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Q.P. Code: 0053301

SYBSc. Biotechnology Semester III Examination

Biotechnology: MOLECULAR BIOLOGY

Total Marks: 75

1. Attempt all questions.
2. All questions carry equal marks.
3. Draw neat labelled diagrams wherever necessary.
4. Use of log tables and non-programmable calculator is allowed.

Q 1	Do as directed (Any fifteen)	15
1.	Define enhancer elements. Enhancer elements are sequences usually present at a large distances from the gene and enhance transcription.	
2.	State the significance of TATA box. TATA box is required for initiation to start at the initiation point.	
3.	State true or false: Sigma factor is required throughout the transcription in prokaryotes. False	
4.	What are spliceosomes? Spliceosomes are structures in which splicing event occurs and are made up of pre-mRNA and snRNPs.	
5.	State function of RNA polymerase II. Synthesis of mRNA and some snRNAs	
6.	What does CPSF stand for? Cleavage and Polyadenylation Specificity Factor.	
7.	What are introns? Intervening sequences present in between amino acid coding sequences i.e. exons.	
8.	_____ is an enzyme which adds formyl group to methionine during initiation of translation in bacteria.	

	Transformylase.	
9.	Give the significance of A-site in translation process. A-site is the first binding site for Amino acyl-tRNA (charged tRNA).	
10.	Ubiquitin tags protein to target it for degradation. (State true or false). True	
11.	What are sense codons? Only 61 of the 64 codons specify amino acids; these codons are called sense codons	
12.	The m-RNA ribosome binding site region in bacteria is commonly known as the _____ sequence. : Shine Dalgarno	
13.	Each m-RNA codon that specifies an amino acid in a polypeptide chain consists of _____ nucleotides. : three	
14.	During protein sorting, once the signal sequence is fully into the cisternal space of the endoplasmic reticulum, it is removed from the polypeptide by the enzyme _____ : Signal peptidases	
15.	All of the genes involved in functioning of the lac operon are inducible. (State True or False) False	
16.	Define : Catabolite repression Preferential utilization of glucose over lactose by organisms, when both are present in the medium.	
17.	The <i>cro</i> protein and λ repressor proteins bind to the same sites within OR. (True or False) True	
18.	Anthranilate synthetase component I is coded by _____ gene. Trp E	
19.	_____ is a phenomenon whereby a gene is transcriptionally silent due to its location and not because of the action of a specific repressor. Telomere position effect	
20.	Define miRNA.	

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	A microRNA is a small non-coding RNA molecule found in plants, animals and some viruses, that functions in RNA silencing and post-transcriptional regulation of gene expression	
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Q 2 A	<p>Explain initiation of transcription in prokaryotes.</p> <p>Promoters and role of consensus sequences in transcription (1M)</p> <p>Role of RNA polymerase (2M)</p> <p>Explanation of the process of transcription (3M)</p> <p>Labelled diagram (2M)</p>	08
Q 2 B	<p>What is 5' capping? Explain.</p> <p>Explanation of what is 5' capping (1M)</p> <p>Explanation of capping as a post transcriptional event (1M)</p> <p>Role of capping enzyme. (2M)</p> <p>Process of capping (3M)</p>	07
OR		
Q 2 C	<p>Explain termination of transcription in eukaryotes.</p> <p>Proteins involved in termination and their roles</p> <ol style="list-style-type: none"> 1. CPSF (1M) 2. CstF (1M) 3. CF I and CF II (1M) <p>Explanation of each step (3M)</p> <p>Labelled diagram (2M)</p>	08
Q 2 D	<p>Explain Rho independent termination of transcription.</p> <p>What is Rho-independent termination (1M)</p> <p>Description of two fold symmetry followed by 'A's (2M)</p> <p>Formation of Hairpin loop and 'U' String (2M)</p> <p>Termination leading to separation of RNA (1M)</p> <p>Diagram of hairpin loop showing termination (1M)</p>	07
Q 3 A	<p>State the steps involved in elongation phase of translation. Explain <u>any two steps</u> in detail.</p> <p>Name of 3 steps in elongation phase (1Mark)</p> <p>Explanation of Any 2 steps (3.5 X 2 = 7Marks)</p> <p>Sequential events in each step with names and significance of elongation factors involved (in prokaryotes and eukaryotes) and GTP. Location of ribosome and tRNA's on mRNA (A/P/E sites). Key enzymes involved in each step.</p>	08

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Q 3 B	Draw the structure of t-RNA. Explain the role of t-RNA in translation. Labelled diagram of tRNA (2.5Marks) Structure of tRNA. (1Marks) Significance of arms, stem loop structure, anticodon, 5'-CCA-3' at the 3' ends. Modified bases. (2Marks) Role and aminoacylation (1.5marks)	07
OR		
Q 3 C	Explain the translocation of proteins into endoplasmic reticulum in eukaryotes with the help of a suitable diagram. Diagram: (3 Marks) Steps involved including - Significance of signal sequence of a protein, SRP, Polypeptide-SRP-ribosome-mRNA complex (2Marks) Significance of SRP binding to an SRP receptor .(2Marks) Reaction catalysed by signal peptidase. (1Mark)	08
Q 3 D	List <u>any four</u> characteristics of genetic code. Explain wobble's hypothesis with an example. List of any 4 characteristics of genetic code (2Marks) Wobble occurs in the anticodon. (0.5Marks) Wobble hypothesis explanation. (2.5Marks) Pairing of nucleotide at 5' end of anticodon and nucleotide at 3' end of codon. (1Mark) Example (1Mark)	07
Q 4 A	Elaborate on the molecular model for attenuation of the trp operon. Introduction about Trp Operon.- 1M Molecular model of attenuation : Organization of region.(Explain with suitable diagram)- 3M Tryptophan staved : Anti termination 4M Non Starved termination .(Explain with suitable diagram)(1M)	08
Q 4 B	Write a note on mutants of lac operon. Operator mutants -2 M Promoter mutants-2M	07

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	Lac I mutants- 3M Suitable diagrams	
	OR	
Q 4 C	Give an account of positive regulation of lac operon. Introduction Lac operon -1 M CAP and c AMP complex-2 M Catabolic repression: Using adenyl cyclase activity-4M Suitable diagram - 1M	08
Q 4 D	Discuss regulation of transcription initiation by activators and repressors. Regulation of Transcription Initiation by Activators- 2M Two classes- GTFs and activators- helix-turn-helix (HTH), zinc finger, and leucine zipper, co-activators Inhibiting Transcription Initiation by Repressors - 1M Repressors, co repressors Case Study: Transcription of the Yeast Galactose Utilization Genes- 4M Suitable diagram	07
Q 5	Write Short notes on any three of the following	15
a	Gene silencing Gene Silencing at a Telomere- 2M Gene Silencing by DNA Methylation- 3M Suitable diagram	
b	Genetic switch in lambda phage Phage λ : Choice of use of either lysogenic pathway or lytic- 1M Suitable Diagram : - 2M Summary- 2M The decision depends on competition between the repressor and the Cro protein	

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	If the repressor dominates, lysogeny takes place. If the Cro protein dominates, the lytic pathway occurs.	
c	Degeneracy of Genetic code. What is degeneracy (3 Marks) Example (2 Marks)	
d	Amino-acylation of t-RNA. Definition of Amino-acylation. (1 Mark) Significance and reaction catalysed by aminoacyl-tRNA synthetase. And step involved. (4 Marks)	
e	RNA editing Place of editing (1M) General phenomenon (1M) Different types- insertion or deletion , deamination (2M)	

Please refer i-Genetics by Peter J Russell, 3rd Ed
