RESEARCH ITEMS

Evolution of Sex Chromosomes

M. J. D. WHITE (*J. Gen.*, **42**, 143–172 and 173–190; 1941) has examined the sex-chromosome mechanisms in praying mantids and in the crickets and grasshoppers. The majority of the Mantoidea have an *XO–XX* sex chromosome mechanism; the *X*-chromosome is mediocentric. In the sub-family Mantiniæ *sensu strictu* a $X_1X_2Y_1 : X_1X_1X_2X_2$ mechanism has been developed. The author shows that this probably arose from the *XO* type by a mutual translocation between the *X* and an autosome. The sizes of the component chromosomes may differ as the result of succeeding translocations. Meiosis appears to be of an anomalous type, and it would seem impossible to determine by cytological methods whether crossing-over occurs, since chiasmata are not seen. It is shown that translocation simultaneously involving both *X* and autosomes in the Tettigondæ occurs rarely if at all. The *X* is therefore in evolutionary isolation. Therefore differences in sizes and shape of the *X*-chromosomes of neighbouring genera have arisen from internal rearrangements. These rearrangements may be beneficial in readjusting genic balance, upon which sex determination depends.

Origin of Cherries

T. RAPTOPOULOS (*J. Gen.*, **42**, 91–113; 1941) has examined the cytological behaviour of Duke, sour and sweet cherries and several hybrids. He shows that the Duke cherries and the sour cherries are autotetraploids, but of different origins. The Duke cherry probably is a tetraploid derivative of *Prunus avium*, whereas the sour cherries probably arose from a species cognate to *Prunus avium* which differed in a number of genetic characters. The quantitative data on which the above conclusions are based are that the Duke cherries have a high chiasma frequency (1·59) while the sour cherries have a lower frequency (1·34). When crossed together, the sour cherries are able to produce as many quadrivalent configurations as in the Dukes themselves. Hence selection has taken place in the sour cherry for low chiasma frequency. There is an inverse ratio between fertility and number of quadrivalents in nine species and varieties of tetraploid cherries.

Ultra-Violet Absorption by *Drosophila melanogaster*

SINCE ultra-violet radiation gives rise to lethal gene mutations in Drosophila, it is important to know how much radiation penetrates the body cells before reaching the sperms. As a first approximation, F. Durand, A. Hollaender and M. B. Houlahon (*J. Hered.*, **32**, 5'–56; 1941) have observed the absorption of radiation by the abdominal wall between 2140 A. and 4400 A. under an ultra-violet microscope. It was found that the abdominal wall is unexpectedly transparent. Below 3000 A. there is a rapid increase in absorption; this ranges from about 20 per cent at 4400 A. to about 94 per cent at 2500 A. It is necessary, therefore, to know the amount of absorption in the overlying tissue in order to know the dose which induces gene mutation in the testis.

Wing Development in Drosophila

MANY genes affect the characters of *Drosophila melanogaster*, and, as shown by Waddington, these affect the wing at different stages of development. A. D. Lees (*J. Gen.*, **42**, 115–142; 1941) has wounded the developing wing of pupæ 0–3½ hours old, 4–6 hours old and 6–21 hours old. Wounding the wings of the youngest pupæ gave rise to tilt, fused, vesiculation and scalloping effects. Wounding of the 4-hour-old pupæ gives characteristic rounded wings due to an inhibition of cell multiplication and to the dumpy effect. Injury of the older pupæ leads to holes in the epithelium, to production of extra veins as in Delta, and alteration of the position of the posterior cross vein. These experiments shed considerable light on the means by which one gene may affect a final character expression by disturbance of the normal development at a particular stage.

Behaviour of Nitrogen and Hydrogen on Osmium

HABER in his classical researches on the synthesis of ammonia found that osmium was an excellent catalyst. The catalysts for this important synthesis have commanded much attention. Recently H. S. Taylor and Joris have investigated the exchange of nitrogen isotopes on a promoted iron catalyst, and they have now extended their studies to an unpromoted, metallic osmium catalyst (*J. Chem. Physics*, **9**, 287; 1941), prepared by the decomposition-reduction of ammonium osmium chloride in a stream of hydrogen at 300° C. Activated adsorption of hydrogen on osmium occurs between 80° and 573° K., but at low temperatures a certain amount of van der Waals' adsorption is also evident. With nitrogen, throughout the same temperature range, van der Waals' adsorption decreases as the temperature is increased. The isobar at 1 atmosphere shows a minimum at 350° and then increases, due to activated adsorption, to a maximum at 428°. The nitrogen adsorption is less than 10 per cent of the hydrogen adsorption at one atmosphere between 273° and 573°. At 473° the isotopic exchange of nitrogen, $^{28}N_2 + {}^{30}N_2 = 2\,{}^{29}N_2$, is just measurable, but at 573° it is very rapid and has an activation energy of 21·8 kgm.cal. The reaction is inhibited by hydrogen and becomes unmeasurable when the hydrogen content exceeds 50 per cent. Ammonia decomposes six times as fast as the rate of the exchange reaction and yields a 1 : 3 nitrogen-hydrogen mixture. The mechanism of the exchange appears to be controlled by the migration of atomically bound nitrogen on a surface on which active centres are few. The area per gram of osmium has been calculated as 30·8 square metres, but only 4 per cent of this area is covered by nitrogen at the temperature of maximum activated adsorption (428°).

