

Polycyclic Hydrocarbons and Cancer

2

Molecular
and Cell Biology

EDITED BY

HARRY V. GELBOIN

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VOLUME 2

Molecular and Cell Biology

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VOLUME 2

Molecular and Cell Biology

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Ask now the beasts, and they
shall teach you;
And the fowl of the air, and they
shall tell you;
Or speak to the earth, and it shall
teach you;
and the fishes of the sea shall declare
unto you.

Job XII, 7

Preface

Two major and interrelated concerns of modern society are the need for an adequate energy supply and the relationship between environmental quality and human health and welfare. Polycyclic aromatic hydrocarbons are products derived from the use of currently prevalent energy sources such as petroleum, coal, and wood. Major sources of the polycyclic aromatic hydrocarbons include emissions from transportation systems, heat and power generation, refuse burning, industrial processes, and oil contamination by effluent disposal or oil spills. These polycyclic aromatic hydrocarbons are omnipresent and abundant pollutants of air, soil, and water. These compounds are present in coal tar and cigarette smoke, which are known to cause human cancer as well as cancer in experimental animals. Thus, from both epidemiological and experimental studies, polycyclic aromatic hydrocarbons are highly suspect as causative agents in human cancer. As major environmental pollutants, they represent a serious threat to health and the quality of life.

Presented in these volumes is a comprehensive summary of the present state of knowledge in polycyclic aromatic hydrocarbon research, particularly in relation to cancer. Information from many diverse disciplines in the environmental, chemical, biological, and medical sciences is brought together. We expect the books to be of interest both to investigators and educators concerned with scientific aspects of polycyclic aromatic hydrocarbon research and to specialists in industry and government concerned with the practical problems in energy production and consumption as well as the quality of the environment. The comprehensive information in these volumes will be particularly useful to government officials and elected representatives as well as industrial leaders who must confront and solve the problems related to the polycyclic aromatic hydrocarbons. The comprehensive reviews and current research reports describe the research in polycyclic aromatic hydrocarbons from the viewpoints of many disciplines, including chemistry, environmental science, biochemistry and enzymology, pharmacology, molecular and cell biology, and genetics. There are fifteen main sections in the two volumes: Volume 1 contains (I) Energy Sources, (II)

Environmental Occurrence and Monitoring, (III) Tobacco Carcinogenesis, (IV) Chemistry, Carcinogenicity, and Theory, (V) Metabolism and Activation, (VI) Enzymology, and (VII) Pharmacokinetics; Volume 2 comprises (I) DNA and Chromatin Interactions, (II) Microbial Mutagenesis, (III) Mammalian Mutagenesis, (IV) DNA Repair, (V) Transformation of Cells in Culture, (VI) Animal and Human Models, (VII) Genetics, and (VIII) Comments and Observations. The first chapter in each section is a general review of the subject as well as a report of recent research; this is followed by research papers related to the review.

Research on polycyclic aromatic hydrocarbons has made rapid and decisive progress in the last decade. New approaches and exciting information have become available on polycyclic aromatic hydrocarbon formation as by-products of various energy sources, on monitoring of the environment, and on synthetic methods for hydrocarbon derivatives and metabolites. In the area of biochemistry, specific routes of benzo[a]pyrene activation and detoxification have been elucidated and the exact structure of a powerful active metabolite of benzo[a]pyrene, a diol epoxide, has been determined. The chemistry of the DNA adduct formed by this active metabolite and the nature of its various interactions with DNA have been characterized. In addition, the biological activity of this reactive form and other metabolites have been under intensive study with respect to *in vitro* transformation, mutagenesis, and DNA repair processes. Other areas in which progress is forthcoming are human population genetics related to hydrocarbon metabolism, cancer induction related to tobacco smoking, and cancer epidemiology in populations exposed to hydrocarbons.

These reviews were specifically prepared for this publication based on the research papers presented at a symposium held in January 1977 in New Orleans, Louisiana, sponsored by the United States-Japan Cooperative Cancer Research Program under the auspices of the National Cancer Institute and the Japan Society for the Promotion of Science. On behalf of the participants, we thank the Program Coordinators, Drs. Arthur C. Upton and I. Bernard Weinstein of the United States and Dr. Takashi Sugimura of Japan, and Robert Omata, Executive Secretary, Office of International Affairs, National Cancer Institute.

Special thanks are due to Dr. Chikayoshi Nagata, who helped develop the scientific program and organized the participation of the Japanese scientists.

Harry V. Gelboin

Paul O. P. Ts'o

Editors' note. Various investigators have used different nomenclatures for the benzo[a]pyrene diol epoxides and related compounds. A summary of the different nomenclatures is shown in Fig. 4 of Chapter 10, Volume 1.

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