

*Methods in Enzymology*

*Volume 131*

*Enzyme Structure*

*Part L*

EDITED BY

*C. H. W. Hirs*

*Serge N. Timasheff*

1986

*Methods in Enzymology*

*Volume 131*

# *Enzyme Structure*

*Part L*

EDITED BY

*C. H. W. Hirs*

DEPARTMENT OF BIOCHEMISTRY, BIOPHYSICS, AND GENETICS  
UNIVERSITY OF COLORADO MEDICAL CENTER  
DENVER, COLORADO

*Serge N. Timasheff*

GRADUATE DEPARTMENT OF BIOCHEMISTRY  
BRANDEIS UNIVERSITY  
WALTHAM, MASSACHUSETTS

1986



ACADEMIC PRESS, INC.

**Harcourt Brace Jovanovich, Publishers**

Orlando San Diego New York Austin  
Boston London Sydney Tokyo Toronto

COPYRIGHT © 1986 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.  
Orlando, Florida 32887

*United Kingdom Edition published by*  
ACADEMIC PRESS INC. (LONDON) LTD.  
24-28 Oval Road, London NW1 7DX

LIBRARY OF CONGRESS CATALOG CARD NUMBER: 54-9110

ISBN 0-12-182031-9

PRINTED IN THE UNITED STATES OF AMERICA

86 87 88 89

9 8 7 6 5 4 3 2 1

## Contributors to Volume 131

Article numbers are in parentheses following the names of contributors.  
Affiliations listed are current.

- ROBERT L. BALDWIN (1, 3), *Department of Biochemistry, Stanford University School of Medicine, Stanford, California 94305*
- JOHN F. BRANDTS (6), *Department of Chemistry, University of Massachusetts, Amherst, Massachusetts 01003*
- THOMAS E. CREIGHTON (5, 9), *Medical Research Council, Laboratory of Molecular Biology, Cambridge CB2 2QH, England*
- C. M. DOBSON (18), *Inorganic Chemistry Laboratory, University of Oxford, Oxford OX1 3QR, England*
- JOAN J. ENGLANDER (22), *Department of Biochemistry and Biophysics, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania 19104*
- S. W. ENGLANDER (22), *Department of Biochemistry and Biophysics, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania 19104*
- ANTHONY L. FINK (10), *Department of Chemistry, University of California, Santa Cruz, Santa Cruz, California 95064*
- ROGER B. GREGORY (21), *Chemistry Department, Kent State University, Kent, Ohio 44242*
- RAINER JAENICKE (12), *Institut für Biophysik und Physikalische Biochemie, Universität Regensburg, D-8400 Regensburg, Federal Republic of Germany*
- MARCEL A. JUILLERAT (11), *Nestec SA, CH-1800 Vevey, Switzerland*
- MARTIN KARPLUS (15, 18), *Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138*
- PETER S. KIM (8), *Whitehead Institute for Biomedical Research, Cambridge, Massachusetts 02142*
- JONATHAN KING (13), *Department of Biology, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- A. A. KOSSIAKOFF (20), *Department of Biocatalysis, Genentech, Inc., South San Francisco, California 94080, and Department of Pharmaceutical Chemistry, School of Pharmacy, University of California, San Francisco, San Francisco, California 94143*
- A. M. LABHARDT (7), *Zentrale Forschungseinheiten (ZFE), F. Hoffmann-La Roche & Co., Aktiengesellschaft, CH-4002 Basel, Switzerland*
- JOSEPH R. LAKOWICZ (23), *Department of Biological Chemistry, University of Maryland, School of Medicine, Baltimore, Maryland 21201*
- LUNG-NAN LIN (6), *Department of Chemistry, University of Massachusetts, Amherst, Massachusetts 01003*
- STANLEY J. OPELLA (17), *Department of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6323*
- C. N. PACE (14), *Biochemistry Department, Texas A&M University, College Station, Texas 77843-2128*
- FRITZ PARAK (24), *Institut für Physikalische Chemie der Universität Münster, D-4400 Münster, Federal Republic of Germany*
- GARY R. PARR (11), *Monsanto Company, St. Louis, Missouri 63167*
- GREGORY A. PETSKO (19), *Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- SERGEY A. POTEKHIN (2), *Institute of Protein Research, Academy of Sciences of the USSR, 142292 Pushchino, Moscow Region, USSR*

