

MOLECULAR STRATEGIES IN BIOLOGICAL EVOLUTION^a

Editor

LYNN HELENA CAPORALE

Conference Organizers

LYNN CAPORALE AND WERNER ARBER

CONTENTS

Preface.	xi
Introductory Remarks.	xiii
Chance Favors the Prepared Genome. <i>By</i> LYNN HELENA CAPORALE.	1
 Part I. Structured Pathways for Variation: Evolution As a Biological Function	
Introduction. <i>By</i> JAMES A. SHAPIRO.	22
Genome System Architecture and Natural Genetic Engineering in Evolution. <i>By</i> JAMES A. SHAPIRO.	23
Involvement of Gene Products in Bacterial Evolution. <i>By</i> WERNER ARBER.	36
Palindromic DNA and Genome Stability. Further Studies. <i>By</i> SUSANNA LEWIS, ERCAN AKGÜN, and MARIA JASIN.	45
Evolution of Immunoglobulin and T-Cell Receptor Gene Assembly. <i>By</i> SUSANNA M. LEWIS.	58
Mobile Gene Cassettes and Integrins in Evolution. <i>By</i> RUTH M. HALL, CHRISTINA M. COLLIS, MI-JURNG KIM, SALLY R. PARTRIDGE, GAVIN D. RECCHIA, and H. W. STOKES.	68

^aThis volume is the result of a conference entitled **Molecular Strategies in Biological Evolution** sponsored by the New York Academy of Sciences and held on June 27-29, 1998 in New York, New York.

Evolutionary Genomics of Vertebrates and Its Implications. <i>By</i> GIUSEPPE D'ONOFRIO, KAMEL JABBARI, HÉCTOR MUSTO, FERNANDO ALVAREZ-VALIN, STEPHANE CRUVEILLER, and GIORGIO BERNARDI	81
Summary. <i>By</i> JAMES A. SHAPIRO	95
<p style="text-align: center;">Part II. Modulation of Fidelity and Repair: Fidelity and Flexibility in Evolution</p>	
Introduction. <i>By</i> STEPHEN J. BENKOVIC	99
The Distribution of Rates of Spontaneous Mutation over Viruses, Prokaryotes, and Eukaryotes. <i>By</i> JOHN W. DRAKE	100
Fidelity of Retrotransposon Replication. <i>By</i> ABRAM GABRIEL and EMILIE H. MULES	108
RNA Processing in Evolution. The Logic of Soft-Wired Genomes. <i>By</i> ALAN HERBERT and ALEXANDER RICH	119
Mechanisms of Mutation in Nondividing Cells. Insights from the Study of Adaptive Mutation in <i>Escherichia coli</i> . <i>By</i> PATRICIA L. FOSTER and WILLIAM A. ROSCHE	133
Evolution of Evolvability. <i>By</i> MIROSLAV RADMAN, IVAN MATIC, and FRANÇOIS TADDEI	146
Summary. <i>By</i> STEPHEN J. BENKOVIC	156
<p style="text-align: center;">Part III. Context-Dependent Genetic Alteration: Cell and Sequence Context-Dependent Effects on Genetic Variation</p>	
Introduction. <i>By</i> LYNN S. RIPLEY	157
Predictability of Mutant Sequences. Relationships between Mutational Mechanisms and Mutant Specificity. <i>By</i> LYNN S. RIPLEY	159
DNA-Directed Mutations. Leading and Lagging Strand Specificity. <i>By</i> RICHARD R. SINDEN, VERA I. HASHEM, and WILLIAM A. ROSCHE	173
Evolution of the U-Insertion/Deletion RNA Editing in Mitochondria of Kinetoplastid Protozoa. <i>By</i> LARRY SIMPSON and DMITRI A. MASLOV	190
Immunoglobulin Switch Recombination May Occur by a DNA End-Joining Mechanism. <i>By</i> AMY KENTER and ROBERT WUERFFEL	206
Summary. <i>By</i> LYNN S. RIPLEY	218

Part IV. New Contexts for Functional DNA Sequences: How Do New Functions Evolve?

Transgenic and Mutational Analyses of Meiotic Recombination in Mice. By DOUGLAS L. PITTMAN, KERRY J. SCHIMENTI, WILLIAM H. HANNEMAN, and JOHN C. SCHIMENTI	220
Speciation of Cone Snails and Interspecific Hyperdivergence of Their Venom Peptides. Potential Evolutionary Significance of Introns. By BALDOMERO M. OLIVERA, CRAIG WALKER, G. EDWARD CARTIER, DAVID HOOPER, AMEURFINA D. SANTOS, ROBERT SCHOENFELD, RESHMA SHETTY, MAREN WATKINS, PRADIP BANDYOPADHYAY, and DAVID R. HILLYARD	223
Evolution of Chordate Hox Gene Clusters. By FRANK H. RUDDLE, CHRIS T. AMEMIYA, JANET L. CARR, CHANG-BAE KIM, CHRISTINA LEDJE, COODUVALI S. SHASHIKANT, and GÜNTER P. WAGNER	238
Summary. By MONICA RILEY	249

