Genetics: Analysis of Genes and Genomes, Ninth Edition

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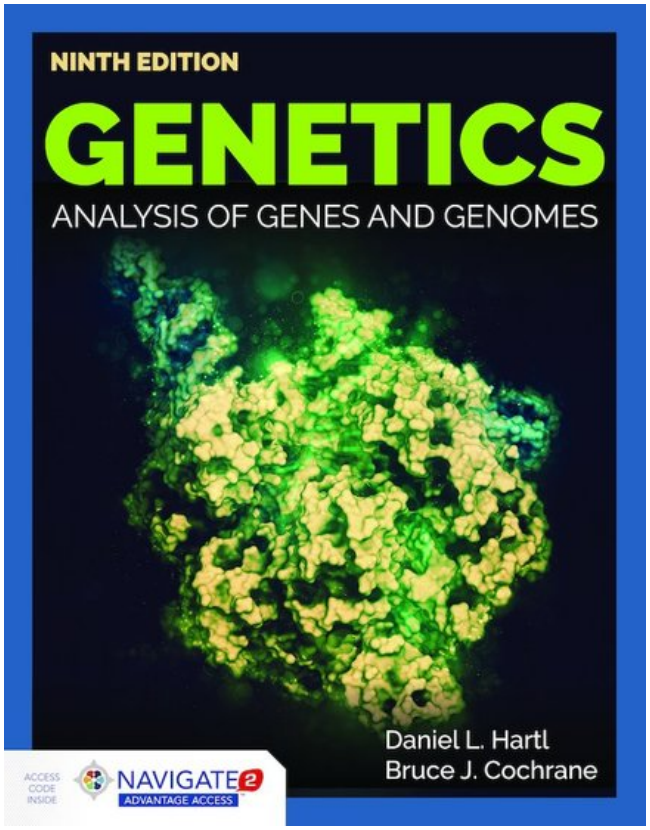

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SEE WHAT'S NEW TO THE NINTH EDITION!

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This Transition Guide outlines many of the changes and new content in the *Ninth Edition*. Use this guide for an easy transition to the new edition.

KEY FEATURES FOR THE NINTH EDITION

- ✓ **NEW** stunning **interior design** with over 225 NEW and revised illustrations that unlock complex topics and biological processes
- ✓ **NEW** Unit structure to organize content based on feedback from peer reviewers
- ✓ **NEW** Summing Up bullets added after all major sections
- ✓ **NEW** *Cutting Edge* box features on recent research and developments in the field of genetics
- ✓ **NEW** suggestions for further reading provided at the end of each chapter.
- ✓ Boxes from the previous edition have been **REDESIGNED** as *Roots of Discovery* boxes and edited to focus on the key points of relevant research and discoveries

CHAPTER OUTLINE

Table of Contents comparison to transition from the *Eighth* to the *Ninth Edition*

8th Edition	***9th Edition***
	Unit 1: Defining and Working with Genes
Chapter 1: Genes, Genomes, and Genetic Analysis	Chapter 1: Genes, Genomes, and Genetic Analysis
Chapter 2: DNA Structure and Genetic Variation	Chapter 2: DNA Structure and Genetic Variation
Chapter 3: Transmission Genetics: The Principle of Segregation	**Unit 2: Transmission Genetics**
Chapter 4: Chromosomes and Sex-Chromosome Inheritance	Chapter 3: Transmission Genetics: The Principle of Segregation
Chapter 5: Genetic Linkage and Chromosome Mapping	Chapter 4: Chromosomes and Sex-Chromosome Inheritance
Chapter 6: Molecular Biology of DNA Replication and Recombination	Chapter 5: Genetic Linkage and Chromosome Mapping
Chapter 7: Molecular Organization of Chromosomes	Chapter 6: Human Karyotypes and Chromosome Behavior
Chapter 8: Human Karyotypes and Chromosome Behavior	Chapter 7: The Genetic Basis of Complex Traits
Chapter 9: Genetics of Bacteria and Their Viruses	Chapter 8: Genetics of Bacteria and Their Viruses
Chapter 10: Molecular Biology of Gene Expression	**Unit 3: Organization and Replication of Chromosomes and DNA**
Chapter 11: Molecular Mechanisms of Gene Regulation	Chapter 9: Molecular Organization of Chromosomes and Genomes

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Chapter 12: Genomics, Proteomics, and Transgenics	Chapter 10: Molecular Biology of DNA Replication and Recombination
Chapter 13: Genetic Control of Development	Chapter 11: Mutation, Repair, and Recombination
Chapter 14: Molecular Mechanisms of Mutation and DNA Repair	**Unit 4: Gene Expression**
Chapter 15: Molecular Genetics of the Cell Cycle and Cancer	Chapter 12: Molecular Biology of Gene Expression
Chapter 16: Mitochondrial DNA and Extranuclear Inheritance	Chapter 13: Molecular Mechanisms of Gene Regulation
Chapter 17: Molecular Evolution and Population Genetics	Chapter 14: Manipulating Genes and Genomes
Chapter 18: The Genetic Basis of Complex Traits	Chapter 15: Genetic Control of Development
Chapter 19: Human Evolutionary Genetics	Chapter 16: Molecular Genetics of the Cell Cycle and Cancer
	Unit 5: Variation
	Chapter 17: Mitochondrial DNA and Extranuclear Inheritance
	Chapter 18: Genes in Populations
	Chapter 19: Molecular and Human Evolutionary Genetics

