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Volume V

A. Environmental Causes
B. Epidemiology and Demography
C. Cancer Education

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Foreword

THE TENTH INTERNATIONAL Cancer Congress, held in Houston, Texas, U.S.A., May 22 through May 29, 1970, was attended by 6,018 physicians and scientists from throughout the world. Of these, 1,957 participated in the sessions. The speakers, representing 72 different countries, presented 1,740 papers; abstracts of 1,342 proffered papers appeared in the book of *Abstracts,* copies of which were distributed at the Congress. The remaining 398 papers appear *in toto* in the five volumes comprising this set of Proceedings. These 1,740 papers were virtually all of the papers submitted for presentation; less than a dozen titles were rejected. Consequently, one might reasonably assume that these papers and abstracts comprise a comprehensive survey of the international status of the science and art of oncology as it existed in the spring of 1970.

The papers, speeches, and lectures may be divided into seven general groups:

1. Congress Ceremonies
2. Preliminary Special Sessions of the Congress
3. Main Congress Panels
4. Postgraduate Course Panels
5. Proffered Paper Sessions
6. Rapporteur Reports
7. The Harold Dorn Lecture

The sequence in which these various presentations were made, their authors, and the organization of the Congress may be found in the *Program* of the Tenth International Cancer Congress (Library of Congress Card Catalogue No. 42-43259). The members of the Congress, i.e. those who registered at the meeting, and the names and addresses of most of the persons who presented papers may be found in the *Members* of the Tenth International Cancer Congress (Library of Congress Card Catalogue No. 73-124104). Abstracts of papers presented at the Proffered Paper Sessions (No. 5 in the general groups listed above) are contained in the *Abstracts* of the Tenth International Cancer Congress (Library of Congress Card Catalogue No. 70-12413). All three of these volumes were published by The Medical Arts Publishing Co., 1603 Oakdale St., Houston, Texas, U.S.A. 77004.

The papers published in the 5 volumes comprising the published

proceedings include the Congress Ceremonies (No. 1 in the above list), the Preliminary Special Sessions (No. 2), the Main Congress Panels (No. 3), the Postgraduate Course Panels (No. 4), the Rapporteur Reports (No. 6), and The Harold Dorn Lecture (No. 7). The papers have not been published in the order in which they were given at the Congress, since during the Congress several presentations occurred simultaneously. Rather, in these volumes, the papers, including the Rapporteur Reports and The Harold Dorn Lecture, have been assembled into groups of related subject matter.

Because of the overwhelming number of citations contained in the reference lists submitted by the authors, it was not possible to verify the citations or to complete those submitted in abbreviated form. Therefore, the reference lists have been published in much the same way in which they were received. In the few instances in which no reference list was submitted, or when the list was excessively lengthy, an editorial note has been added, directing the reader to apply directly to the author for a list of the literature cited.—Editors.

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PART B. *Epidemiology and Demography*

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The Harold Dorn Memorial Lecture

Cancer and Aging: The Epidemiologic Evidence

RICHARD DOLL, M.D., D.Sc., F.R.C.P.

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TO MANY OF US who are attending the Tenth International Cancer Congress, the memory of Harold Dorn is as fresh as it was eight years ago when we met him at the Eighth Congress in Moscow. Men like Harold Dorn are too rare to be forgotten, and the memory of his friendship remains no matter how far we have been separated from him in space or time. Dorn was a quiet, self-effacing man, gentle and tolerant, who knew his own mind but never thrust his views on other people. As honest with others as with himself, it was difficult to extract a false compliment from him and impossible to catch him making an unkind personal comment about a colleague. Dorn is honored by us particularly because of his work as Secretary General to the International Union. He was elected to this post in 1953 at a time when national distrust was so great that even communication between scientists was threatened. It should, therefore, be recorded that the suggestion that Dorn be elected was made by a Frenchman at an Executive Committee meeting in Bombay and agreement was unanimous. Dorn's integrity, objectivity, and devotion to humanity as a whole made him an ideal choice, and the harmony that has since characterized the international aspects of the Union's work is due largely to the example he set.

Dorn trained as a sociologist, but, unlike some sociologists, he was more interested in facts than theory. It was, therefore, not surprising that one of his early comments on cancer was, "The absence of reliable

statistical data concerning variations in the incidence of cancer partially explains the existence of conflicting and inconclusive theories about the etiology of human cancer, since most of these theories are derived from the analysis of clinical data which fail to satisfy the requirements of statistical adequacy." He was, however, not content with criticism, and he set about remedying this defect with characteristic energy and thoroughness. Within the United States, he persuaded the National Institutes of Health to initiate the 10-city survey, in the course of which information was obtained from all doctors, whether working in hospitals or not, about the diagnoses of cancer made in the course of a year.

