

Research Items

Problems of Colour Vision. Colour vision and colour blindness are of much importance in connexion with signal and traffic lights and navigation, as well as being of general interest. Between the colour 'normal' and the actual colour-blind, many intermediate states exist, and a review of literature dealing with colour discrimination by Mr. W. O'D. Pierce has recently been issued by the Medical Research Council (Special Rep. Series, No. 181. London: H.M. Stationery Office). The Committee on the Physiology of Vision of this Council has also undertaken at the request of the Admiralty investigations on the subject which are now published in another report (Special Rep. Series, No. 185. London: H.M. Stationery Office). A surprising number of colour-sense defectives may be found even among men who have been selected after passing colour-vision tests now in general use, and in some of these cases the defect may be present in such degree as to impair efficiency. Thus, in harbour the colour of moving navigation lights may be correctly interpreted by colour-defectives by contrast with known fixed 'key' lights, while moving lights at sea are misnamed. Coloured lights of high intensity may be correctly named when the same lights of low intensity cannot be recognised. The red end of the spectrum may be visually shortened compared with the normal—a dangerous defect—and so on. The report lays down the requirements for an effective system of tests, and recommends those for the Navy, namely, the Ishihara card test first, followed by a lantern test, preferably with the Board of Trade lantern. No single test is infallible.

Stimulus to Colour Change in Fishes. The sensitiveness of response of colour-change in fishes to visual stimulus has been tested by Ellinor Helene Behre with coloured lights the wave-lengths of which were known (*Copeia*, 1933, p. 49). She has found that certain species of fishes can distinguish between lights of different wave-length and between these and daylight or complete darkness, and can record their perception by changing colours. Two species, at least, can record equally well when one eye is obscured, but no response occurs when both eyes are obscured. The six light filters used seemed to affect all fishes in much the same order. Daylight was the extreme darkening factor and absence of light the extreme fading factor. More particularly, the colours fall into line with minus blue, red, minus green, minus red, green and blue, leading towards complete absence of light as fading factors. Apparently the red end of the spectrum, or long wave-lengths, is responsible for darkening, and in combination the short wave-lengths counteract this effect.

Ecology of Japanese Stickleback. J. Kobayashi records observations (*J. Sci. Hiroshima Univ.*, ser. B., div. 1, vol. 2, 1933) on the ecology of a stickleback, *Pungitius sinensis* var. *kaibaræ*, which occurs in brooks. The coloration of the sexes becomes different when the fish are about 2.4 cm. long, about 80 or 90 days after hatching, and the fighting qualities of the male begin to appear about this time. As the spawning period is reached the male becomes dark bluish-black. Spawning occurs between late January and late June. In the shelter of aquatic plants the male makes the almost spherical nest, composed of pieces of soft material and mucus (secreted from the

kidneys) and having at first two openings, one at the back and one in front, but finally only one—the front opening. When the nest is completed the male swims around a female, raising his spines and spreading his fins and oscillating his caudal fin, and endeavours to induce her to enter the nest and lay eggs. As soon as the female has left the nest by breaking through the back wall the male enters and deposits the milt on the eggs, and repeats this after each female has laid eggs. From three to ten females are so induced to lay eggs and then the male assumes protection of the eggs, which hatch about ten days after they have been laid. The fry issue from the nest ten days later, swim in shoals, and three days later leave the care of the male, who conceals himself in the aquatic plants, weakens and dies. Many of the females die after depositing two batches of eggs at intervals of 50 days, but some lay three times.

Observations on *Hydractinia*. Dr. P. L. Kramp (*Vidensk. Medd. Dansk. naturh. Foren.*, Bd. 94, 1933) records observations on the hydroid *Hydractinia echinata*. On examining large poles of fir used in building a new mole on the Skagerrak coast, he observed they had been more or less attacked by the shipworm (*Teredo*) and on several poles he found enormous colonies of *Hydractinia* which seemed to have played a part in stopping the attack of *Teredo*, for on removing the encrusting colonies he observed several small openings leading into short tubes bored by *Teredo*. These *Teredo* had met an early death because their connexion with the water had been cut off by the growing colonies of *Hydractinia*, and several small mussels (*Mytilus*) attached to the same poles were also more or less overgrown by the *Hydractinia*. In another place on the same coast where the perpendicular walls of the moles are covered with creosoted planks of beech-wood, Dr. Kramp found extensive areas covered with a carpet of *Hydractinia* separated from the wood by a thin layer of creosote. Wood when not covered in this way exudes creosote which is washed away, but where the carpet of *Hydractinia* was present it had prevented the escape of the creosote.

