Unit 4 Molecular Genetics

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| **Key Concepts** | Unit Summary |
| • DNA: The Hereditary Material  • Onion DNA Extraction  • DNA Replication  • Chromosome Structure  • Central Dogma  • Protein Synthesis   * Transcription * Translation   • The Protein for Insulin  • The Gene for Insulin  • Gene Expression   * Lac operon   • Chromosomal Mutations   * Inversions * Translocations * Non-disjunctions   • Point Mutations   * Frameshift * Substitution   • Biotechnology Tools   * Gel electrophoresis * Polymerase chain reaction * Recombinant DNA | • The discovery of the chemical composition, function, and structure of DNA involved the work of numerous scientists over many decades. Watson and Crick combined all of the available information into their double helix model of DNA.  • DNA is copied by semiconservative replication. Each strand of the original DNA is incorporated into one of the new copies.  • Eukaryotic chromosomes consist of DNA bound to histones. Together, the DNA and histones form nucleosomes, which are further wound and bundled into solenoids.  • The central dogma outlines the flow of information from DNA to mRNA to protein.  • DNA differs from RNA. RNA is a single strand, it contains a ribose sugar instead of a deoxyribose sugar, and it contains uracil instead of thymine.  • In transcription, the information encoded in DNA is passed to a complementary mRNA molecule.  • In translation, the sequence of nucleotides in an mRNA molecule specifies an amino acid sequence in a polypeptide. A ribosome uses the mRNA sequence to assemble a polypeptide, with the help of tRNA.  • The genetic information that specifies a single amino acid is a sequence of three bases, called a codon.  • A cell responds to changes in its environment by regulating the rate at which its genes are expressed. An operon is a section of DNA that is used to regulate gene expression. The lac operon is an example of enzyme induction in bacteria.  • A mutation is a change in the sequence of DNA. They can be on a small-scale or large-scale. Mutations can either arise spontaneously or be induced by mutagens.  • Genetic engineering biotechnology techniques offer many potential benefits to humans, however many people are concerned that there may be far-reaching, irreversibly harmful effects. |

Key Terms

□ adenine □ amino acid □ anticodon

□ antiparallel □ codon □ complementary base pair

□ cytosine □ deoxyribonucleic acid □ DNA helicase

□ DNA ligase □ DNA polymerase I & III □ exons

□ frameshift mutations □ gel electrophoresis □ genome

□ gene regulation □ gene therapy □ guanine

□ histone □ introns □ lac operon

□ lagging strand □ leading strand □ mRNA

□ mutagens □ nucleotides □ Okazaki fragments

□ operator □ operon □ plasmid

□ poly-A tail □ polymerase chain reaction □ primase

□ promoter □ recombinant DNA □ replication fork

□ repressor protein □ restriction enzymes □ RNA polymerase

□ RNA primer □ rRNA □ spliceosome

□ substitution mutation □ telomere □ thymine

□ transcription □ translation □ tRNA

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