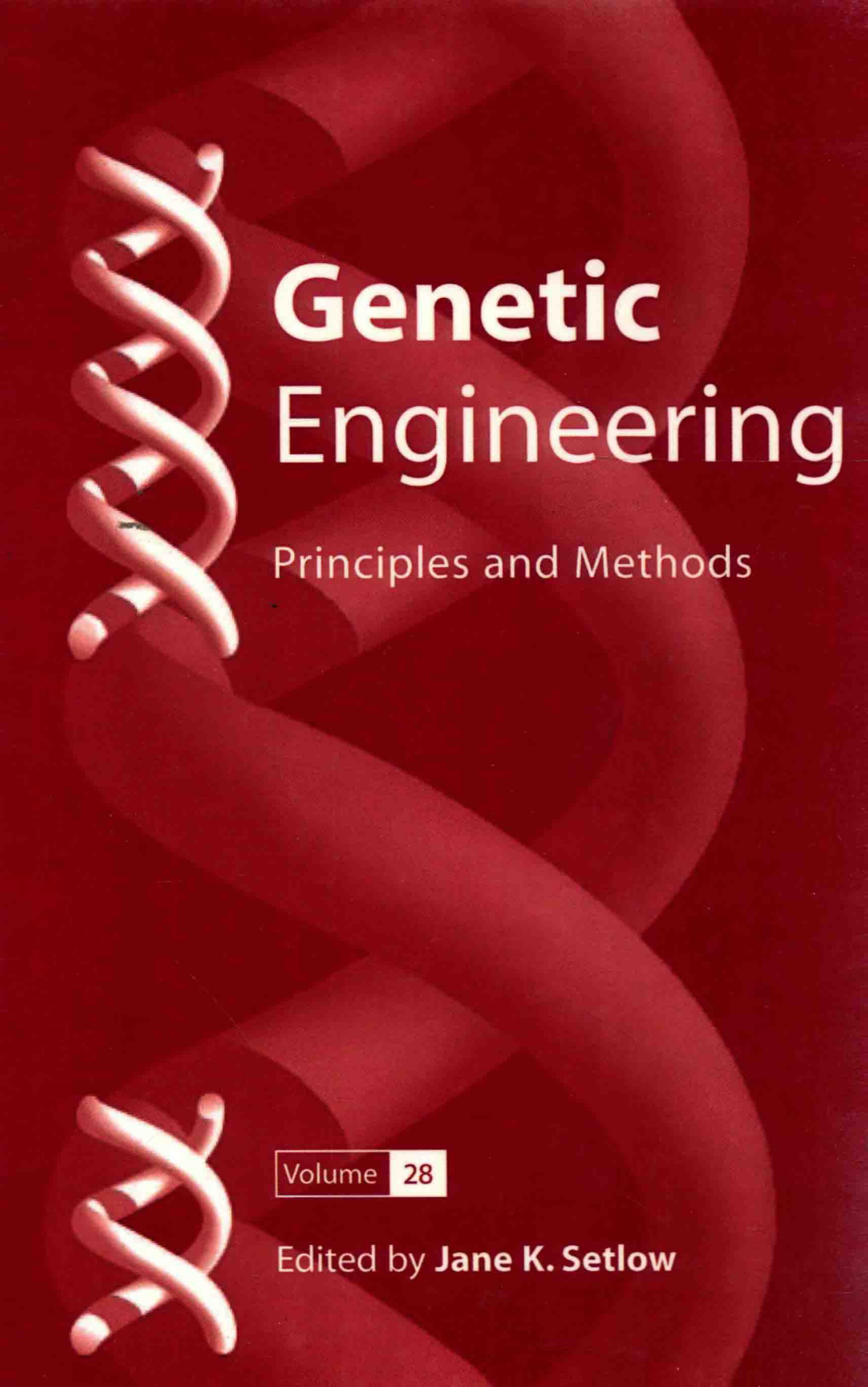




Genetic Engineering

Principles and Methods

Volume 28

Edited by **Jane K. Setlow**

Genetic Engineering

Principles and Methods

Volume 28

Edited by

Jane K. Setlow

Brookhaven National Laboratory
Upton, New York



Springer

The Library of Congress cataloged the first volume of this title as follows:

Genetic engineering: principles and methods. V. 1–

New York, Plenum Press. (1979–

v. ill. 26 cm.

Editors: J. K. Setlow and A. Hollaender

Key title: Genetic engineering. ISSN 0196-3716

1. Genetic engineering—Collected works. I. Setlow, Jane K. (1979–) II. Hollaender, Alexander, (1979–1986).

QH442.G454

575.1

76-644807
MARC-S

ISBN-10: 0-387-33840-3

e-ISBN-10: 0-387-34504-3

ISBN-13: 978-0-387-33840-8

e-ISBN-13: 978-0-387-34504-8

Printed on acid-free paper.

© 2007 Springer Science+Business Media, LLC

All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer Science+Business Media, LLC, 233 Spring Street, New York, NY 10013, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with any form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

9 8 7 6 5 4 3 2 1

springer.com

Genetic Engineering

Principles and Methods

Volume 28

GENETIC ENGINEERING

Principles and Methods

Advisory Board

Carl W. Anderson

Peter Day

Donald R. Helinski

Maynard V. Olson

John Shanklin

A Continuation Order Plan is available for this series. A continuation order will bring delivery of each new volume immediately upon publication. Volumes are billed only upon actual shipment. For further information please contact the publisher.

ACKNOWLEDGMENT

The Editor again praises Bonnie McGahern for the competent final processing, including fixing some of the Editor's errors.

