

MIAMI WINTER SYMPOSIA—VOLUME 19

**FROM GENE TO PROTEIN:
TRANSLATION
INTO BIOTECHNOLOGY**

edited by

Fazal Ahmad

Julius Schultz

The Papanicolaou Cancer Research Institute

Eric E. Smith

William J. Whelan

University of Miami School of Medicine

Proceedings of the Miami Winter Symposium, January 1982

Sponsored by the Department of Biochemistry

University of Miami School of Medicine, Miami, Florida

Symposium Director: W. J. Whelan

and by

The Papanicolaou Cancer Research Institute, Miami, Florida

Symposium Director: J. Schultz



ACADEMIC PRESS

1982

A Subsidiary of Harcourt Brace Jovanovich, Publishers

New York London

Paris San Diego San Francisco São Paulo Sydney Tokyo Toronto

COPYRIGHT © 1982, 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 Cataloging in Publication Data
Main entry under title:

From gene to protein: Translation into Biotechnology.

(Miami winter symposia ; v. 19)
Proceedings of the symposium held in Miami Beach in
Jan. 1982

Includes index.

1. Genetic engineering--Congresses. 2. Protein
biosynthesis--Congresses. I. Ahmad, Fazal, Date
II. Series.

QH442.F75 1982 660'.6 82-18172
ISBN 0-12-045560-9

PRINTED IN THE UNITED STATES OF AMERICA

82 83 84 85 9 8 7 6 5 4 3 2 1

**FROM GENE TO PROTEIN:
TRANSLATION INTO BIOTECHNOLOGY**

MIAMI WINTER SYMPOSIA—VOLUME 19

1. W. J. Whelan and J. Schultz, editors: *HOMOLOGIES IN ENZYMES AND METABOLIC PATHWAYS and METABOLIC ALTERATIONS IN CANCER*, 1970
2. D. W. Ribbons, J. F. Woessner, Jr., and J. Schultz, editors: *NUCLEIC ACID-PROTEIN INTERACTIONS and NUCLEIC ACID SYNTHESIS IN VIRAL INFECTION*, 1971
3. J. F. Woessner, Jr., and F. Huijing, editors: *THE MOLECULAR BASIS OF BIOLOGICAL TRANSPORT*, 1972
4. J. Schultz and B. F. Cameron, editors: *THE MOLECULAR BASIS OF ELECTRON TRANSPORT*, 1972
5. F. Huijing and E. Y. C. Lee, editors: *PROTEIN PHOSPHORYLATION IN CONTROL MECHANISMS*, 1973
6. J. Schultz and H. G. Gratzner, editors: *THE ROLE OF CYCLIC NUCLEOTIDES IN CARCINOGENESIS*, 1973
7. E. Y. C. Lee and E. E. Smith, editors: *BIOLOGY AND CHEMISTRY OF EUKARYOTIC CELL SURFACES*, 1974.
8. J. Schultz and R. Block, editors: *MEMBRANE TRANSFORMATIONS IN NEOPLASIA*, 1974
9. E. E. Smith and D. W. Ribbons, editors: *MOLECULAR APPROACHES TO IMMUNOLOGY*, 1975
10. J. Schultz and R. C. Leif, editors: *CRITICAL FACTORS IN CANCER IMMUNOLOGY*, 1975
11. D. W. Ribbons and K. Brew, editors: *PROTEOLYSIS AND PHYSIOLOGICAL REGULATION*, 1976
12. J. Schultz and F. Ahmad, editors: *CANCER ENZYMOLOGY*, 1976
13. W. A. Scott and R. Werner, editors: *MOLECULAR CLONING OF RECOMBINANT DNA*, 1977
14. J. Schultz and Z. Brada, editors: *GENETIC MANIPULATION AS IT AFFECTS THE CANCER PROBLEM*, 1977
15. F. Ahmad, T. R. Russell, J. Schultz, and R. Werner, editors: *DIFFERENTIATION AND DEVELOPMENT*, 1978
16. T. R. Russell, K. Brew, H. Faber, and J. Schultz, editors: *FROM GENE TO PROTEIN: INFORMATION TRANSFER IN NORMAL AND ABNORMAL CELLS*, 1979
17. W. A. Scott, R. Werner, D. R. Joseph, and J. Schultz, editors: *MOBILIZATION AND REASSEMBLY OF GENETIC INFORMATION*, 1980
18. L. W. Mozes, J. Schultz, W. A. Scott, and R. Werner, editors: *CELLULAR RESPONSES TO MOLECULAR MODULATORS*, 1981
19. F. Ahmad, J. Schultz, E. E. Smith, and W. J. Whelan, editors: *FROM GENE TO PROTEIN: TRANSLATION INTO BIOTECHNOLOGY*, 1982

