Genetics and Genomics

1. The Genetic Code of Genes and Genomes

- DNA is the molecule of heredity
- The structure of DNA is a double helix composed of two intertwined strands
- Genes affect organisms through the action of proteins
- Genes specify proteins by means of a genetic code
- Genes change by mutation
- Most traits are complex traits affected by multiple genetic and environmental factors
- Evolution means continuity of life with change

2. Transmission Genetics: Heritage from Mendel

- Mendel took a distinctly modern view of transmission genetics
- Genes come in pairs, separate in gametes, and join randomly in fertilization
- The alleles of different genes segregate independently
- Chance plays a central role in Mendelian genetics
- The results of segregation can be observed in human pedigrees
- Simple dominance is not always observed
- Epistasis can affect the observed ratios of phenotypes

3. The Chromosomal Basis of Heredity

- Each species has a characteristic set of chromosomes
- The daughter cells of mitosis have identical chromosomes
- Meiosis results in gametes that differ genetically
- Eukaryotic chromosomes are highly coiled complexes of DNA and protein
- The centromere and telomere are essential parts of chromosomes
- Genes are located in chromosomes
- Genetic data analysis makes use of probability and statistics

4. Gene Linkage and Genetic Mapping

- Linked alleles tend to stay together in meiosis
- Recombination results from crossing-over between linked alleles
- Polymorphic DNA sequences are used in human genetic mapping
- Double crossovers are revealed in three-point crosses
- Tetrads contain all four products of meiosis
- Recombination is initiated by a double-stranded break in DNA

5. Human Chromosomes and Chromosome Behavior

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6. DNA Structure, Replication, and Manipulation

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7. The Genetics of Bacteria and Their Viruses

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8. The Molecular Genetics of Gene Expression

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9. Genomics, Proteomics, and Genetic Engineering

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10. Molecular Genetics of the Cell Cycle and Cancer

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11. Molecular Evolution and Population Genetics

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12. The Genetic Basis of Complex Traits

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