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RECENT ADVANCES IN PATHOLOGY

SIXTH EDITION

By Various Authors

Edited by

GEOFFREY HADFIELD

M.D., F.R.C.P.

*Sir William Collins Professor of Pathology,
Royal College of Surgeons of England*

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CHAPTER VII

THE CAUSATION OF CANCER: FURTHER CONSIDERATIONS

SOCIAL AND RACIAL FACTORS IN CANCER

The influence of hygiene, occupational environment and social status on the incidence of cancer has been the subject of a fascinating series of papers by Kennaway and his co-workers (1947, 1948, 1949).

Cancer of the Lung. This disease has increased sixteenfold from 1921 to 1945 in males (in England and Wales), whereas cancer of the larynx showed little change.

In attempting to explain this great increase of lung cancer Kennaway came to the conclusion that "although the incidence of lung cancer on those occupations where there is exposure to road dust (bearing in mind tarred roads) . . ." is rather above the general level, it seems very questionable whether the recent increase in this disease among the general population can be attributed to the tarring of roads. For scores of years before this increase began coal-tar was being discharged into the atmosphere in the form of soot by the domestic fire in quantities vastly greater than any "that could now be derived from roads. Tarring of roads has undoubtedly increased the amount of dust derived from tar in the air, but this increase appears negligible in comparison with the amount of soot already present." "Cotton mule-spinners show an especially small liability to cancer of the lung, although they inhale air sprayed with an oil which produces cancer of the skin."

"The high mortality from cancer of the lung in towns (Stock), the low mortality in agricultural occupations, and the absence of social gradient (Stevenson) are compatible with an aetiological factor in the air such as coal smoke."

Kennaway (1947a) is led to conclude that "coal smoke does not account well for any recent increase in cancer of the lung." "One must look, therefore, for some other factors to explain the increase, if there is a real increase, in cancer of the lung in recent years. Many such factors have been suggested, e.g. influenza, tobacco, popular drugs, tarred roads, exhaust gases and other emanations, including lead ethyl, motor vehicles

Pneumoconiosis due to Silicates

Fibrous Silicates : Asbestos, Talc. The question as to whether silicates are toxic when inhaled has been very much debated since Jones (1933) put forward the view that sciricite, a potassium aluminium silicate, is the cause of much industrial silicosis. Of recent years, however, his view has received very little support. Certain silicates are noxious, and the chief of these is the group of fibrous mineral silicates known as asbestos. There are two views regarding the mode of development of asbestosis. According to the one, the action of the dust is chemical; the other view supposes that the asbestos fibres act mechanically. Experiments carried out at the Saranac laboratories (Trudeau Annual Report, 1948) do not support the chemical theory, since aluminium hydroxide which neutralizes the toxic action of quartz does not prevent asbestosis. Moreover, asbestos fibres shorter than 20μ were found to be relatively innocuous, whereas if the action were chemical an increase in potency would have been expected with reduction in particle size below 5μ , as in the case of silica. A comparison of the effect of asbestos fibres 15μ long with those 2.5μ long (King *et al.*, 1946) showed that rabbits receiving the long fibres developed a nodular reticulin formation comparable with experimental silicotic nodules; animals receiving the short fibres developed a diffuse interstitial reticulin formation. The localization of the asbestos lesions appeared to depend on the size of the fibres; with long fibres, too big for removal by phagocytes, the reaction resulted in the formation of connective tissue within the alveoli; with shorter fibres capable of being taken into the alveolar walls there was diffuse interstitial fibrosis. These workers suggest that if the fibres were shorter than 2.5μ they would be completely removed from the alveolar walls and fail to produce fibrosis. Johnstone (1948) concluded from clinical investigation that workers exposed to high concentrations of extremely fine asbestos dust did not suffer from asbestosis. The Saranac workers conclude that asbestosis is caused by mechanical irritation from the asbestos fibres during the movements of respiration, and that this peculiarity is related to the flexibility of the fibres not possessed by other foreign bodies. The view that movement of the lungs is a factor is supported by the absence of reaction to asbestos in organs other than the lung (Gardner, 1938). Wyers (1949) points out that if the fibrous character is absent, as in the case

of serpentine, the chemical equivalent of asbestos, the dust is inert.

The association of carcinoma with asbestosis has been mentioned above, but more details may be given here. An analysis of 235 cases of asbestosis is given in the 1947 report of the British Chief Inspector of Factories. Cancer of the lung or pleura occurred in 31 (13.2 per cent., average age 52.1 years). These figures were contrasted with the much lower incidence of cancer of the lung in 6,884 cases of silicosis, of whom 1.32 per cent. had carcinoma (average age 59.4 years). A high incidence of tuberculosis was also associated with asbestosis, and the Inspector of Factories found 72 instances in 130 cases of asbestosis.

Talc. Numerous cases of pneumoconiosis due to talc (hydrated magnesium silicate) have been described in different parts of the world, and the first of this type in Britain, proved by autopsy, was reported in 1949 (McLaughlin *et al.*). Throughout the lungs there were grey nodules which had coalesced in some places, especially in the lower lobes. Microscopically the nodules showed whorling, but this had not the typical appearance of silicosis. Within the nodules were fibre-like structures up to 40μ in length arranged singly and in clumps. Some were very similar to asbestos bodies, and the appearances suggested that talc pneumoconiosis and asbestosis are similar diseases and that the former may be caused only by the fibrous varieties of talc. Asbestos is more actively fibrogenic than talc, and this might be due to the higher proportion of fibres in asbestos. In New York State disabling pneumoconiosis occurred in 14.5 per cent. of the workers in the talc mining and milling industry (Siegal *et al.*, 1946). The dust contained fine, straight, needle-like fibres. The talc fibrosis was associated with an increased susceptibility to tuberculosis.

Glass Wool. Glass in the form of fine fibres is being used in increasing quantities for heat insulation, and during its preparation and use the atmosphere may shimmer as a result of floating fibres. No harm appears to result, however, from exposure to this dust, since the fibres do not remain suspended in appreciable concentration owing to the high electrostatic charge on them. Gardner (1942) considers that the material has not the properties required to produce fibrosis.

Non-fibrous Silicates : Fuller's Earth ; Mica. Fuller's earth, composed mainly of a silicate of aluminium, is found in Surrey, where it is quarried, dried and crushed. Middleton (1946) has given an account of the radiological and pathological changes