

## GENETICS RESEARCH ASSIGNMENT

/24 C

/18 KU

/21 I

/15 A

### PART A

1. Research Single Nucleotide Polymorphisms.
  - a. What is a SNP? [2 KU]
  - b. What effects do SNPs have? [2 KU]
  - c. List two examples where a SNP affects human health. [4 KU]
  
2. What are some current and future implications of SNP technology? [5 A]

### PART B

1. Current research is being performed in the hopes of tailoring prescription drugs to an individual based on their genetic code.

Follow the steps below to locate the SNPs in the genetic sequence of your 13 patients.

- i. Compare patient #1 to patient #2 – highlight or circle any SNPs in each row
- ii. Compare patient #2 to patient #3 - highlight or circle any SNPs in each row
- iii. Repeat these steps for all patients.
- iv. Use a pen to draw a vertical column to connect the SNP locations that you have highlighted or circled.

Example:

#1	C	G	G	A	C	T	A	A	G	G	A	G
#2	C	C	G	A	C	T	A	A	G	C	A	G
#3	C	A	G	A	C	T	G	A	G	C	A	G
#4	C	A	G	A	C	T	G	A	G	C	A	G
#5	C	C	G	A	C	T	A	A	G	C	A	G
#6	C	G	G	A	C	T	A	A	G	G	A	G

2. Based on the number of SNPs in specific locations of DNA, individuals can be classified into different haplotypes. Individuals with the same SNPs in the same location are placed in the same haplotype group. Complete the “Haplotypes Table” provided. [8 C]

Example:

Haplotype “a”

#1	C	G	G	A	C	T	A	A	G	G	A	G
#6	C	G	G	A	C	T	A	A	G	G	A	G

Haplotype “b”

#2	C	C	G	A	C	T	A	A	G	C	A	G
#5	C	C	G	A	C	T	A	A	G	C	A	G

Haplotype "c"

#3 C A G A C T G A G C A G  
 #4 C A G A C T G A G C A G

3. Physicians often prescribe the drug Toradol for the relief of migraine symptoms. Most patients find that this drug works very well to relieve their migraines (+), however some have adverse reactions(-). Still other patients find it has no effect at all (o).

You conduct an experiment to examine the the effect of toradol on each of your patients. Record the results in the "Results of the Study" column of the haplotypes table. [8 C]

Results:

- i. Patients in haplotype groups a, d, f, h responded well to toradol. Place a (+) in the corresponding column. [4 C]
  - ii. Patients in haplotype groups b and e found no effect on their migraine symptoms when they took toradol. Place a (o) in the corresponding column. [ 2 C]
  - iii. Patients in haplotype groups c and g had adverse reactions to the drug toradol and had to discontinue use. Place a (-) in the corresponding column. [2 C]
4. A patient comes to the emergency room of the hospital with classic migraine symptoms. The doctor analyzes the patient’s DNA before prescribing medication. Look at the patients SNP to determine if toradol should be given. If not, what other medication should the doctor prescribe? [4 I]

Patient X: TGCCTGACTCTAGTCTATCGTATATCTTATCTA

HAPLOTYPES TABLE

Haplotype	Highlighted SNPs	Patient Numbers	Results of Study
A			
B			
C			
D			
E			
F			
G			
H			

**PART C**

1. What are the main differences between DNA and RNA? [3 KU]

2. Which is the process that produces a new protein from an mRNA strand and where does the process occur? [2 KU]
3. A tRNA molecule has two important regions. What are they and what are each responsible for? [5 KU]
4. If a DNA template strand has the following sequence:  
**3' – TACTAGGTCTAGCTATATGCTAGC – 5'**
  - a. What is the complimentary coding strand sequence? [2 I]
  - b. What is the mRNA sequence? [2 I]
  - c. What anticodons would be found on the tRNAs that will bring in the correct amino acids? [2 I]
  - d. What are the amino acids that will make up the polypeptide product? (note: refer to the amino acid chart given) [2 I]
5. If the DNA template strand was replicated incorrectly, and the following sequence was produced:  
**3' – TAC TAG GTC TAG CTA AT GCT AGC – 5'**
  - a. Transcribe this sequence into the corresponding mRNA strand. [2 I]
  - b. Translate the mRNA into the corresponding amino acid sequence. [2 I]
  - c. What type of mutation is this? [2 I]

#### **PART D**

1. Find a scientific article published within the last 5 years related to this unit of study. Please submit your article with your assignment to receive full marks.
  - a. Write a brief SUMMARY of the article in YOUR OWN WORDS. [5 A]
  - b. What future implications might result because of this study or article? [5 A]
  - c. Your article summary will be evaluated on: Relevancy [1 I], Uniqueness [1 I], and the date of publication [1 I]

DNA SEQUENCE DATA

Patient 1 TGCATGACTCTAGTCTATCGTATATCGTATCTA  
Patient 2 TGCTTGACTCTAATCTATCGTATATCCTATCTA  
Patient 3 TGCGTGACTCTATTCTATCGTATATCATATCTA  
Patient 4 TGCCTGACTCTACTCTATCGTATATCATATCTA  
Patient 5 TGCCTGACTCTAGTCTATCGTATATCCTTATCTA  
Patient 6 TGCTTGACTCTAATCTATCGTATATCCTATCTA  
Patient 7 TGCCTGACTCTAGTCTATCGTATATCCTTATCTA  
Patient 8 TGCCTGACTCTACTCTATCGTATATCATATCTA  
Patient 9 TGCGTGACTCTAATCTATCGTATATCCTATCTA  
Patient 10 TGCTTGACTCTATTCTATCGTATATCATATCTA  
Patient 11 TGCGTGACTCTAATCTATCGTATATCGTATCTA  
Patient 12 TGCGTGACTCTAATCTATCGTATATCCTATCTA  
Patient 13 TGCGTGACTCTAATCTATCGTATATCCTATCTA  
Patient 14 TGCTTGACTCTATTCTATCGTATATCATATCTA  
Patient 15 TGCCTGACTCTACTCTATCGTATATCATATCTA  
Patient 16 TGCCTGACTCTAGTCTATCGTATATCCTTATCTA  
Patient 17 TGCTTGACTCTAATCTATCGTATATCCTATCTA  
Patient 18 TGCATGACTCTAGTCTATCGTATATCGTATCTA

First Letter	Second Letter				Third Letter
	<b>U</b>	<b>C</b>	<b>A</b>	<b>G</b>	
<b>U</b>	phenylalanine	serine	tyrosine	cysteine	<b>U</b>
	phenylalanine	serine	tyrosine	cysteine	<b>C</b>
	leucine	serine	stop	stop	<b>A</b>
	leucine	serine	stop	tryptophan	<b>G</b>
<b>C</b>	leucine	proline	histidine	arginine	<b>U</b>
	leucine	proline	histidine	arginine	<b>C</b>
	leucine	proline	glutamine	arginine	<b>A</b>
	leucine	proline	glutamine	arginine	<b>G</b>
<b>A</b>	isoleucine	threonine	asparagine	serine	<b>U</b>
	isoleucine	threonine	asparagine	serine	<b>C</b>
	isoleucine	threonine	lysine	arginine	<b>A</b>
	(start) methionine	threonine	lysine	arginine	<b>G</b>
<b>G</b>	valine	alanine	aspartate	glycine	<b>U</b>
	valine	alanine	aspartate	glycine	<b>C</b>
	valine	alanine	glutamate	glycine	<b>A</b>
	valine	alanine	glutamate	glycine	<b>G</b>