ULTRA-VIOLET RADIATION IN INDUSTRY*

SOME of the many uses of ultra-violet radiation in modern industry formed the subject of a recent demonstration by Hanovia, Ltd., at the company's showrooms in Victoria Street. Broadly speaking, the industrial applications are of two kinds; in one, the ultra-violet radiation is used to produce some specific photo-chemical or physical change, such as, for example, the ageing of paint; in the other, the radiation is used simply as a detecting agency. Numerous examples of both categories, as applied to diverse industries, were exhibited.

One exhibit which will be of considerable interest to mining technologists consisted of a portable battery-operated ultra-violet lamp which can be conveniently carried on prospecting surveys. When irradiated by this lamp minerals, including uranium and scheelite (tungsten ore), fluoresce in characteristic colours. The equipment is particularly useful for detecting the presence of scheelite, which fluoresces only in response to a narrow waveband, including 2537 Å, and this particular wavelength forms about 90 per cent. of the radiation of the new lamp. In its commercial form the lamp is mounted in a light alloy housing, fitted with a carrying handle. A two-way switch operates the ultra-violet lamp as well as a flash-lamp bulb which provides general illumination when required. The equipment is suitable for mains or battery operation, and it is self-contained in a hardwood box the size of an ordinary attaché case.

A different technique is used for the identification of mercury. The mineral specimen is placed in an ultra-violet beam and is heated by a blow-pipe flame. If mercury vapour is given off shadows will be thrown on a fluorescent screen irradiated by the beam, the shadows being caused by the fact that the mercury vapour absorbs the appropriate wavelengths from the beam, which originates from a mercury vapour lamp.

Fluorescence forms the basis of a very simple test which was demonstrated for detecting the presence of aluminium in water. A concentration of 1 part in 10 million can be detected. A similar method can be used for tracing contamination in water supplies. For example, if a cesspool is suspected of leaking through subterranean cracks into a well, this suspicion can be tested by putting a little fluorescent liquid into the cesspool and subsequently irradiating samples of well water under the ultra-violet lamp. Any fluorescence in the samples proves the source of contamination.

Fluorescence under ultra-violet radiation is used in a very wide range of industries for testing groups of materials and for discriminating between the qualities of similar substances in a particular group.

For example, the shell of a new-laid egg, when exposed to a source of ultra-violet radiation, will fluoresce a delicate rose colour. Stale eggs, on the other hand, will produce a blue or violet fluorescence. Sugars, jams and honey may be similarly tested; in jams, the presence of apple pulp can be shown while turnip pulp, sucrose, molasses and glucose can be disclosed. In brewing, the qualities of barley can be distinguished by their individual fluorescence. The testing of oils and fats, including butter, margarine, lard, cocoa butter and cheese is simplified by fluorescent analysis. In Gorgonzola and Roquefort cheese the living fungi show a brilliant green fluorescence which is absent in dead fungi. In other cheeses the ripening can be followed by use of the ultra-violet lamp, new cheese showing a yellow fluorescence which turns to blue as ripening proceeds.

Ultra-violet lamps are adopted for all types of routine tests in textile production, tanning, paper manufacture, the making of paints and varnishes, rubber industry and so on. In textiles, fibres of all types can be differentiated. There are many ways in which the fluorescence test helps the paper manufacturer. It is possible to distinguish bleached from unbleached pulps, to estimate the nature and amount of loading used and to discover spots and blemishes on finished papers. In the colour and varnish industry the established uses are for distinguishing between gums and phenol-formaldehyde or urea-resins, and for testing the purity of wax and drying oils.

One group of exhibits indicated how the motor industry uses fluorescence analysis to detect the presence of unwanted grease on sheet metal surfaces undergoing preparation for finishing; to distinguish between lubricating oils of different origins and properties, and to trace unwanted mineral oils in brake fluid. Another group of exhibits showed that the uses of ultra-violet in the rubber industry range from the identification and grading of fillers, softeners, vulcanisers, and pigments to the detection of oil on tyre fabric before processing.