IMPORTANT CHAPTER UPDATES

In addition to the key updates made to all chapters, the author has provided more detailed notes on significant changes for each chapter. This is not a comprehensive list of all revisions, just the major ones to help you update your course. Many of these changes were made at the suggestion of our reviewers.

Chapter 1: Genes, Genomes, and Genetic Analysis

- ✓ Added subsection entitled “Variation in Populations”
- ✓ Deleted subsection on the Origin of Life
- ✓ Expanded explanation of complementation and its relationship to the elucidation of biochemical pathways in response to reviewers’ suggestions
- ✓ 2 new Analysis and Application problems added

Chapter 2: DNA Structure and Genetic Variation

- ✓ Rearranged order of sections, so that genetics terminology is introduced early and can be used throughout
- ✓ Added new Cutting Edge box on high throughput genotyping
- ✓ Added subsection on the crystallographic data used by Watson and Crick
- ✓ Reduced content on older hybridization methods has been reduced. In particular, the more technical details of the Southern blotting procedure have been removed
- ✓ Expanded coverage of PCR-based genotyping
- ✓ Rearranged content on DNA markers to address RFLPs first follow by SNP genotyping
- ✓ Added content and figure describing multiplex PCR for DNA typing

Chapter 3: Transmission Genetics: The Principle of Segregation

- ✓ Reorganized probability coverage into a single section covering the basics, conditional probability, and Bayesian logic
- ✓ Clarified the logic of Bayes' Theorem
- ✓ Revised to be less equation-dependent
- ✓ Added example of conditional probability
- ✓ Added new problems involving probability calculations
- ✓ Added the term "particulate gene" to the discussion of segregation
- ✓ Added description and figure of the "forked line" method for predicting phenotypic ratios

Chapter 4: Chromosomes and Sex-Chromosome Inheritance

- ✓ Introduced the concept of hypothesis testing with simulated distributions
- ✓ Clarified the concept of null hypothesis testing
- ✓ Added new, easier to understand table on critical values of chi-squared
- ✓ Added table on XY genotypes and sex is *Drosophila*
- ✓ Edited problems to replace RFLPs with simple sequence repeat polymorphisms

Chapter 5: Genetic Linkage and Chromosome Mapping

- ✓ Expanded the section on recombination mapping using pedigrees to a broader consideration of mapping genes in humans
- ✓ Expanded section on pedigree-based mapping to clarify the logic underlying lod score analysis
- ✓ Added section on Genome-Wide Association Scans including several new figures
- ✓ Revised and relocated Roots of Discovery box on Mapping Markers in the Human Genome previously in Chapter 2
- ✓ Added table on the chromosomal locations of the genes analyzed by Mendel in garden peas
- ✓ Condensed discussion of mapping with unordered tetrads
- ✓ Added new problem on lod score calculation

Chapter 6: Human Karyotypes and Chromosome Behavior

- ✓ Significantly revised figure on segregation in translocation heterozygotes to improve clarity
- ✓ Removed section on genetic mapping of translocation breakpoints
- ✓ Added description of the phenomenon of pseudolinkage in translocation heterozygotes
- ✓ Removed section on genome evolution in the grass family
- ✓ Added content and figures on the role played by gene duplication in the evolution of globin genes

Chapter 7: The Genetic Basis of Complex Traits

Previously Chapter 18

- ✓ New organization into seven sections with a major focus on aspects of heritability
- ✓ Added section on misconceptions about heritability
- ✓ Improved figures show measurements as distributions rather than as simple bar charts
- ✓ Introduction of quantitative traits with a hypothetical case of oil content in corn
- ✓ Expanded explanation of broad- and narrow-sense heritability
- ✓ Expanded section on Genome-wide association studies featuring GWAS analysis of Crohn's disease and the strengths and limitations of GWAS for genetic analysis
- ✓ Added Cutting Edge box on Crowd-sourced Genomics

Chapter 8: Genetics of Bacteria and Their Viruses
Previously Chapter 9

- ✓ Moved section on mobile DNA, so that focus is specifically on F plasmids rather than transposons in general
- ✓ Added details on the original Lederberg Tatum experiment and the Davis U-Tube
- ✓ Added description of replica plating, including figure (previously in Chapter 14)
- ✓ Added figure on recombination in E. coli
- ✓ Added Cutting Edge box on the biological role of CRISPR-Cas9 as an adaptive immune system in bacteria