CONTENTS OF EARLIER VOLUMES

VOLUME 1 (1979)

- Introduction and Historical Background • *Maxine F. Singer*
Cloning of Double-Stranded cDNA • *Argiris Efstratiadis and Lydia Villa-Komaroff*
Gene Enrichment • *M. H. Edgell, S. Weaver, Nancy Haigwood, and C. A. Hutchison III*
Transformation of Mammalian Cells • *M. Wigler, A. Pellicer, R. Axel, and S. Silverstein*
Constructed Mutants of Simian Virus 40 • *D. Shortle, J. Pipas, Sondra Lazarowitz, D. DiMaio, and D. Nathans*
Structure of Cloned Genes from *Xenopus*: A Review • *R. H. Reeder*
Transformation of Yeast • *Christine Ilgen, P. J. Farabaugh, A. Hinnen, Jean M. Walsh, and G. R. Fink*
The Use of Site-Directed Mutagenesis in Reversed Genetics • *C. Weissmann, S. Nagata, T. Taniguchi, H. Weber, and F. Meyer*
Agrobacterium Tumor Inducing Plasmids: Potential Vectors for the Genetic Engineering of Plants • *P. J. J. Hooykaas, R. A. Schilperoort, and A. Rörsch*
The Chloroplast, Its Genome and Possibilities for Genetically Manipulating Plants • *L. Bogorad*
Mitochondrial DNA of Higher Plants and Genetic Engineering • *C. S. Leavings III and D. R. Pring*
Host-Vector Systems for Genetic Engineering of Higher Plant Cells • *C. I. Kado*
Soybean Urease—Potential Genetic Manipulation of Agronomic Importance • *J. C. Polacco, R. B. Sparks, Jr., and E. A. Havir*

VOLUME 2 (1980)

- Cloning of Repeated Sequence DNA from Cereal Plants • *J. R. Bedbrook and W. L. Gerlach*
The Use of Recombinant DNA Methodology in Approaches to Crop Improvement: The Case of Zein • *Benjamin Burr*
Production of Monoclonal Antibodies • *Sau-Ping Kwan, Dale E. Yelton, and Matthew D. Scharff*
Measurement of Messenger RNA Concentration • *S. J. Flint*
DNA Cloning in Mammalian Cells with SV40 Vectors • *D. H. Hamer*
Adenovirus-SV40 Hybrids: A Model System for Expression of Foreign Sequences in an Animal Virus Vector • *Joseph Sambrook and Terri Grodzicker*
Molecular Cloning in *Bacillus subtilis* • *D. Dubnau, T. Gryczan, S. Contente, and A. G. Shivakumar*
Bacterial Plasmid Cloning Vehicles • *H. U. Bernard and D. R. Helinski*

- Cloning with Cosmids in *E. coli* and Yeast • *Barbara Hohn and A. Hinnen*
 DNA Cloning with Single-Stranded Phage Vectors • *W. M. Barnes*
 Bacteriophage Lambda Vectors for DNA Cloning • *Bill G. Williams and Frederick R. Blattner*

VOLUME 3 (1981)

- Constructed Mutants Using Synthetic Oligodeoxyribonucleotides as Site-Specific Mutagens
 • *M. Smith and S. Gillam*
 Evolution of the Insertion Element IS1 that Causes Genetic Engineering in Bacterial Genomes *In Vivo* • *E. Ohtsubo, K. Nyman, K. Nakamura, and H. Ohtsubo*
 Applications of Molecular Cloning to *Saccharomyces* • *M. V. Olson*
 Cloning Retroviruses: Retrovirus Cloning? • *W. L. McClements and G. F. Vande Woude*
 Repeated DNA Sequences in *Drosophila* • *M. W. Young*
 Microbial Surface Elements: The Case of Variant Surface Glycoprotein (VSG) Genes of African Trypanosomes • *K. B. Marcu and R. O. Williams*
 Mouse Immunoglobulin Genes • *P. Early and L. Hood*
 The Use of Cloned DNA Fragments to Study Human Disease • *S. H. Orkin*
 Physical Mapping of Plant Chromosomes by *In Situ* Hybridization • *J. Hutchinson, R. B. Flavell, and J. Jones*
 Mutants and Variants of the Alcohol Dehydrogenase-1 Gene in Maize • *M. Freeling and J. A. Birchler*
 Developmentally Regulated Multigene Families in *Dictyostelium discoideum* • *R. A. Firtel, M. McKeown, S. Poole, A. R. Kimmel, J. Brandis, and W. Rowekamp*
 Computer Assisted Methods for Nucleic Acid Sequencing • *T. R. Gingeras and R. J. Roberts*

VOLUME 4 (1982)

- New Methods for Synthesizing Deoxyoligonucleotides • *M. H. Caruthers, S. L. Beaucage, C. Becker, W. Efcavitch, E. F. Fisher, G. Galluppi, R. Goldman, P. deHaseth, F. Martin, M. Matteucci, and Y. Stabinsky*
 An Integrative Strategy of DNA Sequencing and Experiments Beyond • *J. Messing*
 Transcription of Mammalian Genes *In Vitro* • *J. L. Manley*
 Transcription of Eukaryotic Genes in Soluble Cell-Free Systems • *N. Hointz and R. G. Roeder*
 Attachment of Nucleic Acids to Nitrocellulose and Diazonium-Substituted Supports—B. Seed
 Determination of the Organization and Identity of Eukaryotic Genes Utilizing Cell-Free Translation Systems • *J. S. Miller, B. E. Roberts, and B. M. Paterson*
 Cloning in *Streptomyces*: Systems and Strategies • *D. A. Hopwood and K. F. Chater*
 Partial Sequence Determination of Metabolically Labeled Radioactive Proteins and Peptides • *C. W. Anderson*
 Molecular Cloning of Nitrogen Fixation Genes from *Klebsiella pneumoniae* and *Rhizobium meliloti* • *F. M. Ausubel, S. E. Brown, F. J. deBruijn, D. W. Ow, G. E. Riedel, G. B. Ruvkun, and V. Sandaresan*
 The Cloning and Expression of Human Interferon Genes • *R. M. Lawn*
 Cloning by Complementation in Yeast: The Mating Type Genes • *J. B. Hicks, J. N. Strathern, A. J. S. Klar, and S. L. Dellaporta*
 Construction and Screening of Recombinant DNA Libraries with Charon Vector Phages • *B. A. Zehnbaauer and F. R. Blattner*

