Chapter 14: DNA Structure and Function

Learning Objectives:

- Biology I – III 1: Discuss DNA and its role in heredity, as well as how information from DNA is expressed in cells, and ultimately, the organism.

1. Group Project

DNA/RNA Differences

It is important to know the similarities and differences between DNA and RNA. Use the table below to compare the structures, nucleotides, and sugar components of these two important biological molecules.

	DNA	RNA
Structure		
Nucleotides		
Sugar		

2. Simulation Project (In-class or At-home)

Gel Electrophoresis Tutorial

Activity: Students may complete the gel electrophoresis tutorial at home prior to coming to class or they may work in groups or individually to complete the tutorial in class with access to a smart device or computer and the internet.

https://learn.genetics.utah.edu/content/labs/gel/

3. Homework or In-Class Assignment

Mutation Analysis

Mutations are changes in DNA that occur during DNA replication. Are all mutations deleterious (harmful)? Because of the redundancy of the genetic code, a change from one nucleotide to another may not even cause a change in the amino acid sequence. On the other hand, it might lead to a change in the amino acid 'called for' by a given codon. This might be deleterious, or beneficial. Clearly some mutations must have been beneficial, to have led to all the biological diversity in the world. Mutation is the source of all new genetic variation; it is the raw material upon which natural selection acts.

There are several ways to categorize mutations. You'll look at two main types of mutations: point mutations, and reading frame shifts. A point mutation in one in which there is a base substitution.   Reading frame shifts are caused by insertions or deletions.

Fill in the tables to see the effects of various types of mutations. <u>In this exercise, pay attention to the start and stop signals.</u> For this work, it will be easier to write the sequence from left to right rather than top to bottom you did for the puzzle.

Second letter

First letter	U	C	A	G	Third letter
U	UUU UUC } Phe / UUA UUG } Leu	UCU UCC UCA UCG } Ser	UAU UAC } Tyr / UAA Stop / UAG Stop	UGU UGC } Cys / UGA Stop / UGG Trp	U C A G
C	CUU CUC CUA CUG } Leu	CCU CCC CCA CCG } Pro	CAU CAC } His / CAA CAG } Gln	CGU CGC CGA CGG } Arg	U C A G
A	AUU AUC AUA } Ile / AUG Met	ACU ACC ACA ACG } Thr	AAU AAC } Asn / AAA AAG } Lys	AGU AGC } Ser / AGA AGG } Arg	U C A G
G	GUU GUC GUA GUG } Val	GCU GCC GCA GCG } Ala	GAU GAC } Asp / GAA GAG } Glu	GGU GGC GGA GGG } Gly	U C A G

Original antisense DNA   3'   G   G   T   T   T   A   C   A   A   T   G   C   T   A   C   T 5'

mRNA

Amino acid sequence

Point mutation   3'   G   G   T   T   T   A   C   A   A   C   G   C   T   A   C   T 5'

mRNA

Amino acid sequence

What is the effect of this mutation?

_____

Point mutation	3' G G T T T A C A A T G C T A C C 5'
mRNA
Amino acid sequence

What is the effect of this mutation?
_____

Insertion	3' G G T T T A C A A A T G C T A C T 5'
mRNA
Amino acid sequence

What is the effect of this mutation?
_____

Deletions	3' G G T T T A A A T G C T A T 5'
mRNA
Amino acid sequence

What is the effect of this mutation?
_____

Which type of mutation, point or reading frame, is likely to have the greatest impact? Why?

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