- PETER L. PRIVALOV (2), *Institute of Protein Research, Academy of Sciences of the USSR, 142292 Pushchino, Moscow Region, USSR*
- LOU REINISCH (24), *Physics Department, Northeastern University, Boston, Massachusetts 02115*
- DAGMAR RINGE (19), *Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139*
- JOSE R. ROGERO (22), *Instituto de Pesquisas Energeticas e Nucleares-IPEN, Sao Paulo, Brazil*
- ANDREAS ROSENBERG (21), *Department of Laboratory Medicine and Pathology, University of Minnesota Medical School, Minneapolis, Minnesota 55455*
- RAINER RUDOLPH (12), *Institut für Biophysik und Physikalische Biochemie, Universität Regensburg, D-8400 Regensburg, Federal Republic of Germany*
- FRANZ X. SCHMID (4), *Institut für Biophysik und Physikalische Biochemie, Universität Regensburg, D-8400 Regensburg, Federal Republic of Germany*
- HIROSHI TANIUCHI (11), *Laboratory of Chemical Biology, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Maryland 20892*
- HIROYASU UTIYAMA (3), *Life Science Group, Faculty of Integrated Arts and Sciences, Hiroshima University, Hiroshima 730, Japan*
- GERHARD WAGNER (16), *Institut für Molekularbiologie und Biophysik, Eidgenössische Technische Hochschule, Hönggerberg HPM, CH-8093 Zürich, Switzerland*
- KURT WÜTHRICH (16), *Institut für Molekularbiologie und Biophysik, Eidgenössische Technische Hochschule, Hönggerberg HPM, CH-8093 Zürich, Switzerland*
- MYEONG-HEE YU (13), *Center for Genetic Engineering, Korea Advanced Institute of Science and Technology, Seoul, Korea*

## Preface

Volumes 117 and 130, Parts J and K of *Enzyme Structure*, were published recently. They were devoted to physical methods. This volume also deals with physical methods. It is hoped that together they will bring up-to-date coverage of techniques currently available for the study of enzyme conformation, interactions, and dynamics.

This volume deals in detail with the questions of protein folding and protein dynamics. Many of the methods presented, even though based on experiments, are conceptual in nature. We hope that the expositions will result in proper guidance to the correct ways of asking questions and analyzing observations in these areas. In those articles which are primarily experimental, techniques have been described in detail and, where necessary, guidance has been provided for assembling the proper equipment if not commercially available.

We wish to acknowledge with pleasure and gratitude the generous cooperation of the contributors to this volume. Their suggestions during its planning and preparation have been particularly valuable. The staff of Academic Press has provided inestimable help in the assembly of this volume. We thank them for their many courtesies.

C. H. W. HIRS  
SERGE N. TIMASHEFF

# METHODS IN ENZYMOLOGY

EDITED BY

Sidney P. Colowick and Nathan O. Kaplan

VANDERBILT UNIVERSITY  
SCHOOL OF MEDICINE  
NASHVILLE, TENNESSEE

DEPARTMENT OF CHEMISTRY  
UNIVERSITY OF CALIFORNIA  
AT SAN DIEGO  
LA JOLLA, CALIFORNIA

- I. Preparation and Assay of Enzymes
- II. Preparation and Assay of Enzymes
- III. Preparation and Assay of Substrates
- IV. Special Techniques for the Enzymologist
- V. Preparation and Assay of Enzymes
- VI. Preparation and Assay of Enzymes (*Continued*)
  - Preparation and Assay of Substrates
  - Special Techniques
- VII. Cumulative Subject Index