VOLUME 5 (1983)

- Microcloning of Microdissected Chromosome Fragments • V. Pirrotta, H. Jackle, and J. E. Edstrom
- Transient Expression of Cloned Genes in Mammalian Cells • J. Banerji and W. Schaffner
- Transposable Elements in Archaeobacteria • W. F. Doolittle, C. Sapienza, J. D. Hofman, R. M. Mackay, A. Cohen, and W.-L. Xu
- The Application of Restriction Fragment Length Polymorphism to Plant Breeding • B. Burr, S. V. Evola, F. A. Burr, and J. S. Beckmann
- Antibodies against Synthetic Peptides • G. Walter and R. F. Doolittle
- Wheat α -Amylase Genes: Cloning of a Developmentally Regulated Gene Family • D. Baulcombe
- Yeast DNA Replication • J. L. Campbell
- Chromosome Engineering in Wheat Breeding and Its Implications for Molecular Genetic Engineering • C. N. Law
- Bovine Papillomavirus Shuttle Vectors • N. Sarver, S. Miltrani-Rosenbaum, M.-F. Law, W. T. McAllister, J. C. Byrne, and P. M. Howley
- Chemical Synthesis of Oligodeoxyribonucleotides: A Simplified Procedure • R. L. Letsinger

VOLUME 6 (1984)

- Cloning of the Adeno-Associated Virus • K. I. Berns
- Transformation of the Green Alga *Chlamydomonas reinhardtii* • J.-D. Rochaix Vectors for Expressing Open Reading Frame DNA in *Escherichia coli* Using lacZ Gene Fusions • G. M. Weinstock
- An Enigma of the Leghemoglobin Genes • J. S. Lee and D. P. S. Verma
- Yeast Transposons • G. S. Roeder
- Rearrangement and Activation of C-MYC Oncogene by Chromosome Translocation in the B Cell Neoplasias • K. B. Marcu, L. W. Stanton, L. J. Harris, R. Watt, J. Yang, L. Eckhardt, B. Birshtein, E. Remmers, R. Greenberg, and P. Fahrlander
- Screening for and Characterizing Restriction Endonucleases • I. Schildkraut
- Molecular Studies of Mouse Chromosome 17 and the T Complex • L. M. Silver, J. I. Garrels, and H. Lehrach
- Use of Synthetic Oligonucleotide Hybridization Probes for the Characterization and Isolation of Cloned DNAs • A. A. Reyes and R. B. Wallace
- Hybridization of Somatic Plant Cells: Genetic Analysis • Yu. Yu. Gleba and D. A. Evans
- Genetic Analysis of Cytoskeletal Protein Function in Yeast • P. Novick, J. H. Thomas, and D. Botstein
- Use of Gene Fusions to Study Biological Problems • L. Guarente
- The Use of the Ti Plasmid of *Agrobacterium* to Study the Transfer and Expression of Foreign DNA in Plant Cells: New Vectors and Methods • P. Zambryski, L. Herrera-Estrella, M. De Block, M. Van Montagu, and J. Schell
- Analysis of Eukaryotic Control Proteins at Their Reception Sequences by Scanning Transmission Electron Microscopy • P. V. C. Hough, M. N. Simon, and I. A. Mastrangelo
- The Mass Culture of a Thermophilic *Spirulina* in the Desert • K. Qian, G. H. Sato, V. Zhao, and K. Shinohara
- DNA-Mediated Gene Transfer in Mammalian Gene Cloning • F. H. Ruddle, M. E. Kamarck, A. McClelland, and L. C. Kühn

VOLUME 7 (1985)

- Biochemical and Genetic Analysis of Adenovirus DNA Replication *In Vitro* •
B. W. Stillman
- Immunoscreening λ GT11 Recombinant DNA Expression Libraries • *R. A. Young*
and R. W. Davis
- In Situ* Hybridization to Cellular RNAs • *R. C. Angerer, K. H. Cox, and L. M. Angerer*
- Computer Methods to Locate Genes and Signals in Nucleic Acid Sequences •
R. Sladen
- Biochemical and Molecular Techniques in Maize Research • *N. Fedoroff*
- Analysis of Chromosome Replication with Eggs of *Xenopus laevis* • *R. A. Laskey,*
S. E. Kearsey, and M. Mechali
- Molecular Genetic Approaches to Bacterial Pathogenicity to Plants • *M. J. Daniels and*
P. C. Turner
- Synthesis of Hybridization Probes and RNA Substrates with SP6 RNA Polymerase •
P. A. Krieg, M. R. Rebagliati, M. R. Green, and D. A. Melton
- Identification and Isolation of Clones by Immunological Screening of cDNA Expression
 Libraries • *D. M. Helfman, J. R. Feramisco, J. C. Fiddes, G. P. Thomas, and S. H.*
Hughes
- Molecular Studies on the Cytomegaloviruses of Mice and Men • *D. H. Spector*
- Gene Transfer with Retrovirus Vectors • *A. Bernstein, S. Berger, D. Huszar, and J. Dick*
- HPRT Gene Transfer as a Model for Gene Therapy • *T. Friedmann*
- Catabolic Plasmids: Their Analysis and Utilization in the Manipulation of Bacteria Metabolic
 Activities • *S. Harayama and R. H. Don*
- Transcription of Cloned Eukaryotic Ribosomal RNA Genes • *B. Sollner-Webb, J. Tower,*
V. Culotta, and J. Windle
- DNA Markers in Huntington's Disease • *J. F. Gusella*

