

ORIGINS
OF
MOLECULAR
BIOLOGY

A Tribute to Jacques Monod

Edited by

ANDRÉ LWOFF
AGNES ULLMANN

**ORIGINS
OF MOLECULAR BIOLOGY
A Tribute to Jacques Monod**

This page intentionally left blank

**ORIGINS
OF MOLECULAR BIOLOGY**
A Tribute to Jacques Monod

edited by
André Lwoff and Agnes Ullmann

*Institut Pasteur
Paris, France*



ACADEMIC PRESS New York San Francisco London
A Subsidiary of Harcourt Brace Jovanovich, Publishers

1979

COPYRIGHT © 1979, BY ACADEMIC PRESS, INC.

ALL RIGHTS RESERVED.

**NO PART OF THIS PUBLICATION MAY BE REPRODUCED OR
TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC
OR MECHANICAL, INCLUDING PHOTOCOPY, RECORDING, OR ANY
INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT
PERMISSION IN WRITING FROM THE PUBLISHER.**

ACADEMIC PRESS, INC.

111 Fifth Avenue, New York, New York 10003

United Kingdom Edition published by

ACADEMIC PRESS, INC. (LONDON) LTD.

24/28 Oval Road, London NW1 7DX

Library of Congress Catalogue Card Number: 79-50407

ISBN 0-12-460480-3

PRINTED IN THE UNITED STATES OF AMERICA

79 80 81 82 9 8 7 6 5 4 3 2 1

CONTENTS

<i>Contributors</i>	vii
<i>Preface</i>	ix
Jacques Lucien Monod	1
<i>André Lwoff</i>	
The Outer and the Inner Man	25
<i>Roger Y. Stanier</i>	
A Bit of Luck	31
<i>Madeleine Jolit</i>	
Once Upon a Time	37
<i>Madeleine Brunerie</i>	
Le Labo de Jacques	43
<i>Annamaria Torriani</i>	
Remembrance of Things Past	49
<i>Germaine Stanier Cohen-Bazire</i>	
Whatever Happened to Pz?	55
<i>A. M. Pappenheimer, Jr.</i>	
An Exciting But Exasperating Personality	61
<i>Martin Pollock</i>	
In Memoriam	75
<i>Melvin Cohn</i>	
Permeability as an Excuse to Write What I Feel	89
<i>Georges N. Cohen</i>	
The Switch	95
<i>François Jacob</i>	
The PaJaMa Experiment	109
<i>Arthur B. Pardee</i>	
The Messenger	117
<i>François Gros</i>	
From Lactose to Galactose	125
<i>Gérard Buttin</i>	
The Wonderful Year	133
<i>David Perrin</i>	

From Diauxie to the Concept of Catabolite Repression	137
<i>Boris Magasanik</i>	
Permeases and Other Things	143
<i>B. L. Horecker</i>	
Early Kinetics of Induced Enzyme Synthesis	149
<i>Adam Kepes</i>	
From Acetylase to β -Galactosidase	157
<i>Irving Zabin</i>	
Being Around	165
<i>Agnes Ullmann</i>	
Another Route	171
<i>Maxime Schwartz</i>	
The Lively Corridor	179
<i>Marie-Hélène Buc</i>	
To Fold or Not to Fold: The Way toward Research	183
<i>Michel Goldberg</i>	
A Ph.D. with Jacques Monod: Prehistory of Allosteric Proteins	191
<i>Jean-Pierre Changeux</i>	
Discussions about Proteins	203
<i>Robert L. Baldwin</i>	
Some Memories of Jacques Monod	209
<i>D. E. Koshland, Jr.</i>	
Mother Nature and the Design of a Regulatory Enzyme	213
<i>Henri Buc</i>	
Recollections of Jacques Monod	221
<i>Jeffries Wyman</i>	
Sailing with Jacques	225
<i>Francis Crick</i>	
The Ode to Objectivity	231
<i>Gunther Stent</i>	
Jacques Monod: Scientist, Humanist, and Friend	239
<i>S. E. Luria</i>	
Conjectures and Refutations	243
<i>Antoine Danchin</i>	

CONTRIBUTORS

Numbers in parentheses indicate the pages on which authors' contributions begin.

- ROBERT L. BALDWIN (203), *Department of Biochemistry, Stanford Medical Center, Stanford, California 94305*
- HENRI BUC (213), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- MARIE-HÉLÈNE BUC (179), *Institut Pasteur, 28 rue du Dr. Roux, 75015, Paris, France*
- GÉRARD BUTTIN (125), *Institut de Recherche en Biologie Moléculaire, Faculté des Sciences, Université de Paris VII, 2, Place Jussieu, 75221 Paris Cedex 05, France*
- MADELEINE BRUNERIE (37), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- JEAN-PIERRE CHANGEUX (191), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- GEORGES N. COHEN (89), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- GERMAINE COHEN-BAZIRE (49), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- MELVIN COHN (75), *Salk Institute, San Diego, California 92112*
- FRANCIS CRICK (225), *Medical Research Council, Laboratory of Molecular Biology, Hills Road, Cambridge CB2 2QH, England*
- ANTOINE DANCHIN (243), *Institut de Biologie Physico-Chimique, 13 rue Pierre et Marie Curie, 75005 Paris, France*
- MICHEL GOLDBERG (183), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- FRANÇOIS GROS (117), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- BERNARD L. HORECKER (143), *Roche Institute of Molecular Biology, Nutley, New Jersey 07110*
- FRANÇOIS JACOB (95), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*