SPEAKERS AND DISCUSSANTS

- M. Adesnik* New York University School of Medicine, New York, New York
A. A. Ansari Northrop Services, Inc., Research Triangle Park, North Carolina
M. A. Apple International Plant Research Institute, Inc., San Carlos, California
R. Axel College of Physicians and Surgeons of Columbia University,
New York, New York
D. Baltimore Massachusetts Institute of Technology, Cambridge, Massachusetts
D. Barngorver Massachusetts Institute of Technology, Cambridge, Massachusetts
L. Baumbach University of Florida, Gainesville, Florida
M. Bina Purdue University, West Lafayette, Indiana
H. de Boer Genentech, Inc., South San Francisco, California
D. Botstein Massachusetts Institute of Technology, Cambridge Massachusetts
V. Braman University of Pennsylvania, Philadelphia, Pennsylvania
R. L. Brinster University of Pennsylvania, Philadelphia, Pennsylvania
D. W. Buck University of Pennsylvania, Philadelphia, Pennsylvania
D. Burke University of Warwick, Coventry, England
J. P. Burnett Eli Lilly and Company, Indianapolis, Indiana
H. Busch Baylor College of Medicine, Houston, Texas
J. Cahill Revlon Health Care Group, Tuckahoe, New York
M. H. Caruthers University of Colorado, Boulder, Colorado
S. I. Chavin University of Rochester Medical School, Rochester, New York
V. Chowdhry E. I. Du Pont de Nemours and Company, Wilmington, Delaware
M. Chretien Montreal Clinical Research Institute, Montreal, Canada
C. Colby Cetus Corporation, Berkeley, California
L. Comstock Genentech, Inc., South San Francisco, California
C. M. Croce The Wistar Institute of Anatomy and Biology, Philadelphia,
Pennsylvania
A. C. Cuello University of Oxford, Oxford, England

Names in bold indicate speakers at the conference.

- D. T. Denhardt* University of Western Ontario, London, Ontario, Canada
R. Derynck Genentech, Inc., South San Francisco, California
C. Desaymard Albert Einstein College of Medicine, Bronx, New York
T. Van Dyke University of Florida, Gainesville, Florida
K. B. Eager University of Pennsylvania, Philadelphia, Pennsylvania
H. Faber Papanicolaou Cancer Research Institute, Miami, Florida
S. Fein University of Texas System Cancer Center, Houston, Texas
J. Fenno Genentech, Inc., South San Francisco, California
J. A. Galloway Eli Lilly and Company, Indianapolis, Indiana
D. Garfinkel University of Washington, Seattle, Washington
J. R. Geiger Olin Corporation, New Haven, Connecticut
D. H. Gelfand Cetus Corporation, Berkeley, California
A. Giusti Albert Einstein College of Medicine, Bronx, New York
D. V. Goeddel Genentech, Inc., South San Francisco, California
M. P. Gordon University of Washington, Seattle, Washington
P. W. Gray Genentech, Inc., South San Francisco, California
J. Guterman University of Texas System Cancer Center, Houston, Texas
F. E. Hagie Genentech, Inc., South San Francisco, California
R. W. F. Hardy E. I. Du Pont de Nemours and Company, Wilmington, Delaware
J. Harford National Institutes of Health, Bethesda, Maryland
G. Haughton University of North Carolina, Chapel Hill, North Carolina
R. J. Hay American Type Culture Collection, Rockville, Maryland
D. V. Hendrick Bethesda Research Laboratories, Inc., Gaithersburg, Maryland
H. Heyneker Genentech, Inc., South San Francisco, California
P. A. Hieter National Institutes of Health, Bethesda, Maryland
R. Hintz Stanford University, Stanford, California
R. A. Hitzeman Genentech, Inc., South San Francisco, California
G. F. Hollis National Institutes of Health, Bethesda, Maryland
T. Horn Genentech, Inc., South San Francisco, California
D. H. Hoscheit Schuyler, Banner, Birch, McKie and Beckett, Washington, D.C.
T. Huang City of Hope Research Institute, Duarte, California
P. P. Hung Bethesda Research Laboratories, Inc., Gaithersburg, Maryland
K. Itakura City of Hope Research Institute, Duarte, California
S. L. Kaplan University of California, San Francisco, California
R. H. Kennett University of Pennsylvania, Philadelphia, Pennsylvania
R. Kierzek Polish Academy of Sciences, Poznan, Poland
S. King F. Eberstadt and Company, Inc., New York, New York
H. Klee University of Washington, Seattle, Washington
G. Knapp University of Alabama, Birmingham, Alabama
V. Knuf University of Washington, Seattle, Washington
P. C. Kung Centocor, Inc., Malvern, Pennsylvania
S. Kwan Albert Einstein College of Medicine, Bronx, New York
W. Kwok University of Washington, Seattle, Washington
E. Lamon University of Alabama, Birmingham, Alabama

