

Biol4241 Final Exam: **DRAFT QUESTIONS, 2026 Apr 05**

From the set of questions below: answer # X, and any six others. Each answer should be about one-half to one page. [Do not answer more than five total]

1. Biol4241 is called **Advanced Genetics**. Distinguish the sciences of **Genetics** and **Molecular Biology of the Gene**.
2. Nirenberg's **poly-UUU experiment** is said to 'prove' that the Genetic Code is a **triplet** code. Is this true, or not? Explain
3. Show **how many codons** in the **Genetic Code** can be inferred from **RNA poly-monomers** and **poly-dimers** of **RNA**. (Use the code diagrams on the reverse).
4. Identify all DNA triplets that can mutate to the **TGA** Stop triplet in one step. Is there any pattern that might suggest how the Genetic Code evolved? Discuss.
5. For the data at [https://www.mun.ca/biology/scarr/Restriction_Mapping.html], an animation explains the logic of **double-digest restriction mapping** for a 0.8 kbp DNA fragment cut with three restriction endonuclease, **EcoRI**, **BglII**, and **MboI**. Follow the animation, and complete the map of the restriction sites. Show your work. [You do not need to calculate the exact sizes of the fragments: their relative sizes are sufficient].
6. Popular accounts of **automated DNA sequencing** (such as "*Jurassic Park*") often state that "*the sequencer reads the DNA sequence with a laser*". Is this statement accurate? Explain how a laser is used in an automated **DNA** sequencer.
7. [https://www.mun.ca/biology/scarr/VNTR_fingerprinting_for_parentage.html] shows a **DNA fingerprint** for the following scenario. Two parents (**#1 & 2**) with missing children ask whether any of six children (**A - F**) of the correct age could be the children of one or both of them. **For each of the children, determine whether they could be the offspring of (1) #1 only, (2) #2 only, (3) both #1 and #2, (4) neither #1 nor #2.** Explain each determination in detail. For a match of type **(3)**, is the identification certain? Why or why not?
8. [https://www.mun.ca/biology/scarr/CASP12_human_vs_chimp.html] discusses a **SNP** variant between Chimps and Humans in the **CASP12** gene, which codes for the enzyme **caspase**. One hypothesis is that the *loss-of-function* **SNP** in the human **CASP12** gene relative to that of Great Apes confers a *short-term advantage* by mediating an improved immunological response, balanced against a longer-term disadvantage from susceptibility to Alzheimer disease in longer-lived humans. The lifespan of Chimps is typically than humans. **Evaluate this hypothesis**, taking into consideration the genetic variation, difference in immunological response, and susceptibility to Alzheimer Disease.
9. The **polymerase chain reaction (PCR)** is often described as a simple series of Denaturation, Annealing, & Extension steps [https://www.mun.ca/biology/scarr/PCR_simplified.html]. It concludes, "**One cycle doubles the number of dsDNA molecules.**" Is this accurate? Explain. Label the **5'** and **3'** ends of the molecules in the diagram
10. For the Bio-Similar Insulin variants at [https://www.mun.ca/biology/scarr/Biosimilar_Insulin.html], Identify the **SNP variants necessary to produce the bio-similar insulin molecules** from the original human **insulin / Humulin DNA** sequence,

2nd		2nd								
1st	U	C	A	G	1st	U	C	A	G	3rd
U	F	S	Y	C	U	U				U
	F	S	Y	C	C					C
	L	S	*	*	*					A
	L	S	*	*	W					G
C	L	P	H	R	R	U				U
	L	P	H	R	R	C				C
	L	P	Q	R	R	A				A
	L	P	Q	R	R	G				G
A	I	T	N	S	S	U				U
	I	T	N	S	S	C				C
	I	T	K	R	R	A				A
	M	T	K	R	R	G				G
G	V	A	D	G	G	U				U
	V	A	D	G	G	C				C
	V	A	E	G	G	A				A
	V	A	E	G	G	G				G

In conjunction with the complete table of the **Genetic Code** [left], use this blank table [right] to identify the **Codons** whose coding properties can be inferred from Nirenberg & Khorana's **poly-monomer** ex.: **UUUUUUUUU** and **poly-dimer** ex.: **CGCGCGCGCG** experiments