But if Dorn was not interested in theorization, he was also not interested in facts for their own sake. He wanted them to provide clues to the etiology and prevention of disease, and he was convinced that these could be obtained from knowledge of the incidence of different types of cancer in different communities under different physical and cultural conditions. Obvious though this may seem now, it was not so apparent 35 years ago when Dorn first turned his mind to the problem. The ability to produce cancer in animals and the discovery of pure carcinogens had encouraged research workers to believe that a shortcut was just around the corner, and that it would be necessary only to extend laboratory experiments a little further to discover the mechanism by which the disease was produced, and hence to be able to prevent it at its source.

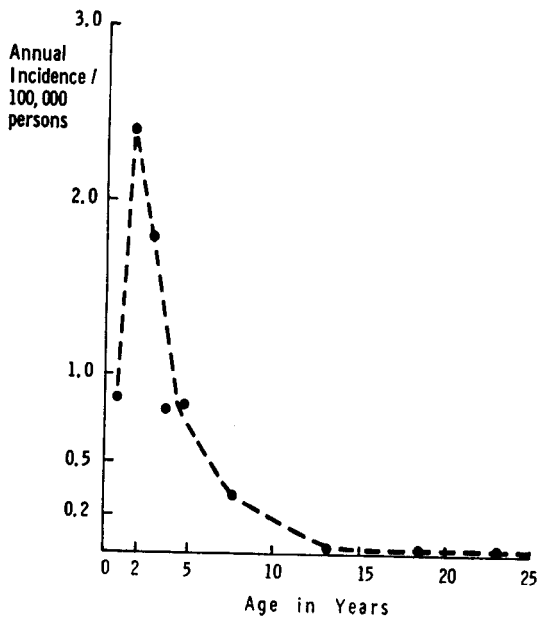
This is still my own belief. Nevertheless, it has to be admitted that some of the most attractive shortcuts have turned out to be blind alleys, while the epidemiologic observations which Dorn encouraged have shown several new ways in which cancer can be prevented in practice. This, indeed, is the great advantage of human studies. They are certainly relevant to the animal whose disease we are trying to prevent, and the conclusions drawn from them may point to some simple action which can be immediately effective.

Today, however, I should like to consider a way in which human studies can contribute to oncology, which is based on another, and perhaps less obvious, advantage. The human animal is available for observation in immense numbers; it feeds and maintains itself and, in many parts of the world, has a highly developed system at its service for diagnosing its ills and recording the cause of its death. In principle, therefore, observations can be made with a quantitative precision that could never be hoped for in an experiment on smaller mammals in the laboratory. If, to this, we are able to add knowledge of the amount and duration of exposure to a carcinogenic agent, we should be able to obtain a detailed mathematical description of the relationship between exposure and the development of the disease. Such a description will not, of course, lead to the discovery of the nature of the mechanism involved. That can be obtained only by laboratory experiment. It does, however, provide a means by which models of the mechanism of carcinogenesis can be tested—and if the model does not satisfy the description, it is not likely to be of much relevance to the development of the human disease.

In recent years, opportunities for investigation by this means have increased enormously. The development of cancer registries has provided details of the incidence of different types of cancer by sex and age in large populations of different genetic constitutions, or of similar constitution under different environmental conditions; and increasing knowledge of the factors responsible for the development of cancer has enabled populations to be defined which have been exposed to carcinogens in known amounts. These data are far from perfect, and conclusions can be drawn from them only with extreme caution. They can, however, be used tentatively to fill the gaps in knowledge that result from the small scale of so many animal experiments and to suggest new forms of experiment.

One such gap is the contribution of age to the production of the disease. Does age, in fact, play any part other than by determining the limits of the duration of exposure to the agent? That newborn animals are qualitatively more susceptible to some carcinogenic agents than other animals has been shown experimentally on many occasions,[30] but how does susceptibility to cancer induction vary between adolescence, maturity, middle age, and senescence? Is there any evidence that the old animal, in whom, it is suggested, the mechanism of immune surveillance has become less efficient, is more susceptible to cancer induction than the young?[4] Does the prolongation of exposure have any effect other than by increasing the time in which a rare event can have the opportunity of

FIG. 1–1.—Incidence of nephroblastoma at different ages: Birmingham region, England (1957-1968).