- J. W. Larrick* Stanford University, Palo Alto, California
R. M. Lawn Genentech, Inc., South San Francisco, California
A. Leder National Institutes of Health, Bethesda, Maryland
P. Leder National Institutes of Health, Bethesda, Maryland
S. H. Lee Genentech, Inc., South San Francisco, California
D. W. Leung Genentech, Inc., South San Francisco, California
A. D. Levinson Genentech, Inc., South San Francisco, California
N. L. Levy Abbott Laboratories, North Chicago, Illinois
A. Leza University of Florida, Gainesville, Florida
P. A. Liberti Jefferson Medical College, Philadelphia, Pennsylvania
C. Lichtenstein University of Washington, Seattle, Washington
A. Lichtler University of Florida, Gainesville, Florida
B. J. Marafino Genentech, Inc., South San Francisco, California
F. Marashi University of Florida, Gainesville, Florida
J. McPherson University of Washington, Seattle, Washington
R. B. Meagher University of Georgia, Athens, Georgia
G. F. Merrill University of Washington, Seattle, Washington
B. Meyer University of Pennsylvania, Philadelphia, Pennsylvania
J. Mills University of London King's College, London, England
C. Milstein Medical Research Council Centre, Cambridge, England
A. Montoya University of Washington, Seattle, Washington
U. R. Muller East Carolina University, Greenville, North Carolina
R. Najarian Genentech, Inc., South San Francisco, California
B. Nelkin The Johns Hopkins University, Baltimore, Maryland
E. Nester University of Washington, Seattle, Washington
S. Newberry University of Pennsylvania, Philadelphia, Pennsylvania
M. Nilsen-Hamilton The Salk Institute, San Diego, California
P. O'Hara University of Washington, Seattle, Washington
I. Paek College of Physicians and Surgeons of Columbia University,
 New York, New York
R. D. Palmiter University of Washington, Seattle, Washington
M. Pater New Jersey Medical School, Newark, New Jersey
D. Pennica Genentech, Inc., South San Francisco, California
M. Plumb University of Florida, Gainesville, Florida
R. R. Pollock Albert Einstein College of Medicine, Bronx, New York
A. Powell University of Washington, Seattle, Washington
J. Quesada University of Texas System Cancer Center, Houston, Texas
V. R. Racaniello Massachusetts Institute of Technology, Cambridge,
 Massachusetts
L. W. Ream University of Washington, Seattle, Washington
P. Reczek Harvard Medical School, Boston, Massachusetts
L. C. M. Reid Albert Einstein College of Medicine, Bronx, New York
K. W. Renton Dalhousie University, Halifax, Nova Scotia
R. Rickles University of Florida, Gainesville, Florida
S. B. Roberts Albert Einstein College of Medicine, Bronx, New York

