

Maulana Azad College  
DSCC 10 Microbial Genetics  
Semester V

**Unit wise model questions**

**Unit 1**

**Answer the following questions in one to two words (1 mark each)**

1. What type of association is mediated by Histone and DNA?
2. What is the difference between mutation rate and mutation frequency?
3. What is the overall rate at which new mutations arise spontaneously at any given site on the chromosome per round of replication?
4. What do alkylating agents do?
5. By which process miss-incorporated base can change into a permanent mutation?
6. Give example of ionising radiation.
7. In mutational event what happens if Adenine is replaced by Guanine?
8. What kind of mutation causes sickle-cell anemia?
9. Which mutation has the most significant effect on protein synthesis?
10. What % of SINES occur in the human genome?
11. What is the size of Yeast genome?
12. How many chromosomes *Saccharomyces* have?
13. What is the genome size of *Tetrahymena thermophila*
14. Why Histones are positively charged proteins?
15. What is a mutation?
16. How many times DNA wrap around the Histone octamer?
17. Write the name of the disease that is caused by the tandem DNA repeats in the human chromosome.
18. What is the difference between genotype and phenotype?
19. In which region of the chromosome satellite DNA is present.

**Answer the following short questions (2 marks each)**

1. What is the result of mutation occurring in a suppressor gene?
2. What is reversion mutation?
3. What are the 4 types of mutations?
4. What are the different types of exons?
5. What is Nucleosome?
6. What is C-value paradox?
7. What features pseudo genes have?
8. What is yeast transposable element?
9. Why Nuclear Dimorphism is observed in the genome of *Tetrahymena*?

10. Define mutation rate and mutation frequency?
11. How many types of histone molecules are found in nature?
12. How many contacts are observed between the DNA and the histone core protein?  
Explain
13. What is the difference between a missense mutation and a nonsense mutation?
14. Why are mutations so important to living organisms?
15. State the difference between Chromosome and Chromatin
16. What is the solenoid structure of chromatin?
17. State the different types of chromatin
18. What are LINES and SINES?

**Answer the following broad questions (more than 2 marks)**

1. How does a mutation in an upstream gene alter the expression of a downstream gene? What cellular processes are disrupted? What is base analogue? The sequence of a nucleotide in an mRNA is 5'- AUGACCCAUUGGUCUCGUUAG-3' Assuming that ribosome could translate this mRNA, how many amino acid would you expect the resulting polypeptide change to be? (2+1+1+1)
2. What is repetitive DNA? Draw the classification of various types of repetitive DNA. (1+3+1)
3. How many types of Lines are present in the human genome? Among them which one is active? Write the mechanism of LINES repeat jumps with diagram? (1+1+3)
4. Write short note on gene families along with its category. Name the multi-gene family present in yeast genome (3+1)

**Unit 2**

**Answer the following questions in one to two words (1 mark each)**

1. Define curing of plasmid.
2. Why does not F<sup>+</sup>X F<sup>+</sup>mating takes place?
3. How are F' factors formed?
4. How plasmid clones can be screened?
5. Which gene in the pUC18 vector confers antibiotic resistance to the transformed cells?
6. Which is the first engineered plasmid vector?
7. What are relaxed plasmids?
8. Which characteristics do F-plasmid confer to the host bacterium?
9. What do you mean by acridine curing?

