ADVANCES IN TUMOUR PREVENTION, DETECTION AND CHARACTERIZATION

Vol. 2

CANCER DETECTION AND PREVENTION

Advances in tumour prevention,
detection and characterization

Editor: Ç. Maltoni

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Cancer detection and prevention

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Foreword

At the present time much is expected from cancer detection and prevention in the fight against tumours.

The major aim of this Symposium has been to convene from all over the world scientists whose fields are the prevention and early detection of tumours, and with different approaches and disciplinary experiences (basic oncologists, epidemiologists, experimentalists, pathologists, clinicians, etc.) to present the results of their own studies, to point out the potentialities of operative tools, to exchange up-to-date information and to discuss future lines, programs and priorities.

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Lectures

Developments in cancer prevention through environmental control

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Introduction

While there are several approaches to the problem of cancer control, the present discussion is largely oriented to the role of the environment in human cancer.

Cancer prevention through the identification and subsequent removal of causative factors was clearly implied by the work of Potts in the late 18th century. This approach was later expanded in the occupational studies of the present century which provided the base for modern environmental carcinogenesis. However, the full potential of the epidemiological method in cancer control was only fully appreciated after the extensive studies on lung cancer and cigarette smoking in the fifties. Today the potentials and limitations of epidemiology and experimental carcinogenesis, which form the basis of environmental carcinogen studies in man have been established. Nonetheless, it has become increasingly clear that it may not be possible to initiate preventative measures following the identification of the cause of a cancer, in the absence of a suitable social and technological background. Thus, man has proved notoriously unwilling to change a pleasurable cultural habit, such as cigarette smoking, no matter how hazardous. The modern oncologist must therefore take into consideration both the legislative and the social aspects of prevention, in addition to the scientific problems.

The role of epidemiological studies

The major contributions of the epidemiological method to cancer control include the following areas:

1. The identification of environmental hazards to which man is already exposed, e.g. asbestos, cigarettes, occupational risks, etc.

2. The observation of changes in the incidence of a specific cancer, indicating the possible entry of a new carcinogenic agent into the environment. Such secular changes are illustrated by the associated increase in cigarette smoking with the rise in lung cancer, and the appearance of mesothelioma following exposure to crocidolite.

3. An improved understanding of the biology of human cancer can be used:

(a) to explore the action of suspected environmental stimuli through the appropriate biochemical investigations, e.g. the development of comparative metabolic studies in human and animal tissues (Montesano and Magee, 1970);

(b) to determine the nature of animal models best approximating to the situation in man as a basis for the establishment of systems for testing suspected carcinogens, e.g. selection of dog for testing aromatic amines as a bladder carcinogen;

(c) to permit the application of sophisticated laboratory techniques to epidemiological studies on human cancer, e.g. endocrine studies in breast cancer (Bulbrook and Thomas, 1964; Bulbrook and Hayward, 1967); sero-epidemiological studies on African childhood lymphoma (Biggs et al., 1972).

4. The identification of levels of exposure to potential or known carcinogenic stimuli in the environment which do not apparently modify the incidence of cancer. Such studies

are invaluable in assessing whether or not an 'acceptable risk' level does exist for man.

More recently, in addition to investigations on the direct carcinogenic effects of external stimuli, changes in host susceptibility, e.g. nutritional and immunological status, as a result of exogenous stimuli, have received attention (Doll and Vodopija, 1973). The epidemiological method is equally suitable for such studies.

