The Association's physics laboratories are equipped with an electron microscope, an electron-diffraction apparatus and an X-ray generator, with a wide range of cameras. The techniques thus available are applied as required throughout the Association's work both in its internal research programme and as *ad hoc* service to assist member firms in dealing with current technical problems. The electron microscope is proving of special value in the study of grain-boundary structures, which have been found to be of great importance in the technical properties of alloys. Electron-diffraction has been applied usefully to the study of the adhesion of electrodeposits on aluminium alloys and to the examination of the oxide films formed on liquid and solid metals, while the X-ray equipment is in constant use for the identification of chemical compounds and for studies of the constitution and texture of materials. In the physics section also, measurements of surface energy and surface tension are throwing light on soldering, brazing and hot-dip metal coatings; while multiplier photocells are being applied to the direct measurement of the intensities of spectral lines, in further development of the Association's well-known investigations on the spectrographic analysis of metals.

CHEMICAL ATTRACTANTS FOR INSECTS: SEX- AND FOOD-ODOURS OF THE COTTON LEAF WORM AND THE CUT WORM

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WE have been investigating the cotton leaf worm (*Prodenia litura*, Fab.) and the cut worm (*Agrotis ypsilon*, Rott.), the most harmful pests of cotton in Egypt¹⁻³. Female moths are found to attract the male moth and not vice versa, as with the gypsy moths⁴. If the females are separated in a glass chamber from the males, no attraction occurs. The odour of the female appears an hour after hatching and is restricted to the last two abdominal segments. The sex-odour disappears from the cut abdominal segments in a vacuum, but reappears again after 15 min. under normal pressure. It disappears totally after one and a half hours. It can be extracted from the abdominal segments with purified ether, and the ethereal residue shows the same power of attraction as the living moth. This proves that the female attracts the male by one or more chemical substances and not by sound or radiation.

We have developed an apparatus (an odour-analyser) which enables us to study sex- and food-odours chemically and biologically simultaneously. It consists of three parts: an odour-developer containing the females or the food, the odour-receiver with which we investigate the physical and chemical properties of the odours, and the odour-tester in which the males are able to migrate against the odour-stream and not the reverse. With this apparatus the sex-odour of the cotton leaf worm was found to be a volatile, neutral substance or mixture; it could be frozen out at -20°C . It was stable

against dilute sulphuric acid and dilute sodium hydroxide. With concentrated sodium hydrogen sulphite we were able to extract the sex-odour from the air-stream. This suggested the presence of an oxo-group in the molecule.

We found that fermenting 'bouza', the Egyptian wheat-beer⁵ which is used in the Andree-Maire trap to attract the moths of cotton pests^{1,2}, contains a volatile mixture, consisting mainly of ethanol and acetic acid. However, pure ethanol attracts very few moths, and acetic acid does not attract any moth; but a mixture of the two attracts many more. The bouza odour is volatile with steam and can be frozen out. It is stable with dilute sulphuric acid and 1 per cent formalin, but is partially destroyed by dilute sodium hydroxide. Concentrated sodium hydrogen sulphite had no effect on bouza-odour, in contrast to its effect on the female sex-odour.

The extraordinary sensitivity of the sense organs of insects enables us to investigate with our apparatus some of the chemical properties of sex- and food-odours, in order to find the best way of enriching them and also to test the fractions of extracts.

Reports on this work were given on September 29, 1948, at Frankfurt before the Deutsche Physiologische-Chemische Gesellschaft (*Angew. Chem.*, **61**, 252; 1949), and on November 30, 1948, at the Faculty of Science, Farouk I University, Alexandria.

¹ Bishara, I., *Bull. Soc. Roy. Entomol.*, **18**, 288 (1943); *Tech. and Sci. Service Bull.*, **114**, 1 (1932) (Ministry of Agriculture, Cairo: Government Press).

² Willcocks, F., "The Insects and Related Pests in Egypt", **1**, Pt. 2 (Cairo, 1937).

³ Kamal, M., *Proc. VI. Internat. Congress Entomol., Madrid, 1935*, **2**, 567 (1940).

⁴ Haller, H. L., Potts, S. F., and Acree, F., *J. Amer. Chem. Soc.*, **66**, 1659 (1944).

⁵ Monib, M., *Fac. of Agriculture (Cairo, 1948)*.

⁶ See also Dithier, A. M., "Chemical Attractants and Repellents" (London, 1947). Wigglesworth, V. B., "The Principles of Insect Physiology" (3rd. edit., London, 1947). Moncreiff, R. M., "Chemical Senses" (London, 1944). Frisch, v. K., "Duftgelenkte Bienen im Dienste der Landwirtschaft und Imkererei" (Wien, 1947).

PERCEPTION AND MEASUREMENT OF ODOUR

A LECTURE in Esperanto on "The Perception and Measurement of Odour" was given by Dr. D. R. Duncan on January 17 at University College, London, at the conclusion of the annual general meeting of the British Esperanto Scientific Association. Dr. Duncan first reviewed the attempts which have been made by Linnæus¹, Zwaardemaker², Henning³, Crocker⁴ and others to evolve systematic classifications of the known types of odour, mainly on the basis of subjective judgments of similarity and dissimilarity. He felt that Zwaardemaker's was by far the best attempt; but that the real solution of the problem demands attack by other methods, including a quantitative approach. Dr. Duncan described the *pO* scale of odour intensity and various instruments which have been used for estimating odour intensities, including the Fair-Wells osmoscope⁵ (which is now an article of commerce) and an improved apparatus designed by Dr. G. H. Cheesman and himself. He gave reasons for assuming that there is a limited, though large, number of primary odours, other odours being produced by simultaneous stimulation of more than one type of receptor.

He then described unpublished work carried out by himself in a preliminary attempt to analyse