Optically Active Dyes

THE present view of the mechanism of the dyeing of textile fibres is that it occurs in three stages: (1) diffusion of the dye into the submicroscopic voids of the fibre, (2) adsorption of the dye, (3) irreversible fixation of the dye. The nature of the union between the

dye molecule and fibre molecule is not established, but it is generally supposed to be a physical adsorptive phenomenon occurring through hydrogen bonds and secondary valencies in the dyeing of vegetable fibres, and chemical phenomena such as salt formation in the dyeing of animal fibres. But the distinction between these two types of combination is not sharp, and the process might be the result of both. Some slight evidence of optically selective adsorption of one form of a dye containing an asymmetric carbon atom, claimed by Morgan and Skinner in 1925, has not been substantiated, so that the partial resolution of a dye in the racemic form in associating with the optically active structure of protein and cellulose fibres, which would favour a chemical combination, is not proved. W. R. Brode and R. E. Brooks (*J. Amer. Chem. Soc.*, **63**, 923; 1941) have now synthesized a dye in which the whole molecule, and not merely a carbon atom well removed from the origin of colour, is asymmetric, and the chromophore and auxochrome groups are situated as nearly as possible to the seat of optical activity. It was prepared by tetrazotization of the active and racemic forms of 2, 2′-diamino-1, 1′- dinaphythyl and coupling with phenyl-*J*-acid. Dyeing tests with these active and racemic dyes failed to show any selective absorption by wool or rayon fibres, and support a physical, rather than a chemical, combination between fibre and dyestuff.

Vapour Density of Iodine

AT ordinary temperatures, iodine consists of diatomic molecules. At 600° dissociation is less than 1 per cent, but at 1200° it is 50 per cent. The equilibrium $I_2 \rightleftarrows 2I$ has been previously investigated several times, but there is a lack of concordance among the data. A re-examination has been made by G. K. Rollefson and Perlman (*J. Chem. Physics*, **9**, 362; 1941) in order to obtain reliable data and to test experimentally if existing difficulties arise from the presence of triatomic molecules, which, on theoretical grounds, are considered sufficiently stable to exist in the vapour state (*J. Amer. Chem. Soc.*, **54**, 170; 1932). The pressure – volume products of iodine vapour were measured between 723° and 1274° K. In this region iodine vapour contains no trace of triatomic molecules, but is an equilibrium mixture of I_2 and I. From equilibrium constants and known energy levels of I_2 and I, the heat of dissociation of iodine is $35{,}514 \pm 50$ gm.cal., in close agreement with the value obtained directly from spectroscopic data.

Design of Joint Boxes for Super-Tension Cables

C. E. ROSE has published a useful practical paper on the design of a joint for splicing together consecutive cable-lengths or for connecting up cables to station switchgear (*Eng. Supp., Siemens Mag.*, No. 292, 1941). One of the main causes of trouble results from the expansion caused by the temperature effects of the load. The expansion of insulating compound used in joints is of the order of about 3 per cent over the usual working temperature range. Cable oil expands to an even greater extent when the conductors are carrying heavy loads, exerting pressure on the lead sheaths and sealing ends, and so tends to penetrate the joint boxes. When solid compounds are used for filling the joints and end boxes, up to 11 kilovolt working voltage, a high melting-point solid-setting compound of bituminous nature is usually employed. This tends to act as a barrier to the flow of cable oil. Provision has to be made in the end boxes for the expansion of this compound and also for the seeping of the cable oil, which may soften the solid compound in places where they come into contact. For voltages greater than 11 kilovolts, a compound of a semi-fluid nature with a similar constitution to that of the cable impregnating oil is used for filling joint sleeves and end boxes. Hence all boxes used for these compounds must be perfectly oil-tight. Where steep gradients occur in the cable route, it may be advisable to stop the interchange of compound between the cable and the joint so as to isolate each length of cable on a slope. This will limit the pressure set up at the lower end of each cable length, and prevent undue draining of the cable oil. These joints are known as barrier joints and virtually comprise a double-end box, each cable terminating on either side of the barrier plate.

Limits of Uniform Galactic Absorption

THE results of investigations on the question of general galactic absorption have been rather discordant. This is partly due to the recognized irregular distribution of the absorbing matter, partly to the uncertainty about the distances of the stars, and partly to the non-homogeneous working material which includes early stars, late stars, Cepheids, open clusters, etc. George Alter has now shown that in a uniform and continuous absorbing galactic layer, it is possible to determine the absorbing conditions by the observed relation between colour index and absolute magnitude (*Mon. Not. Roy. Astro. Soc.*, **101**, 2; 1941). An investigation is made on the limits for the photovisual, photographic and selective absorption coefficients, and the two assumptions of this investigation are based on experience. If an additional theoretical assumption is made, the selective law, derived by Stebbins, Huffer and Whitford, these limits are restricted further. Some suggestions are made for the determination of the actual coefficients. One of these is that the absorption conditions in the 'galactic windows' might be carefully investigated, the influence of absorbing clouds being thus avoided so far as possible.

Stellar Lithium

RECENT theories of energy generation in the cooler stars (see, for example, NATURE, **144**, 575; 1939) postulate the interaction of protons and the nuclei of light elements such as lithium in stellar interiors. Until now the only extra-terrestrial evidence for the existence of lithium atoms has been the faint occurrence in the solar spectrum of the resonance doublet of neutral lithium at 6708 A., the lithium analogue of the sodium *D* lines. Now, however, Dr. A. McKellar reports (*Observatory*, **64**, 4; 1941) that this doublet occurs strongly in the spectrum of the *N*-type giant variable star *WZ* Cassiopeiæ, being second in intensity only to the *D* lines themselves. A puzzling feature of the discovery is that this star is alone among the ten or more *R*- and *N*-type stars examined by McKellar in showing the lithium lines; yet in other respects, such as absolute magnitude and radius, it does not appear abnormal. Astrophysicists are always loth to attribute abnormal strength of a spectral line to abnormal abundance of the emitting element, but the facts here do seem to suggest that lithium is unusually abundant in the atmosphere of this particular star.