Devaj Rathore 2023190

Time: 1 hour | GMB Quiz Number: 3 | 10 marks each question |

Attempt any 5 questions

1) Name different types of RNA found in cells, and what are their specific locations and functions within the cellular context?

2) Write the components of transcription unit. Give a brief overview of mechanism of transcription alongwith well labelled diagram. Also mention the mechanism of action of α-amanitin on in inhibition of transcription.

3) A biologist is studying a gene involved in cell cycle regulation, called GeneX. To investigate the regulation of GeneX, he used CRISPR-Cas9 technology to delete the promoter region of GeneX in a cultured human cell line. After verifying that the promoter deletion was successful, they monitored the cells to observe any changes in GeneX expression levels, as well as any downstream effects on cell cycle progression. Explain why deleting the promoter region of GeneX would impact the transcription rate. Would you expect GeneX transcription to increase, decrease, or cease entirely?

4) A hospital lab is studying a bacterial population with temperate phage infections. They notice that the OD readings for Culture C remain stable over time, but some of the bacteria begin showing antibiotic resistance even though antibiotics were not used in the culture. Upon introducing a stressor, mitomycin C, the researchers observe a rapid decline in OD.

a) What does the stable OD over time suggest about the initial phage infection cycle in Culture C?
b) Explain how the decline in OD following mitomycin C treatment relates to the phage infection cycle.
c) How might antibiotic resistance spread through the bacterial population due to phage infection, even without direct antibiotic exposure?

5) A geneticist isolates two bacteriophage r mutants (r_{13} and r_2) that cause rapid lysis.he carried out the following crosses and counts the number of plaques listed below:
Calculate the recombination frequencies between (r_2 and h) and between (r_{13} and h).

Genotype of parental phage	Progeny	Number of plaques
$h^+ r_{13}^- \times h^- r_{13}^+$	$h^+ r_{13}^-$	1
	$h^- r_{13}^+$	105
	$h^+ r_{13}^-$	110
	$h^- r_{13}^-$	2
Total		216
$h^+ r_2^- \times h^- r_2^+$	$h^+ r_2^-$	6
	$h^- r_2^-$	86
	$h^+ r_2^+$	81
	$h^- r_2^+$	7
Total		180

6) You are studying two strains of bacteriophages, Phage A and Phage B, which both exhibit a mutation that prevents them from lysing a specific bacterial host. You decide to perform a complementation test to determine whether the mutations in these phages are in the same gene or in different genes.

a) Describe the steps you would take to perform the complementation test with these bacteriophages.
b) What results would you expect if the mutations are in different genes?
c) If the mutations are found to be in the same gene, what implications would this have for the understanding of the genetic basis of the phage's ability to lyse the host?