

PLEASE WRITE LEGIBLY. IF THE GRADER CANNOT READ YOUR ANSWER IT WILL BE MARKED WRONG.

INSTRUCTIONS for regrade requests: DUE Fri Apr 9 (no exceptions)

- 1) Make no marks on your test paper.
- 2) On a separate sheet of paper (typed or neatly handwritten): indicate the number of the question and why your answer should be considered for additional credit. This should be detailed not just "I deserved more points for my answer".
- 3) Calculation errors: please put request on a sheet of paper separate from the exam.
- 4) Submit requests in class. Red regrade request folder will be on the front table

There are 20 multiple choice questions below. Each question is worth 1 point. Please write the letter for the correct answer in the appropriate space in the table. 5 points will be deducted for blank table.

1. C	2. C	3. B	4. C	5. B
6. A	7. C	8. B	9. D	10. A
11. B	12. D	13. D	14. B	15. A
16. C	17. A	18. C	19. D	20. A

Use of incorrect terms – e.g transcription instead of translation, ribosome instead of RNA polymerase – was penalized. It is ESSENTIAL that you use correct terms.

21. The sequence of a portion of an mRNA appears below. The **Shine-Dalgarno sequence** bolded.

5' ...CAUGA**AGGAGG**UAGCAACCAUGCACUGGAUUCCAA3'

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

a. (3 pts) Use the genetic code to translate the first 3 amino acids of the peptide encoded in the sequence above **AS IT WOULD BE TRANSLATED BY A RIBOSOME** MetHisTrp 1pt for

@ AA must have correct code

a. (1pt) This mRNA is **bacterial** eukaryotic cannot tell from information provided

b. (2pts) what is the significance of the bolded sequence (why is it important)?

Sequence is complementary to 3' end of 16S rRNA

(important for ribosome positioning)

22. (2pts) Label the amino terminal and carboxy terminal ends of the following peptide:

Amino terminal (Nterminal) **MetAlaSerLysGlyGluGlu** Carboxy terminal (C term)

The following phrases describe various aspects of protein synthesis.

- a. initiator tRNA binds the small ribosomal subunit before the complex binds to mRNA **EUK**
- b. GTP hydrolysis provides energy for elongation step **BOTH**
- c. intact ribosomes located in the cytosol **NEITHER**
- d. 3' end of 16S rRNA complementary to ribosome binding site **BACTERIAL**
- e. Peptidyl transferase activity resides in rRNA of large subunit **BOTH**
- f. termination requires release factor **BOTH**
- g. occurs concurrently with transcription **BACTERIAL**
- h. initiation factors interact with 5' cap and 3' poly A of mRNA **EUK**
- i. initiator is N-formyl methionine tRNA **BACTERIAL**
- j. small ribosomal subunit scans for initiation site on mRNA **EUK**

If you list more than 2 only the first 2 are graded. It is essential that you follow directions.

23. (4 pts) At least 2 phrases refer to events **unique to bacterial** protein synthesis. (2 points each)

Put the letters for 2 of these phrases in the space provided ANY 2: D, G, I

- 24 (4pts) At least 2 phrases refer to events **unique to eukaryotic** protein synthesis. (2 points each)

Put the letters for 2 of these phrases in the space provided any 2: A, H, J

- 25 (4pts) At least 2 phrases refer to events that are **common features** of both bacterial and eukaryotic protein synthesis.

Put the letters for 2 of these phrases in the space provided ANY 2: B, E, F

26. (2 pts) What is the **role** of initiation factors in translation initiation? **ROLE= what does it do?**

Initiation factors are necessary to form the initiation complex (intact ribosome containing initiator tRNA)

- 27 (2pts) **How** is the initiator tRNA distinct from tRNA^{Met} that is added during elongation?

Initiator tRNA has **distinct structure** (different anticodon stem) that enables it to bind to partial P site small subunit of the ribosome but prevents it from entering the A site. In bacteria, initiator tRNA is charged with fMet

28. (6pts) Use the one letter OR the 3 letter code for **one** amino acid that fits the description MUST use abbreviation lose ½ credit for full name

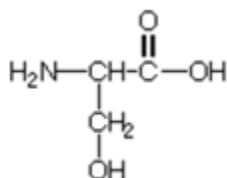
a. side chain may be methylated (K / Lys) or (R / Arg) or (H / His)

b. side chain may be phosphorylated (S / Ser) or (Y / Tyr) or (T / Thr)

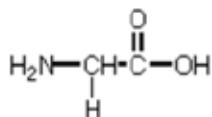
c. side chain may be glycosylated (S / Ser) or (T / Thr) or (N / Asn)

29. (10 pts) Match the amino acid with its structure

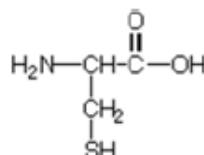
a.



b.



c.



Aspartic Acid g

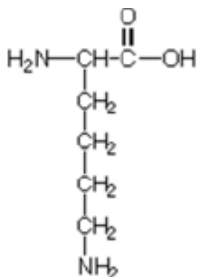
Cysteine c

Glycine b

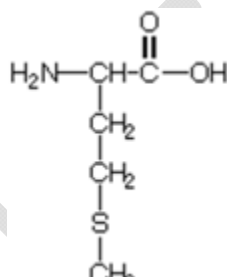
Lysine d

Phenylalanine f

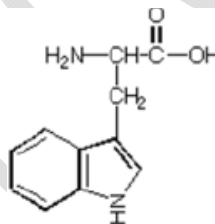
d.



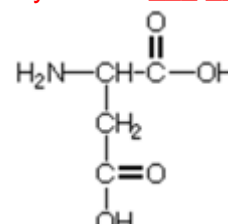
e.



f.



g.