Part V. Regulation of Genetic Variation

Transposable Elements As a Molecular Evolutionary Force. By NINA V. FEDOROFF.	251
Floricultural Traits and Transposable Elements in the Japanese and Common Morning Glories. By SHIGERU IIDA, ATSUSHI HOSHINO, YASUYO JOHZUKA-HISATOMI, YOSHIKI HABU, and YOSHISHIGE INAGAKI	265
Mechanisms of Genome-Wide Hypermutation in Stationary Phase. By MARY-JANE LOMBARDO, JOEL TORKELSON, HAROLD J. BULL, GREGORY J. MCKENZIE, and SUSAN M. ROSENBERG	275
Summary. By EVELYN FOX KELLER	290

Part VI. Genomes As Evolving Systems

Introduction. By TAKASHI GOJOBORI	292
Dynamic Evolution of Genomes and the Concept of Genome Space. By MATTHEW I. BELLGARD, TAKESHI ITOH, HIDEKI WATANABE, TADASHI IMANISHI, and TAKASHI GOJOBORI	293
Evolution of DNA Organization in Hypotrichous Ciliates. By DAVID M. PRESCOTT.	301
Detecting Alien Genes in Bacterial Genomes. By JAN MRÁZEK and SAMUEL KARLIN	314
Elucidating Sequence Codes: Three Codes for Evolution. By EDWARD N. TRIFONOV	330

Summary. By TAKASHI GOJOBORI	339
------------------------------------	-----

Closing Session

Future Directions: Strategies and Perspectives. By WERNER ARBER	341
Further Remarks. By MACLYN MCCARTY	342
Concluding Remarks. By WERNER ARBER	344

Poster Session

Introduction to the Poster Presentations. Developmental Themes and Evolution. By DAVID THALER	346
Evolution of Gene Scrambling in Ciliate Micronuclear Genes. By EDWARD A. CURTIS and LAURA F. LANDWEBER	349
Protein Binding to Meiotic Recombination Hotspots in Mouse Testis. By HIDEO GOTOH, DAHAI ZHU, and E. M. EDDY	351
Homologous Recombination and Sex As a Strategy against Selfish Genes Attacking the Genome. By ICHIZO KOBAYASHI	354
Random Amplified Polymorphic DNA Analysis of <i>Ustilago violacea</i> . By CAROLL E. HENRY, PHILIP OKORO, EVLENE STEWARD-CLARK, EDWARD D. GARBER, and MANFRED RUDDAT	357
Human Chromosome 21. Why 40 Mb? By KATHELEEN GARDINER	362
Sequence Patterns Observed in 5' Flanking Regions of Primate <i>Alu</i> Elements. By YOSHIMA TODA, RINTARO SAITO, and MASARU TOMITA	369
<i>EXO1</i> of <i>Saccharomyces cerevisiae</i> Functions in Mutagenesis during Double-Strand Break Repair. By SUSAN L. HOLBECK and JEFFREY N. STRATHERN	375
Contingency Loci, Mutator Alleles, and Their Interactions. Synergistic Strategies for Microbial Evolution and Adaptation in Pathogenesis. By DAWN FIELD, MARCELO O. MAGNASCO, E. RICHARD MOXON, DAVID METZGAR, MARK M. TANAKA, CHRISTOPHER WILLS, and DAVID S. THALER	378
Specificity of Transcription-Enhanced Mutations. By ANGELIKA LONGACRE, JACQUELINE M. REIMERS, and BARBARA E. WRIGHT	383
<i>E. coli</i> RNA Polymerase Bypass of DNA Base Damage. Mutagenesis at the Level of Transcription. By A. VISWANATHAN, J. LIU, and P.W. DOETSCH	386
Gonad Recruitment of Carboxylesterase Genes during Evolution of the Reproductive System. Conserved Male-Specific Overexpression in Mussels, Fruitflies, and Mammals. By A.T. MIKHAILOV, M. TORRADO, M. PAZ, and L.I. KOROCHKIN	389

Mutagenesis Patterns in a tRNA Mutation Marker Gene Altered to Include Repetitive Sequence Replicated in <i>mutS E. coli</i> . By DAN D. LEVY and THOMAS A. CEBULA	392
Modeling Selection for Adjustable Genes Based on Simple Sequence Repeats. By DAVID G. KING	396
Directed Evolution of Mesophilic Enzymes into Their Thermophilic Counterparts. By FRANCES H. ARNOLD, LORI GIVER, ANNE GERSHENSON, HUIMIN ZHAO, and KEN MIYAZAKI.	400
Protein Salvage by Directed Evolution. Functional Restoration of a Defective Lysozyme Mutant. By MILAN JUCOVIC and ANTHONY R. POTEETE	404
Is the Genetic Code Really a Frozen Accident? New Evidence from <i>in Vitro</i> Selection. By ROBIN D. KNIGHT and LAURA F. LANDWEBER	408
The Linguistics of DNA: Words, Sentences, Grammar, Phonetics, and Semantics. By SUNGCHUL JI	411
Is There a Link between Mutation Rates and the Stringent Response in <i>Bacillus subtilis</i> . By RIVKA RUDNER, AUDREY MURRAY, and NAZMUL HUDA	418
Does the Fountain™ Epitope Model's Rhythmic Hydropathy Continuum Pattern Satisfy the Requirements of a Nucleic Acid Meta-code or Protein Meta-form? By WILLIAM J. KOKOLUS, DENNIS A. JOHNSTON, and HERBERT A. FRITSCH	423
A Comparative Genomics Approach to DNA Asymmetry. By M. PILAR FRANCINO and HOWARD OCHMAN	428

Index of Contributors	433