VOLUME 8 (1986)

- Regulation of Gene Activity During Conidiophore Development in *Aspergillus nidulans* •
W. E. Timberlake and J. E. Hamer
- Regulation of Expression of Bacterial Genes for Bioluminescence • *J. Engebrecht and*
M. Silverman
- Analysis of Genome Organization and Rearrangements by Pulse Field Gradient Gel
 Electrophoresis • *C. L. Smith, P. E. Warburton, A. Gaal, and C. R. Cantor*
- Structural Instability of *Bacillus subtilis* Plasmids • *S. D. Ehrlich, Ph. Noirot, M. A. Petit,*
L. Janni  re, B. Michel, and H. te Riele
- Geminiviruses, The Plant Viruses with Single-Stranded DNA Genome • *A. J. Howarth*
- The Use of Bacterial Plasmids in the Investigation of Genetic Recombination •
A. Cohen
- Shuttle Mutagenesis: A Method of Introducing Transposons into Transformable Organisms
 • *H. S. Seifert, M. So, and F. Heffron*
- Genetic Advances in the Study of *Rhizobium* Nodulation • *S. R. Long*
- Galactokinase Gene Fusion in the Study of Gene Regulation in *E. coli*, *Streptomyces*,
 Yeast and Higher Cell Systems • *M. Rosenberg, M. Brawner, J. Gorman, and*
M. Reff
- Structure and Function of the Signal Recognition Particle • *V. Siegel and P. Walter*
- Alteration of the Structure and Catalytic Properties of Rubisco by Genetic Manipulation •
S. Gutteridge
- Electrophoresis of DNA in Denaturing Gradient Gels • *L. S. Lerman*
- Caulimoviruses as Potential Gene Vectors for Higher Plants • *R. J. Shepherd*
- An Insect Baculovirus Host-Vector System for High-Level Expression of Foreign Genes •
D. W. Miller, P. Safer, and L. K. Miller
- Preparation of cDNA Libraries and the Detection of Specific Gene Sequences •
J. Brandis, D. Larocca, and J. Monahan

Construction of Human Chromosome Specific DNA Libraries: The National Laboratory of Gene Library Project • *L. L. Deaven, C. E. Hildebrand, J. C. Fuscoe, and M. A. Van Dilla*

New Approaches to the Expression and Isolation of a Regulatory Protein • *D. Bastia, J. Germino, S. Mukherjee, and T. Vanaman*

VOLUME 9 (1987)

Gene Transfer in the Sea Urchin • *B. R. Hough-Evans and E. H. Davidson*

Properties and Uses of Heat Shock Promoters • *H. Pelham*

The Expression of Introduced Genes in Regenerated Plants • *D. Dunsmuir,*

J. Bedbrook, D. Bond-Nutter, C. Dean, D. Gidoni, and J. Jones

Control of Maize Zein Gene Expression • *R. S. Boston and B. A. Larkins*

Dnase I Footprinting as an Assay for Mammalian Gene Regulatory Proteins • *W. S. Dynan*

Use of Gene Transfer in the Isolation of Cell Surface Receptor Genes • *D. R. Littman and M. V. Chao*

A New Method for Synthesizing RNA on Silica Supports • *D. J. Dellinger and M. H. Caruthers*

Activity Gels: Reformation of Functional Proteins from SDS-Polyacrylamide Gels • *R. P. Dotin, B. Haribabu, C. W. Schweinfest, and R. E. Manrow*

Plasmid Vectors Carrying the Replication Origin of Filamentous Single-Stranded Phages • *G. Cesareni and J. A. H. Murray*

High Level Production of Proteins in Mammalian Cells • *R. J. Kaufman*

Plant Microinjection Techniques • *R. J. Mathias*

Genetic Transformation to Confer Resistance to Plant Virus Disease • *R. N. Beachy, S. G. Rogers, and R. T. Fraley*

Alternative Splicing: Mechanistic and Biological Implications of Generating Multiple Proteins from a Single Gene • *B. Nadal-Ginard, M. E. Gallego, and A. Andreadis*

VOLUME 10 (1988)

Genomic Footprinting • *P. B. Becker and G. Schütz*

Theoretical and Computer Analysis of Protein Primary Sequences: Structure Comparison and Prediction • *P. Argos and P. McCaldon*

Affinity Chromatography of Sequence-Specific DNA-Binding Proteins • *C. Wu, C. Tsai, and S. Wilson*

Applications of the Firefly Luciferase as a Reporter Gene • *S. Subramani and M. DeLuca*

Fluorescence-Based Automated DNA Sequence Analysis • *L. M. Smith*

Phosphorothioate-Based Oligonucleotide-Directed Mutagenesis • *J. R. Sayers and F. Eckstein*

Design and Use of Agrobacterium Transformation Vectors • *M. Bevan and A. Goldsbrough*

Cell Commitment and Determination in Plants • *F. Meins, Jr.*

Plasmids Derived from Epstein-Barr Virus: Mechanisms of Plasmid Maintenance and Applications in Molecular Biology • *J. L. Yates*

