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Soil and Stomach Cancer

Subjects such as " the soil " and " cancer " engender beliefs based on emotion rather than scientific fact. Special caution is necessary therefore when considering possible associations between the two. A. Haviland[1-4] at the end of the nineteenth century suggested that there is an association between cancer mortality and low-lying damp areas. In more recent years S. W. Tromp and J. C. Diehl,[5] in Holland, and E. D. Allen-Price,[6] in West Devon, found differences in mortality from cancer of all sites in association with residence on different types of soil. Such studies, however, must be regarded as uncritical. Certain well-defined environmental factors cause very big differences in the incidence of cancer of particular sites. For example, in one survey there was a 45-fold difference in lung-cancer mortality between non-smokers and heavy cigarette smokers.[7] Surveys which reveal small differences in total cancer mortality rates may have little value unless variables which cause much bigger differences are properly controlled.

In 1936 P. Stocks[8] reported a survey of the geographical distribution of cancer of various organs in England and Wales. For the period 1921–30 the mortality from cancer of the stomach was significantly higher than expected in both sexes over a large area of North and West Wales. No excess of cancers of other sites was found, and in no other geographical area of England or Wales was a similar excess seen. For various reasons explanations based on social class and race characteristics seemed unlikely. In 1951–2 C. D. Legon,[9] comparing stomach-cancer mortality in the different rural districts of Wales, concluded that there was an association between high mortality from stomach cancer and residence on peaty soils. He suggested that a deficiency of copper in such soils would be reflected in crops grown on them and in people who ate them, and that copper deficiency might predispose to stomach cancer.

Between 1954 and 1962 the problem became less clear-cut. Correlations were found between mortality from stomach cancer and the amounts of organic matter, zinc, chromium, and cobalt in the soil, and between deaths from intestinal cancer and soil chromium.[10] Yet the association between deaths from stomach cancer and residence on particular types of soil was limited to persons following *non-agricultural* occupations,[11] and a history of eating green vegetables grown in a suspect soil was not associated with an especially high mortality from stomach cancer.[12] In other studies miners were found to have a higher mortality from stomach cancer than non-miners living in the same areas,[13] and the frequency of consumption of fried foods was found to be positively associated with the disease.[14]

Earlier this year Stocks and R. I. Davies,[15] in a re-examination of the problem, found that the zinc/copper ratio in the soil was consistently higher in gardens at houses where persons had just died of stomach cancer after a period of 10 or more years' residence than it was at houses where similar residents had died from non-malignant causes. They found also

that the zinc/copper ratio, though not the zinc content as such, in potatoes correlated well with that in the soil in which the potatoes were grown.

The value of epidemiological surveys such as those of Stocks and his colleagues is not that they indicate definite causes of particular diseases but that they point to certain possibilities that should be investigated in greater detail, both epidemiologically and in the laboratory. In fact there is a big gap between the suggestion that the zinc/copper ratio in soils plays some part in determining the incidence of cancer of the stomach and any known carcinogenic mechanism in which this ratio is likely to be important. Neither zinc nor copper appears to be directly carcinogenic. An earlier report of the carcinogenicity of zinc[16] lacks confirmation.[17] R. C. Turner[18] found relatively low levels of radioactivity in drinking-water supplies to those areas of Wales showing a surplus mortality from gastric cancer, but this observation has not been shown to having a bearing on the zinc or copper content of the soil. A. Voisin[19] has put forward many theoretical reasons for the belief that copper deficiency predisposes to cancer, but he was unable to adduce any experimental evidence for a direct carcinogenic effect of such deficiency. Since Voisin's book was published two reports from Birmingham have indicated that copper protects the liver from the carcinogenic effect of an azo dye, butter yellow.[20 21]

The evidence, such as it is, suggests either that the zinc/copper ratio investigated by Stocks and Davies[15] acts as a co-factor rather than as a complete determinant in the genesis of stomach cancer ; or that the factor which is really responsible for the excessive incidence of deaths from stomach cancer tends to move in parallel with the zinc/copper ratio in the soil—the latter being itself irrelevant. Clearly, more detailed studies such as the projected survey in the Tamar Valley organized by the College of General Practitioners are necessary. It is important that these studies be conducted by minds open to the full range of possibilities. Cancer of the stomach is almost certainly a disease of many causes.[22] It follows that surveys limited to only a few of the potential causes may give misleading results. Perhaps what has been most lacking so far is a series of relevant studies on laboratory animals. They are urgently needed to guide new field surveys. Without this kind of help from the laboratory it is difficult for the epidemiologist to know where best to put the emphasis of his inquiries. Cancer of the stomach is a major cause of death: a serious attempt to investigate the possibility of preventing it is long overdue.

