

Evolution

A View from the 21st Century

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**The following material can be found online only
(www.ftpress.com/shapiro):**

Appendixes to Part I and Part II of the Printed Book

- Appendix I.1.** The *lac* operon control circuit.
- Appendix I.2.** *S. cerevisiae* pheromone response signal network (Sprague 1991).
- Appendix II.1.** Formatting the genome for transcriptional control.
- Appendix II.2.** Natural genetic engineering in B lymphocytes for the rapid evolution and maturation of a virtually infinite diversity of antigenbinding proteins.

References

Table References for Part II and Part III of the Printed Book

- Table II.1** DNA content in higher eukaryotes (Shapiro and Sternberg 2005)
- Table II.2** Different classes of annotated repetitive genome components (amplified from (Shapiro and Sternberg 2005))
- Table II.3** Generic Cell Operations That Facilitate DNA Restructuring [30, 61, 392] **Note:** *These references are listed in the printed book only.*
- Table II.4** Natural Genetic Engineering Systems [6-8] **Note:** *These references are listed in the printed book only.*
- Table II.5** Control of bacterial protein synthesis (phase variation) and modification of protein structure (antigenic variation) by natural genetic engineering (expanded from (Wisniewski-Dye and Vial 2008))
- Table II.6** Applications of site-specific recombination to different functions in bacterial cells (Hallet and Sherratt 1997)
- Table II.7** Various stimuli documented to activate natural genetic engineering
- Table II.8** Genomic responses to changes in ploidy and interspecific hybridization in plants and animals
- Table II.9** RNA-based defense against viruses and plasmids in bacteria, archaea, fungi and plants
- Table II.10** Life history events that alter the epigenome (DNA methylation and chromatin formatting)
- Table II.11** Examples of targeted natural genetic engineering
- Table III.1** Examples of intercellular and interkingdom DNA transfer
- Table III.2** Natural genetic engineering documented in the evolution of sequenced genomes

Suggested Readings for Non-Professionals

Introduction Readings

The traditional perspective
Heredity outside the genome
New conceptual approaches

Part I Readings

How *E. coli* chooses the best sugar to eat
Proofreading DNA replication
DNA damage repair and mutagenesis
Cell cycle checkpoints
From the cell surface to the genome
The role of intercellular signals in the cell death decision
Revisiting the central dogma of molecular biology

Part II Readings

Genome formatting for properly accessing stored information
Genome compaction, chromatin formatting, and epigenetic regulation
Genome formatting for replication and transmission to daughter cells
Distinct classes of DNA in the genome
The molecular mechanisms of natural genetic engineering
Natural genetic engineering as part of the normal life-cycle
Developmental, cell, and molecular biology of the adaptive immune system
Cellular regulation of natural genetic engineering

Part III Readings

Antibiotic resistance and horizontal DNA transfer
The modular and duplicative nature of protein evolution
Nucleic acid sequencing, molecular taxonomy, and the discovery of a new cell type
Cell evolution: mutualism, parasitism, pathogenesis, endosymbiosis, bacterial multicellularity, symbiogenesis, and the origin of eukaryotic cells
Natural genetic engineering and genomic innovation
Use and reuse of evolutionary inventions:
Basic biology of morphogenesis and multicellular development
Molecular biology of animal and plant development

Evolutionary combinatorics and reuse
Whole genome doubling at critical stages of evolutionary innovation and divergence

Part IV Readings

Reorganizing established functions to generate novelty
The implications of targeting genome restructuring
Can genomic changes be linked to ecological disruptions?
Biogeochemical influences of evolution on the environment
Paleontological record and mass extinctions
What might a 21st Century theory of evolution look like?
Where does evolution fit in 21st Century science?
Molecular biology background readings in chronological order

References for the Printed Book

Extra References

Cell Cycle Checkpoints
Cellular Regulation of Natural Genetic Engineering
DNA Damage Repair and Mutagenesis
From the Cell Surface to the Genome
The Genome as a Read-Write (RW) Storage System
How *E. Coli* Chooses the Best Sugar to Eat
Molecular Mechanisms of Natural Genetic Engineering
Proofreading DNA Replication
Symbiogenesis and the Origin of Eukaryotic Cells
What Makes a Man Different from a Mouse