Chromosome Jumping: A Long Range Cloning Technique • *A. Poustka and H. Lehrach*
Isolation of Intact mRNA and Construction of Full-Length cDNA Libraries: Use of a New Vector, λ gt22, and Primer-Adapters for Directional cDNA Cloning • *J. H. Han and W. J. Rutter*

The Use of Transgenic Animal Techniques for Livestock Improvement • *R. M. Strojek and T. E. Wagner*

Plant Reporter Genes: The GUS Gene Fusion System • *R. A. Jefferson*

Structure of the Genes Encoding Proteins Involved in Blood Clotting • *R. T. A. MacGillivray, D. E. Cool, M. R. Fung, E. R. Guinto, M. L. Koschinsky, and B. A. Van Oost*

VOLUME 11 (1989)

DNA Methylases • *A. Razin*Advances in Direct Gene Transfer into Cereals • *T. M. Klein, B. A. Roth, and M. E. Fromm*The Copy Number Control System of the 2 μ m Circle Plasmid of *Saccharomyces cerevisiae* • *B. Futcher*The Application of Antisense RNA Technology to Plants • *W. R. Hiatt, M. Kramer, and R. E. Sheehy*The Pathogenesis-Related Proteins of Plant • *J. P. Carr and D. F. Klessig*The Molecular Genetics of Plasmid Partition: Special Vector Systems for the Analysis of Plasmid Partition • *A. L. Abeles and S. J. Austin*DNA-Mediated Transformation of Phytopathogenic Fungi • *J. Wang and S. A. Leong*Fate of Foreign DNA Introduced to Plant Cells • *J. Paszkowski*Generation of cDNA Probes by Reverse Translation of Amino Acid Sequence • *C. C. Lee and C. T. Caskey*Molecular Genetics of Self-Incompatibility in Flowering Plants • *P. R. Ebert, M. Altschuler, and A. E. Clarke*Pulsed-Field Gel Electrophoresis • *M. V. Olson*

VOLUME 12 (1990)

Folding of Eukaryotic Proteins Produced in *Escherichia coli* • *R. F. Kelley and M. E. Winkler*Human Retinoblastoma Susceptibility Gene • *C.-C. Lai and W.-H. Lee* α -Oligodeoxynucleotides (α -DNA): A New Chimeric Nucleic Acid Analog • *F. Morvan, B. Rayner, and J.-L. Imbach*The Utility of *Streptomyces* and Hosts for Gene Cloning • *P. K. Tomich and Y. Yagi*From Footprint to Function: An Approach to Study Gene Expression and Regulatory Factors in Transgenic Plants • *E. Lam*Purification of Recombinant Proteins with Metal Chelate Adsorbent • *E. Hochuli*Determinants of Translation Efficiency of Specific mRNAs in Mammalian Cells • *D. S. Peabody*The Polymerase Chain Reaction • *N. Arnheim*Regulation of Alternative Splicing • *M. McKeown*Structure and Function of the Nuclear Receptor Superfamily for Steroid, Thyroid Hormone and Retinoic Acid • *V. Giguère*Identification and Functional Analysis of Mammalian Splicing Factors • *A. Bindereif and M. R. Green*The Genes Encoding Wheat Storage Proteins: Towards a Molecular Understanding of Bread-Making Quality and Its Genetic Manipulation • *V. Colot*Control of Translation Initiation in Mammalian Cells • *R. J. Kaufman*Electroporation of Bacteria: A General Approach to Genetic Transformation • *W. J. Dower*The Isolation and Identification of cDNA Genes by Their Heterologous Expression and Function • *G. G. Wong*Molecular Cloning of Genes Encoding Transcription Factors with the Use of Recognition Site Probes • *H. Singh*

VOLUME 13 (1991)

The Mutator Transposable Element Family of Maize • *V. Walbot*Protein Phosphorylation and the Regulation of Cellular Processes by the Homologous Two-Component Systems of Bacteria • *A. J. Ninfa*The Peculiar Nature of Codon Usage in Primates • *S. Zhang and G. Zubay*

- The Role of Nodulation Gene in Bacterium-Plant Communication • *A. Kondorosi, E. Kondorosi, M. John, J. Schmidt, and J. Schell*
- Regulation of Gene Expression by Epidermal Growth Factor • *L. G. Hudson and G. N. Gill*
- Machinery of Protein Import into Chloroplasts and Mitochondria • *D. Pain, D. J. Schnell, H. Murakami, and G. Blobel*
- High-Level Expression of Foreign Genes in Mammalian Cells • *S. E. Kane*
- Aromatic Hydrocarbon Degradation: A Molecular Approach • *G. J. Zylstra and D. T. Gibson*
- Employment of Fibroblasts for Gene Transfer Applications for Grafting into the Central Nervous System • *M. D. Kawaja, J. Ray, and F. H. Gage*
- The Molecular Biology of Amino Acid Biosynthesis in Plants • *T. Brears and G. M. Coruzzi*
- Genetic Manipulation of *Bacillus thuringiensis* Insecticidal Crystal Protein Genes in Bacteria • *C. Gawron-Burke and J. A. Baum*
- Progress Towards Gene Targeting in Plants • *J. I. Yoder and E. Kmiec*
- Molecular Biology of Mating-Type Determination in *Schizophyllum commune* • *R. C. Ullrich, C. A. Specht, M. M. Stankis, H. Yang, L. Giasson, and C. P. Novotny*
- Functions of Intracellular Protein Degradation in Yeast • *M. Hochstrasser*
- Transgenic Fish for Aquaculture • *G. L. Fletcher and P. L. Davies*

VOLUME 14 (1992)

