Chapter 17

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- Protein Synthesis is Split into Two Steps:
    1. Transcription − Synthesis of RNA using DNA as a template (occurs in the nucleus)
    2. Translation − Actual synthesis of a polypeptide using mRNA (occurs in the cytoplasm, specifically the ribosome)
- "Central Dogma" − Flow of genetic information in a cell
- DNA → RNA → protein → trait
- RNA − Ribose sugar, uracil instead of thymine, single stranded, and comes in three forms: mRNA, tRNA, and rRNA
- RNA Polymerase separates 2 strands and adds nucleotides (does not need primer or helicase, like DNA)
- Promoter Region − A binding site before the beginning of the gene
    1. The TATA box binding site is a repeating AT sequence
    2. Binding site for RNA polymerase and transcription factors
    3. Transcription factors (suite of DNA-binding proteins) bind to promoter region, and turn on or off transcription, which triggers the binding of RNA polymerase to DNA
- RNA bases are matched to DNA bases on one of the DNA strands, goes in the 5' to 3' direction
- Transcription Process
    1. Initiation − Transcription factors mediate the binding of RNA polymerase to an initiation sequence (TAT box)

2. Elongation − RNA polymerase continues unwinding DNA and adding nucleotides to the 3' end
3. Termination − RNA polymerase reaches a (codon) terminator sequence, such as UGA, UAA, or UAG

- Post-transcriptional processing

1. Need to protect mRNA from enzymes on its trips from nucleus to cytoplasm
2. Enzymes in cytoplasm attack mRNA
3. Protect ends of the molecule
4. Add 5' GTP cap
5. Add poly-A tail (50-250+ A nucleotides)
6. Longer tail, mRNA lasts longer, producing more protein
7. Eukaryotic genes are not continuous, split into segments
8. RNA splicing
   (a) Exons − the real gene
      i. Expressed/coding DNA
   (b) Introns − the junk
      i. In between sequence

- Splicing must be accurate! A single base added or lost throws off the reading frame
- RNA Splicing Enzymes (snRNPs)

1. Small nuclear RNA
2. Proteins

- Spliceosome

1. Several snRNPs
2. Recognize splice site sequence
   (a) Cut and paste gene

- Alternative Splicing

1. A single gene can code for more than one protein
   (a) Certain introns may be included or exons excluded
   (b) Allows humans to have a large diversity of proteins

- DNA transcribes to mRNA, which is translated into proteins, which can code for traits