- D. M. Robins* College of Physicians and Surgeons of Columbia University, New York, New York
- M. A. Root* Eli Lilly and Company, Indianapolis, Indiana
- M. Rose* Massachusetts Institute of Technology, Cambridge, Massachusetts
- J. J. Rossi* City of Hope Research Institute, Duarte, California
- R. Samulski* University of Florida, Gainesville, Florida
- G. H. Sato** University of California, La Jolla, California
- W. I. Schaeffer* University of Vermont College of Medicine, Burlington, Vermont
- M. D. Scharff** Albert Einstein College of Medicine, Bronx, New York
- D. Schlessinger* Washington University School of Medicine, St. Louis, Missouri
- J. Schultz** Papanicolaou Cancer Research Institute, Miami, Florida
- P. H. Seeburg* Genentech, Inc., South San Francisco, California
- H. M. Shepard* Genentech, Inc., South San Francisco, California
- S. A. Sherwin* Biological Response, Frederick, Maryland
- P. J. Sherwood* Genentech, Inc., South San Francisco, California
- D. Shortle* Massachusetts Institute of Technology, Cambridge, Massachusetts
- F. Sierra* University of Florida, Gainesville, Florida
- C. Simonsen* Genentech, Inc., South San Francisco, California
- R. Simpson* University of Washington, Seattle, Washington
- K. Sirotkin* University of Tennessee, Knoxville, Tennessee
- A. M. Skalka* Roche Institute of Molecular Biology, Nutley, New Jersey
- R. G. Smith* University of Texas Medical Center, Houston, Texas
- N. Stebbing** Genentech, Inc., South San Francisco, California
- G. S. Stein** University of Florida, Gainesville, Florida
- J. L. Stein* University of Florida, Gainesville, Florida
- J. L. Strominger** Harvard University, Cambridge, Massachusetts
- R. Swift* Genentech, Inc., South San Francisco, California
- B. Taylor* University of Washington, Seattle, Washington
- P. Thammana* Albert Einstein College of Medicine, Bronx, New York
- W. G. Thilly** Massachusetts Institute of Technology, Cambridge, Massachusetts
- J. N. Thomas* Massachusetts Institute of Technology, Cambridge, Massachusetts
- S. C. Turner** Bethesda Research Laboratories, Inc., Gaithersburg, Maryland
- A. Ullrich* Genentech, Inc., South San Francisco, California
- M. Vasser* Genentech, Inc., South San Francisco, California
- P. Walker* City of Hope Research Institute, Duarte, California
- R. L. Ward* Christ Hospital Institute for Medical Research, Cincinnati, Ohio
- P. K. Weck* Genentech, Inc., South San Francisco, California
- W. J. Whelan** University of Miami School of Medicine, Miami, Florida
- F. White* University of Washington, Seattle, Washington
- A. Wieland* Genentech, Inc., South San Francisco, California
- S. L. C. Woo* Baylor College of Medicine, Houston, Texas
- D. E. Yelton* Albert Einstein College of Medicine, Bronx, New York
- E. Yelverton* Genentech, Inc., South San Francisco, California
- H. Young* Bethesda Research Laboratories, Inc., Gaithersburg, Maryland
- D. J. Zack* Albert Einstein College of Medicine, Bronx, New York
- J. B. Zeldis* Massachusetts General Hospital, Boston, Massachusetts

PREFACE

The Miami Winter Symposia are now well established on the national and international scene as one of the major annual expositions of the new biology of the 1970s and 1980s. This nineteenth volume is the record of the proceedings of the fourteenth symposium held in Miami Beach in January 1982. The theme was the translation of the new basic research findings into the practical application of biotechnology, with reviews of methodology and the applications of such methodology that lie behind the practical innovations.

The theme of the symposium was set by the Feodor Lynen Lecturer, Cèsar Milstein, whose development, with George Köhler, of monoclonal antibodies promises to be the dominating tool of medical technology in the next decade, both for diagnosis and therapy. The symposium began with reviews of techniques of eukaryotic cell culture, hybridoma technology and uses, and the *in vitro* synthesis of DNA and its use in the generation of protein analogs. Cloning into eukaryotic cells and methods of increasing the levels of gene expression were sessions that clearly reflected current areas of intensive research that have important commercial and clinical value. The formal presentations concluded with descriptions of the biological activities of cloned gene products, including reports on trials with human subjects of interferon, human insulin, and growth hormone, reports that indicate how far and how fast this field has moved in the space of less than a decade since the technologies were developed. A panel session on horizons in biotechnology concluded the meeting, with the speakers looking forward to the directions of future research and its applications.

