

Name:

Subjects: Molecular Biology

Time: 60 min

Date: Apr. 5th, 2024

Grade:

Q1/ Fill in the blanks with the suitable word(s). (20 M)

1. The first and most effective step for regulating gene expression occurs at _____.
2. The formation of a _____ hairpin loop signals RNA polymerase to pause in the trp operon.
3. Riboswitches can be described as _____.
4. Any transcription factor has two structural components: a _____ and a _____ site.
5. Blocking of translation initiation in an unfertilized egg could be done by _____.
6. In order to cause a frameshift mutation, _____ must occur.
7. A base substitution mutation where the triplet codon changes to code for a different amino acid is called _____, and the effect it produces could be described as _____ (none, serious, or variable).
8. An example of a chromatin remodeling system is _____, which plays a role in the regulation of gene expression via chromatin remodeling.

Q2/ Give the reason(s) for the following statements. (10 M)

1. Regulation of gene expression is essential for cellular differentiation and response to environmental changes.
2. Transcription factors can regulate gene expression even if the gene is located thousands of nucleotides away from the transcription factor's gene or location due to DNA looping.

Q3/ Practical Problem Solving. (14 M)

1. Isolating Specific mRNA: Describe a method to isolate a specific mRNA from a mixture of total cellular RNA.
2. CRISPR-Cas9 Point Mutation: Explain how CRISPR-Cas9 can be used to introduce a point mutation in a gene of interest.
3. Gene Cloning: Outline the steps required to clone a gene using PCR and a bacterial plasmid vector.
4. Gene Expression Measurement: Describe a technique to measure the expression levels of a specific gene in different tissue samples.

Q4/ Indicate True or False, then CORRECT the false statements if there are any. (14 M)

1. TrpR is the repressor protein in the tryptophan operon.
2. The two tryptophan codons in the trp operon are located directly after the leader region.
3. When eukaryotic cells aren't dividing, chromosomes exist in a condensed state called chromatin.
4. Mutation in non-reproductive cells will not be transmitted to the next progeny.
5. Allolactose is the repressor molecule in the lactose operon system.
6. In all organisms, the lifespan of their mRNAs is the same.
7. Chemical modifications for newly synthesized proteins in terms of gene regulation can also determine where a protein is found in the cell.

Q5/ Experimental Design. (6 M)

Explain how you would design an experiment to determine the effect of glucose levels on the activity of the lac operon. Include controls and expected outcomes.

BEST LUCK

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