

Chapter 9 Microbial Genetics

9.1 Introduction to Genetics and Genes

Genetics: the study of the inheritance, or **heredity**, of living things. It explores:

- The transmission of biological properties (traits) from parent to offspring
- How those traits are expressed
- The structure and function of the genetic material
- How this material changes

The Nature of the Genetic Material

For a species to survive, it must be able to self-replicate.

The Levels of Structure and Function of the Genome

Genomes: sum total of genetic material of an organism.

- **Genomics:** study of an organism's entire genome.

Chromosome: a distinct cellular structure composed of a neatly packaged DNA molecule.

- Eukaryotic chromosomes have DNA around histone proteins
 - Located in the nucleus
 - Few to hundreds
 - Linear appearance
- Bacterial chromosomes are condensed into a packet form by histonelike proteins.
 - Singular
 - Some have multiple, circular or linear chromosomes

Gene: a site on the chromosome that provides info for a certain cell function.

- A segment of DNA that has the info to make a **protein** or an RNA.

3 basic categories of genes:

- Structural genes that code for proteins
- Genes that code for the RNA machinery used in protein production
- Regulatory genes that control gene expression
- The sum of all three is an organism's genetic makeup, or **genotype**.
- Only a portion of genes are expressed, creating traits referred to as the **phenotype**
 - Organisms have more genes than in their genotypes and phenotypes
 - Phenotype can change depending on which genes are turned on

The Size and Packaging of Genomes

Genomes vary in size

- Smallest viruses have 4 or 5 genes
- Bacterium *E. coli* has a single chromosome with 4000 and 5000 genes

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Gerard J. Tortora



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Microbiology, Principles & Applications, Third Edition [by] Jacquelyn G. Black Jacquelyn G. Black, George Allan Wistreich, Black, 1996 *Study Guide for Life on Earth* Carl S. Pike, 1973 Microbiology and Immunology Review Lawrence I. Rothfield, Peter A. Ward, Richard C. Tilton, 1975 Modern Microbial Genetics Uldis N. Streips, Ronald E. Yasbin, 2002-02-07 Section 1 DNA metabolism Chapter 1 Prokaryotic DNA replication Chapter 2 DNA repair mechanisms and mutagenesis Chapter 3 Gene expression and its regulation Chapter 4 Bacteriophage genetics Chapter 5 Bacteriophage and its relatives Chapter 6 Single stranded DNA phages Chapter 7 Restriction modification systems Chapter 8 Recombination Chapter 9 Molecular applications Section 2 Genetic response Chapter 10 Genetics of quorum sensing circuitry in *Pseudomonas aeruginosa* Implications for control of pathogenesis biofilm formation and antibiotic biocide resistance Chapter 11 Endospore formation in *Bacillus subtilis* an example of cell differentiation by a bacterium Chapter 12 Stress shock Chapter 13 Genetic tools for dissecting motility and development of *Myxococcus xanthus* Chapter 14 *Agrobacterium* genetics Chapter 15 Two component regulation Chapter 16 Molecular mechanisms of quorum sensing Section 3 Genetic exchange Chapter 17 Bacterial transposons An increasingly diverse group of elements Chapter 18 Transformation Chapter 19 Conjugation Chapter 20 The subcellular entities a k a plasmids Chapter 21 Transduction in gram negative bacteria Chapter 22 Genetic approaches in bacteria with No natural genetic systems *Schaum's Outline of Theory and Problems of Microbiology* I. Edward Alcamo, 1998 Containing more that 2 500 self test questions and dozens of visual aids this guide avoids jargon while helping you quickly expand your vocabulary of essential terminology No matter what kind of student you are solo in a class undergrad graduate or in health sciences school it can help you conquer microbiology Research & Creative Activity , 2003 **Laboratory Experiments in Microbiology** Ted R. Johnson, Christine L. Case, 1989 **Microbiology & Immunology** David J. Hentges, 1995

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