20^\circ$  and at the end a little more than  $5^\circ$ . The synodic period of rotation corresponding to these latitudes is 27.5 and 26.9 days, respectively, and if terrestrial magnetic phenomena are connected with the areas of sunspots, there should be a sensible difference between the recurrence intervals in years of low and high sunspot latitudes. Chree and Stagg used the magnetic character figures of the years 1906-1925 and could not detect any effect in the case of terrestrial magnetism, but Archenhold has utilized data going back to 1847 and arrives at a different conclusion. As the data are not uniform, he found it necessary to employ different methods of analysis for different periods, and very full details are given of the procedure adopted. For all the groups dealt with he finds a recurrence interval of 27.02 days for the years before sunspot minima and of 27.52 days after the minima. The mean error of the first value is  $\pm 0.13$  day, and that of the second is  $\pm 0.05$  day. The difference of 0.5 day between the recurrence intervals in years before and after sunspot minima is thus 3.6 times the mean error,  $\pm 0.14$  day. From the beginning of the cycle to the end, the recurrence interval shortens continually, and this is what would be expected because of the decrease in the mean equator distance of the sunspots. When sunspot zones occur near the equator and also in higher latitudes, the shorter recurrence interval of the equator belt prevails, because of the greater effectiveness of disturbed areas near to the equator on the earth's magnetism.