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News of Science

Smoking, Air Pollution, and Lung Cancer

P. C. Stocks and J. M. Campbell summarize the results of the first 2 years of a 5-year study in England of environmental histories of persons with and without pulmonary cancer in the *British Medical Journal* [**1955, II,** 923 (15 Oct. 1955)]. The death rates from cancer of the lung, bronchus, and pleura were calculated in men between 45 and 74 years of age, of different smoking habits, living in rural, mixed, and urban areas. The death rates were then related to measurements of 3:4-benzpyrene and other carcinogens present in the air in the areas studied. Concentrations of smoke and sulfur dioxide were determined according to standard methods, and anthracene, pyrene, fluoroanthrene, 3:4-benzpyrene, and 1:12-benzperylene were quantitatively determined by spectrophotometric techniques.

It was found that the concentration of smoke, 3:4-benzpyrene, other polycyclic hydrocarbons, and sulfur dioxide in the air rises with increasing urbanization. The air concentration of benzpyrene in Liverpool was 8 to 11 times that in rural areas. This ratio corresponded with the estimated mortality ratio among nonsmokers in those areas. The rural death rate from lung cancer increased proportionately to the number of cigarettes smoked per week, and pipe smokers as a group ranked with cigarette smokers of approximately 25 per week. The city death rates exceeded the rural rates, but the urban/rural ratio fell from approximately 9/1 in nonsmokers to nearly 1 in heavy smokers. The authors estimate that approximately one-half of Liverpool deaths of men from lung cancer arise from cigarette smoking, and about three-fourths of the remaining half are due to a factor only slightly present in rural areas.

All death rates from lung cancer were directly proportional to the estimated amount of exposure to 3:4-benzpyrene, either from cigarette smoke, air pollution, or both. Stocks and Campbell suggest an "urban" factor in the etiology of lung cancer, and feel that benzpyrene plays a dual part, through cigarettes and air pollution. The authors note that their report is presented as an interim communication and that its indicated conclusions are far from final.

W. C. Hueper notes that the total evidence from epidemiological, clinical, and pathological studies indicates that lung cancer is caused by several atmospheric pollutants, rather than a single factor, in *Public Health Reports* [**71,** 94 (Jan. 1956)]. He states that the available data do not allow determination of the relative importance of the various recognized respiratory carcinogens in the general population, although single carcinogens in the air have been implicated in lung cancer in restricted occupational groups exposed to well-defined, potent carcinogens.

He feels that the recent alarming increase in frequency of lung cancer may be causally related, in part, to atmospheric pollutants that are carcinogenic, as a by-product of modern industrial development. A number of general environmental and specific occupational air pollutants have been implicated in the causation of lung cancer, such as dusts and fumes of nickel, chromium compounds, arsenicals, asbestos, coal tar, soot, vapors or mists of isopropyl oil, certain cancer-producing petroleum derivatives, radioactive ores and gases; and carcinogens present in gasoline or diesel engine exhaust, dust of asphalted roads, and carbon black (in automobile tires). Numerous epidemiological observations strongly suggest that industry-related factors have played an important causal role in the increase of lung cancers observed in industrialized countries during the last 50 years.

According to Hueper, there does not seem to exist any parallelism between the lung cancer death rate and the per capita consumption of cigarettes for different countries, but the lung cancer death rate parallels as closely, or even more closely, the rise in production and/or consumption rates of motor fuel, coal tar, and several other carcinogenic substances, or the production of asphalted roads, than that of cigarettes. He feels that the medical evidence supporting a major role of cigarette smoking in the causation of cancer is inadequate.

Although the reports of these workers are essentially opposed regarding the unity or multiplicity of causative agents of respiratory cancer among the general population, as well as regarding the role of cigarette smoking in this disease, certain common factors are apparent. The identification of more-or-less proved carcinogens in air pollutants and/or in cigarette smoke is becoming increasingly correlated with the incidence of lung cancer. The qualitative relationship appears convincing; the quantitative relationship to the estimation of concentrations of these compounds is of importance if the quantification of lung cancer incidence can be accurately established from reliable pathological observations. At present, the latter does appear to correlate with this incidence, and does support the qualitative relationship thereto.

An interesting and important consideration is raised by Hueper: that the indications that tobacco tar contains carcinogenic agents have been derived from observations of the skin of a selectively inbred strain of hyper-reactive mice, and have no equivalent in man. However, the finding of Stocks and Campbell that exposure to 3:4-benzpyrene, whether from tobacco smoke or from air pollution, is consistently and quantitatively related to human lung cancer incidence constitutes a strongly suggestive piece of evidence.

It would appear at present that at least one, if not several, carcinogenic compounds are of etiological significance in this disease, and that increasing industrialization with its by-product of air pollution is a significant factor in the increasing evidence of lung cancer. Although the more quantitative aspects have yet to be firmly established, the present reports represent somewhat of an advance in the direction of clarifying a field of investigation that has too frequently been the subject of extremely equivocal or sensational reports.—E.M.L.

Cosmic Spherules in Deep Sea Sediments

The small magnetic spherules contained in deep-sea deposits [*Science* **123,** 1081, 2 Dec. 1955)] continue to interest scientists in various parts of the world. E. J. Opik (Ireland) considers various kinds of evidence for the cosmic source of these deep-sea deposits, stressing particularly that the frequency of spherule diameter distribution extracted from samples of deposits obtained by the Swedish deep-sea expedition shows excellent agreement with theoretical frequency of micro meteors (*Nature* 176, 926 (1955)]. The large amount of excess nickel in [illegible] with [illegible] wise [illegible] the [illegible] that these particles [illegible] may have

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