Genetical Classification of Roses. A paper in the *Gardeners' Chronicle* of November 4, 1933 ("Origin of Species in *Rosa*, Linn.", by Dr. C. C. Hirst, pp. 347-348) shows how recent advances in genetics can be used to clear up difficulties in the classification of roses. Of the tribe *Roseæ*, there are six genera, containing ten diploid species and possibly eighty-one polyploid species (that is, species with more than one contribution from each parent— $3n$, $4n$, $5n$ chromosomes and so on, instead of the normal $2n$). Of the possible eighty-one polyploids, only forty-one have so far been identified, but the author shows how a new pentaploid variety, which may be designated *ABCDD* and is apparently *Rosa farinosa*, Bech., appeared on Limepit Hill, in Cambridgeshire. Its parents must have been the pentaploid *R. Eglantheria* (*ABB CD*), pollinated by the tetraploid *R. mollis* (*CDDE*). The former produces female gametes *ABCD*, and the latter male gametes of constitution *D*, therefore giving the desired combination. The reciprocal cross would result in a sterile hybrid, but *R. farinosa* produces germ cells which are similar in constitution to those of its original parents, and

therefore breeds true from seed. It is, indeed, spreading quickly in the district under study, and bids fair to be a successful rival to *R. mollis*, its male parent.

Fungi Imperfecti. The presidential address of Mr. John Ramsbottom to the Quekett Microscopical Club deals with the "Fungi Imperfecti" (*J. Quekett Micro. Club*, Ser. 2, 16, No. 99, 261-276, Oct. 1933). Several ways in which the conidial stages of members of the Phycomyces, Ascomycetes and Basidiomycetes can be classified as separate fungi are discussed. An ingenious suggestion is that many of the Fungi Imperfecti are mutants from one sex of certain heterothallic fungi, which cannot unite with mycelium of the opposite sex, owing to the mutation, and are therefore propagated only by vegetative means. Various systems of classification are described, including those of Saccardo, von Hoehnel and Vuillemin.

Structure of Timber in Relation to its Use. A paper of great interest to scientific users of timber has recently been published by Mr. F. W. Jane (*J. Quekett Micro. Club*, 16, No. 99, 277-300, Oct. 1933). The various ways in which medullary rays are found to occur in microscopic section are shown to have a very definite bearing upon the beauty of 'figuring' in the sawn timber. Parenchyma round the vessels can also account for figuring. Examination of a section under the microscope should make it possible to determine the best way of sawing to obtain the maximum beauty. Strength, resilience, uniformity of structure and other characters are all discussed from the point of view of microscopic structure. Special interest is attached to the presence or absence of thyloses in the wood vessels, in rendering a wood either porous or impermeable. Microscopic structure will not, of course, explain all the characters of a timber, but Mr. Jane's paper represents a definite contribution to the application of science to the art of wood-working.

Grass Treading and Grazing by Poultry. Up to the present, very little information has been available as to the capacity of different grasses to withstand the treading and grazing of poultry. Experience gained in management of pastures grazed by cattle, sheep and horses is not necessarily applicable to poultry runs, as in the latter case treading is of a different nature and also more intensive. Further, no rotational grazing is practised and the droppings are relatively rich in nitrogen, both of which are factors influencing the nature of the sward. Results of preliminary experiments, however, recently described by D. H. Robinson (*J. Minis. Agric.*, 4, 510), show that the state of the turf in poultry runs is of more importance than has hitherto been realised, for it seems to be associated with egg-laying capacity. In trial pens, set up at the National Institute of Poultry Husbandry, sown with single species of grasses, crested dogstail and the meadow poas gave the most satisfactory results, the rye grasses proving less persistent and forin quite unsuitable. As regards non-graminaceous plants, yarrow, or yarrow in conjunction with rib grass (plantain), seemed particularly promising. Interesting points of contrast arose if ducks or geese were kept in the place of hens. The peculiar flat tread of the duck brought about a complete destruction of the grass species in the turf, leaving broad-leaved plantain and mayweed as the dominant species, but on replacing the ducks by hens the plantain and mayweed disappeared and the grasses regained their dominant position. Geese also

exerted an entirely characteristic effect on the turf, both on account of their specially vigorous grazing habits and also because of the different chemical composition of their excreta. Relationships suggestive of a correlation between the state of the turf and egg production, and between the type of feeding and the demands made by the poultry upon the grass were also obtained. The confirmation and extension of these results will be awaited with interest.