The symposium drew a capacity audience of almost 800. We are gratified to have been so successful in our efforts to stage a timely and topical meeting, and we believe that this volume, which also includes the discussions of each presentation, will be a most useful source of reference to basic scientists and biotechnologists alike.

Our ability to organize these meetings and subsequently publish the proceedings depends heavily on the help we receive from our faculty colleagues. Special thanks are due to the committee chaired by Thomas R. Russell and the secretarial staff, no-

tably Sandra Black, Olga Sanchez, and Pat Buchanan. We are also most indebted to Dr. Ralph W. F. Hardy for his convening of the panel on "Horizons in Biotechnology."

The symposium was made possible in part by the financial assistance of Abbott Laboratories; Beckman Instruments, Inc.; Eli Lilly and Company; Hoffmann-La Roche, Inc.; ICN Pharmaceuticals, Inc.; Merck Sharp & Dohme Research Laboratories; New England Nuclear; Smith Kline & French Laboratories; and the University of Miami School of Medicine, Departments of Dermatology and Pathology, and the Office of the Dean. Our special thanks are due to Bethesda Research Laboratories, Inc., who have become the sponsors of the Feodor Lynen Lecture.

Fazal Ahmad
Julius Schultz
Eric E. Smith
William J. Whelan

CONTENTS

SPEAKERS AND DISCUSSANTS
PREFACE

xvii
xxi

The Thirteenth Lynen Lecture

Messing About with Isotopes and Enzymes and Antibodies 3
César Milstein

Introduction

Moving Genes: Promises Kept and Pending 27
Philip Leder, Philip A. Hieter, Gregory F. Hollis, and
Aya Leder
DISCUSSION: D. C. Burke, G. Haughton, G. F. Merrill,
and C. Simonsen

Techniques of Eukaryotic Cell Culture

Cell Culture and Physiology 45
Gordon H. Sato
DISCUSSION: D. Balinsky, D. T. Denhardt, and
G. Knapp

Regulation of Growth and Differentiation of Mammalian Cells by Hormones and Extracellular Matrix	53
Lola C. M. Reid	
DISCUSSION: H. Busch and R. G. Smith	
Microcarriers and the Problem of High Density Cell Culture	75
William G. Thilly, Debra Barngrover, and James N. Thomas	
DISCUSSION: D. H. Gelfand and G. H. Sato	
Crown Gall—Nature's Genetic Engineer	105
Milton P. Gordon, David Garfinkel, Harry Klee, Vic Knauf, William Kwok, Conrad Lichtenstein, Joan McPherson, Alice Montoya, Eugene Nester, Patrick O'Hara, Ann Powell, Lloyd W. Ream, Robert Simpson, Brian Taylor, and Frank White	
DISCUSSION: J. R. Geiger and K. Sirotkin	
 Monoclonal Antibodies—Production and Uses	
Monoclonal Antibodies: The Production of Tailor-Made Serological Reagents	129
Dale E. Yelton, Pallaiah Thammana, Catherine Desaymard, Susan B. Roberts, Sau-Ping Kwan, Angela Giusti, Donald J. Zack, Roberta R. Pollock, and Matthew D. Scharff	
DISCUSSION: A. A. Ansari, N. L. Levy, P. A. Liberti, and W. I. Schaeffer	
Monoclonal Antibodies in the Analysis of the Molecular Basis for Human Genetic Diseases	143
Robert H. Kennett, Kendra B. Eager, Barbara Meyer, Virginia Braman, Suzanne Newberry, and David W. Buck	
DISCUSSION: J. Harford, R. J. Hay, J. L. Strominger, and R. L. Ward	
Human Cell Surface Antigens Studied with Monoclonal Antibodies	165
Jack L. Strominger	
DISCUSSION: D. H. Gelfand	
Immunocytochemistry with Monoclonal Antibodies: Potential Applications in Basic Sciences and Histopathology	175
A. Claudio Cuello and César Milstein	
Human Immunoglobulin Expression in Hybrid Cells	193
Carlo M. Croce	
DISCUSSION: S. I. Chavin, J. W. Larrick, and J. L. Strominger	

