

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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