KATHMANDU UNIVERSITY
End Semester Examination
August/September 2017

Mark Scored :

Level : B. Tech.
Year : II

Course : BIOT 206
Semester : II

Exam. Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date SEP 10 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

1. The pitch of Z-helix is:
   a. 3.4 nm b. 4.5 nm c. 5.2 nm d. 3.2 nm

2. The salt concentration should be high enough during renaturation of DNA because:
   a. It disrupts the intrastrand H-bonds present in ssDNA.
   b. It protects the DNA from chemical attacks.
   c. It eliminates the repulsion in the phosphate backbone.
   d. It decreases the repulsion of the bases in DNA.

3. The DNA, that are able to move from one location to another in a chromosome is called:
   a. Satellite DNA b. Jumping genes
   c. Transposable elements d. Repetitive elements

4. During DNA replication, daughter strand synthesis occurs in 5' → 3' direction only because:
   a. The primer is always synthesized in 5' → 3' direction
   b. DNA polymerase moves in 3' → 5'
   c. In the 3' end there is an OH group that makes bond with α phsophate of incoming dNTPs
   d. Helicase always unwinds in 5' → 3' direction

5. The amino acids, responsible for the discrimination of dNTPs and rNTPs during DNA replication are:
   a. Tyrosine and Glycine b. Glutamine and Tyrosine
   c. Histidine and Tyrosine d. Lysine and Arginine

6. Bacterial DNA replication is coordinated with cell division by:
   I. The newly synthesized strands that are bound by DnaA proteins, which signals polymerase not to act on them.
   II. Adenine residues in the daughter strands are not methylated which signals polymerase that the unmethylated strands are the newly synthesized strands.
   III. Adenine residues in the daughter strands are methylated as soon as are formed signaling polymerase not to act on them.
   IV. After DNA replication, DnaA proteins are in insufficient amount and cannot bind to DnaA boxes
   a. I and II b. II and III c. II and IV d. III and IV

7. The main function of 16S rRNA in the ribosome is to:
   a. Catalyze the peptide bond formation in the P site.
   b. Catalyze the synthesis of aminoacyltRNA
   c. Recognize the Shine-Dalgarno sequence in the mRNA and base pair with it
   d. Catalyze the transformation of methionine to formyl-methionine and scans the start codon

8. In Uvr excision repair mechanism, which of the given order is correct?
   I. $(UvrA)_2UvrB$ recognizes the damaged site and $(UvrA)_2$ dissociates.
   II. UvrB phosphorylates UvrC and UvrD
   III. UvrC binds with UvrB and UvrBC nicks both 5' and 3' to the damaged site
   IV. DNA pol fills the gap and DNA ligase seals the nicks
   V. UvrD unwinds and excise the DNA fragment
   a. I, II, III, IV and V b. I, III, V and IV
   c. I, II, IV and V d. II, I, III, IV and V

9. In restriction modification system of the mismatch-repair, the following statements are true:
   I. Viral DNA is unmethylated, as a result of which it cannot attack the host DNA
   II. This prevents infection by effectively destroying the foreign DNA introduced by phage
   III. Restriction endonuclease cleaves the foreign DNA and not its own DNA.
   IV. This is primarily done by methylating the host DNA, which discriminates between host and foreign DNA
   a. I, II, III and IV b.I, II and IV c. I, III and IV d. II, III and IV

10. Arrange the followings according to the methyl directed mismatch repair system:
   I. MutS recognizes the mismatches, holds the DNA and bends it to make a curve
   II. MutH is recruited to MutS and MutL is then recruited
   III. MutL is recruited, which in-turn recruits MutH
   IV. MutL makes nick on single strand in DNA
   V. MutH makes nick on single strand in DNA
   VI. UvrD and Polymerase III are recruited that unwinds and fill in the gap which is later sealed by DNA ligase.
   a. I, II, IV and VI b. I, III, V and VI c. I, II, V and VI d. I, III, IV and VI

11. Thymine dimers are often corrected by light induced repair mechanism. The enzyme involved is:
   a. Photolyase b. Photoligase c. DNA glycosylase d. All of the above