In Vitro Synthesis of DNA and the Generation of Protein Analogs

The Role of Synthetic DNA in the Preparation of Structural Genes Coding for Proteins	213
John J. Rossi, Ryszard Kierzek, Ting Huang, Peter Walker, and Keiichi Itakura	
DISCUSSION: A. A. Ansari and U. R. Muller	
The Synthesis and Biochemical Reactivity of Biologically Important Genes and Gene Control Regions	235
Marvin H. Caruthers	
DISCUSSION: H. Heyneker, and unknown speaker	
Synthesis of Human Interferons and Analogs in Heterologous Cells	249
R. Derynck, P. W. Gray, E. Yelverton, D. W. Leung, H. M. Shepard, R. M. Lawn, A. Ullrich, R. Najarian, D. Pennica, F. E. Hagie, R. A. Hitzeman, P. J. Sherwood, A. D. Levinson, and D. V. Goeddel	
DISCUSSION: M. Bina, D. Botstein, D. C. Burke, V. Chowdhry, M. Chretien, C. Colby, D. V. Hendrick, P. A. Liberti, U. R. Muller, S. A. Sherwin, S. L. C. Woo, H. Young, and J. B. Zeldis	

Cloning into Eukaryotic Cells

Making Mutations <i>in Vitro</i> and Putting Them Back into Yeast	265
David Botstein, David Shortle, and Mark Rose	
DISCUSSION: D. Gelfand, D. Schlessinger, K. Sirotkin, and A. M. Skalka	
Expression of the Human Growth Hormone Gene Is Regulated in Mouse Cells	275
Diane M. Robins, Inbok Paek, Richard Axel, and Peter H. Seeburg	
DISCUSSION: R. Meagher, M. Nilsen-Hamilton, and M. Pater	
Transfer of the Mouse Metallothionein-I Gene into Cultured Cells and into Animals	289
Richard D. Palmiter and Ralph L. Brinster	
DISCUSSION: M. Bina, D. Botstein, H. Faber, and J. Mills	

Increasing Levels of Gene Expression

- Construction of Three Hybrid Promoters and Their Properties in *Escherichia coli* 309
 Herman de Boer, Herbert Heyneker, Lisa Comstock,
 Alice Wieland, Mark Vasser, and Thomas Horn
 DISCUSSION: D. Botstein and D. Gelfand

Biological Activities of Cloned Gene Products

- Regulation of Histone Gene Expression in Human Cells 331
 Gary S. Stein, J. L. Stein, L. Baumbach, A. Leza,
 A. Lichtler, F. Marashi, M. Plumb, R. Rickles, F. Sierra,
 and T. Van Dyke
 DISCUSSION: M. Adesnik, B. Nelkin, and P. Reczek
- Clinical Investigation of Partially Pure and Recombinant DNA-Derived Leukocyte Interferon in Human Cancer 367
 Jordon Gutterman, Jorge Quesada, and Seymour Fein
 DISCUSSION: D. Burke, J. Cahill, V. Chowdhry,
 P. A. Liberti, and H. Young
- The Use of Biosynthetic Human Insulin in Man 391
 John A. Galloway and Mary A. Root
 DISCUSSION: S. King
- The Biological Effectiveness of Pituitary-Derived and Biosynthetic Methionyl-hGH in Animals and Man 419
 S. L. Kaplan, J. Fenno, N. Stebbing, R. Hintz, and R. Swift
- Biological Activity of a Cloned Human Enzyme Urokinase 429
 P. P. Hung
 DISCUSSION: H. Heyneker and unknown speaker
- Activity of Cloned Gene Products in Animal Systems 445
 Nowell Stebbing, Sang He Lee, Benedict J. Marafino,
 Philip K. Weck, and Kenneth W. Renton
 DISCUSSION: L. Baumbach, D. Burke, D. Gelfand, and
 R. Ward
- Studies on Poliovirus Produced by Transfection with Cloned Viral cDNA 459
 Vincent R. Racaniello and David Baltimore
 DISCUSSION: D. Burke, E. Lamon, R. Samulski, and
 N. Stebbing

Horizons in Biotechnology

Friday Afternoon Panel Discussion	473
Martin A. Apple, J. Paul Burnett, Ralph W. F. Hardy, Dale H. Hoscheit, Patrick C. Kung, J. Schultz, Stephen C. Turner, and William J. Whelan	