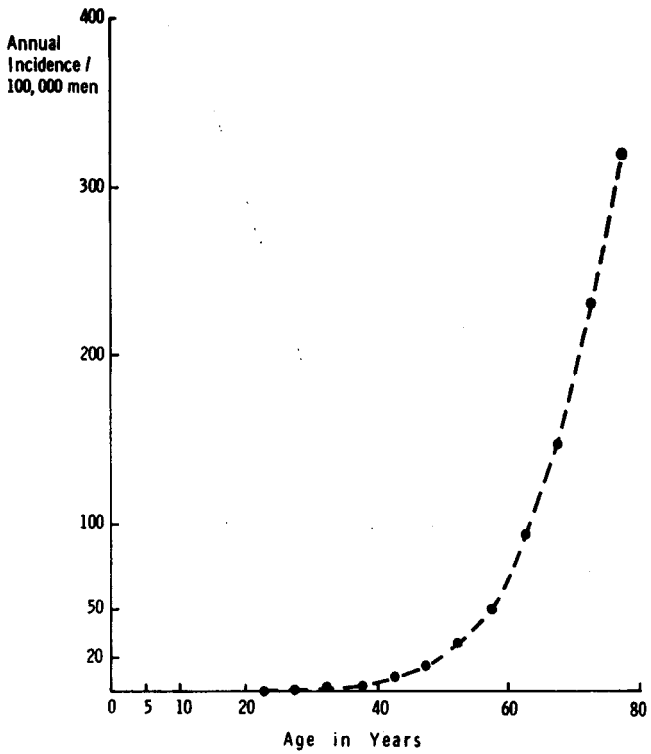


taking place? And if so, does the relationship between the duration of exposure and the increase of risk throw any light on the way in which prolongation of exposure exerts its effect?

Patterns of Distribution with Age

Examination of the data from cancer registries amplified, in some cases, by mortality data and clinical series shows that the incidence of cancer varies with age in many different ways.[16, 31, 32] Four main patterns however, characterize the great majority of common tumors. The first, typified by Wilms' tumor of the kidney (Figure 1-1) shows a rise in incidence to a peak in childhood, adolescence, or early adult life, followed by a decline. The second, typified by carcinoma of the stomach in most countries (Figure 1-2) shows a rapid, uninterrupted, and regular increase in incidence from adolescence to old age, with practically no cases in childhood. The third, typified by bronchial carcinoma almost everywhere and carcinoma of the stomach in much of Africa (Figure 1-3) is similar to the second but shows a reduction in incidence in old age.

FIG. 1–2.—Incidence of cancer of the stomach at different ages: Sweden (1962-1965).



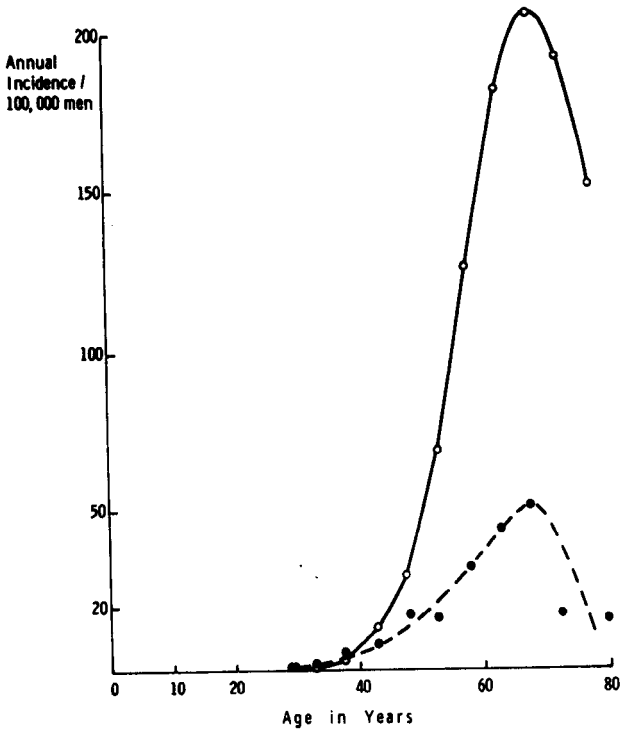


FIG. 1–3.—Incidence of cancer of the lung (O) in Denmark (1958-1962) and cancer of the stomach (●) in Ibadan, Nigeria (1960-1965) at different ages.

The fourth, typified by carcinomas of the breast and cervix uteri (Figure 1-4) shows a rise in incidence until middle life, after which the rate of increase slows down or ceases.

Before we seek to explain these patterns, we have to consider the reliability of the figures on which they are based. This depends not only on the accuracy of medical diagnosis but also on the extent to which medical services are available to, and made use of by, the public. Both factors vary between countries and, more importantly for the present purpose, between age groups. Many cancer registries provide a close estimate of the true incidence of cancer under 65 years of age; at higher ages utilization of services and the intensity of medical investigation are liable to fall off and few, if any, registries provide useful estimates of incidence over 80 years of age. Differences in the completeness of registration almost certainly account for the fact that many epithelial cancers are reported to decline in incidence in old age throughout large parts of the world, whereas they continue to increase in incidence in countries in which the medical services have been most intensively developed. We must remember also that, with rare exceptions, even the best