# METHODS IN ENZYMOLOGY

EDITORS-IN-CHIEF

Sidney P. Colowick and Nathan O. Kaplan

**VOLUME VIII. Complex Carbohydrates**

*Edited by* ELIZABETH F. NEUFELD AND VICTOR GINSBURG

**VOLUME IX. Carbohydrate Metabolism**

*Edited by* WILLIS A. WOOD

**VOLUME X. Oxidation and Phosphorylation**

*Edited by* RONALD W. ESTABROOK AND MAYNARD E. PULLMAN

**VOLUME XI. Enzyme Structure**

*Edited by* C. H. W. HIRS

**VOLUME XII. Nucleic Acids (Parts A and B)**

*Edited by* LAWRENCE GROSSMAN AND KIVIE MOLDAVE

**VOLUME XIII. Citric Acid Cycle**

*Edited by* J. M. LOWENSTEIN

**VOLUME XIV. Lipids**

*Edited by* J. M. LOWENSTEIN

**VOLUME XV. Steroids and Terpenoids**

*Edited by* RAYMOND B. CLAYTON

**VOLUME XVI. Fast Reactions**

*Edited by* KENNETH KUSTIN

**VOLUME XVII. Metabolism of Amino Acids and Amines (Parts A and B)**

*Edited by* HERBERT TABOR AND CELIA WHITE TABOR

**VOLUME XVIII. Vitamins and Coenzymes (Parts A, B, and C)**

*Edited by* DONALD B. MCCORMICK AND LEMUEL D. WRIGHT



**VOLUME XIX. Proteolytic Enzymes***Edited by* GERTRUDE E. PERLMANN AND LASZLO LORAND**VOLUME XX. Nucleic Acids and Protein Synthesis (Part C)***Edited by* KIVIE MOLDAVE AND LAWRENCE GROSSMAN**VOLUME XXI. Nucleic Acids (Part D)***Edited by* LAWRENCE GROSSMAN AND KIVIE MOLDAVE**VOLUME XXII. Enzyme Purification and Related Techniques***Edited by* WILLIAM B. JAKOBY**VOLUME XXIII. Photosynthesis (Part A)***Edited by* ANTHONY SAN PIETRO**VOLUME XXIV. Photosynthesis and Nitrogen Fixation (Part B)***Edited by* ANTHONY SAN PIETRO**VOLUME XXV. Enzyme Structure (Part B)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME XXVI. Enzyme Structure (Part C)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME XXVII. Enzyme Structure (Part D)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME XXVIII. Complex Carbohydrates (Part B)***Edited by* VICTOR GINSBURG**VOLUME XXIX. Nucleic Acids and Protein Synthesis (Part E)***Edited by* LAWRENCE GROSSMAN AND KIVIE MOLDAVE**VOLUME XXX. Nucleic Acids and Protein Synthesis (Part F)***Edited by* KIVIE MOLDAVE AND LAWRENCE GROSSMAN**VOLUME XXXI. Biomembranes (Part A)***Edited by* SIDNEY FLEISCHER AND LESTER PACKER**VOLUME XXXII. Biomembranes (Part B)***Edited by* SIDNEY FLEISCHER AND LESTER PACKER

**VOLUME XXXIII. Cumulative Subject Index Volumes I-XXX***Edited by* **MARTHA G. DENNIS AND EDWARD A. DENNIS****VOLUME XXXIV. Affinity Techniques (Enzyme Purification: Part B)***Edited by* **WILLIAM B. JAKOBY AND MEIR WILCHEK****VOLUME XXXV. Lipids (Part B)***Edited by* **JOHN M. LOWENSTEIN****VOLUME XXXVI. Hormone Action (Part A: Steroid Hormones)***Edited by* **BERT W. O'MALLEY AND JOEL G. HARDMAN****VOLUME XXXVII. Hormone Action (Part B: Peptide Hormones)***Edited by* **BERT W. O'MALLEY AND JOEL G. HARDMAN****VOLUME XXXVIII. Hormone Action (Part C: Cyclic Nucleotides)***Edited by* **JOEL G. HARDMAN AND BERT W. O'MALLEY****VOLUME XXXIX. Hormone Action (Part D: Isolated Cells, Tissues, and Organ Systems)***Edited by* **JOEL G. HARDMAN AND BERT W. O'MALLEY****VOLUME XL. Hormone Action (Part E: Nuclear Structure and Function)***Edited by* **BERT W. O'MALLEY AND JOEL G. HARDMAN****VOLUME XLI. Carbohydrate Metabolism (Part B)***Edited by* **W. A. WOOD****VOLUME XLII. Carbohydrate Metabolism (Part C)***Edited by* **W. A. WOOD****VOLUME XLIII. Antibiotics***Edited by* **JOHN H. HASH****VOLUME XLIV. Immobilized Enzymes***Edited by* **KLAUS MOSBACH****VOLUME XLV. Proteolytic Enzymes (Part B)***Edited by* **LASZLO LORAND****VOLUME XLVI. Affinity Labeling***Edited by* **WILLIAM B. JAKOBY AND MEIR WILCHEK**

