

GENERAL BIOLOGY Lecture 15 - Genes, Gene Control, & Genetic Engineering

- I. Genes
 - A. What is a gene?
 - 1. A section of DNA which encodes for a specific RNAs and subsequently, specific protein products
 - B. What are the different forms of genes?
 - 1. Alleles - alternate forms of genes
- II. Gene control
 - A. How are genes expressed?
 - 1. Prokaryotes - the operon model
 - A. Regulator gene
 - 1) Produces a repressor which can interact with the operator
 - B. Operator site (the operon)
 - 1) Promoter - precedes genes and serves as binding site for RNA polymerase
 - 2) Operator - (like allosteric site in enzymes) site for repressor
 - 3) Activator protein - allows transcription by preventing repressor binding
 - 2. Eukaryotes - much less known about mechanisms
 - A. Cells do become specialized - they differentiate
 - B. Differentiation through selective gene expression
 - C. Types of gene expression
 - 1) Transcriptional
 - 2) Transcript processing (mRNA processing)
 - 3) Transport control (from nucleus to ribosome)
 - 4) Translational
 - 5) Post-translational - protein modification
- III. Genetic engineering
 - A. Natural recombination
 - 1. Exchange of DNA and recombination of DNA segments
 - A. Crossing over of chromosomes
 - B. Recombination of chromosomes pairs
 - C. Transposition - genes jump from one region of DNA to another
 - 2. Variation of species
 - A. Humans have 3 billion nucleotides in each of 23 chromosomes
 - B. There are 2^{23} , or 8,388,608 possible combinations of the 23 chromosomes
 - B. Recombinant DNA technology - targeted manipulation
 - 1. Genes of interest are isolated
 - 2. Genes are modified
 - 3. Genes are reinserted into the same organism or into a different organism
 - C. Generalized procedure
 - 1. Focus on a protein of interest
 - 2. Determine the DNA sequence which encodes for that protein
 - 3. Clone the DNA to obtain a large supply - use a vector which will "splice in" foreign DNA (plasmid, bacteriophage, etc.)
 - 4. Allow the vector to integrate its DNA into a host (like E. coli)
 - 5. In mammals, foreign DNA is integrated by ...
 - a) Calcium phosphate precipitants
 - b) Microinjection
 - c) Viruses
 - 6. Integrated DNA can be used to make bulk protein (insulin)
 - 7. Integrated DNA may or may not alter the organism
 - D. Problems
 - 1. Location of DNA integration (organelle)
 - 2. Expression and regulation
 - 3. Complexity