- Cleavage-Site Motifs in Protein Targeting Sequences • *G. von Heijne*
- Complications of RNA Heterogeneity for the Engineering of Virus Vaccines and Antiviral Agents • *E. Domingo and J. J. Holland*
- The Quaternary Structures of SV40 Large T Antigen and Tumor Suppressor p53: Analysis by Gel Electrophoresis • *J. E. Stenger, G. A. Mayr, K. Mann, S. Ray, M. E. Anderson, and P. Tegtmeyer*
- Assembly of Antibodies and Mutagenized Variants in Transgenic Plants and Plant Cell Cultures • *A. Hiatt, Y. Tang, W. Weiser, and M. B. Hein*
- Maize Endosperm Tissue as an Endoreduplication System • *R. V. Knowles, G. L. Yerk, F. Crienc, and R. L. Phillips*
- Study of Chlorate-Resistant Mutants of *Arabidopsis*: Insights into Nitrate Assimilation and Ion Metabolism of Plants • *N. M. Crawford*
- Approaches and Progress in the Molecular Cloning of Plant Disease Resistance Genes • *J. L. Bennetzen and J. D. G. Jones*
- Is GRP78 a Sensor of Cellular Secretory Activity? • *T. Leustek*
- The Molecular Biology of Pathogenesis in *Ustilago maydis* • *B. J. Saville and S. A. Leong*
- Molecular Design of Oligomeric Channel Proteins • *A. Grove, J. M. Tomich, and M. Montal*
- Regulation of Gene Expression by Thyroid Hormones and Retinoic Acids • *S. M. Lipkin, M. G. Rosenfeld, and C. K. Glass*
- RNA Trans-Splicing • *X.-Y. Huang and D. Hirsch*
- Structural Constraints on Residue Substitution • *J. Overington*
- Molecular and Functional Analysis of the A Mating Type Genes of *Coprinus cinereus* • *U. Kues and L. A. Casselton*
- Physical Mapping of Human Chromosomes • *G. A. Evans and D. L. McElligott*

VOLUME 15 (1993)

- Application of Computational Neural Networks to the Prediction of Protein Structural Features • *S. R. Holbrook*

- Human Cellular Protein Patterns and Their Link to Genome Data Mapping and Sequencing Data: Towards an Integrated Approach to the Study of Gene Expression • *J. E. Celis, H. H. Rasmussen, H. Leffers, P. Madsen, B. Honore, K. Dejgaard, P. Gromov, and E. Olsen, H. J. Hoffman, M. Nielsen, B. Gesser, M. Puype, J. Van Damme, and J. Vandekerckhove*
- Regulation of Translation in Plants • *A. Danon, C. B. Yohn, and S. P. Mayfield*
- On the Origins, Structures and Functions of Restriction-Modification Enzymes • *J. Heitman*
- Manipulation of Amino Acid Balance in Maize Seed • *T. Ueda and J. Messing*
- Investigational Approaches for Studying the Structures and Biological Functions in Myeloid Antimicrobial Peptides • *M. E. Selsted*
- Progress in the Cloning of Genes for Plant Storage Lipid Biosynthesis • *V. C. Knauf*
- Genes for Crop Improvement • *J. Bennett*
- Molecular Biology and Genetics of Protective Fungal Endophytes of Grasses • *C. L. Schardl and Z. An*
- Prospects for Human Gene Therapy • *A. B. Moseley and C. T. Caskey*
- The Use of Microparticle Injection to Introduce Genes into Animal Cells *In Vitro* and *In Vivo* • *S. A. Johnston and D-C. Tang*

VOLUME 16 (1994)

- RNA Polymerase III Transcription in the Yeast *Saccharomyces cerevisiae* • *Stephen Buratowski*
- Lens Oncogenesis and Differentiation • *Heiner Westphal*
- Genetic Engineering of Cardiac Muscle Cells: *In vitro* and *In vivo* • *Stephen J. Fuller and Kenneth R. Chien*
- Genetic Control of Plant Ureases • *Joseph C. Polacco and Mark A. Holland*
- Gene Discovery of *Dictyostelium* • *William F. Loomis, Adam Kuspa, and Gad Shaulsky*
- Transfer of YACs to Mammalian Cells and Transgenic Mice • *Clare Huxley*
- Plant Genetic Engineering and Future Agriculture • *S. Riazuddin*
- Internal Initiation of mRNA Translation in Eukaryotes • *Ann Kaminski, Sarah L. Hunt, Catherine L. Gibbs, and Richard J. Jackson*
- Genetic Recombination Analysis Using Sperm Typing • *Karin Schmitt and Norman Arnheim*
- Genetic Regulation in Plant Pathogenic Pseudomonads • *David K. Willis, Jessica J. Rich, Thomas G. Kinscherf, and Todd Kitten*
- Defense-Related Gene Induction in Plants • *Danny Alexander, Kay Lawton, Scott Uknes, Eric Ward, and John Ryals*
- The P1 Vector System for the Preparation and Screening of Genomic Libraries • *Nancy S. Shepherd and David Smoller*
- The Unmasking of Maternal mRNA During Oocyte Maturation and Fertilization • *James L. Grainger*
- Recognizing Exons in Genomic Sequences Using Grail II • *Ying Xu, Richard Mural, Manesh Shah, and Edward Uberbacher*
- Gene Expression of Plant Extracellular Proteins • *Beat Keller*

VOLUME 17 (1995)

- The Molecular Biology of Nucleotide Excision Repair and Double-Strand Break Repair in Eukaryotes • *Alan R. Lehman*
- Manipulating and Mapping RNA with RecA-Assisted Restriction Endonuclease (RARE) Cleavage • *Lance J. Ferrin*
- Molecular Studies on the Virulence of *Listeria monocytogenes* • *Michael Kuhn and Werner Goebel*