**VOLUME XLVII. Enzyme Structure (Part E)***Edited by C. H. W. HIRS AND SERGE N. TIMASHEFF***VOLUME XLVIII. Enzyme Structure (Part F)***Edited by C. H. W. HIRS AND SERGE N. TIMASHEFF***VOLUME XLIX. Enzyme Structure (Part G)***Edited by C. H. W. HIRS AND SERGE N. TIMASHEFF***VOLUME L. Complex Carbohydrates (Part C)***Edited by VICTOR GINSBURG***VOLUME LI. Purine and Pyrimidine Nucleotide Metabolism***Edited by PATRICIA A. HOFFEE AND MARY ELLEN JONES***VOLUME LII. Biomembranes (Part C: Biological Oxidations)***Edited by SIDNEY FLEISCHER AND LESTER PACKER***VOLUME LIII. Biomembranes (Part D: Biological Oxidations)***Edited by SIDNEY FLEISCHER AND LESTER PACKER***VOLUME LIV. Biomembranes (Part E: Biological Oxidations)***Edited by SIDNEY FLEISCHER AND LESTER PACKER***VOLUME LV. Biomembranes (Part F: Bioenergetics)***Edited by SIDNEY FLEISCHER AND LESTER PACKER***VOLUME LVI. Biomembranes (Part G: Bioenergetics)***Edited by SIDNEY FLEISCHER AND LESTER PACKER***VOLUME LVII. Bioluminescence and Chemiluminescence***Edited by MARLENE A. DELUCA***VOLUME LVIII. Cell Culture***Edited by WILLIAM B. JAKOBY AND IRA PASTAN***VOLUME LIX. Nucleic Acids and Protein Synthesis (Part G)***Edited by KIVIE MOLDAVE AND LAWRENCE GROSSMAN***VOLUME LX. Nucleic Acids and Protein Synthesis (Part H)***Edited by KIVIE MOLDAVE AND LAWRENCE GROSSMAN*

**VOLUME 61. Enzyme Structure (Part H)***Edited by C. H. W. HIRS AND SERGE N. TIMASHEFF***VOLUME 62. Vitamins and Coenzymes (Part D)***Edited by DONALD B. MCCORMICK AND LEMUEL D. WRIGHT***VOLUME 63. Enzyme Kinetics and Mechanism (Part A: Initial Rate and Inhibitor Methods)***Edited by DANIEL L. PURICH***VOLUME 64. Enzyme Kinetics and Mechanism (Part B: Isotopic Probes and Complex Enzyme Systems)***Edited by DANIEL L. PURICH***VOLUME 65. Nucleic Acids (Part I)***Edited by LAWRENCE GROSSMAN AND KIVIE MOLDAVE***VOLUME 66. Vitamins and Coenzymes (Part E)***Edited by DONALD B. MCCORMICK AND LEMUEL D. WRIGHT***VOLUME 67. Vitamins and Coenzymes (Part F)***Edited by DONALD B. MCCORMICK AND LEMUEL D. WRIGHT***VOLUME 68. Recombinant DNA***Edited by RAY WU***VOLUME 69. Photosynthesis and Nitrogen Fixation (Part C)***Edited by ANTHONY SAN PIETRO***VOLUME 70. Immunochemical Techniques (Part A)***Edited by HELEN VAN VUNAKIS AND JOHN J. LANGONE***VOLUME 71. Lipids (Part C)***Edited by JOHN M. LOWENSTEIN***VOLUME 72. Lipids (Part D)***Edited by JOHN M. LOWENSTEIN***VOLUME 73. Immunochemical Techniques (Part B)***Edited by JOHN J. LANGONE AND HELEN VAN VUNAKIS*

