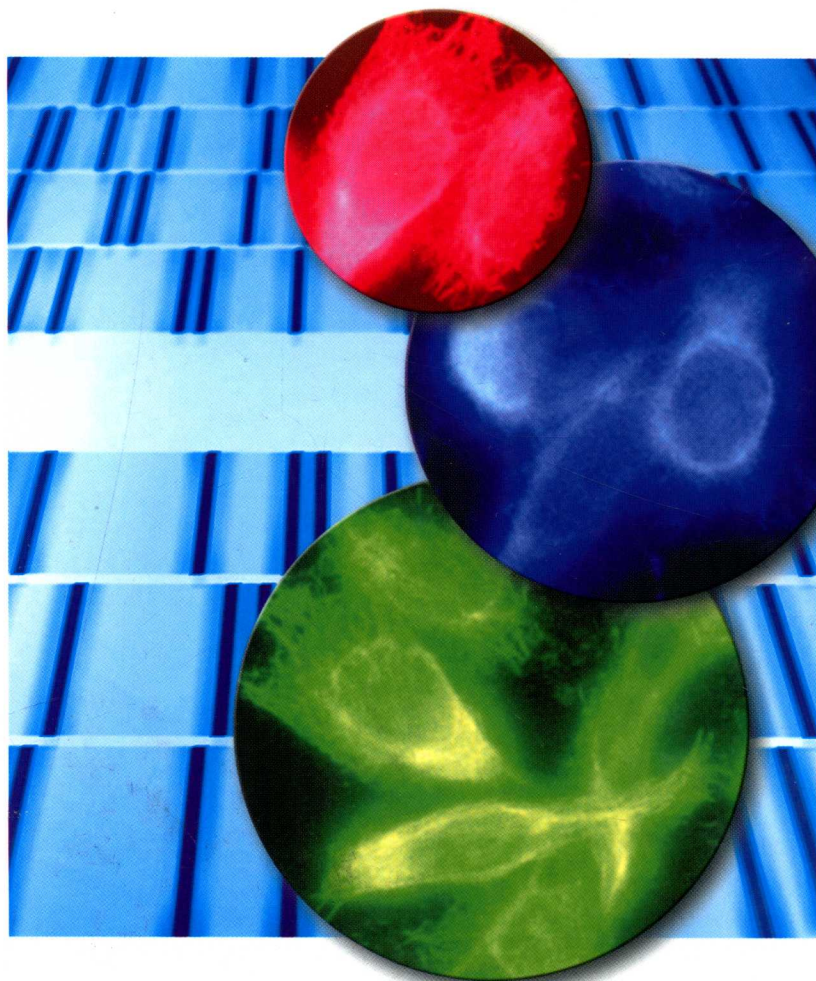


 WILEY-VCH

Encyclopedia of Molecular Cell Biology and Molecular Medicine

Edited by Robert A. Meyers



Volume 10

Second Edition
Orig-Prot

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Origins of Life, Molecular Basis of to Programmed Cell Death



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Editor:

Dr. Robert A. Meyers

President, Ramtech Limited
7 Harbor Point Drive, 7A
Mill Valley, CA 94941
USA

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Programmed Cell Death**

Encyclopedia of Molecular Cell Biology and Molecular Medicine

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- *Nobel Laureate

Preface

The *Encyclopedia of Molecular Cell Biology and Molecular Medicine*, which is the successor and second edition of the *Encyclopedia of Molecular Biology and Molecular Medicine* (VCH Publishers, Weinheim), covers the molecular and cellular basis of life at a university and professional researcher level. The first edition, published in 1996–97, was very successful and is being used in libraries around the world. This second edition will almost double the first edition in length and will comprise the most detailed treatment of both molecular cell biology and molecular medicine available today. The Board Members and I believe that there is a serious need for this publication, even in view of the vast amount of information available on the World Wide Web and in text books and monographs. We feel that there is no substitute for our tightly organized and integrated approach to selection of articles and authors and implementation of peer review standards for providing an authoritative single-source reference for undergraduate and graduate students, faculty, librarians, and researchers in industry and government.