- Indirect Use of Immobilized Metal Affinity Chromatography for Isolation and Characterization of Protein Partners • *Michèle Sawadogo and Michael W. Van Dyke*
- Structure and Function of RNA Pseudoknots • *C. W. A. Pleij*
- Role of Molecular Chaperones in the Initiation of Plasmid DNA Recognition • *Dhruba K. Chattoraj*
- Structure, Function and Engineering of *Bacillus thuringiensis* Toxins • *Mark A. Thompson, H. Ernest Schnepf, and Jerald S. Feitelson*
- Uses of GAL4 Expression in Mammalian Cells • *Ivan Sadowski*
- Protein Thiol Modification of Glyceraldehyde-3-Phosphate Dehydrogenase • *Bernhard Brüne and Eduardo G. Lapetina*
- The Genetics of Nuclear Migration in Fungi • *Susan M. Beckwith, Christian H. Roghi, and N. Ronald Morris*
- Structure and Function of the Platelet-Derived Growth Factor Family and Their Receptors • *Kristen C. Hart, Brendan D. Galvin, and Daniel J. Donoghue*
- Recombination between Prokaryotic and Eukaryotic DNA: Integration of *Agrobacterium tumefaciens* T-DNA into the Plant Genome • *Bruno Tinland and Barbara Hohn*
- Metal Precipitation by Marine Bacteria: Potential for Biotechnological Applications • *Bradley M. Tebo*

VOLUME 18 (1996)

- Cloning and Characterization of DNAs with Palindromic Sequences • *David R. F. Leach*
- DNA Isolation, Manipulation and Characterization from Old Tissues • *Rob DeSalle and Elizabeth Bonwich*
- Growth Factors and Neural Connectivity • *Sarah McFarlane and Christine E. Holt*
- Gene Identification by 3' Terminal Exon Trapping • *David B. Krizman*
- Engineering Transgenes for Use in the Mammary Gland • *Sinai Yarus, Darryl Hadsell, and Jeffrey M. Rosen*
- Problems that Can Limit the Expression of Foreign Genes in Plants: Lessons to Be Learned from B.t. Toxin Genes • *Scott H. Diehn, E. Jay De Rocher, and Pamela J. Green*
- Renaturation and Reconstitution of Functional Holoenzyme from Recombinant Subunits of Casein Kinase II Expressed as Inclusion Bodies in *E. coli* • *Wey-Jinq Lin, Rolf Jakobi, and Jolinda A. Traugh*
- Plant ACYL-ACP Thioesterases: Chain-Length Determining Enzymes in Plant Fatty Acid Biosynthesis • *Toni Voelker*
- Genetic Engineering of an Insect Parasite • *Randy Gaugler and Sarwar Hashmi*
- The Stop Signal Controls the Efficiency of Release Factor-Mediated Translational Termination • *Warren P. Tate, Mark E. Dalphin, Herman J. Pel, and Sally A. Manning*
- Mechanism of Replication and Copy Number Control of Plasmids in Gram-Positive Bacteria • *Saleem A. Khan*
- Pathways of Protein Remodeling by *Escherichia coli* Molecular Chaperones • *Marie Pak and Sue H. Wickner*
- Pheromones and Pheromone Receptors as Mating-Type Determinants in Basidiomycetes • *Lisa J. Vaillancourt and Carlene A. Raper*
- Synthesis and Applications of Phosphopeptides • *Kazuyasu Sakaguchi, Peter K. Roller, and Ettore Appella*

VOLUME 19 (1997)

- Novel Approaches to Engineering Disease Resistance in Crops • *Kathy M. M. Swords, Jihong Liang, and Dilip M. Shah*

- The Structure of Plant Gene Promoters • *Tom J. Guilfoyle*
 Plasmid Stabilization by Post-Segregational Killing • *Kenn Gerdes, Jimmy Schouv Jacobsen, and Thomas Franch*
 Pathways and Genes Involved in Cellulose Synthesis • *Yasushi Kawagoe and Deborah P. Delmer*
 Conjugative Transposons • *Abigail A. Salyers and Nadja B. Shoemaker*
 Termination of DNA Replication in Prokaryotic Chromosomes • *Deepak Bastia, Adhar C. Manna, and Trilochan Sahoo*
 Regulation of Protein Degradation in Plants • *Judy Callis*
 Genetic Engineering of Oilseeds for Desired Traits • *Anthony J. Kinney*
 Specificity of Receptor Tyrosine Kinase Signaling Pathways: Lessons from *Drosophila* • *Willis Li and Norbert Perrimon*
 Switching on Gene Expression: Analysis of the Factors that Spatially and Temporally Regulate Plant Gene Expression • *Lee Meisel and Eric Lam*
 Nucleic Acid Transport in Plant-Pathogen Interactions • *Robert Lartey and Vitaly Citovsky*
 Leaf Senescence: Gene Expression and Regulation • *Louis M. Weaver, Edward Himelblau, and Richard M. Amasino*
 Production and Analysis of Transgenic Mice Containing Yeast Artificial Chromosomes • *Kenneth R. Peterson*
 Comparative Molecular Analysis of Genes for Polycyclic Aromatic Hydrocarbon Degradation • *Gerben J. Zylstra, Eungbin Kim, and Anil K. Goyal*
 Recognition and Signaling in Plant-Pathogen Interactions: Implications for Genetic Engineering • *Michael Lawton*

VOLUME 20 (1998)