30. (2pts) The human genome encodes 48 species of tRNA to read 61 codons. How is this possible? Wobble pairing --GU or non standard such as inosine in the anticodon

31 (2pts) How is selenocysteine incorporated at certain UGA codons?

UGA is followed by structural feature (stem-loop) that is recognized by alternate elongation factor that allows seleno-cysteine tRNA to enter A site

32 (6 pts) Where is the promoter for a typical prokaryotic gene located and what is its role?

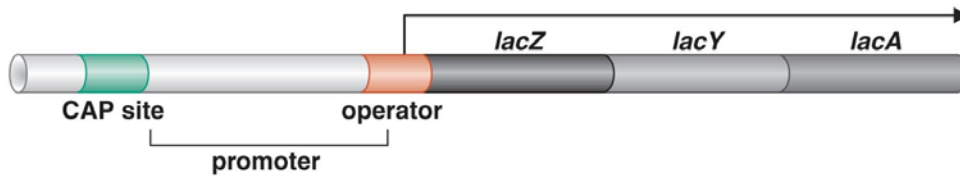
Upstream of transcription start site (-35/10 region important) Promoter is the region that contains sequences that are important for transcription initiation

What is the role of the sigma factor? Sigma factor is involved in promoter selection (controls binding to DNA).

How is polymerase with sigma 70 different from polymerase with sigma 32?

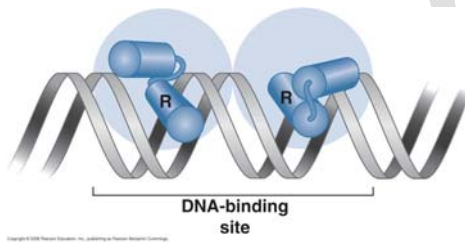
Polymerase transcribes a Different set of genes transcribed

33 (2pts) What is the function of Rho in bacterial transcription? **Rho is involved in site specific bacterial transcription termination. (not necessary but if extra detail is added it should be correct -- binds to rut seq on transcript – tracks to RNA pol and terminates transcription when termination site is reached)**



34 (10 pts) Identify the region of the lac operon that is bound by each DNA binding protein under the condition indicated . Use figure of the Lac operon for reference.

- a. lac repressor in the absence of lactose? **Binds operator**
- b. lac repressor in the presence of lactose? **Does not bind DNA**
- c. RNA polymerase in the presence of lactose? **Binds promoter**
- d. RNA polymerase in the absence of lactose? **Does not bind DNA- blocked by lac repressor**
- e. CRP bind in the absence of glucose? **Binds CAP site**

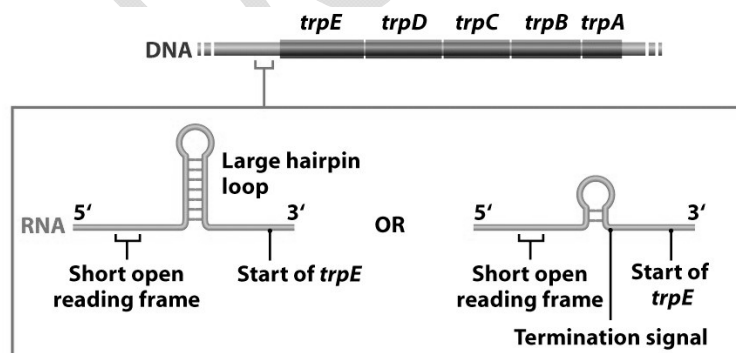


35. (4pts) The figure shows binding of bacterial repressor to DNA.

What is the importance of the feature labeled R?

Recognition helix – (specific contacts between the side chains of the helix and bases in the DNA)

The lambda and lac repressor binding sites are palindromic. What does that tell you about lambda and lac repressor. **They bind DNA as dimers**



36. (6points) The Trp operon is regulated at transcription initiation and transcription termination.

This is E coli Trp operon. Bacillus operon does NOT have leader peptide. TRAP is a Bacillus protein

How is transcription initiation

affected by high levels of Trp? **Trp**

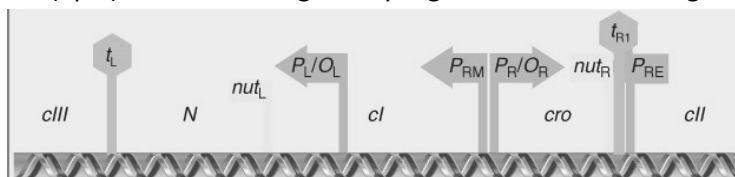
repressor binds operator and blocks transcription initiation

Which structure is formed when intracellular Trp levels are limited? **_A: (Limited Trp no termination)**

What is the significance of the short open reading frame? **_____ Short ORF has adjacent Trp codons. If there is sufficient Trp translation keeps up with transcription and forms terminator. Insufficient Trp ribosome pauses**

37 (2pts) What is a riboswitch? **Regulatory RNA - activity is different in presence/ absence of a ligand. (Alternate structures)**

38 (6pts) The lambda regulatory region is shown in the figure



What protein is encoded by the N gene? **antiterminator**

Why expression of lambda N required for both the lytic and lysogenic pathways?

pN is required for expression beyond first termination sites

Lytic – Enables expression of 2nd antiterminator Q (req'd for late genes)

Lysogenic- enables expression of cII which is required for expression of lambda repressor cI

Extra credit: 2pts

MicroRNAs and siRNAs originate from different sources.

What is the source of microRNA (miRNA) (where encoded)? **In the host genome**

What is the source of siRNA (where encoded)? **Viral (ds RNA in viral replication)**