**Unit 5 Study Guide: DNA and Replication**

1. **Materials to Study:**
   1. Notes on the topics:
      1. DNA Structure and Function
      2. Traits, Genes and Inheritance
      3. DNA Replication
      4. Types of Proteins
   2. Handouts:
      1. DNA Packet
      2. DNA Fingerprinting worksheet
      3. Types of Proteins research worksheet
      4. Genetics Research: DNA, Traits and Inheritance sheet
      5. DNA Replication Coloring Worksheets
      6. DNA Replication Summary
   3. Book/Online Resources:
      1. Section 13.2 and 13.3 in book
      2. Links #1-6 in the ‘DNA/Protein Synthesis weebly section
      3. WANT on ‘DNA Structure and Replication: Crash Course biology #10’
2. **Vocabulary Terms:**

* Nucleotide
* Deoxyribose
* Nitrogen base
* Phosphate
* Double helix
* Pyrimidines
* Purines
* ATCGU
* Hydrogen Bonds
* Covalent Bonds
* Chagraff
* Watson/Crick/Franklin
* Hershey/Chase/Avery
* Gene
* Protein
* Trait
* Inheritance
* Mutations
* Chromosome
* Chromatin
* Replication
* Semi-Conservative
* Anti-Parallel
* Template
* Replication Fork
* Replication Bubble
* Helicase
* DNA Polymerase
* Ligase
* Gene Mutation
* Point Mutation
* Frameshift Mutation
* Deletion and Insertion

1. **Topics to Know:**
   1. Basic structure of DNA molecules:
      1. Know how DNA is a macromolecule made of various parts.
         1. What are the three parts of a nucleotide?

Answer: deoxyribose sugar, phosphate and a nitrogen base

* + - 1. What is the shape of a DNA molecule called?

Answer: double helix

* + - 1. What is the chagraff’s rule?

Answer: pyrimidines match purines, or in other words, A always matched T and C always matched G in a double helix.

* + - 1. What bonds exist between bases?

Answer: weak hydrogen bonds (this is in the middle of the double helix)

* + - 1. What about between sugars/phosphates?

Answer: strong covalent bonds (this is along the ‘sides’ of the double helix)

* + - 1. What are pyrimidines and purines?

Answer:Groupings of nitrogen bases; pyrmidines are C and T. purines are A and G.

* + - 1. Who developed a model for its structure?

Answer: Watson and Crick, but Franklin helped and never got credit.

* 1. DNA, Proteins and Traits:
     1. Understand that DNA contains instructions for all living organisms.
        1. What is the connection between DNA and proteins?

Answer: DNA contains genes, and each gene determined the assembly of a unique protein.

* + - 1. What are the major groups of proteins and examples of their jobs?

Answer: Overall, you need to understand that proteins range in their functions. The groups were on the ‘Types of Proteins” worksheet and spanned 9 groups from Enzymes to structural proteins.

* + - 1. What are traits and genes?

Answer: traits are physical or behavioral characteristics of organisms (either visible or can be internal, like disease risk) Genes determine our traits by holding information to direct the assembly of proteins that carry out jobs to make our traits.

* + - 1. What is a chromosome?

Answer: a structure that holds our packaged DNA in an organized way. They store the DNA in chromatin.

* + - 1. How is DNA stored in chromosomes?

Answer: DNA is stored as chromatin, which is DNA wrapped around proteins for storage in chromosomes.

* + - 1. How does inheritance create diversity?

Answer: In sexually reproducing organisms, gene recombination through the passing on of genes allows for offspring to be unique, which created diversity.

* + - 1. What are mutations, and why are they both good and bad?

Answer: Mutaitons can be helpful if the errors in DNA are passed on and provide a benefit such as creating diversity through the creation of new alleles (forms of traits). They can be harmful if the errors are in a gene and cause a disease or disorder, or fail to produce the correct proteins.

* 1. DNA Replication
     1. Know how DNA replication works, and why it occurs prior to cell division.
        1. What enzymes aid in replication and their **functions**?

Answer: Helicase – unzips the DNA by breaking hydrogen bonds between bases. DNA Polymerase – adds free nucleotides to the template DNA to construct the new DNA strands. Ligase – seals the newly replicated DNA strands.

* + - 1. What are the major steps during replication and the **result**?

Answer: see above for what the enzymes do, and the order they do it. The result is two DNA molecules, each exact copies of the original.

* + - 1. How is DNA replication semi-conservative?

Answer: When DNA is replicated, the original strands serve as a template for new material to be build upon. Therefore, the process is said to be ‘semi-conservative’ because the new DNA contains half new material, and half original material.

* + - 1. What are replication bubbles and replication forks?

Answer: a replication bubble is a location of active replication, where the DNA is opened up appearing to look like a ‘bubble’. The bubble has two replication forks, where the DNA is splitting (be helicase)

* 1. Mutations
     1. Know where mutations can occur, and the results of these changes.
        1. What is a mutation?

Answer: an error in DNA, or ‘mistake’

* + - 1. Where can a mutation occur?

Answer: In the DNA of either in body cells (aka somatic cells) or sex cells (aka gametes, like our egg/sperm.)

* + - 1. What are the different types of mutations?

Answer: point mutations, like a substitution. Frameshifts, like insertion or deletion.

* + - 1. What causes mutations?

Answer: they can either happen randomly, OR through environmental factors. Things in an organism’s environment that cause mutations could be radiation, or harmful substance, just to name a few.