

**Microbial Genetics – TD 5 / Mobile Genetic Elements and Transposons****Exercise 1 — Basic Concepts**

1. What is transposition?
2. Does transposition require homologous DNA sequences?
3. What is site-specific recombination?
4. What is a mobile genetic element?

**Exercise 2 — Insertion Sequences (IS)**

1. What is an insertion sequence (IS)?
2. What is the approximate size range of IS elements described in the course?
3. What characteristic sequences are present at their ends?
4. Which enzyme is encoded by an IS element?
5. What is the role of transposase?

**Exercise 3 — Insertion Mutations**

An IS element inserts into a gene encoding a bacterial protein.

1. What can happen to the gene?
2. What can be the phenotypic consequence?
3. Can insertion into an operon affect other genes?

**Exercise 4 — Polar Mutation**

1. Define a polar mutation.
2. Why can an IS element cause a polar effect?
3. What is the consequence for downstream genes?

**Exercise 5 — Transposons**

1. What is a transposon?
2. Which additional genes are commonly found in transposons?
3. Why are transposons important in bacterial genetics?

**Exercise 6 — Composite Transposons**

1. What is a composite transposon?
2. What is the role of the IS elements?
3. What happens during transposition?
4. What type of genes can be carried by composite transposons?

**Exercise 7 — Tn5**

1. What type of transposon is Tn5?
2. What important genetic trait can Tn5 carry?
3. How is the resistance gene organized in Tn5?
4. Why is this organization important?

**Exercise 8 — Tn3**

1. How does Tn3 differ from a composite transposon?
2. What sequences are present at its ends?
3. Which antibiotic-resistance gene is found in Tn3?
4. Which two genes are involved in transposition?
5. What is resolvase?

**Exercise 09 — Experimental Interpretation**

A bacterium initially sensitive to several antibiotics becomes resistant to multiple antibiotics after acquisition of a mobile DNA element.

1. What type of genetic element could explain this phenotype?
2. Could a composite transposon be involved?
3. What enzyme is essential for transposition?
4. What is the possible consequence of an IS insertion into a bacterial gene?
5. If the IS insertion occurs within an operon, what additional effect may occur?

**Synthesis Problem**

A bacterial resistance gene is located between two IS elements. The whole DNA segment moves from a plasmid to the bacterial chromosome.

1. What type of genetic element is described?
2. What mechanism is involved?
3. What enzyme catalyzes the transposition process?
4. Does this process require homologous sequences between the donor and recipient sites?
5. What is the importance of this mechanism in bacterial adaptation?