Our purpose is to provide a comprehensive foundation for the expanding number of molecular biologists, cell biologists, pharmacologists, biophysicists, biotechnologists, biochemists, and physicians, as well as for those entering molecular cell biology and molecular medicine from majors or careers in physics, chemistry, mathematics, computer science, and engineering. For example, there is an unprecedented demand for physicists, chemists, and computer scientists who will work with biologists to define the genome, proteome, and interactome through experimental and computational biology.

The Board Members and I first divided the entire study of molecular cell biology and molecular medicine into primary topical categories and further defined each of these into subtopics. The following is a summary of the topics and subtopics:

- *Nucleic Acids*: amplification, disease genetics overview, DNA structure, evolution, general genetics, nucleic acid processes, oligonucleotides, RNA structure, RNA replication and transcription.
- *Structure Determination Technologies Applicable to Biomolecules*: chromatography, labeling, large structures, mapping, mass spectrometry, microscopy, magnetic resonance, sequencing, spectroscopy, X-ray diffraction.
- *Biochemistry*: carbohydrates, chirality, energetics, enzymes, biochemical genetics, inorganics, lipids, mechanisms, metabolism, neurology, vitamins.

- *Proteins, Peptides, and Amino Acids*: analysis, enzymes, folding, mechanisms, modeling, peptides, structural genomics (proteomics), structure, types.
- *Biomolecular Interactions*: cell properties, charge transfer, immunology, recognition, senses.
- *Cell Biology*: developmental cell biology, diseases, dynamics, fertilization, immunology, organelles and structures, senses, structural biology, techniques.
- *Molecular Cell Biology of Specific Organisms*: algae, amoeba, birds, fish, insects, mammals, microbes, nematodes, parasites, plants, viruses, yeasts.
- *Molecular Cell Biology of Specific Organs or Systems*: excretory, lymphatic, muscular, nervous, reproductive, skin.
- *Molecular Cell Biology of Specific Diseases*: cancer, circulatory, endocrinal, environmental stress, immune, infectious, neurological, radiational.
- *Pharmacology*: chemistry, disease therapy, gene therapy, general molecular medicine, synthesis, toxicology.
- *Biotechnology*: applications, diagnostics, gene-altered animals, bacteria and fungi, laboratory techniques, legal, materials, process engineering, nanotechnology, production of classes or specific molecules, sensors, vaccine production.

We then selected some 400 article titles and author or author teams to cover the above topics. Each article is designed as a self-contained treatment which begins with a keyword section including definitions, to assist the scientist or student who is unfamiliar with the specific subject area. The Encyclopedia includes more than 3000 key words, each defined within the context of the particular scientific field covered by the article. In addition to these definitions, the glossary of basic terms found at the back of each volume, defines the most commonly used terms in molecular cell biology. These definitions, along with the reference materials (the genetic code, the common amino acids, and the structures of the deoxyribonucleotides) printed at the back of each volume, should allow most readers to understand articles in the Encyclopedia without referring to a dictionary, textbook, or other reference work. There is, of course, a detailed subject index in Volume 16 as well as a cumulative table of contents and list of authors, as well as a list of scientists who assisted in the development of this Encyclopedia.

Each article begins with a concise definition of the subject and its importance, followed by the body of the article and extensive references for further reading. The references are divided into secondary references (books and review articles) and primary research papers. Each subject is presented on a first-principle basis, including detailed figures, tables and drawings. Because of the self-contained nature of each article, some articles on related topics overlap. Extensive cross-referencing is provided to help the reader expand his or her range of inquiry.

The articles contained in the Encyclopedia include core articles, which summarize broad areas, directing the reader to satellite articles that present additional detail and depth for each subject. The core article Brain Development is a typical example. This 45-page article spans neural induction, early patterning, differentiation, and wiring at a molecular through to cellular and tissue level. It is directly supported, and cross-referenced, by a number of molecular neurobiology satellite articles, for example, Behavior Genes, and further supported by other core presentations, for example,

Developmental Cell Biology; Genetics, Molecular Basis of, and their satellite articles. Another example is the core article on Genetic Variation and Molecular Evolution by Werner Arber. It is supported by a number of satellite articles supporting the evolutionary relatedness of genetic information, for example, Genetic Analysis of Populations.

