

Question Bank on Mechanisms of Genetic Exchange

TRANSFORMATION

Q1. Design an experiment to prove that the incoming DNA during bacterial transformation is in the single stranded form.

Q2. What are transformasomes? How do they influence the transformation efficiency in *H. influenzae* ?

Q3. Describe the process of natural transformation giving a specific example.

Q4. "Cell needs to synthesize a series of pheromones to complete the transformation event naturally"- state whether the statement is true or false and justify your answer.

Q5. What is spo0K gene?

Q6. How is merozygote formed?

Q7. What do you mean by transformation efficiency?

Q8. What do you mean by the term 'competence' in the process of transformation? Name two naturally competent bacterial genera.

Q9. What experimental result showed that transformation consists of permanent genetic change?

Q10. Why 'arg' gene was taken during the single stranded DNA uptake during transformation?

Q11. What is the chemical nature of the 'transforming principle' that had converted the live *Streptococcus pneumoniae* type R into type S?? How it was experimentally demonstrated?

Q12. Mention the roles of the following in artificial transformation - i) CaCl₂, ii) heat shock, iii) cold shock

Q13. How could you determine if an isolated bacterium is naturally competent?

Q14. Discuss why all kinds of bacteria cannot be used for transformation of DNA?

Q15. What would be the possible fates of a DNA after it entered in a bacterium?

Q16. A transformation experiment was carried out using donor DNA 'A+B+C+' and recipient 'A-B-C-'. 'A+' transformants were selected and tested further. It was found that 64% of them were 'B+' and none were 'C+'. When 'B+' transformants were selected, 8% of them were found to be 'C+'. What is the gene order? Give proper explanation.

Q17. A transformation experiment was carried out using donor DNA 'A+B+C+' and recipient 'A-B-C-'. 'A+' transformants were selected and tested further. Of these, 60% were 'B+', none were 'C+'. When 'B+' was selected, 10% were also 'C+'. What is the gene order? Give proper explanation.

Q18. A competent culture of *S. pneumoniae* is mixed with (¹⁴C)DNA having a radioactivity of 10⁴ counts per minute. After 5 minutes, the cells are centrifuged; no acid precipitable count can be found in the supernatant fluid. How much radioactivity do you expect to be associated with the cells? Justify.

TRANSDUCTION

Q1. How phage is involved in abortive transduction?

Q2. Differentiate between transformation & Transduction as mode of gene transfer.

Q3. What makes a transducing phage?

Q4. Design an experiment to determine that genetic exchange between two bacteria occurred through transduction, not by transformation.

Q5. What is the significance of complete transduction?

Q6. Generalized transduction could not be discovered if only lysogenic phage were present in nature - justify.

Q7. Differentiate between complete & abortive transduction.

Q8. Why can generalized transduction transfer any gene but specialized transduction is restricted to only a small set of genes?

Q9. A temperate bacteriophage has gene order ABCattDEF. What is the gene order in prophage?

Q10. Some temperate phages can integrate their DNA but do not seem to form specialized transducing particles- give reasons for this observation.

Q11. Briefly describe the difference between a low frequency transducing (LFT) lambda dgal lysate and a high frequency transducing (HFT) lambda dgal lysate of phage lambda. Indicate how the two types of transducing particles are obtained and the relative frequency of transducing particles in each lysate.

Q12. What is high frequency transducing lysates? Explain with diagrams the mechanism for this phenomenon.

Q13. Experimentally prove that generalized transducing particles contain only bacterial DNA?

Q14. Why are lambda specialized transducing particles generated only by induction rather than lytic infection?

Q15. Why does bacteriophage lambda produces transducing particles carrying only 'gal' or 'bio' genes?

Q16. How cotransduction frequency varies with the distance of genes?

Q17. What does "co-transduction frequency" mean? Write down the relation between co-transduction frequency and map distance.

Q18. What does the term co-transduction mean? How can co-transduction frequencies are used to map genetic markers.

Q19. Why generalized transduction can transfer a large set of gene while specialized transduction can only transfer a small set?

CONJUGATION

Q1. When F+ cell is mixed with F - cell, all F+ cells are generated, but when Hfr cells are mixed with F- cell, the latter remains F- cell - Justify.

Q2. How does an Hfr cell differ from F+ cell? Why does an Hfr cell rarely transfer its whole genome in conjugation experiments?

Q3. What are the roles of DNA synthesis in the donor and the recipient cells during conjugation?

Q4. Conjugation requires physical contact and pili formation - How can you prove it?

Q5. Define Hfr, F+, F- cells. In what condition does F+ cell turn into an Hfr cell?

Q6. Distinguish between F+ and Hfr transfer with respect to the amount of genetic material transferred and the intactness of transferred unit.

Q7. Do you think that conjugation is a pheromone mediated process?

Q8. Is there any difference between Gram positive and Gram negative cell's conjugation process?

Q9. What is the function of 'tra' gene products of F plasmid in conjugation? How does an Hfr cell transfer its DNA into a F- cell?

Q10. Design an experiment to determine the origin of replication of F plasmid.

Q11. Explain what is meant by interrupted mating technique. How is it useful to predict the order of the genes?

Q12. Discuss the mechanism of formation of F' factor. What are the uses of F' factor in genetic analysis?

Q13. In what respect is the formation of lambda dgal transducing phages similar to the formation of F' factors?

Q14. Recombination assures new type generation of all time - Justify.

Q15. Draw and explain "Time of entry curve" of interrupted mating experiment.