Free Communications

Genes for Cytochrome P-450 and Their Regulation	507
Michael Atchison, Eugene Ryvkin, Andrea Lippman, Cynthia Raphael, and Milton Adesnik	
Localization of a Heparin Binding Site of Fibronectin with the Aid of Monoclonal Antibodies	508
Blair T. Atherton, Elizabeth V. Hayes, and Richard O. Hynes	
Nucleotide Sequence on the <i>glg C</i> Gene Coding for ADP-Glucose Synthetase from <i>E. coli</i>	509
Preston A. Baecker, Clement E. Furlong, and Jack Preiss	
Isolation and Characterization of a Soybean Gene for the Small Subunit of Ribulose-1,5-Bisphosphate Carboxylase	510
S. L. Berry, D. M. Shah, and R. B. Meagher	
Studying Polyoma Virus Gene Expression and Function by Site- Directed Mutagenesis Using Synthetic Oligonucleotides	511
Gordon G. Carmichael, David Dorsky, Brian Schaffhausen, Donald Oliver, and Thomas L. Benjamin	
Characterization of Four Divergent Human Genomic Clones Homologous to the Transforming P21 Genes of Harvey and Kirsten Murine Sarcoma Viruses	512
Esther H. Chang, Matthew A. Gonda, Ronald W. Ellis, Edward M. Scolnick, and Douglas R. Lowy	
<i>In Vitro</i> Synthesis of Enzymes Involved in Membrane Biosynthesis in <i>E. coli</i>	513
Yang Chang Chen and William Dowhan	
Studies on Expression of the Phaseolin Gene of French Bean Seeds in Sunflower Plant Cells	514
Prabhakara V. Choudary, John D. Kemp, Dennis W. Sutton, and Timothy C. Hall	
DNA Stimulates ATP-Dependent Proteolysis and Protein- Dependent ATPase Activity of Protease La from <i>Escherichia coli</i>	515
Chin Ha Chung, Lloyd Waxman, and Alfred L. Goldberg	

Methylation in Cellular Membranes of Friend Virus Tumors of Mice	516
W. E. Cornatzer, Dennis R. Hoffman, and Judy A. Haning	
Identification of a Novel, H-2-Like Gene by Analysis of cDNA Clones	517
David Cosman, George Khoury, and Gilbert Jay	
A Genetic Analysis of the Glucocorticoid Response	518
Mark Danielsen and Michael R. Stallcup	
Nucleotide Sequence of the Region Surrounding the 5' End of 18S rRNA from Soybean Inferred from the Gene Sequence	519
V. K. Eckenrode, R. T. Nagao, and R. B. Meagher	
An ELISA Assay for Detecting Cell Surface Antigens on Adherent Cells	520
C. Feit, A. H. Bartal, G. Tauber, and Y. Hirshaut	
The Involvement of DNA Polymerase α in Adenovirus DNA Replication	521
David A. Foster and Geoffrey Zubay	
Development of Human Growth Hormone Produced in Recombinant Bacteria as a Therapeutic Agent	522
L. Fryklund, K. Fohlenhag, H. Flodh, B. Holstrom, A. Skottner-Lundin, B. Strindberg, and A. Wichman	
Expression of the Genes for the PST Restriction-Modification Enzymes after Cloning into a Temperature-Sensitive Replication Plasmid	523
Roy Fuchs and James F. Kane	
The Nucleotide Sequence of pACYC 177	524
J. Galen, D. Kuebbing, L. Runkel, and K. Rushlow	
The Isolation of Sea Nettle Lethal Factor I via Immobilized Monoclonal Antibodies	525
Pramod K. Gaur, Carrington S. Cobb, A. J. Russo, Gary J. Calton, and Joseph W. Burnett	
Synthesis of a Specific Sequence of DNA Using Restriction Enzymes	526
Richard Gayle and George Bennett	
Induction of Stress Proteins by Heat Shock and Metal Ions	527
L. Gedamu, N. Shworak, J. J. Heikkila, and G. A. Schultz	
Analysis of the Rous Sacroma Virus Promoter Region by Site-Directed Mutagenesis	528
Gregory M. Gilmartin and J. T. Parsons	