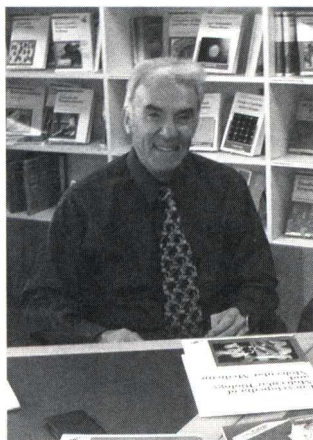
Approximately 250 article titles from the first edition are retained, but rewritten, half by new authors and half by returning authors. Approximately 80 articles on cell biology and 70 molecular biology articles have been added covering areas that have become prominent since preparation of the first edition. Thus, we have compiled a totally updated single source treatment of the molecular and cellular basis of life.

Finally, I wish to thank the following Wiley-VCH staff for their outstanding support of this project: Andreas Sendtko, who provided project and personnel supervision from the earliest phases, and Prisca-Maryla Henheik and Renate Dötzer, who served as the managing editors.

November 2003

Robert A. Meyers
Editor-in-Chief

Editor-in-Chief



Robert A. Meyers

Dr. Meyers earned his Ph.D. in organic chemistry from the University of California Los Angeles, was a post-doctoral fellow at California Institute of Technology and manager of chemical processes for TRW Inc. He has published in *Science*, written or edited 12 scientific books and his research has been reviewed in the *New York Times* and the *Wall Street Journal*. He is one of the most prolific science editors in the world having originated, organized and served as Editor-in-Chief of three editions of the *Encyclopedia of Physical Science and Technology*, the *Encyclopedia of Analytical Chemistry* and two editions of the present *Encyclopedia of Molecular Cell Biology and Molecular Medicine*.

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Werner Arber

Biozentrum, University of Basel, Switzerland

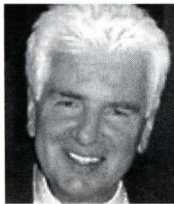
Nobel Prize in Physiology/Medicine for the discovery of restriction enzymes and their application to problems of molecular genetics



David Baltimore

California Institute of Technology, Pasadena, USA

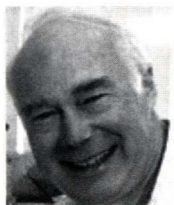
Nobel Prize in Physiology/Medicine for the discoveries concerning the interaction between tumor viruses and the genetic material of the cell



Günter Blobel

The Rockefeller University, New York, USA

Nobel Prize in Physiology/Medicine for the discovery that proteins have intrinsic signals that govern their transport and localization in the cell



Martin Evans

Cardiff University, United Kingdom

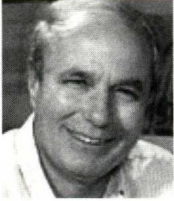
Lasker Award for the development of a powerful technology for manipulating the mouse genome, which allows the creation of animal models of human disease



Paul Greengard

The Rockefeller University, New York, USA

Nobel Prize in Physiology/Medicine for the discoveries concerning signal transduction in the nervous system



Avram Hershko

Technion – Israel Institute of Technology, Haifa, Israel

Nobel Prize in Chemistry for the discovery of ubiquitin-mediated protein degradation



Robert Huber

Max Planck Institute of Biochemistry, Martinsried, Germany

Nobel Prize in Chemistry for the determination of the three-dimensional structure of a photosynthetic reaction centre



Aaron Klug

MRC Laboratory of Molecular Biology Cambridge, United Kingdom

Nobel Prize in Chemistry for the development of crystallographic electron microscopy and his structural elucidation of biologically important nucleic acid-protein complexes



Stanley B. Prusiner

University of California, San Francisco, USA

Nobel Prize in Physiology/Medicine for the discovery of Prions – a new biological principle of infection



Bengt Samuelsson

Karolinska Institute, Stockholm, Sweden

Nobel Prize in Physiology/Medicine for the discoveries concerning prostaglandins and related biologically active substances



Phillip A. Sharp

Massachusetts Institute of Technology, Cambridge, USA
Nobel Prize in Physiology/Medicine for the discoveries of split genes



Alexander Varshavsky

California Institute of Technology, Pasadena, USA
Lasker Award for the discovery and the recognition of the significance of the ubiquitin system of regulated protein degradation