12. Which of the following statements are true about the RecBCD pathway?
   a. RecBCD is loaded on one end of DNA and unwinds it in 3' to 5', which is then cleaved by its 3' to 5' nuclease activity leaving other strand intact
   b. Binding of RecA protein depends upon on RecBC until it has encountered χ sites, upon which the 3' to 5' endonuclease activity is stopped and 5' to 3' activity stimulated
   c. The endonuclease activity is shown by RecB of the RecBCD complex.
   d. All of them are true

13. Ectopic recombination or homeologous recombination is:
    a. Recombination between different regions in chromosomes
    b. Recombination between different sites in same chromosome
    c. The recombination, which cells explicitly cannot bypass and as a result, cell-death occurs
    d. Recombination, via which cell produces abnormal phenotypes.

14. In the function of the *lac* operon in *E. coli*, the *lac* genes are transcribed in the presence of lactose because:
    a. RNA polymerase binds to the operator
    b. The repressor cannot bind to the promoter
    c. An isomer of lactose binds to the repressor
    c. CAP does not bind to the operator

15. The mutations that changes the repressor, such that it cannot bind to the inducer in Lac operon is known as:
    a. *lacp* mutation b. *lacO*^{c} mutation c. *lacI*^{s} mutation d. *lacI*$^{-d}$ mutation

16. In Gal operon,
    a. Two repressors act synergistically binding to palindromic sequence on same side (parallel) of helix thus repressing transcription.
    b. Only one repressor bind to the operator repressing transcription.
    c. Two repressor bind to opposite sides of helix on the palindromic operator sequence, which will repress transcription.
    d. Gal operon is transcribed by activators; they are not repressed.

17. When tryptophan is present in the medium, the transcription of tryptophan producing genes in *E. coli* is stopped by a HTH regulator binding to the:
    a. *trp* repressor b. *trp* operon c. *trp* operator d. *trp* promoter

18. In two color microarray analysis:
    a. The intensity data is recorded and analyzed
    b. The ratio data is recorded and analyzed
    c. Both ratio and intensity data are recorded and analyzed
    d. The gene expression can be seen without intensity or ratio data.

19. In heat shock regulation, the sigma 32 and Dnak complex under unstressed condition:
    a. Is cleaved by proteases like Hfq
    b. Is cleaved by proteases like FtsH
    c. Is inhibited by sigma 24 or sigma E
    d. Refolds the denatured and misfolded proteins.

20. *trpD* codes for:
    a. Tryptophan synthetase b. Chorismatecyclase
    c. Anthranilatesynthetase d. glycerolphosphatesynthetase

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SECTION "B"

Attempt *ALL* questions. Support your answers with **figures**, whenever appropriate.

1. Based on Nucleic Acids and Macromolecular interaction, answer the following questions:
   a. What is supercoiling? What induces positive and negative supercoils in bacteria? [2]
   b. What are the variations in the structure of DNA? How can you differentiate between right handed and left handed helix? [2]
   c. What is a core particle? [1]

2. Based on DNA replication, answer the following questions:
   a. How is DNA replicated in prokaryotes? Explain. [5]
   b. What are the functions of finger domain of DNA polymerase? [3]

3. On the basis of DNA mutation, answer the following questions:
   a. What is auxotrophic mutant? How is DNA repaired via nucleotide excision repair mechanism? Write an example. [1+4]
   b. The testes of warm-blooded animals are outside their body to avoid higher temperatures. Higher temperature causes deamination of DNA. What could be its consequence? [2]

4. Based on recombination, answer the following questions:
   a. What are the components involved in resolution of holiday junction? Explain each component's working mechanism. [2]
   b. How is Holliday junction resolved? [5]

5. Based on transcription and translation, answer the following questions:
   a. What are promoter escape and abortive initiation? [2]
   b. How does protein synthesis occurs in prokaryotes? [5]

6. Based on Regulation of gene expression, answer the following questions:
   a. What are constitutive mutants? Define them in context of positively and negatively regulated operons. If they are to be complemented via a F' factor or extra DNA element, what kind of phenotypes will you observe? [3]
   b. Describe gene regulation in *gal* operon. [5]
   c. Exemplify quorum sensing. [5]
   d. How are toxin genes regulated in diphtheria? [5]
   e. How does the A-B toxin show its effect in case of diphtheria and whooping cough? [2]
   f. What is one color microarray? [1]