DIRECTIONS: Read each question carefully at the beginning of the exam period. Ask for help if the question is unclear. The number in parentheses by each question is the points for that question. Enough space is given for each question for a complete answer. Partial credit is given for partial answers. Please fill in your name and student ID on the front page and your name on every other page!

1. (20) Short Answer. Answer each of the following questions in the space provided.

a) Give a one sentence description of each level of protein structure.
   
   i) Primary  **Amino Acid Sequence**
   
   ii) Secondary  **First level folding, e.g., \( \beta \)-sheets or \( \alpha \)-helices**
   
   iii) Tertiary  **Three-dimensional folding w/ conformation**
   
   iv) Quaternary  **Interaction & bonding with other proteins**

b) Why is attenuation only found in bacteria?
   
   *For attenuation to work, transcription & translation must occur simultaneously, which only happens in bacteria.*

   

c) If an organism lack the gene for a rho factor, how would that effect transcription?
   
   *Those operons where the termination is rho-dependent will not terminate.*

   

d) What is the function of splicesomes, as discussed in class?
   
   *Splicing out introns during RNA processing.*

   

e) Describe the difference between a repressible and an inducible regulatory system.
   
   *When the trigger molecule has a high concentration, a repressible system is turned off & an inducible system is turned on.*

   

Video Extra Credit: Three topics were discussed at the end of the video. What was one of them?
2. (6) The following is the entire mRNA transcript for a Eukaryotic gene. Give the protein as translated from this mRNA.

\[ 5' \text{ AGGACGG|AUGCCG|AUGUGG|UAGGUG|AAA|AAA|A3'} \]

\[ \text{N Met Pro Met Trp C} \]

Label the N-Terminus and C-Terminus

3. (5) Here is a codon from some gene in a Prokaryote.

\[ 5' \text{ ACU} 3' \]

Give all the possible tRNAs that could pair with this during translation (there are more spaces given than needed).

\[ 3' \text{ UGA 5'} 3' \text{ UGC 5'} 3' \text{ UGT 5'} 3' \]

4. (4) This helix is (Circle ONE) Right Handed  Left Handed

5. (10) Attenuation for His operon (Fill in the blanks, be specific)

The his operon contains ten cistrons which are transcribed and translated into proteins that create histidine. In addition to these cistrons is a 5' region used for attenuation, called the \underline{leader} region. As transcription starts, Regions 1 and 2 are transcribed. Translation starts at Region \underline{1}. If the concentration of his is \underline{low}, then translation will stall, due to several adjacent \underline{his cistrons} in that Region. Since translation is stalled, this will allow the pairing of Regions \underline{2} and \underline{3}, and transcription continues into the his genes. If the concentration of his is \underline{high}, then translation will go quickly, which allows pairing of Regions \underline{3} and \underline{4}. This pairing is a \underline{termination hairpin} and terminates transcription.
6. (6) This diagram shows a transcription bubble.

[Diagram of DNA with RNA strand]

a) Label all the 5' and 3' ends (6 total).
b) Identify the three strands given as RNA or DNA.

7. (7) This is a diagram from your Course Packet concerning a typical Eukaryotic gene.

[Diagram of gene structure with labeled regions]

Answer the following questions by giving the name of the region specified by the letter given.

- TATA Box: C
- CAAT Box: B
- Exon: G
- Intron: H
- Transcript: F
8. (10) The following is a list of scientists (and teams of scientists) who did important early experiment in molecular genetics.

1. Avery, MacLeod, and McCarty
2. Chargaff
3. Franklin
4. Griffith
5. Hershey and Chase
6. Meselson and Stahl
7. Watson and Crick

Fill in the number of the scientist (or team) that is BEST described by the statement given. Each number may be used at most one time (and only one answer for each statement).

2. Did a large quantitative analysis of DNA from several organisms.
3. Discovered major and minor grooves.
4. Discovered the cause of the transforming principle.
5. Used radioactive Phosphorus and Sulfur.
6. Used Heavy Nitrogen.

9. (10) All of the following questions have to do with Initiation of one steps of the Central Dogma.

1. Ori
2. cis-element
3. ^Met tRNA
4. Ligase
5. ^Met Init tRNA
6. Primase
7. Rho Factor
8. Shine-Dalgarno
9. Sigma Factor
10. Start Codon
11. UGA

Fill in the number of the answer that is BEST described by the statement given. Each number may be used at most one time (and only one answer for each statement).

6. Enzyme that helps initiate each Okazaki Fragment.
5. Part of the Translation Initiation Complex in Eukaryotes, but not on the mRNA
2. Sequence on DNA that identifies when to transcribe the gene (Eukaryotes)
1. Signal to initiate replication in Prokaryotes
8. Upstream signal to initiate translation in Prokaryotes

10. (4) Circle the sequence that is the most likely a transcription termination sequence.

a) 5’CCCAGAGAUGCCAGAGAUGAAAAAAAAAA3’
b) 5’CCCAGAGAUGCCAGGAUGGUUUUUUUU3’
c) 5’AGCAGCCAGAUCUGGCUGCUUUUUUUU3’
d) 5’AGCAGCCAGAUCUGGCUGCAAAAAAAAA3’
11. (18) The following are some diagrams describing possible modes of Prokaryotic Regulation. Although the components are not labeled, it should be clear which is which.

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<th>Low Concentrations of Trigger</th>
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i) b c d  Circle the letter(s) for ALL those that represent an inducible system

ii) Answer the questions. Choose the best system that is described by each sentence. As system can be used more than one time, and you need not choose each system.

- Which of these regulation systems is positive control where the genes are produced when the trigger is present in low concentrations.
- Which of these regulation systems is negative control where the genes are produced when the trigger is present in high concentrations.
- Which system could be used to help initiate transcription when there is a lot of some trigger molecule.
- Which shows the classic Tryp Operon?

**Coding Dictionary**

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