Akiyoshi Wada

RIKEN Yokohama Institute, Japan
Director of the RIKEN Genomic Science Center



Shigeyuki Yokoyama

RIKEN Yokohama Institute, Japan
Head of the RIKEN Structural Genomics Initiative



Rolf M. Zinkernagel

University Hospital Zurich, Switzerland
Nobel Prize in Physiology/Medicine for the discoveries concerning the specificity of the cell mediated immune defence

List of Contributors

Sailen Barik

University of South Alabama,
Mobile, AL,
USA

Andreas Bechthold

Albert-Ludwigs-Universität Freiburg,
Freiburg,
Germany

Vira Bitko

University of South Alabama,
Mobile, AL,
USA

Silvia Bulfone-Paus

Department of Immunology and
Cell Biology,
Parkallee, Borstel,
Germany

Dhruba K. Chattoraj

Center for Cancer Research,
NCI, NIH,
Bethesda, MD,
USA

Jose B. Cibelli

Michigan State University,
East Lansing, MI,
USA

Philip Dean

DeNovo Pharmaceuticals Limited,
Cambridge,
UK

Melvin L. DePamphilis

National Institute of Child Health and
Human Development Bethesda,
Bethesda, MD,
USA

Hartmut Derendorf

University of Florida,
Gainesville, FL,
USA

Rob DeSalle

Division of Invertebrates,
American Museum of Natural History,
New York,
USA

Matt Dickinson

The University of Nottingham,
Nottingham,
UK

Ulrich Dirnagl

Department of Experimental Neurology
(Charité) Humboldt University,
Berlin,
Germany

Mary G. Egan

Division of Invertebrates,
American Museum of Natural History,
New York,
USA

Stefan Ehlers

Department of Immunochemistry and
Biochemical Microbiology,
Parkallee, Borstel,
Germany

James P. Ferris

Department of Chemistry and NY Center
for Studies on the Origins of Life,
Rensselaer Polytechnic Institute,
Troy, NY,
USA

Paul Gane

DeNovo Pharmaceuticals Limited,
Cambridge,
UK

Kathleen A. Grant

Wake Forest University School of Medicine,
Winston-Salem, NC,
USA

Rebecca M. Henry

University of Michigan Medical School,
Ann Arbor, MI,
USA

Jason D. Hipp

Wake Forest University School of Medicine,
Winston-Salem, NC,
USA

Dirk Hoffmeister

Albert-Ludwigs-Universität Freiburg,
Freiburg,
Germany

Nancy Khardori

University School of Medicine,
Springfield, IL,
USA

Jörg Knäblein

Schering AG,
Berlin,
Germany

Minoru S. H. Ko

National Institute on Aging,
National Institutes of Health,
Baltimore, MD,
USA

Andrzej K. Konopka

BioLingua Research, Inc.,
Gaithersburg, MD,
USA

Kit S. Lam

University of California Davis,
Sacramento, CA,
USA

Ruiwu Liu

University of California Davis,
Sacramento, CA,
USA

Peter A. McNaughton

University of Cambridge,
Cambridge,
UK

Bernd Meibohm

The University of Tennessee Health Science
Center,
Memphis, TN,
USA

Andreas Meisel

Department of Experimental Neurology
(Charité) Humboldt University,
Berlin,
Germany

Irmgard Merfort

Albert-Ludwigs-Universität Freiburg,
Freiburg,
Germany

Josyf C. Mychaleckyj

Wake Forest University School of Medicine,
Winston-Salem, NC,
USA

Pravendra Nath

National Botanical Research Institute,
Lucknow,
India

Stefan Pelzer

Combinature Biopharm AG,
Berlin,
Germany

Konstantin Prass

Department of Experimental Neurology
(Charité) Humboldt University,
Berlin,
Germany

Stanley B. Prusiner

University of California,
San Francisco, CA,
USA

Aniruddha P. Sane

National Botanical Research Institute,
Lucknow,
India

Vidhu A. Sane

National Botanical Research Institute,
Lucknow,
India

Andreas Strasser

The Walter and Eliza Hall Institute of
Medical Research,
Royal Parade,
Parkville, Victoria,
Australia