**Answer the following short questions (2 marks each)**

1. Distinguish between stringent and relaxed plasmid.
2. What regulates the copy number of a plasmid in the cell?

3. What is fertility inhibition?
4. Describe F-factor and R-factor.
5. Of what use are F-prime factors in genetic analysis?
6. Define the term conjugative mobilizable and self-transmissible plasmid.
7. What mode of replication are used by plasmids for their reproduction and their transfer? Give a brief account of these two modes.
8. If a particular cell type rifampicin was used to inhibit DNA transfer what you conclude about the transfer mechanism?
9. Distinguish  $F^+$  and HFR transfer with respect to the amount of genetic material transferred and the intactness of the transferred unit.
10. Which of the following terms such as conjugative, mobilizable and self-transmissible can be used to describe and ColE1 plasmid?
11. What features of F not present in ColE1 enables F but not ColE1 to integrate into the host chromosome?
12. Most self-transmissible plasmid express a pilus only immediately after entering a cell and only intermittently thereafter, explain why?
13. Define plasmid incompatibility.
14. What are the causes of plasmid incompatibility?
15. How do Par protein function in Plasmid partitioning?
16. If a plasmid is mobilizable but not conjugative what function does it lack?
17. How do you determine the origin of plasmid replication experimentally?
18. Name 2 vital condition for artificial transformation.
19. What basic characteristics can make a plasmid mobilize?
20. Define segregative instability of plasmid.
21. Plasmid replication is dependent on host cell. Justify.
22. How does Hfr x F mating differ from a  $F^+ \times F^-$  mating?

**Answer the following broad questions (3 marks each)**

1. Describe the process of natural transformation with a specific example.
2. If two plasmids cannot be maintained in a single cell, what properties may be common in these plasmids?
3. Describe briefly the different processes of replication control in plasmid.

**Unit 3**

**Answer the following questions in one to two words (1 mark each)**

1. What is  $F^+$  strain?
2. What is  $F^-$  strain?
3. Define Hfr strain?
4. Define  $F'$  strain?
5. Define bacterial transformation
6. What are competence factors?

7. What is transformosome?
8. Define generalized transduction.
9. Define specialized transduction.
10. Define abortive transduction
11. What is low frequency transducing lysate?
12. What is high frequency transducing lysate?

**Answer the following short questions (2 marks each)**

1. Write the function of F pilus.
2. What is sexduction?
3. Write the role of relaxase in bacterial conjugation
4. Write the characteristics of Hfr strains
5. Compare between Hfr and F+
6. Write the role of competence factors in transformation process.
7. Write the significance of transformation in bacteria.
8. Differ between natural and artificial competence.
9. Describe the role of pseudopilus in transformation process.
10. Write the basic differences between generalized transduction and specialized transduction
11. What do you mean by co-transduction frequency?
12. Describe how co-transduction frequency could be used to map genetic markers.
13. Describe the biological significance of transduction
14. Explain how is co-transduction frequency calculated?

**Answer the following broad questions (3 marks each)**

1. Describe Davis U tube experiment
2. Describe the general structure of F plasmid
3. Describe the Mpf and Dtr components of tra genes
4. Describe the characteristics of F<sup>+</sup> x F<sup>-</sup>, F' x F<sup>-</sup> and Hfr x F<sup>-</sup> crosses
5. What do you mean by Interrupted mating experiment?
6. In E.coli four Hfr strains donate the following genetic markers in following order:  
Strain 1: MZXWC, Strain 2: LANCW, Strain 3: ALBRU, Strain 4: ZMURB. What is the order of these markers in circular chromosome of the original F<sup>+</sup>?
7. Schematically describe transformation process in gram-positive bacteria
8. Schematically describe transformation process in gram-negative bacteria
9. Describe the Lederberg-Zinder experiment for bacterial transduction
10. Schematically describe the process of specialized transduction
11. Schematically describe the process of generalized transduction

## Unit 4

### **Answer the following questions in one to two words (1 mark each)**

1. What will be the phenotype of a mutant CI phage?
2. Differentiate between the r<sup>+</sup> and rII phage plaques on the basis of their morphology in E. coli strain B.
3. Why is E coli strain B known as permissible host with respect to T4 R locus?
4. What are Hfl strains?
5. Why does lambda dgal always need a helper virus for infection?
6. What is a dilysozen?
7. How does a lambda phage associate with E. coli before pushing its genome inside?