- Agrobacterium*-Mediated Horizontal Gene Transfer • *Clarence I. Kado*
 Computer-Assisted Methods for the Identification and Characterization of Polymerase II Promoters • *Ingmar Reuter, Thomas Werner, and Edgar Wingender*
 Retroviral cDNA Integration: Mechanism, Applications and Inhibition • *Mark S. T. Hansen, Sandrine Carteau, Christopher Hoffman, Ling Li, and Frederic Bushman*
 The Signal Transduction of Motion and Antigen Recognition: Factors Affecting T Cell Function and Differentiation • *Stephen C. Bunnell and Leslie J. Berg*
 Synthetic DNA Arrays • *Alan Blanchard*
 Detection of Single Nucleotide Variations • *Pui-Yan Kwok and Xiangning Chen*
 Antisense: A Key Tool for Cell and Developmental Studies in *Dictyostelium* • *Richard H. Gomer*
 Antisense in Abundance: The Ribosome as a Vehicle for Antisense RNA • *Rosemary Sweeney, Qichaag Fan, and Meng-Chao Yao*
 Salinity Tolerance—Mechanisms, Models and the Metabolic Engineering of Complex Traits • *Donald E. Nelson, Bo Shen, and Hans J. Bohnert*
 Biochemistry, Molecular Biology and Regulation of Starch Synthesis • *Jack Preiss and Mirta N. Sivak*
 Genetic Engineering and the Expression of Foreign Peptides or Proteins with Plant Virus-Based Vectors • *Christophe Lacomma, Lisa Smolenska, and T. Michael A. Wilson*
 Cloning and Expression of Large Mammalian cDNAs: Lessons from ATM • *Yosef Shiloh, Anat Bar-Shira, Yaron Galanty, and Yael Ziv*
 The Use of Genetically Engineered Cells in Drug Discovery • *Gerhard Loeber and Renate Schnitzer*
 Molecular Engineering of Monoterpene Production • *Christian D. Haudenschild and Rodney B. Croteau*

VOLUME 21 (1999)

- Nuclear Plasmids of *Dictyostelium* • *Joanne E. Hughes and Dennis L. Welker*
 The Translation Initiation Signal in *E. coli* and Its Control • *Eckart Fuchs*
 Direct Isolation of Specific Chromosomal Regions and Entire Genes by Tar Cloning • *Vladimir Larionov*
 Regulation of Lysine and Threonine Metabolism in Plants • *Rachel Amir and Gad Galili*
 Genetic Engineering of Plant Chilling Tolerance • *James Tokuhisa and John Browse*
 Role of Bacterial Chaperones in DNA Replication • *Igor Konieczny and Maciej Zylcz*
 Transformation of Cereals • *Roland Bilang, Johannes Fütterer, and Christof Sautter*
 Mechanisms of Initiation of Linear DNA Replication in Prokaryotes • *Margarita Salas*
 Diverse Regulatory Mechanisms of Amino Acid Biosynthesis in Plants • *Katherine J. Denby and Robert L. Last*
 Forage and Turf-Grass Biotechnology: Principles, Methods, and Prospects • *John W. Forster and Germán C. Spangenberg*
 Informatics Needs of Plant Molecular Biology • *Mary Polacco*

VOLUME 22 (2000)

- Post-Transcriptional Light Regulation of Nuclear-Encoded Genes • *Marie E. Petracek and William F. Thompson*
 Novel Methods of Introducing Pest and Disease Resistance to Crop Plants • *Jeremy Bruenn*
 Targeting Gene Repair in Mammalian Cells Using Chimeric Oligonucleotides • *Eric B. Kmiec, Sarah Ye, and Lan Peng*
 Exploring the Mechanism of Action of Insecticidal Proteins by Genetic Engineering Methods • *Jeremy L. Jenkins and Donald H. Dean*
 Enzyme Stabilization by Directed Evolution • *Anne Gershenson and Frances H. Arnold*
 ET-Cloning: Think Recombination First • *Joep P. P. Muyrers, Youming Zhang, and A. Francis Stewart*
 Growth and Genetic Modification of Human β -Cells and β -Cell Precursors • *Gillian M. Beattie, Albert Hayek, and Fred Levine*
 Elucidation of Biosynthetic Pathways by Retrodictive/Predictive Comparison of Isotopomer Patterns Determined by NMR Spectroscopy • *Wolfgang Eisenreich and Adelbert Bacher*
 Are Gene Silencing Mutants Good Tools for Reliable Transgene Expression or Reliable Silencing of Endogenous Genes in Plants? • *Philippe Mourrain, Christophe Béclin, and Hervé Vaucheret*
 Manipulating Plant Viral RNA Transcription Signals • *Cynthia L. Hemenway and Steven A. Lommel*
 Genetic Engineering Strategies for Hematologic Malignancies • *Thomas J. Kipps*
 Telomerase and Cancer • *Murray O. Robinson*

VOLUME 23 (2001)

- Evolution of Transport Proteins • *Milton H. Saier, Jr.*
 Mechanisms of Apoptosis Repression • *Collin C. Q. Vu and John A. Cidlowski*
 Cytokine Activation of Transcription • *Kerri A. Mowen and Michael David*
 Enzymatic Approaches to Glycoprotein Synthesis • *Pamela Sears, Thomas Tolbert, and Chi-Huey Wong*
 Vector Design and Development of Host System for *Pseudomonas* • *Herbert P. Schweizer, Tung T. Hoang, Katie L. Propst, Henry R. Ornelas, and RoxAnn R. Karkhoff-Schweizer*
 Genetic and Biochemical Studies on the Assembly of an Enveloped Virus • *Timothy L. Tellinghuisen, Rishika Perera, and Richard J. Kuhn*