Joel A. Swanson

University of Michigan Medical School,
Ann Arbor, MI,
USA

Prabodh K. Trivedi

National Botanical Research Institute,
Lucknow,
India

Vincent Vanburen

National Institute on Aging,
National Institutes of Health,
Baltimore, MD,
USA

Dennis E. Vance

University of Alberta,
Edmonton, Alberta,
Canada

David L Vaux

The Walter and Eliza Hall Institute of
Medical Research,
Royal Parade,
Parkville, Victoria,
Australia

Kent E. Vrana

Penn State University College of Medicine,
Hershey, PA,
USA

J. David Winger

Wake Forest University School of Medicine,
Winston-Salem, NC,
USA

Tilo Wolf

Department of Experimental Neurology
(Charité) Humboldt University,
Berlin,
Germany

Edward Zanders

DeNovo Pharmaceuticals Limited,
Cambridge,
UK

Color Plates

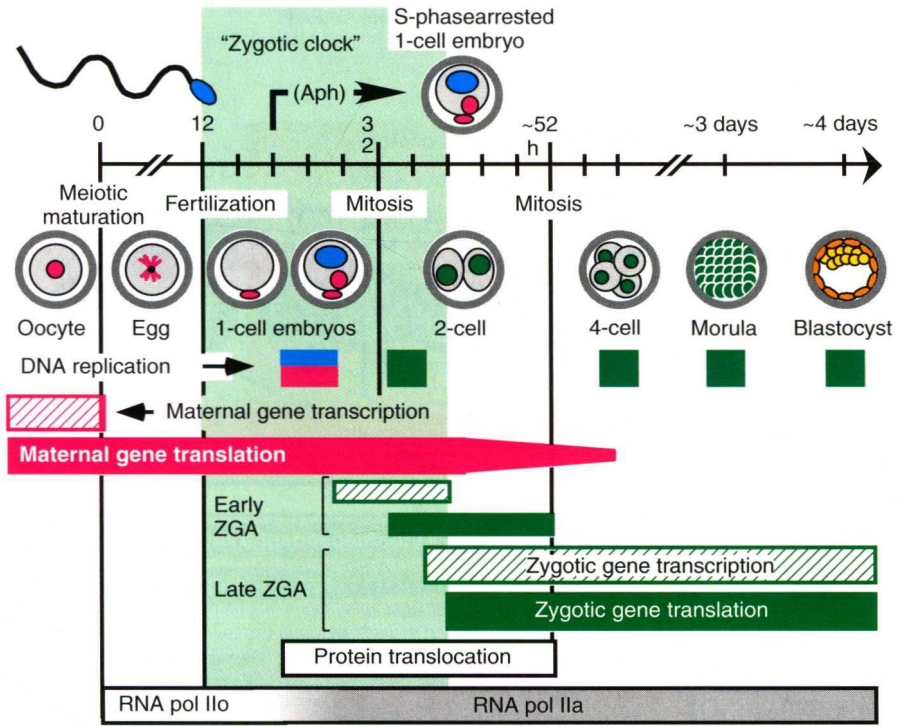


Fig. 1 (p. 485) Maternal to zygotic gene transition in the mouse. Maternal events are indicated in red, paternal events in blue, and zygotic events in green. Open bars apply to all three. Embryonic stem cells ("inner cell mass") are indicated in yellow and trophectodermal cells in orange. Periods of transcription are indicated by hatched bars and translation is indicated by solid bars.

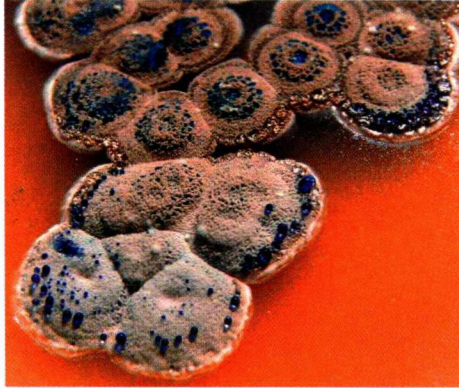


Fig. 1 (p. 642) Photograph of a sporulated streptomyces strain growing on solid medium. The blue drops indicate the production of an antibiotic (aromatic polyketide).