**VOLUME 74. Immunochemical Techniques (Part C)***Edited by* JOHN J. LANGONE AND HELEN VAN VUNAKIS**VOLUME 75. Cumulative Subject Index Volumes XXXI, XXXII, and XXXIV-LX***Edited by* EDWARD A. DENNIS AND MARTHA G. DENNIS**VOLUME 76. Hemoglobins***Edited by* ERALDO ANTONINI, LUIGI ROSSI-BERNARDI, AND EMILIA CHIANCONE**VOLUME 77. Detoxication and Drug Metabolism***Edited by* WILLIAM B. JAKOBY**VOLUME 78. Interferons (Part A)***Edited by* SIDNEY PESTKA**VOLUME 79. Interferons (Part B)***Edited by* SIDNEY PESTKA**VOLUME 80. Proteolytic Enzymes (Part C)***Edited by* LASZLO LORAND**VOLUME 81. Biomembranes (Part H: Visual Pigments and Purple Membranes, I)***Edited by* LESTER PACKER**VOLUME 82. Structural and Contractile Proteins (Part A: Extracellular Matrix)***Edited by* LEON W. CUNNINGHAM AND DIXIE W. FREDERIKSEN**VOLUME 83. Complex Carbohydrates (Part D)***Edited by* VICTOR GINSBURG**VOLUME 84. Immunochemical Techniques (Part D: Selected Immunoassays)***Edited by* JOHN J. LANGONE AND HELEN VAN VUNAKIS**VOLUME 85. Structural and Contractile Proteins (Part B: The Contractile Apparatus and the Cytoskeleton)***Edited by* DIXIE W. FREDERIKSEN AND LEON W. CUNNINGHAM

**VOLUME 86. Prostaglandins and Arachidonate Metabolites***Edited by WILLIAM E. M. LANDS AND WILLIAM L. SMITH***VOLUME 87. Enzyme Kinetics and Mechanism (Part C: Intermediates, Stereochemistry, and Rate Studies)***Edited by DANIEL L. PURICH***VOLUME 88. Biomembranes (Part I: Visual Pigments and Purple Membranes, II)***Edited by LESTER PACKER***VOLUME 89. Carbohydrate Metabolism (Part D)***Edited by WILLIS A. WOOD***VOLUME 90. Carbohydrate Metabolism (Part E)***Edited by WILLIS A. WOOD***VOLUME 91. Enzyme Structure (Part I)***Edited by C. H. W. HIRS AND SERGE N. TIMASHEFF***VOLUME 92. Immunochemical Techniques (Part E: Monoclonal Antibodies and General Immunoassay Methods)***Edited by JOHN J. LANGONE AND HELEN VAN VUNAKIS***VOLUME 93. Immunochemical Techniques (Part F: Conventional Antibodies, Fc Receptors, and Cytotoxicity)***Edited by JOHN J. LANGONE AND HELEN VAN VUNAKIS***VOLUME 94. Polyamines***Edited by HERBERT TABOR AND CELIA WHITE TABOR***VOLUME 95. Cumulative Subject Index Volumes 61-74 and 76-80***Edited by EDWARD A. DENNIS AND MARTHA G. DENNIS***VOLUME 96. Biomembranes [Part J: Membrane Biogenesis: Assembly and Targeting (General Methods; Eukaryotes)]***Edited by SIDNEY FLEISCHER AND BECCA FLEISCHER***VOLUME 97. Biomembranes [Part K: Membrane Biogenesis: Assembly and Targeting (Prokaryotes, Mitochondria, and Chloroplasts)]***Edited by SIDNEY FLEISCHER AND BECCA FLEISCHER*