Extinct Waterways of the Fens. Certain raised banks of laminated silt which meander over the peat lands of the Fens have been identified by Major G. Fowler and called by him roddons. In a lecture to the Royal Geographical Society on November 13, he explained their formation and discussed the courses of some of these ancient waterways. Their present raised position is due to differential shrinkage or wastage as between the deposited silt of the stream and the deep peat through which it flowed. In some cases shell marl takes the place of silt. Another type is a deep and steep-sided channel in the clay which is filled with peat. The silt of many roddons contains marine or brackish water foraminifera which show that they were once tidal waterways. The roddon that marks the original course of the Little Ouse is shown to go back as far as Mesolithic times. The Fenland Research Committee has investigated the chronology of the fens in the area near King's Lynn. The floor of the Fenland basin there appears to be eroded Kimmeridge clay which was a land surface 60 ft. above sea-level in Mesolithic times. A later subsidence associated with the formation of the North Sea led to bad drainage and peat formation and afterwards brackish lagoons. Then after a deposition of silt a slight re-elevation or cessation of subsidence led to a second period of peat formation, and so on until four distinct peat beds had been formed, or further inland only two. Through these peat beds the old waterways can often be traced and so the ancient topography reconstructed.

Rainfall of the Dutch East Indies. In *Verhandeligen* No. 24 of the Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia, under the heading "Regenval in Nederlandsch-Indie", Prof. Dr. J. Boerema continues his account of the rainfall of the Dutch East Indies by a cartographical study of the mean rainfall over Borneo for each month of the year and for the whole year. The monthly distribution is shown by shading, with steps of 50 mm. up to 200 mm., and above that in steps of 100 mm., and the annual distribution by steps of 500 mm. to 3,000 mm., the interval then becoming 1,000 mm. These maps illustrate well the persistently wet climate of an island through which the equator passes almost centrally, and the large influence of elevation in condensing the moisture carried by the north-east and south-east trade winds, which here cross the equator in the winter and summer respectively of the northern hemisphere, but they do not bring out very clearly the different types of seasonal rainfall to which different parts of the island are subject: for example, it is not easily seen that a part of the island shares the Indian type of distribution and gets most rain from south-east trades that have crossed the equator and become the south-west monsoon. It is seen from the annual map that a part of the central region, lying slightly north of the equator, receives on an average more than 4,000 mm. of rain (London

receives about 600 mm.), and that it is only in the north that the figure falls below 1,500 mm. In judging of the extent of the service to climatology of studies of this kind, it is necessary to bear in mind the trying tropical conditions under which the work of maintaining uniformity of method of observation and of handling the accumulated material has always to be carried on.

Magnetisation by Rotation. In part 8 of the thirteenth volume of *Physica*, Prof. S. J. Barnett, of the University of California, gives an account of the various gyromagnetic effects and the experiments which have been carried out to detect and measure them. In the June issue of the *Proceedings of the American Academy* he describes his most recent experiments to detect the axial magnetisation of a rod of magnetic material, due to the rotation about its axis of a transverse magnetic field. The rods used were of compressed iron and permalloy dust 25 cm. long and 1.4 cm. in diameter with their axes running horizontally magnetic east and west. They were magnetised transversely by flat coils with their planes horizontal and vertical respectively, through which alternating currents in quadrature of frequencies 14,000 and 21,000 per sec. were sent and produced a rotating field of about 15 gauss. The axial field was measured by an astatic magnetometer, a rod being placed on each side of it. The results for both materials are about a fiftieth of those calculated on the supposition that the magnetic elements rotate with the field, and the author concludes that they do not rotate but have their moments periodically reversed by the rotating field.

