**Unit 8 – DNA, RNA & Protein Synthesis**

**MCAS Frameworks:** This unit addresses the following MA State Frameworks in Biology:

**3.1** Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary

nucleotide pairs) of DNA, and describe its function in genetic inheritance.

**3.2** Describe the basic process of DNA replication and how it relates to the transmission and conservation

of the genetic code. Explain the basic processes of transcription and translation, and how they result in

the expression of genes. Distinguish among the end products of replication, transcription, and

translation.

**3.3** Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in

an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.

**SIS1.** Make observations, raise questions, and formulate hypotheses.

**SIS2.** Design and conduct scientific investigations.

**SIS3.** Analyze and interpret results of scientific investigations.

**SIS4.** Communicate and apply the results of scientific investigations.

**Big Ideas**

1. DNA is the universal code for life; it enables an organism to transmit hereditary information and, along with the environment, determines an organisms characteristics.

**Essential Questions**

1. What is the structure of DNA, and how does it function in genetic inheritance?
2. How are proteins made in cells?

**Unit 8 – DNA, RNA & Protein Synthesis**

**Reading:** Chapter 12

**Objectives:** By the conclusion of this unit the student should be able to:

**Topic 1: Experimental evidence (12-1)**

1. Summarize the experiments of Griffith and explain his conclusions.
2. Summarize the experiments of Avery and explain his conclusions.
3. Summarize the experiments of Hershey and Chase and explain their conclusions.

**Topic 2: DNA structure (12-1)**

1. Describe the structure of a nucleotide.
2. Describe the structure of the DNA double helix.
3. Explain Chargaff’s rule.

**Topic 3: Chromosome structure and replication (12-2)**

1. Explain how DNA is coiled into chromosomes.
2. Explain the contribution of Franklin’s X-ray experiment to the development of the DNA double helix model.
3. Explain the contribution of Watson and Crick to the development of the DNA double helix model.
4. Summarize the process of DNA replication (use a diagram to help).

**Topic 4: RNA and Protein Synthesis (12-3)**

1. Describe the structure of RNA and compare it to that of DNA.
2. Describe the unique roles of the three types of RNA: messenger RNA (mRNA), transfer RNA (tRNA), and ribosomal RNA (rRNA) and relate them to one another.
3. Summarize the process of transcription (use a diagram to help).
4. Describe the relationship among DNA, codons, anticodons, and amino acids.
5. Explain what is meant by “Genetic Code”.
6. Explain how the primary RNA transcript is edited (introns removed and exons remain).
7. Summarize the process of translation (use a diagram to help).

**Topic 5: Mutations (12-4)**

1. Describe the 3 ways point mutations alter genes.
2. Describe the 2 types of frameshift mutations.
3. Describe the ways in which chromosomal mutations take place.

**Topic 6: Regulation (12-5)**

1. Explain the role of the TATA box in eukarotic gene regulation.
2. Explain the role of the Hox gene in regulating the development (and differentiation) of an organism.

**Key Terms/Concepts**

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| --- | --- |
| Adenine  Amino acid  Anticodon  Bacteriophage  Base pairing  Chargaff’s rules  Chromatin  Chromosomal mutation  Chromosomes  Codon  Cytosine  Deoxyribonucleic acid (DNA)  Differentiation  DNA polymerase  DNA Replication  Double helix  Exons  Frameshift mutation  Genes  Genetic Code  Guanine  Histones  Hox genes  Introns  Messenger RNA (mRNA) | Mutations  Nucleotide  Point mutation  Polyploidy  Promoters  Purine  Pyramidine  Radioactive markers  Ribosomal RNA (rRNA)  RNA polymerase  TATA box  Template  Thymine  Transcription  Transfer RNA (tRNA)  Transformation  Translation  Uracil |

**Assessment Evidence**

Project: DNA Replication & Protein Synthesis Modeling

Lab: DNA Extraction

Assessment: Unit quiz and test

Observation: Teacher observation and feedback

**Period 5**

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| **Day** | **Topic** | **Homework** |
| Tues 3/13  E day | Pandora’s Box | Obj 1-7 by Wednesday |
| Wed 3/14  F day | Topic 1: Experiments  Topic 2: Structure of DNA | Obj 8-10 |
| Thur 3/15  A day | Topic 3: Chromosomes and DNA Replication – Modeling | Obj 11-13 |
| Mon 3/19  C day | DNA Modeling | Obj 14-17 |
| Tue 3/20  D day | DNA Modeling | Study for quiz |
| Wed 3/21  E day | Quiz: Topics 1-3 (short – not whole period)  Topic 4: RNA & Protein Synthesis | Obj 18-20 |
| Thur 3/22  F day | Topic 4: RNA & Protein Synthesis | Obj 21-22 |
| Fri 3/25  A day | Topic 5 – Mutations | TBA |
| Tue 3/27  C day | Topic 6: Regulation | Study |
| Wed 3/28  D day | Review | Study |
| Thur 3/29  E day | Unit Test | Unit 9 Objectives TBA |

**Assessment Evidence**

Project: DNA Replication & Protein Synthesis Modeling

Lab: DNA Extraction

Assessment: Unit quiz and test

Observation: Teacher observation and feedback

**Period 6**

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| **Day** | **Topic** | **Homework** |
| Tues 3/13  E day | Pandora’s Box | Obj 1-7 by Wednesday |
| Wed 3/14  F day | Topic 1: Experiments  Topic 2: Structure of DNA | Obj 8-10 |
| Fri 3/16  B day | Topic 3: Chromosomes and DNA Replication – Modeling | Obj 11-13 |
| Mon 3/19  C day | DNA Modeling | Obj 14-17 |
| Tue 3/20  D day | DNA Modeling | Study for quiz |
| Wed 3/21  E day | Quiz: Topics 1-3 (short – not whole period)  Topic 4: RNA & Protein Synthesis | Obj 18-20 |
| Thur 3/22  F day | Topic 4: RNA & Protein Synthesis | Obj 21-22 |
| Mon 3/26  B day | Topic 5 – Mutations | TBA |
| Tue 3/27  C day | Topic 6: Regulation | Study |
| Wed 3/28  D day | Review | Study |
| Thur 3/29  E day | Unit Test | Unit 9 Objectives TBA |