Chapter 9: Molecular Organization of Chromosomes and Genomes
Previously Chapter 7

- ✓ Updated title to reflect addition of content on transposable DNA
- ✓ Incorporated material on IS elements in bacteria from previous Chapter 9
- ✓ Incorporated material on transposons in eukaryotes from previous Chapter 14
- ✓ Condensed section on Cot kinetics
- ✓ Increased focus on the nature of different classes of sequences in eukaryotes
- ✓ Updated description of chromosome condensation in mitosis and changed presentation to emphasize genetic significance of the process

Chapter 10: Molecular Biology of DNA Replication and Recombination
Previously Chapter 6

- ✓ Reorganized to describe basics of replication in prokaryotes first
- ✓ Removed section on recombination mechanisms (relocated to Chapter 11)
- ✓ Added new section in Illumina sequencing to replace material on now-obsolete 454 sequencing
- ✓ Introduced concept of contig assembly

Chapter 11: Mutation, Repair, and Recombination
Previously Chapter 14

- ✓ Added description of the Luria-Delbruc experiment, including 2 figures.
- ✓ Incorporated the molecular basis of recombination, previously part of Chapter 6

Chapter 12: Molecular Biology of Gene Expression
Previously Chapter 10

- ✓ Separated content on transcription in prokaryotes and eukaryotes into 2 primary sections
- ✓ Incorporated information from the previous section entitled “Complex Transcription Units” into the sections on transcription and translation
- ✓ Promoted content on protein folding and chaperonins to a primary section
- ✓ Introduced sequence logos as a means of visualizing consensus sequences

Chapter 13: Molecular Mechanisms of Gene Regulation
Previously Chapter 11

- ✓ Elevation of RNA-based regulation in eukaryotes to major subheading status
- ✓ Added new section and figure describing how *Xist* and *Tsix* RNA’s control X inactivation in mammals
- ✓ Added description of the role played by *MALAT1* in alternative splicing and of lincRNA-p21 in translational regulation

Chapter 14: Manipulating Genes and Genomes
Previously Chapter 12

- ✓ Added subsection describing the strategy employed to sequence the human genome
- ✓ Added content and figure on whole exome sequencing
- ✓ Elevated content on Functional Genomics to a major subdivision to include a definition of transcriptosome, expanded coverage of RNA-seq, quantitative RT-PCR, and multiple new figures
- ✓ Added subsection on RNAi for gene knockdown
- ✓ Added major section on gene editing with CRISPR-Cas9
- ✓ Added Cutting Edge box on using CRISPR-Cas9 for gene repair in muscular dystrophy
- ✓ Removed information on number of patents for human gene technology as it is no longer an indicator of the state of the field

Chapter 15: Genetic Control of Development
Previously Chapter 13

- ✓ Added new section on Regulatory RNAs in Development including covers of mi-RNA regulation and recent work demonstrating epigenetic fine-tuning involving a linc-RNA (HOTAIR and the *HOX* genes in mammals)
- ✓ Several new figures including a version of the canonical comparison of *Hox* genes in *Drosophila* and in vertebrates
- ✓ Removed some tangential material including embryonic induction and *wingless* patterning in *Drosophila*

Chapter 16: Molecular Genetics of the Cell Cycle and Cancer
Previously Chapter 15

- ✓ Added section and several new figures on Cancer Genomics

Chapter 17: Mitochondrial DNA and Extranuclear Inheritance
Previously Chapter 16

- ✓ Added new section and figures about *Wolbachia* in arthropod species

Chapter 18: Genes in Populations
Previously Chapter 17

- ✓ Relocated section on molecular evolution to Chapter 19
- ✓ Added Cutting Edge box on CRISPR-Cas9 for Disease Control
- ✓ Added subsection on linkage disequilibrium including both the calculations and the introduction of heat maps as a means of visualization
- ✓ Added 2 new figures showing electropherograms of short tandem repeat (STR) markers currently employed in forensic and paternity analysis
- ✓ Rearranged order of topics to cover genetic drift prior to natural selection
- ✓ Added section on molecular signals of selection including material on lactase persistence previously in chapter 19
- ✓ Edited problems to include ones on linkage disequilibrium, as well as on interpretation of capillary electrophoresis results

Chapter 19: Molecular and Human Evolutionary Genetics
Previously Chapter 19

- ✓ Incorporated section on molecular evolution previously in Chapter 17
- ✓ Added subsection on ancient DNA

- ✓ Replaced previous, more ambiguous data from multiple gene trees with more definitive data, obtained from analysis of Alu insertion sites, regarding the relationship of humans, gorillas and chimpanzees
- ✓ Relocated section on detection of selective sweeps to Chapter 18
- ✓ Added material based on the current state of knowledge regarding *Homo floresiensis* and the Denisovans
- ✓ Added Cutting Edge box on the Peopling of Western Europe
- ✓ Added new figure showing a "Structure" plot of human genetic variation

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