

further on the 'half-life' appears as 1,590 years. Dr. Gamow seems to have forgotten that the original product of the mines of Joachimsthal (given as Joachischal) was silver—and hence the name of his country's best-known money unit—and not uranium. The style is popular and sometimes racy. Occasionally it will offend the English reader who has some feeling for his Mother tongue, but on the whole, in spite of his "oodles and oodles", the author has avoided the ambiguities and half-statements which are a feature of so many attempts to vulgarize science.

The book is well produced, with good plates, diagrams and end-plates. W. L. SUMNER

VIRUSES INFECTING PLANTS

Plant Virology

Edited by Dr. M. K. Corbett and Dr. H. D. Sisler. Pp. xvii + 527. (Gainesville: University of Florida Press, 1964.) 12.50 dollars.

THIS valuable summary of modern information regarding viruses infecting plants and the diseases caused thereby was compiled from a series of lectures by specialists, delivered during the 1963 Southern Regional Graduate Summer Session in Plant Virology at the University of Maryland. After a historical introduction by one of the editors the various symptoms by which virus infection of plants is expressed are summarized by F. O. Holmes and the means by which viruses can be transmitted from plant to plant are described by R. W. Fulton, with comments on inhibiting factors and on the mechanism of infection of an individual plant cell. The technique of identification of a plant virus is discussed by A. F. Ross, followed naturally by a chapter on virus strains, mutations, acquired immunity on the part of the host and interference by one virus with multiplication in the host by an unrelated virus (W. C. Price). Next B. D. Harrison summarizes recent information regarding the transmission of plant viruses in soil. Two groups of nematode-transmitted viruses are recognized, one with polyhedral particles, the other with tubular particles. Both the viruses and the nematodes have wide host ranges, ensuring survival on weed hosts while virus-immune crops are being grown on the contaminated soil. Transmission of lettuce big-vein virus and tobacco necrosis virus appears to be assisted by zoospores of the chytrid genus *Olpidium*. Susceptible plants may become infected when grown in soil to which tobacco mosaic virus has been added, but it is still not known whether any vector is involved in this instance.

Two chapters follow which deal with the mechanism of virus transmission by insect vectors. R. H. E. Bradley concentrates on the precise method of stylet transmission on the part of aphids, a process apparently beset by so many difficulties and inhibiting factors that it seems astonishing that any aphid ever succeeds in transmitting any virus. K. Maramorosch summarizes the less-extensive work on so-called 'circulative' and 'propagative' viruses, which are not carried immediately on the stylets but are accumulated in the insect's tissues, either multiplying there or not, and afterwards re-introduced into a host plant by the insect. The group includes a few aphid-borne viruses, notably that of potato leaf-roll, and also viruses transmitted by treehoppers, leafhoppers, whiteflies, mealy bugs, thrips and mites. Some of these viruses appear to be in some degree pathogenic to their vectors, others may possibly be in some way beneficial to an insect which ingests them.

The following seven chapters are perhaps those of most general interest since they deal with the nature of viruses themselves. Methods for assaying plant viruses are described by D. A. Roberts, with emphasis on the local lesion technique, virus purification techniques by R. L. Steere and serology by E. M. Ball. The principles of electron

microscopy and their application to virus research are summarized by C. E. Hall, followed by a detailed account by D. L. D. Caspar of modern inferences regarding the structure and function of regular virus particles. These consist essentially of a ribonucleic acid chain (or deoxyribonucleic acid in some animal viruses) enclosed in a regularly constructed coat of protein units, called rather unhappily the 'capsid', the shape and structure of which are characteristic of the virus. The shape of virus capsids is comprehensible if it is accepted that the most probable minimum energy designs for surface crystals composed of a large number of units are tubes with helical or cylindrical symmetry and closed shells with icosahedral symmetry. Each of these types of pattern is now known to be adopted by and characteristic of different plant viruses and, even though the morphologies of helical and icosahedral virus particles appear very different, it seems that the principles applied in their construction are the same. Unfortunately the morphology of a virus particle is not necessarily an indication of its relationship with other viruses. Since there are only 230 types of crystal lattices it is not surprising that chemically unrelated compounds can form crystals with identical symmetry and the structure of biologically unrelated viruses, for example, poliovirus and turnip yellow mosaic virus, may be based on very similar designs. The helical structure of the tobacco mosaic virus rod is described in great detail, with interesting indications of small differences in the arrangement of protein units in different strains of the virus. Next C. A. Knight elucidates the structural biochemistry of plant viruses, both as regards the construction of viral proteins and the fine structure of the ribonucleic acid chain. Finally, W. N. T. Takahashi discusses the biochemistry of virus infection and such information as exists regarding the synthesis of viral proteins and virus particles within the host cell.

Three final chapters summarize methods for control of plant virus diseases (L. Broadbent), frankly facing the fact that quarantine may delay but cannot prevent the spread of viruses around the world to a maximal distribution determined by the geographical distribution of their hosts and vectors. F. C. Bawden speculates on the origins and nature of viruses and the application to virus studies of the principles of molecular taxonomy is discussed by F. Lanni.

An appendix contains two papers on non-plant viruses: virus diseases of arthropods by K. M. Smith and an introduction to the tumour viruses by R. A. Manaker.

Each chapter is followed by a comprehensive bibliography. R. W. G. DENNIS

GOLD

Gold

Recovery, Properties, and Applications. Edited by Edmund M. Wise. Pp. x + 367. (Princeton, New Jersey, Toronto, New York and London: D. Van Nostrand Company, Inc., 1964.) 93s.

THE metal gold has had a special place in civilized communities even from the most ancient times. It has been known to man for 6,000 years, and rivals copper as the first metal ever to be used. Early applications became possible because the gold occurred naturally in the metallic state in the beds of streams and alluvial sands in an easily recognizable form. Large pieces could be hand-sorted from neighbouring rocks, and fine particles trapped by washing gold-bearing sand over fabrics or animal fur. Sheepskin was popular for the latter purpose, and it seems probable that the 'Legend of the Golden Fleece' arose in this way. The gold was used in the earliest times exclusively for ornament, and was sufficiently ductile to be hammered into the required shapes without the need for sophisticated metallurgical treatment. Its attractive appearance, relative rarity, and chemical inertness led naturally to it being a prized possession, and to its use as