**VOLUME 98. Biomembranes [Part L: Membrane Biogenesis (Processing and Recycling)]**

*Edited by* SIDNEY FLEISCHER AND BECCA FLEISCHER

**VOLUME 99. Hormone Action (Part F: Protein Kinases)**

*Edited by* JACKIE D. CORBIN AND JOEL G. HARDMAN

**VOLUME 100. Recombinant DNA (Part B)**

*Edited by* RAY WU, LAWRENCE GROSSMAN, AND KIVIE MOLDAVE

**VOLUME 101. Recombinant DNA (Part C)**

*Edited by* RAY WU, LAWRENCE GROSSMAN, AND KIVIE MOLDAVE

**VOLUME 102. Hormone Action (Part G: Calmodulin and Calcium-Binding Proteins)**

*Edited by* ANTHONY R. MEANS AND BERT W. O'MALLEY

**VOLUME 103. Hormone Action (Part H: Neuroendocrine Peptides)**

*Edited by* P. MICHAEL CONN

**VOLUME 104. Enzyme Purification and Related Techniques (Part C)**

*Edited by* WILLIAM B. JAKOBY

**VOLUME 105. Oxygen Radicals in Biological Systems**

*Edited by* LESTER PACKER

**VOLUME 106. Posttranslational Modifications (Part A)**

*Edited by* FINN WOLD AND KIVIE MOLDAVE

**VOLUME 107. Posttranslational Modifications (Part B)**

*Edited by* FINN WOLD AND KIVIE MOLDAVE

**VOLUME 108. Immunochemical Techniques (Part G: Separation and Characterization of Lymphoid Cells)**

*Edited by* GIOVANNI DI SABATO, JOHN J. LANGONE, AND HELEN VAN VUNAKIS

**VOLUME 109. Hormone Action (Part I: Peptide Hormones)**

*Edited by* LUTZ BIRNBAUMER AND BERT W. O'MALLEY

**VOLUME 110. Steroids and Isoprenoids (Part A)**

*Edited by* JOHN H. LAW AND HANS C. RILLING

**VOLUME 111. Steroids and Isoprenoids (Part B)***Edited by* JOHN H. LAW AND HANS C. RILLING**VOLUME 112. Drug and Enzyme Targeting (Part A)***Edited by* KENNETH J. WIDDER AND RALPH GREEN**VOLUME 113. Glutamate, Glutamine, Glutathione, and Related Compounds***Edited by* ALTON MEISTER**VOLUME 114. Diffraction Methods for Biological Macromolecules (Part A)***Edited by* HAROLD W. WYCKOFF, C. H. W. HIRS, AND SERGE N. TIMASHEFF**VOLUME 115. Diffraction Methods for Biological Macromolecules (Part B)***Edited by* HAROLD W. WYCKOFF, C. H. W. HIRS, AND SERGE N. TIMASHEFF**VOLUME 116. Immunochemical Techniques (Part H: Effectors and Mediators of Lymphoid Cell Functions)***Edited by* GIOVANNI DI SABATO, JOHN J. LANGONE, AND HELEN VAN VUNAKIS**VOLUME 117. Enzyme Structure (Part J)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME 118. Plant Molecular Biology***Edited by* ARTHUR WEISSBACH AND HERBERT WEISSBACH**VOLUME 119. Interferons (Part C)***Edited by* SIDNEY PESTKA**VOLUME 120. Cumulative Subject Index Volumes 81-94, 96-101****VOLUME 121. Immunochemical Techniques (Part I: Hybridoma Technology and Monoclonal Antibodies)***Edited by* JOHN J. LANGONE AND HELEN VAN VUNAKIS**VOLUME 122. Vitamins and Coenzymes (Part G)***Edited by* FRANK CHYTIL AND DONALD B. MCCORMICK



**VOLUME 123. Vitamins and Coenzymes (Part H)***Edited by* FRANK CHYTIL AND DONALD B. MCCORMICK**VOLUME 124. Hormone Action (Part J: Neuroendocrine Peptides)***Edited by* P. MICHAEL CONN**VOLUME 125. Biomembranes (Part M: Transport in Bacteria, Mitochondria, and Chloroplasts: General Approaches and Transport Systems)***Edited by* SIDNEY FLEISCHER AND BECCA FLEISCHER**VOLUME 126. Biomembranes (Part N: Transport in Bacteria, Mitochondria, and Chloroplasts: Protonmotive Force)***Edited by* SIDNEY FLEISCHER AND BECCA FLEISCHER**VOLUME 127. Biomembranes (Part O: Protons and Water: Structure and Translocation)***Edited by* LESTER PACKER**VOLUME 128. Plasma Lipoproteins (Part A: Preparation, Structure, and Molecular Biology)***Edited by* JERE P. SEGREST AND JOHN J. ALBERS**VOLUME 129. Plasma Lipoproteins (Part B: Characterization, Cell Biology, and Metabolism)***Edited by* JOHN J. ALBERS AND JERE P. SEGREST**VOLUME 130. Enzyme Structure (Part K)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME 131. Enzyme Structure (Part L)***Edited by* C. H. W. HIRS AND SERGE N. TIMASHEFF**VOLUME 132. Immunochemical Techniques (Part J: Phagocytosis and Cell-Mediated Cytotoxicity) (in preparation)***Edited by* GIOVANNI DI SABATO AND JOHANNES EVERSE**VOLUME 133. Bioluminescence and Chemiluminescence (Part B) (in preparation)***Edited by* MARLENE DELUCA AND WILLIAM D. McELROY**VOLUME 134. Structural and Contractile Proteins (Part C: The Contractile Apparatus and the Cytoskeleton) (in preparation)***Edited by* RICHARD B. VALLEE