- MADELEINE JOLIT (31), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- ADAM KEPES (149), *Institut de Recherche en Biologie Moléculaire, Faculté des Sciences, Université de Paris VII, 2, Place Jussieu, 75221 Paris Cedex 05, France*
- DANIEL E. KOSHLAND, JR. (209), *Department of Biochemistry, University of California, Berkeley, California 94720*
- SALVADOR E. LURIA (239), *Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- ANDRÉ LWOFF (1), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- BORIS MAGASANIK (137), *Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- A. M. PAPPENHEIMER, (55), *Biological Laboratories, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138*
- ARTHUR B. PARDEE (109), *Sidney Farber Cancer Institute, Charles A. Dana Cancer Center, 44 Zinney Street, Boston, Massachusetts 02115*
- DAVID PERRIN (133), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- MARTIN POLLOCK (61), *Marsh Farm House, Margaret Marsh, Shaftesbury, Dorset SP7 0AZ, England*
- MAXIME SCHWARTZ (171), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- ROGER Y. STANIER (25), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- GUNTHER STENT (231), *Department of Molecular Biology, University of California, Berkeley, California 94720*
- ANNAMARIA TORRIANI (43), *Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- AGNES ULLMANN (165), *Institut Pasteur, 28 rue du Dr. Roux, 75015 Paris, France*
- JEFFRIES WYMAN (221), *Centro di Biologia Molecolare, Consiglio Nazionale delle Ricerche, Città Universitaria—00185, Rome, Italy*
- IRVING ZABIN (157), *University of California at Los Angeles, School of Medicine, Los Angeles, California 90024*

PREFACE

Occasionally the career of a scientist is marked by an important discovery. It is most unusual that it be illuminated by an uninterrupted series of great discoveries, and still more unusual when each discovery gives rise to new concepts and opens new vistas.

Sometimes a scientist by his work or personality influences his contemporaries. It is rare that he establishes a school. The founder of a school must dominate a field. He must have enough insight to foresee the direction research has to assume in order to achieve his goal. He should be able to judge the potential of young scientists and to assess the manifold aspects of their personalities so that he can provide them with projects in harmony with their interests and talents. He should be able to propose projects that can be solved or be channeled in a productive manner. He should love his students and collaborators, and be generous. Jacques Monod possessed all these qualities, therefore he was not only a brilliant scientist, but the founder of a renowned school as well.

During the first phase of his career, Jacques Monod worked alone. In the Institut Pasteur, he attracted a number of scientists. Some were students at various phases of their scientific careers, often at onset, others were mature, accomplished scientists. They worked with him a few months or a few years; some stayed at the Institut Pasteur. They had different personalities.

These scientists were asked to narrate their adventure; to relate their experiences with Jacques Monod. Almost all responded with enthusiasm; and most provided the contributions they promised. The result is fascinating. One sees Jacques Monod through the eyes of his technician, his secretary, his peers, his friends, and also of his enemies—love, friendship, and hate. The portraits of Jacques Monod—or, better still, images of the manifold aspects of his personality—are often painted with talent. Necessarily, the personality of the contributor appears as a watermark.

More important, the history of various discoveries is unfolded. This unique document illustrates the birth and development of concepts. It also shows the importance of a close, friendly, confident cooperation between different types of minds, the importance of interactions. One learns how a

great scientist receives, discusses, rejects, accepts, assimilates, and creates ideas; how ideas are turned into experiments; how experimental results are interpreted and how concepts are born; in short, how science is constructed. The reader participates in the formulation of problems, in the conquest of knowledge, and in the building of a discipline—a unique contribution to the life of a laboratory and to the dynamic history of science.

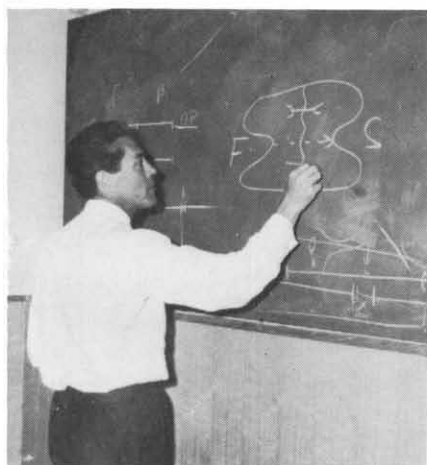
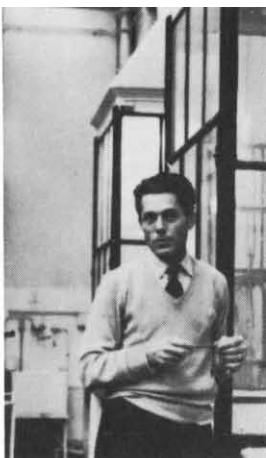
It will be noted that the depiction of the same discovery may be told differently by different scientists who worked at the same time in the same laboratory. Obviously, the personality of the narrator has sometimes influenced the narration. Certainly each one perceives the importance of his own contribution better than that of others. Where is truth? Does truth exist? The *métier* of detective, or coroner, is difficult.

Some aspects of Jacques Monod's activities have been omitted: mountain climbing, music, the underground, human rights, philosophy. Our goal was to depict the scientist. An intense light has been projected on one of the founders of molecular biology. Light engenders shades, and the contrast contributes to the relief. The image of Jacques Monod has been shaped step by step, and a portrait has emerged. "One becomes and one remains as others have seen you."

The royalties of this book will be deposited in a Jacques Monod Memorial Fund, which will be administrated by the Institut Pasteur. We wish to express our gratitude to the staff of Academic Press for their friendly cooperation.

ANDRE LWOFF
AGNES ULLMANN

A Tribute to Jacques Monod
1910–1976



Jacques Monod: 1910–1976. The first picture is a drawing made by his father in 1927.



Photographs were taken by Madeleine Brunerie, Ralph Alberto, Rene Saint-Paul, Jean Hardy, and others.