

Carcinogenesis By Ultraviolet Light

By HAROLD F. BLUM

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Harold F. Blum is a member of the National Cancer Institute and a Visiting Professor at Princeton University. Besides numerous journal articles he has published two other books: *PHOTODYNAMIC ACTION AND DISEASES CAUSED BY LIGHT*, 1941 (Reinhold); and *TIME'S ARROW AND EVOLUTION*, 1951 (Princeton University Press), now in its second edition.



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**CARCINOGENESIS
BY ULTRAVIOLET LIGHT**

**INVESTIGATIONS
IN THE BIOLOGICAL SCIENCES**

ADVISORY EDITORS

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ERRATA

Title page should carry the subtitle:

AN ESSAY IN QUANTITATIVE BIOLOGY.

page 48, third line below equation (4.4) should read:

ordinate at a point which corresponds to the value of $\ln n$. Note

page 65, footnote 2, line 2

kg. cal. per mol. *should read:* kg. cal. per molecule

page 67, line 20

of O_2 *should read:* by O_2

page 186, line 15

Rekling (1941) *should read:* Rekling (1936)

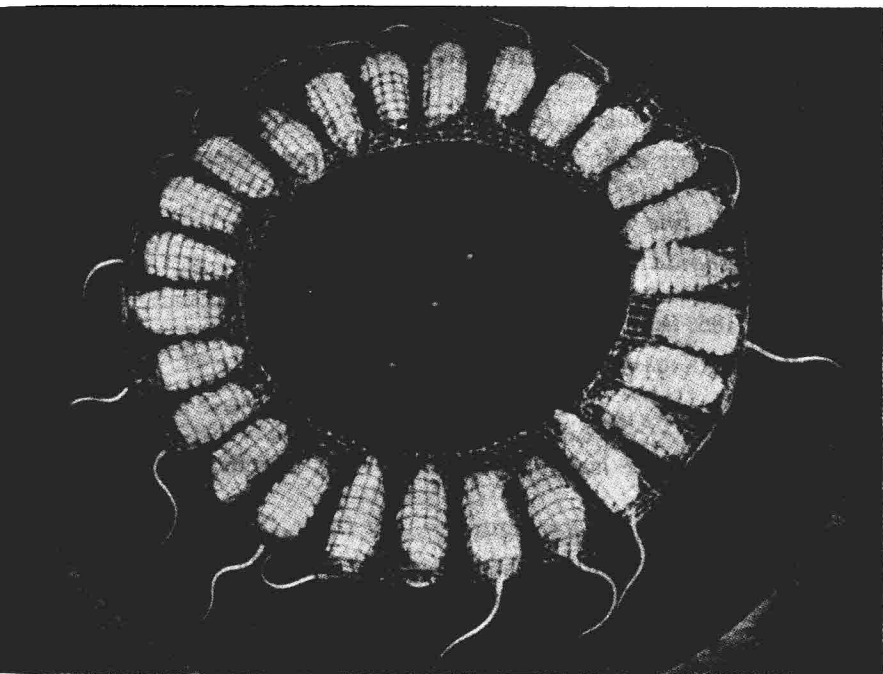
page 201, TABLE 12.3

Heading above last column should read: Carcinoma/Sarcoma

page 213, Legend for Figure 37, last item

acceleration slightly greater than for a) *should read:*

acceleration slightly less than for a)



Frontispiece. Pure strains of animals play an important role in cancer research. Here is seen a genetically homogeneous group of albino mice ready on a turntable to be rotated in a field of ultraviolet light. In a few months they will develop cancers of the skin. From Blum, Kirby-Smith, and Grady (1941), *Journal of the National Cancer Institute* 2; 259-268.

PREFACE

WHY do scientists write books? I have asked, or been asked this question a good many times. Leaving aside textbooks and compendia, where utility is obvious, I suppose the initial motivation comes from a desire for catharsis. When one has pondered a problem for a long time, some relief may be hoped for in setting down his ideas. Later there comes the realization of the need for further education, and, of more importance to the reader, the development of new ideas that were not there at the beginning. For a book supposes readers, and the conscientious author must hope that what he has to say contains something of novelty that is worth their attention as well as his own.

This brings up the matter of the value of ideas in general. At the moment there seems—principally outside science although to a certain extent within—a tendency to discount the importance of ideas in research by emphasizing the importance of techniques, although in the physical sciences the success of unifying concepts is so apparent that even the most “practical” experimentalist must needs respect them. In biology, on the other hand, the material with which one deals often appears so complex that unifying principles are particularly difficult to formulate with exactitude, and the physically trained worker who wanders into these fields may think at first that there are none.

There are, of course, general simplifying concepts in biology of the greatest importance—one need only mention evolution and the principles of inheritance; and there are many that are less general. It is true, however, that when one sets out to explore a field such as cancer, he finds a dearth of codified rules to follow. One reason for this may be that so many biological hypotheses based on too naive applications of physical concepts have failed in the past. This tended a few decades ago to discourage the search for general explanations. Many were led at that time to believe that the attempt to formulate theoretical aspects of biology should be left until more exact data could be obtained from

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experiment, and to a certain extent this attitude still persists. Of course, one can no more obtain useful data without ideas than one can obtain useful ideas without data—overemphasis on the one or the other has led to much unfruitful searching. For a variety of reasons, including pressures from both inside and outside the scientific fraternity, there is at present a predominant emphasis on experiment, which sometimes results in waste of effort that might be avoided if a little more time could be taken to think over the problems both before and during their attack.

But when confronted with a subject as seemingly complex and evasive, and so lacking in rules and adequate definitions, as is cancer, a theoretical approach may be difficult though nonetheless to be recommended. So many basic unsolved problems of biology seem to enter the picture—and so many questions pertaining to special aspects. It has seemed all the more important, for these reasons, to try to find some pathway through the woods, cutting away the entangling underbrush of detail where this has seemed necessary, at the risk of losing the way altogether. I am not quite sure if I am closer to my goal at the end than when I set out, although I am sure that I have not returned to my starting point. Perhaps I should have taken off in another direction somewhere along the line—if so I hope one or another of my readers may be able to find the proper point for a new departure.

The majority of the experimental studies that form the backbone of this book were carried out while I have been a member of the National Cancer Institute of the United States Public Health Service, during the greater part of which I have also been Visiting Professor in the Department of Biology at Princeton University; some of them while at the Naval Medical Research Institute, and others at the Marine Biological Laboratory, Woods Hole. The developing of ideas and writing were greatly aided by Fellowships from the John Simon Guggenheim Foundation and a Special Research Fellowship from the Public Health Service, which permitted periods of escape from the laboratory.

PREFACE

During the latter Fellowship I have been the guest of the Laboratoire Pasteur, Institut du Radium, and have also enjoyed facilities for writing provided by the Centre Universitaire Internationale. The book has profited greatly from the criticism of Dr. B. M. Eberhardt, Professor Elmer G. Butler, Dr. Sterling B. Hendricks, Dr. Raymond Latarjet, Dr. Herbert Marcovich, Dr. Roger Pinkham, Mr. Gerald A. Soffen, and Dr. Julius White, who read various parts of the manuscript in the course of its composition. And throughout the studies upon which this book is based, I have been rarely privileged in my collaborators, who have contributed much more than may be apparent in these pages, or in those we have published together elsewhere. There are many who have lent mind or hand at one time or another without any formal recognition of the part they played. I could hardly list them all.

So I will only say to all of you who have helped, directly or indirectly, that I am profoundly grateful, and that without your aid the book could not have been written.

HAROLD F. BLUM

Paris, July, 1958

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PART I
INTRODUCTORY

