Name: [redacted]

1. Define the following terms briefly. You may give an example *if* you think this would be helpful. (30 points)

a. operator → Seq of DNA to which an repressor or activator binds to either initiate transcription or prevent it.

b. euchromatin → Euchromatin is chromatin that is loosely packed, it stains light, contains most of the genes, and can undergo transcription B/C the enzymes can get to the proper place B/C it is loosely packed.

c. plasmid → A self replicating circular DNA piece that is present in bacteria, and is separate from the bacterial C-some. Can confer resistance, and have some pathogenicity properties
ex: F plasmid

d. anti-codon → A 3 base pair site on the tRNA which pairs w/ the codon of the mRNA, bringing the correct Amino Acid to the mRNA.

e. Shine-Dalgarno sequence → Part of the mRNA in Prokaryotes, which is responsible for correctly aligning the mRNA onto the small subunit of the ribosome.

f. transcriptome → The sequence and expression patterns of all transcripts in a cell / organism.

(30)

Name: [redacted]

2. Given the following prokaryotic coding strand sequence, please answer the following questions: 30 pts. total

a. What is the sequence and polarity of the template strand? (5 pts.)
b. Where is the approximate transcriptional start site? (5 pts.)
c. What is the sequence and polarity of the mRNA? (5 pts.)
d. Translate the mRNA, indicating amino and carboxy termini of protein. (5 pts.)
e. What is the complement to the mRNA (with polarity indicated)? (5 pts.)
f. Can you translate the complementary mRNA (does it have a start codon), and if so, what would be the protein sequence? (5 pts.)

5'TTATAATCTGTGCGCTTGACATGGGCCGGATGCTAAGCAGTATAATTGATGCCAGTCCACAATGAC
TCATGGAACCCGGCCGT3'

-35 -10

b) transcriptional start site

a) 3' AATATTAGACACGCGAACTGTACCCGGCCTACGATTCGTCATATTAACTACGGTC
AGGTGTTACTGAGTACCTTGGGCCGGCA 5'
(3' -> 5' complementary to coding strand)

c) 5' AGUCCACAAUGACUCAUGGAACCCGGCCGU 3'
start

d) Amino - formyl-Met - Thr - His - Gly - Thr - Arg - Pro - carboxy

e) 3' UCAGGUGUUACUGAGUACCUUGGGCCGGCA 5'
start

translate

f) Amino - formyl-Met - Ser - His - Cys - Gly - carboxy

30

Name: [redacted]

3. Please explain in detail what key feature of attenuation in the *trp* operon limits this mechanism to prokaryotes, and why? A drawing may be helpful to supplement your answer, but you may be able to stick to words alone—use your best judgment. (15 pts.)

In attenuation translation is controlling/regulating transcription so the 2 processes need to be simultaneous. This limits attenuation to prokaryotes because in Eukaryotes transcription + translation are not simultaneous and occur in 2 different areas of the ~~cell~~ cell. In trp attenuation the presence of a large amount of trp means there are many + tRNAs "charged" with trp. Two codons in the leader sequence of the trp ~~operon~~ code for trp. If trp is abundant, tRNA's charged with trp are quickly added (translation) this allows for the formation of 3+4 hairpin structure which is next to a poly U region of the mRNA causing transcription (+ translation) to stop. When trp ↓ 2+3 form a hairpin because there is less tRNA charged w/ trp and the ribosome stalls. This hairpin is further from the poly U sequence and therefore transcription continues. (and translation)

nice

15