Many industries make use of ultra-violet radiation in quite a different way—in the pro-

* By Courtesy of the *British Information Services.*

duction of controlled photo-chemical changes. For example, the ultra-violet lamp is commonly used for accelerating fading and ageing processes: to determine the resistance of dyed fabrics, paints and inks to sunlight, and to examine the conditions governing the ageing of rubber, bitumen and similar substances. The exhibits drawn from the automobile industry included a section designed to illustrate ageing and fading tests on safety glass, paint finish and upholstery materials. To illustrate the testing of paints and bitumen finishes photographs were exhibited showing the extensive installations of ultra-violet lamps at the Building Research Station and at the Paints Division of Imperial Chemical Industries, Ltd. Among these exhibits were samples of magnesium alloy showing the effect of six cycles of weathering test and also showing the protection afforded by temporary corrosion preventatives after twelve similar weathering cycles.

Finally, photo-chemical changes induced by ultra-violet radiation can be used productively in a recently developed process whereby acrylic sheets are cemented in such a way that the joint does not impair the excellent optical properties of the material. In this process cement is applied to the pieces to be jointed ; irradiation by ultra-violet light then converts the joint into a solid homogeneous whole.

SEX HORMONES*

PROGRESS in sex hormones has been very rapid, but books reporting it are few. The second edition of the book, *Biological Action of Sex Hormone*, will therefore receive a warm welcome by all those who wish to gain insight into the fundamental aspects of sex hormones. In this volume, the author has included recent rapid developments in the field and has succeeded in presenting a co-ordinated summary of contributions in the field and their practical application.

According to the author the purpose of the book is to survey the present knowledge of sex hormones and to acquaint the readers with the methods employed by the scientists in their research. The book is divided in six parts. The first part which includes Chapters I to IV concerns gonadotrophins of the pituitary and placenta. Discussing the nature and functions of gonadotrophins, the author remarks that its chemical nature has not been exactly determined, but it has been established that the pituitary and placental gonadotrophins are not identical Evidence of a difference between the gonadotrophins derived from pituitary and placenta is afforded in this chapter. In subsequent chapters the author deals with factors which influence the gonadotrophic activity of the pituitary, factors which influence the reaction of gonads to gonadotrophins and the factors which affect the cytological structure and weight of the anterior lobe of pituitary.

Part II deals with a general view of the gonadal hormones. After a general preview the author discusses the experimental inquiry into the nature and action of sex hormones. The chemical structure of the three main types of gonadal hormones—œstradiol, testosterone and progesterone—has the same basis and the divergence from the common pattern which account for the diverse actions of these hormones in the body are seemingly slight.

Part III which includes Chapters VI to X relates to androgen, its action on reproductive organs before and after their complete differentiation, the action of androgen on accessory generative organs and on tissue and organs other than these The first experimental demonstration of hormonal action by testes was made by John Hunter (1794) and later on Brown Séquard (1889) tried testicular extract on himself. The effects were not very striking. Subsequently various other workers carried on investigations on the effects of testicular hormone on different organs and noted the results. With the results obtained by these pioneers to give encouragement, a rapidly growing volume of research has been done and the author has referred to some of these.

Part IV, Chapters XI to XX, is concerned with œstrogens. It gives a brief consideration of the source, metabolism and excretion of œstrogens, gradient of responsiveness, and reversibility of the effects. The action of œstrogens on embryonic gonads and Mullerian and Wolffian system, on the anterior lobe of pituitary and on the gonads after their differentiation, on the accessory genital organs, has been very elaborately discussed. Discussing the factors in the causation of mammary cancer the author quotes that long before the identification of œstrone, the ovary was thought to be an agent

* *Biological Action of Sex Hormones.* By Harold Burrows. Second Edition (Cambridge: At the University Press) 1949. Pp. xiii+615 Price 42 *s.*