

BIOLOGY CHAPTER 11 – DNA and the Language of Life

- **Genes** = small pieces of DNA
- Multiple experiments, beginning in the 1920s, were conducted to determine that DNA is the material of heredity.
 - o *For diagrams that illustrate these experiments, see pages 226-228, figs. 11-1, 11-2, 11-3, and 11-4.*
- **What is DNA?**
 - o A type of organic molecule known as a nucleic acid
 - o Full name: Deoxyribonucleic acid
 - o Monomer is a **nucleotide**; polymer is a nucleic acid (either DNA or RNA).
 - o What is a nucleotide?
 - A nucleic acid monomer (building block) – *For a review of monomers and polymers, refer to chapter 5 of your book, p. 93.*
 - Each nucleotide has three parts:
 - A ring shaped sugar
 - A phosphate group
 - A nitrogenous base; it is this base that makes one nucleotide different from another
 - o If the nitrogenous base is made of **two nitrogen-rings**, it is called a **purine**. (A way to remember this is if an angel has *two* halos, he is extra *pure*.)
 - o If the nitrogenous base is made of **just one nitrogen-ring**, it is called a **pyrimidine**.
- DNA is made of four nucleotides:
 - o Adenine (A)
 - o Thymine (T)
 - o Cytosine (C)
 - o Guanine (G)
- Adenine and Guanine are purines; Cytosine and Thymine are primidines.
- **What does DNA look like?**
 - o Double stranded; looks like a ladder
 - o Each strand's backbone is the vertical part of the "ladder"; this backbone (on each strand) is made of the sugar and phosphate groups of the nucleotides.
 - o The "rungs" of the ladder are made of the nucleotides; one nucleotide from one strand pairs with a nucleotide from the other strand.
 - **Adenine always pairs with thymine**
 - **Guanine always pairs with cytosine**
 - o The double strands twist around each other, forming a **double helix**.
 - o **See p. 230-231, figs. 11-7 and 11-8 for pictures of DNA structure.**

- **DNA replication** – the process of DNA copying itself prior to mitosis or meiosis
 - Several steps take place to make DNA replication possible:
 - Each strand of the “parent” DNA acts as a template for a new, complementary strand
 - The first step uses enzymes that will unwind the double helix of the parent DNA so that each strand is exposed.
 - Enzymes called **DNA polymerases** shuttle in nucleotides to pair up with each parent strand. These polymerases also make the bonds between the nucleotides.
 - When a new DNA double strand is formed, realize that one of those strands is a “parent strand” and one is a “new strand”.
 - See p. 233, fig. 11-9 and p. 234, fig. 11-10.

- **What does a gene actually do?**
 - **A gene provides the information for making a specific protein.**
 - Scientists Beadle and Tatum came up with the “one gene, one polypeptide” hypothesis (every gene codes for a unique protein).
 - The gene contains the recipe for protein production; the protein actually determines the phenotype of the trait.

- **Steps of protein production:**
 - In order for a protein to be made, DNA has to be “re-copied” into a more readable form called **RNA**. (Basically, the recipe found in DNA is not in a writing that can be easily read by the ribosome, so the recipe must be copied into a neater handwriting that is RNA!)
 - **Transcription** = the process of making **RNA** from DNA.
 - *Transcription occurs in the nucleus.*
 - Once RNA is made, the RNA leaves the nucleus and goes to ribosomes (either free-floating ribosomes or ribosomes attached to the ER).
 - **Translation** = the process of making protein from RNA.
 - *Translation occurs on ribosomes (either free-floating in the cytoplasm or on ribosomes attached to the ER).*
 - **See p. 236, fig. 11-12 for diagram.**

- **Note: understand that RNA is different from DNA.**
 - RNA is single stranded.
 - RNA also has four nucleotides, but they are not exactly the same as those found in DNA.
 - RNA’s four nucleotides:
 - Adenine
 - Cytosine
 - Guanine
 - Uracil
 - During transcription, adenine from DNA will pair with uracil from RNA.

- **The flow of information from gene to protein is based on codons.**
 - **Codon** = a set of three nucleotides in RNA that codes for one amino acid.
 - **See page 237, fig. 11-13 for table of codons.**