

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.Tech.
Year : III

Course : BIOT 302
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

01 AUG 2024

SECTION "A"

[20 Q. × 1 = 20 marks]

Choose and encircle in the most appropriate option from each set of choices

1. Which of the following is **NOT** a commonality between CSSR and transposition
 - a. In both cases recombinases recognize DNA to be recombined
 - b. In both cases synaptic complexes are formed
 - c. In both cases donor DNA and recipient sequences are specific
 - d. In both cases recombination is tightly controlled so that unwanted recombination does not take place
2. Rag1 recombinase
 - a. Can function without Rag2 to carry out VDJ recombination
 - b. Has no sequence similarity to DDE transposase superfamily
 - c. Requires another transposase to cleave untransferred strand
 - d. Possibly evolved from Transib family of transposons
3. What about -10 and -35 promoter sequence is **TRUE**
 - a. These are consensus sequences meaning there can be some variability from promoter to promoter
 - b. All the E. coli gene promoters possess these sites
 - c. These sites bind to RNA polymerase directly
 - d. Gene regulation is not dependent on these sites
4. What does transient excursion, inchworming and scrunching represent
 - a. These are ways in which RNA polymerase in E coli moves
 - b. These are mechanisms in which abortive transcription possibly takes place
 - c. These describe the relative position of RNA polymerase and DNA during initiation
 - d. These describe the structure of RNA polymerase that carries out transcription
5. In the two step splicing reaction
 - a. Energy is overall neither produced nor required
 - b. 3'OH of branch point A attacks the phosphodiester bond in the first step
 - c. 2'OH of terminal guanosine attacks the phosphodiester bond in the second step
 - d. Lariat or Y shaped structure is formed normally in exon intron boundary in 1 chromosome
6. To **CORRECT** Spinal Muscular Atrophy which of the following mechanisms was used
 - a. Oligonucleotide was used to inhibit inhibitor of SMN2 splicing
 - b. Small molecule was used to promote SMN1 exon 7 splicing
 - c. Protein was used to inhibit exon 7 splicing of SMN2
 - d. Antibody was used to correct exon 7 splicing error of SMN1

7. Which of the following is **NOT** a valid RNA-RNA hybrid in spliceosome
 - a. U1 RNA binding to the 5' splice site
 - b. U2 RNA binding to the U6 RNA
 - c. U2 RNA binding to the branch site
 - d. BBP RNA binding to the branch site

8. Which of the following is **NOT TRUE**:
 - a. Attachment of amino acid to tRNA is called charging
 - b. Attachment of amino acid to tRNA results in the formation of an acyl bond
 - c. Acyl bond formed between tRNA and amino acid releases energy during formation
 - d. tRNA amino acid bonding is carried out by tRNA synthetase

9. What about adding formyl methionine as the first amino acid is **TRUE**?
 - a. It takes place in both prokaryotes and eukaryotes
 - b. An enzyme called deformylase removes formyl group in prokaryotes
 - c. The initiator tRNA that binds to formyl methionine is special in eukaryotes
 - d. Formyl group is basically a carboxylic acid group

10. Release factor
 - a. Class I are of two types in eukaryotes
 - b. Class I cleave polypeptide from P site tRNA
 - c. Class II mimic a tRNA
 - d. Class II have a GGQ motif

11. What is the advantage of ribosome profiling over polysome profiling
 - a. Actively translated mRNA can be discovered
 - b. The exact site that occupy P and A sites in the ribosome can be identified
 - c. Cycloheximide treatment is less aggressive
 - d. Sequencing gives the exact mRNA that is translated

12. Suppose a gene is frame shift mutated in the middle. This causes premature stop codon and terminates the production of the gene little bit beyond the midway. What is a good suppressor of this mutation?
 - a. Another frame shift downstream
 - b. Substitution of the stop codon to another codon
 - c. Substitution mutations upstream of the frame shift
 - d. tRNA suppressor mutations

13. What is the function of the product of lacA gene
 - a. Degradation of lactose to glucose and galactose
 - b. Transport of lactose into cells that will eventually utilize it
 - c. Getting rid of thiogalactosides that inadvertently get transported
 - d. Conversion of lactose to allolactose which acts as an inducer

