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important constituent of the bodies. It is possible that the fixation of iron in the tissues in this way may contribute to the appearance of the chest radiograph. Recent work (Rossiter et al., 1966) on other types of pneumoconiosis has shown a close relation between iron content of the lung and the category of simple pneumoconiosis in the radiograph. Although asbestos bodies now seem of less interest in the development of fibrosis, they have become of greater interest as an epidemiological index of exposure (Meurman, 1966) and there is a need to standardise methods for search in tissues and sputum.

#### Experimental carcinogenesis

At the time of the earlier work on experimental asbestosis the association between asbestos exposure and cancer had not been well established. Little attention was, therefore, paid to asbestos as an experimental carcinogen. The position is now very different. Many investigations are in progress following the preliminary report by Wagner and his colleagues (1962) that they were able to produce mesothelial tumours by intra-pleural inoculation of asbestos. The earlier work has been now fully confirmed in standard and specific pathogen-free strains of rats by Wagner (1964). Twenty mg. of asbestos injected into the pleura has produced mesothelial tumours in a high proportion of animals. This is so for chrysotile, amosite, and crocidolite, both natural and after extraction of its natural oil by a single solvent. The investigation—a survival experiment—is not yet complete so we do not yet know whether there are significant differences in the number of tumours produced by the different types of fibre. So far amosite has produced the least. The yield of the tumours has been unexpectedly high and further experiments are now in progress to investigate the effects of smaller intrapleural doses and the effects of the dust inhalation. Under animal experimental conditions asbestos, therefore, appears to be a powerful carcinogen. How it acts is not yet known. It is relatively insoluble, contains iron, and has adsorbed on it natural oils and waxes (Harrington, 1962). It also takes up oil readily from jute bags while in transport and from other sources (Harrington and Roe, 1965). It is not yet at all clear whether these oils are of any biological or medical importance, nor is it yet clear whether the iron is an important factor. Wagner's animal experiments perhaps make this unlikely as the iron

content of the chrysotile is only about one-tenth that of crocidolite or amosite.

We may expect a great increase in experimental work on the carcinogenic effects of asbestos. To help in this work the producers of all the main types of asbestos have generously agreed to help the International Union Against Cancer (U.I.C.C.) to assemble at the Pneumoconiosis Research Unit in Johannesburg standard samples of the main types of asbestos, for use for biological testing in any part of the world. These standard samples will remove one of the variables which at present make comparison between the results of different laboratories difficult. They will also provide standards against which to compare materials used in different parts of the industry.

#### Health hazards of asbestos

Asbestosis—present position in the U.K.

In his summary Wyers (p. 137) concluded, 'Legislation has been generally effective in controlling asbestosis but not entirely'. I propose to look at some of the recent evidence on this, but at the outset it is necessary to emphasise how incomplete it is. We have no reliable figures for the prevalence of asbestosis in the country, nor do we even know the numbers of workers continuously exposed to asbestos; still less those intermittently or casually exposed. Wyers reported a study of deaths from asbestosis in a factory. Dr. W. J. Smither has kindly provided me with recent figures for the same factory. These show (Table 2) that between the two periods 1931-46 and 1957-64 there has been no striking change in the years of exposure or duration of illness in the deaths with this disease. There has been a marked change in the average age at death—a rise of nearly 10 years in the men and 20 in the women. This is in part apparently due to a very striking change in the importance of tuberculosis, which was present in 31 per cent of Wyers's group, but only 4 per cent of the more recent group. The absolute numbers of cases have little significance without a knowledge of the populations exposed. It looks as though Wyers was too optimistic, but it has to be remembered that the second period includes the results of World War II when long hours, the black-out, and the difficulties of maintenance must have markedly increased the dose of dust.

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