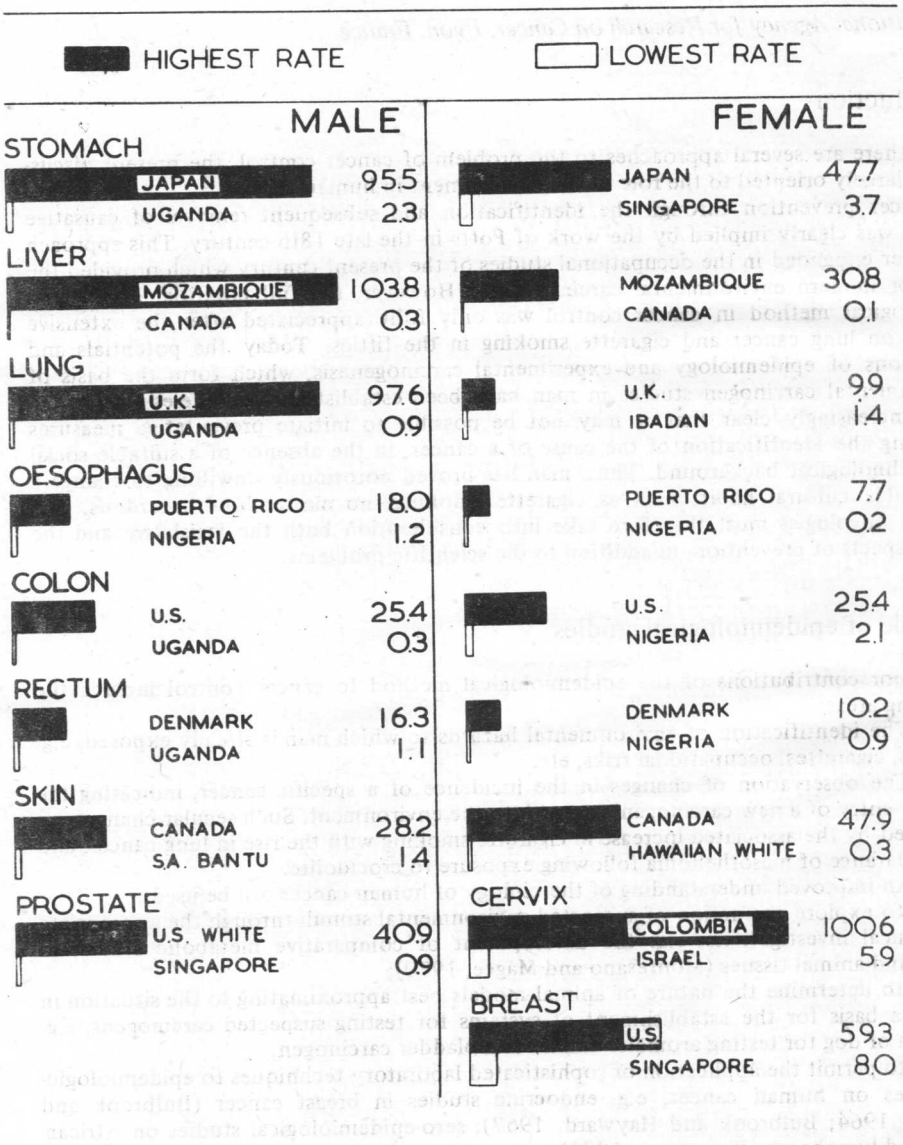

FIG. 1 *Age-adjusted cancer morbidity rates with theoretical low rates illustrating cancer incidence in areas of high and low cancer rates. Black bar represents areas with the highest known cancer rates; white bar represents those with the lowest reported rates.*

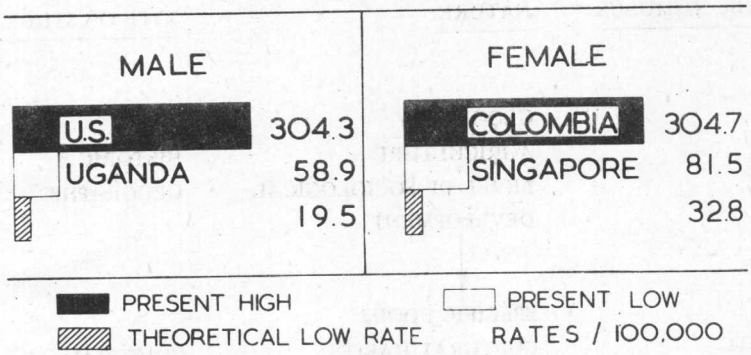

FIG. 2 *Age-adjusted cancer morbidity rates with theoretical low rates, indicating the theoretical low rate that could pertain if the lowest incidence rates were summated from all countries.*

Cancer and the environment

Amplifying earlier epidemiological studies, it has been calculated by various authors that the aetiology of approximately 80% of cancers in western industrialized countries are directly or indirectly dependent on environmental factors (Boyland, 1967; Doll, 1967; Higginson, 1969) (Figs. 1 and 2). That this calculation is a reasonable estimate is suggested by analysing the aetiology of individual cancers of known cause (Higginson, 1969). Thus, 90% of cancers of the mouth and lung are caused by factors which have already been identified. On the other hand, for cancers of other sites, such as colon, rectum, stomach and breast, no satisfactory hypotheses as to aetiology are available.

While individual susceptibility has an important role, even for such strong carcinogenic stimuli as cigarette smoking, non-hereditary factors, with a few exceptions, would appear of paramount importance (Haenszel, 1961; Haenszel and Kurihara, 1968) as suggested by studies on migrant populations. Although host factors may be of significance in relation to cancers of the breast and genital system, it cannot be excluded that such factors may not be wholly or partly dependent on environmental stimuli possibly often operating *in utero* or in very early life. From the viewpoint of practical prevention, Huebner's 'oncogene' hypothesis, if confirmed, would not reduce significantly the necessity to identify environmental factors, since the theory implies that the latter activate the 'oncogene'.

Identification of exogenous carcinogenic factors

While from a philosophical viewpoint carcinogenic stimuli may represent the interaction of a multitude of factors, e.g. historical, climatic, sociological, etc., such a vague approach to identification has so far led to few practical benefits. Thus, a distinction should be made between such distant and relatively immeasurable factors and 'intermediate' or 'immediate' stimuli (Fig. 3). These terms are not used here with the same connotation as 'proximate' or 'ultimate' carcinogen as in experimental carcinogenesis, but refer to stimuli which can be expressed in quantitative or qualitative terms for practical purposes, e.g. specific chemicals, cultural habits, etc.

Method of exposure

Man is most commonly exposed to exogenous carcinogens through *direct contact*, *inhalation*, *ingestion* or by the *parenteral route*. Direct contact occurs in certain occupations, e.g. shale oil workers, or as a result of a cultural habit, e.g. betel chewing. Occupational