14. Which of the following is **NOT** true?
 - a. NtrC works in nitrogen fixation pathway.
 - b. NtrC has separate DNA binding and activating domains.
 - c. NtrC mechanism involves action at a distance
 - d. NtrC activation involves allostery

15. What is true about Cro, CI, CII and CIII
 - a. CIII is transcribed from PR promoter.
 - b. CI is transcribed from PRE and PRM promoters.
 - c. Cro is transcribed from PL promoter.
 - d. CII acts as a transcriptional repressor of PRE promoter.

16. Lactose tolerance has developed in certain populations of humans. That means certain humans can digest lactose using lactase enzyme late into adulthood. In most mammals lactase enzyme is not expressed except for early childhood when the animal is drinking mother's milk. What mutation could most likely lead to development of lactose tolerance in certain human populations?
 - a. Nonsense mutation in the coding sequence of the lactase gene
 - b. Missense mutation in the coding sequence of the lactase gene
 - c. Mutation in the enhancer of lactase gene
 - d. Mutation in the region encoding for mediators of transcription

17. Which of the following is **NOT** an example of epigenetic control?
 - a. The Dutch survivor victims of starvation produced affected offsprings
 - b. Lac repressor level maintenance after *E. coli* divides
 - c. Inheritance of height from parents to offsprings
 - d. Genomic imprinting

18. Which of the following RNA acts in cis?
 - a. sRNA in bacteria that triggers destruction of mRNA
 - b. miRNA in eukaryotes that regulate several gene products
 - c. HOTAIR lncRNA that regulates HoxD gene cluster
 - d. siRNA that regulate destruction of mRNA through slicer activity

19. Which of the following is **TRUE**?
 - a. Fusion yeast has very robust RNAi machinery
 - b. Histones within heterochromatin carry high levels of acetylation and low levels of methylation on lysine 9 of H3 tail.
 - c. siRNA in centromere acts directly on DNA to cause silencing
 - d. Transcription regulation by miRNA is most studied in fission yeast

20. Which of the following is exclusively a synthetic circuit
 - a. Positive feed forward loop
 - b. Bistable switch
 - c. Negative feed forward loop
 - d. Repressillator

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Indicate by checking (✓) of each question you have answered in the cover page of main answer book.

SECTION "B"

[5 Q. × 3 = 15 marks]

Attempt *ANY FIVE* questions.

1. Describe the mechanism of PolyA retrotransposon movement. [3]
2. Write a short note on mediators of transcription. [3]
3. How is GCN4 regulated at the level of translation? [3]
4. How does transcriptional antitermination work in lamda development? [3]
5. What is locus control region? What does it regulate? [3]
6. More regulators and more extensive regulations are found in eukaryotes than prokaryotes. How? [3]
7. Describe RNAi as defense mechanism that protects against transposons. [3]

SECTION "C"

[5 Q. × 5 = 25 marks]

Attempt *ANY FIVE* questions.

8. With structure describe how mRNA cap is added at the 5' end. [5]
9. Describe intron exon boundary for splicing. What are Group I introns? [2.5+2.5]
10. Describe the ribosome recycle factors. Describe the function of EF-G. [5]
11. What is wobble in the anticodon? What was tRNA binding to defined codons used to solve? Describe. [2.5+2.5]
12. How do lamda repressor and cro bind to OR1, 2 and 3? How does that regulate choice between lysis and lysogeny? [5]
13. Describe how CRISPR confer immunity in lower organisms. [5]
14. What are feed forward loops? Describe. [5]

P.T.O.

SECTION "D"

[2 Q. × 2.5 = 15 marks]

Attempt *ANY TWO* questions.

15. Describe the tyrosine recombinase. Draw and describe the genomic organization of the three classes of transposons? Describe LINE element. [2.5+2.5+2.5]
16. Describe alternative splicing of SV40 T antigen. How does mutually exclusive splicing of Dscam work. [2.5+5]
17. Describe, compare and contrast bacterial translation initiation from eukaryotic translation initiation with figures. [7.5]