### **Answer the following short questions (2 marks each)**

1. Explain the role/s of the transcript made from P<sub>RE</sub> during lambda lysogenic cycle?
2. Is there any single most important event which brings about switch of lambda from lysogenic to lytic mode on exposure to UV radiation?
3. Explain in brief the molecular basis of super infection immunity.
4. State the function of any one antiterminator involved in lytic progression lambda.
5. At high repressor concentration, both O<sub>L</sub> and O<sub>R</sub> are sequestered preventing transcription from either side. Explain with a diagram.
6. How is CII protein stabilized inside the host inspite of being susceptible to proteolytic cleavage?
7. Explain why T4 rII mutants are known as conditional mutants.  
What do you mean by a cistron? Explain with example

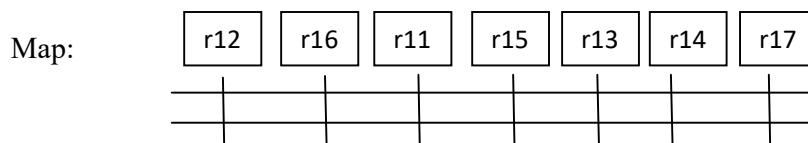
### **Answer the following broad questions (more than 2 marks)**

1. Co-operative binding of cII to O<sub>R</sub> is critical for maintenance of lambda in the lysogenic state. Explain. 3
2. Explain the role of cro in inhibition of repressor synthesis. 3
3. Categorically state the immediate early gene products and their functions in lambda life cycle. 3
4. Lambda repressor and cro have autoregulatory mechanisms. Explain 4
5. Construct a map from the following two factor phage cross data (show map distance)

Cross	Percentage recombination
r1 x r2	0.10
r1 x r3	0.05
r1 x r4	0.19
r2 x r3	0.15
r2 x r4	0.10
r3 x r4	0.23

6. E. coli strains K12 and B can be used to discriminate between T4 r<sup>+</sup> and rII mutants. Design experiments to distinguish between recombination and complementation analyses using these tools. 3
7. Given the following map with point mutants and data in the following table, draw a topological representation of deletion mutants r21, r22, r23, r24, r25 (Be sure to show the endpoint of deletions, + indicates r<sup>+</sup> recombinants are obtained, 0 indicates not obtained). 5

Deletion mutants	Point mutants						
	r11	r12	r13	r14	r15	r16	r17
r21	0	+	0	+	0	+	+
r22	+	+	0	0	+	+	0
r23	0	0	0	+	0	0	+
r24	+	+	0	0	+	+	+
r25	+	+	0	0	0	+	+



### Unit 5

**Answer the following questions in one to two words (1 mark each)**

1. What are cryptic transposons?
2. What do you mean by a co-integrate?
3. How can a co-integrate resolve in the absence of a functional transposase?
4. What is a superbug?
5. Name a transposon like element which uses reverse transcriptase,
6. Which transposable element is present in F factor?

7. What is a transposome?
8. What is a suicide vector?

**Answer the following short questions (2 marks each)**

1. What are Ac and Ds elements?
2. Explain the significance of G loop in a Mu phage.
3. Explain the phenomenon of hybrid dysgenesis in *Drosophila*.
4. How can you look for the presence of a transposon like element in a given sequence without doing any genetic experiment?
5. Mention one evolutionary consequence of transposition in the human genome
6. State true or false with explanation:
7. Recombination can lead to deletion but transposition does not.
8. What are integrons? Explain their significance in antibiotic resistance.
9. What is a “sleeping beauty” element?
10. How are transposition and recombination fundamentally different?
11. Explain with a diagram, how direct repeat is generated at the site of insertion of a transposition.

**Answer the following broad questions (more than 2 marks)**

1. Design an experiment to prove that a certain antibiotic resistance gene reside in a transposable element. 4
2. What do you mean by inside end and outside end transpositions? Explain the consequences involved in each case. (2+2)
3. How can you differentiate (through experiment) between a transposable element which transposes by a replicative mechanism from another one which moves by non replicative mechanism. 3
4. Citing the example of any typical transposon, explain how is transposition regulated in bacteria? 4
5. Explain clearly the advantages and disadvantages associated with *in vitro* transposon mediated mutagenesis. 4
6. Explain with sketches the genetic consequences mediated by transposons. 4