Protection of Magnesium Alloys. The employment of magnesium alloys for engineering purposes is in many cases restricted on account of their liability to corrode and of the serious effects of corrosion on their mechanical properties. In particular it is found that localised corrosion may set up a pronounced notch effect, and this factor, in a group of materials already markedly susceptible to stress-concentration effects, has naturally hampered their development where corrosive conditions have to be met. The problem has recently been attacked by the development of protective films as bases for the usual painting processes, and several methods of producing such films by chemical immersion have been devised. Owing to the high reactivity of magnesium, it is comparatively easy to produce films on these alloys, but it has required much patient investigation to arrive at really successful processes. In a paper read before the Institution of Chemical Engineers on December 8, Bengough and Whitby described the successful application of their selenium process for the protection of magnesium alloys against marine corrosion. Specimens were immersed for 5-15 minutes in a solution containing 10 per cent selenious acid and 0.5 per cent sodium chloride, at ordinary temperature, and were then subjected to four months' exposure to sea-water spray, applied thrice daily, without suffering appreciable attack. The success of the process is attributed largely to the self-healing properties of the film, which are thought to depend upon the following reactions. The magnesium surface becomes coated with a thin layer of magnesium selenide, which is decomposed by water penetrating through pores in the selenium layer. The hydrogen selenide thus formed reacts with oxygen to give selenium, which seals the pores through which the water penetrated.

Structure of Glasses. In an extension of their previous work, J. T. Randall and H. P. Rooksby have described (*J. Soc. Glass Technology*, September) experiments on the diffraction of X-rays by vitreous bodies (*NATURE*, 130, 473; 1932), including cadmium pyrophosphate, selenium, lithium metaborate, antimony and bismuth sesquioxides, lead metasilicate and a number of common glasses. In agreement with the previous work, it is concluded that the diffraction bands can, in general, be explained on the basis of the idea of minute crystals or groups of atoms regularly arranged over very small volumes in the glassy solid. In more complex commercial glasses, the regular groups of atoms may not be so definite in composition or size as in the case of the simpler glasses. The complex glasses might, from the results, be either assemblages of SiO_4 groups joined and cemented together by the large Na and Ca ions, or mixtures of silicates such as CaSiO_3 and $\text{Na}_2\text{Si}_2\text{O}_6$. Although crystals of, for example, CaSiO_3 , separate on annealing, it does not follow that these silicates are present as such before devitrification commences, since at temperatures near the annealing range, motion of ions such as Na and Ca may occur so as to destroy existing complexes and form new ones. The general question of the state of affairs favourable for the formation of a glass is considered, and it is suggested that the probability of the formation of a glass is high for those substances in the normal crystalline forms of which the forces binding the atoms together are either strongly directional or localised in character. The authors point out that the average widths of X-ray diffraction bands for liquids are about the same as those of the glasses, and hence conclude that similar groups of atoms or molecules are present. A suggested mechanism for the fusion of solids is sketched in the paper.

Chemistry of Tobacco Curing. The importance of the chemical changes which occur in the tobacco leaf during the process of curing has led to a detailed investigation by H. B. Vickery, G. W. Pucher, A. J. Wakeman, and C. S. Leavenworth (Carnegie Institution of Washington, Publication 445). Tobacco leaves from one picking were either subjected to the curing process or placed with their bases in distilled water, random samples being selected for chemical analyses at frequent intervals. The changes in water and solids and various leaf constituents, the distribution of nitrogen, the synthesis of nitrate and various other factors were examined in both sets of leaves. Generally speaking, the reactions in both cases were very similar, but there was a marked difference in the time relationships, as most processes were hastened in the cured leaves compared with those in which turgor had been maintained as long as possible. Full comparisons of results were made and inferences drawn from the slope of the graph curves with regard to the chemical reactions that proceed in intact tobacco leaves. Loss of organic solids due to the formation of volatile products is a continuous process, but apparently reducing carbohydrates play a relatively small part in the reaction. Digestion of protein to amino acids occurs slowly in cured leaves, as the full efficiency of the protein-digesting mechanism is not called into play under these conditions. The relevant data are set out in tabular form, and details are given as to methods used in the work for the determination of carbohydrates in tobacco leaf extracts.