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[3] —— *Practitioner*, 1899, **62**, 416.
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[5] Tromp, S. W., and Diehl, J. C., *Experientia (Basel)*, 1954, **10**, 510.
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[7] Doll, R., and Hill, A. B., *Brit. med. J.*, 1964, **1**, 1399 and 1460.
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[9] Legon, C. D., *Brit. J. Cancer*, 1951, **5**, 175 ; *Brit. med. J.*, 1952, **2**, 700
[10] Stocks, P., and Davies, R. I., *Brit. J. Cancer*, 1960, **14**, 8.
[11] Griffith, G. W., and Davies, R. I., ibid., 1954, **8**, 594.
[12] Stocks, P., ibid., 1961, **15**, 701.
[13] —— ibid., 1962, **16**, 592.
[14] —— *Rep. Brit. Emp. Cancer Campaign*, 1957, **35**, Supplement to Part II, p. 1.
[15] —— and Davies, R. I., *Brit. J. Cancer*, 1964, **18**, 14.
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[17] Roe, F. J. C., and Lancaster, M. C., *Brit. med. Bull.*, 1964, **20**, 127.
[18] Turner, R. C., *Brit. J. Cancer*, 1962, **16**, 27.
[19] Voisin, A., *Soil, Grass and Cancer*, translated by C. T. M. Herriot and H. Kennedy, 1959, Crosby Lockwood and Son, London.
[20] Howell, J. S., *Brit. J. Cancer*, 1958, **12**, 594.
[21] Fare, G., and Woodhouse, D. L., ibid., 1963, **17**, 512.
[22] Wynder, E. L., Kmet, J., Dungal, N., and Segi, M., *Cancer (Philad.)*, 1963, **16**, 1461.

Lessons from the U.S.A

In 1965 the University of Pennsylvania is celebrating the bicentenary of the foundation of its medical school in Philadelphia, the first in America. On 3 May tribute will be paid to Dr. John Morgan, an Edinburgh graduate, who as the first medical professor imparted a strongly Scottish flavour to early American medical education. In 1840 Philadelphia was to have been the meeting place of the first national medical convention. Delegates had been invited to it by the New York State Medical Society, which was greatly concerned about the standards of medical education. No one accepted this invitation. But a second attempt to get agreement was successful, and a convention held at New York University in 1846 led to the formation of the American Medical Association in the following year. Although concern about education was one of the main reasons for its foundation, the A.M.A. did not form its Council on Medical Education until 1904.

The next ten years were to prove revolutionary. Much of the remarkable success of the present American system of medical education (if anything so rich and varied can be called a system) can be traced back to the self-searching and ruthlessness of those years. In 1904, when an editorial in the *Journal of the American Medical Association* fulminated against the custom of young graduates going to Germany to gain clinical experience, there were 160 American medical schools, the majority being run for private profit, with poor facilities and low standards. In 1907 the Council on Medical Education reported on them all, and by 1910 40 had closed voluntarily. In that year Flexner published his famous report, *Medical Education in the United States and Canada*, following it in 1912 with another, *Medical Education in Europe*. Flexner greatly admired the European system, with its full-time professors and the use made of wards, clinics, and laboratories for teaching and research. It was fortunate for America that his report, unlike so many British ones, led to action. He himself was largely instrumental in persuading the Rockefeller Foundation to endow full-time clinical chairs at Johns Hopkins in 1913 and to support the medical schools of state universities in the Middle West in the years that followed.[1]

Flexner lived to see the wheel turn full circle. When he died, at the age of 93, in 1955, the " brain-drain " was already in operation. American medical schools then felt confident enough to modify the old patterns of education and even to change them entirely, as Western Reserve did in introducing its integrated curriculum from 1952 to 1955. In the last few years teaching hospitals have been built in which the basic sciences, the wards, the research and routine laboratories, and even the paramedical sciences have been closely and deliberately integrated. The remarkable new hospital planned for the University of British Columbia will draw more inspiration from Gainesville, Florida, and Lexington, Kentucky, than from any European centre. Recently the Federal Government has launched an immense programme of clinical research, building and equipping specialized units in many teaching hospitals. To-day the average medical school with