Paper 201
Unit-5
Transposable elements

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SOS IN MICROBIOLOGY

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INTRODUCTION

- Transposons (Transposable Elements) A transposable element (TE) is a DNA sequence that can change its relative position (self- transpose) within the genome of a single Barbara McClintock first discovered transposable elements in corn in the 1940.
- Transposable elements, transposons or even jumping genes are regions of genomethat can move from one place to another.
- The first transposable element was discovered in bacteria is called insertion sequences or IS elements.

- In 1940s by McClintock Barbara in maize Found genetic elements regularly jump to new location affect gene expression Maize kernels show variation in colour.

- Later in 1960s bacteria & bacteriophages were shown to posses TE. Development of recombinant technology demonstrate TE exist in all organisms.

TYPES OF TRANSPOSABLE ELEMENTS

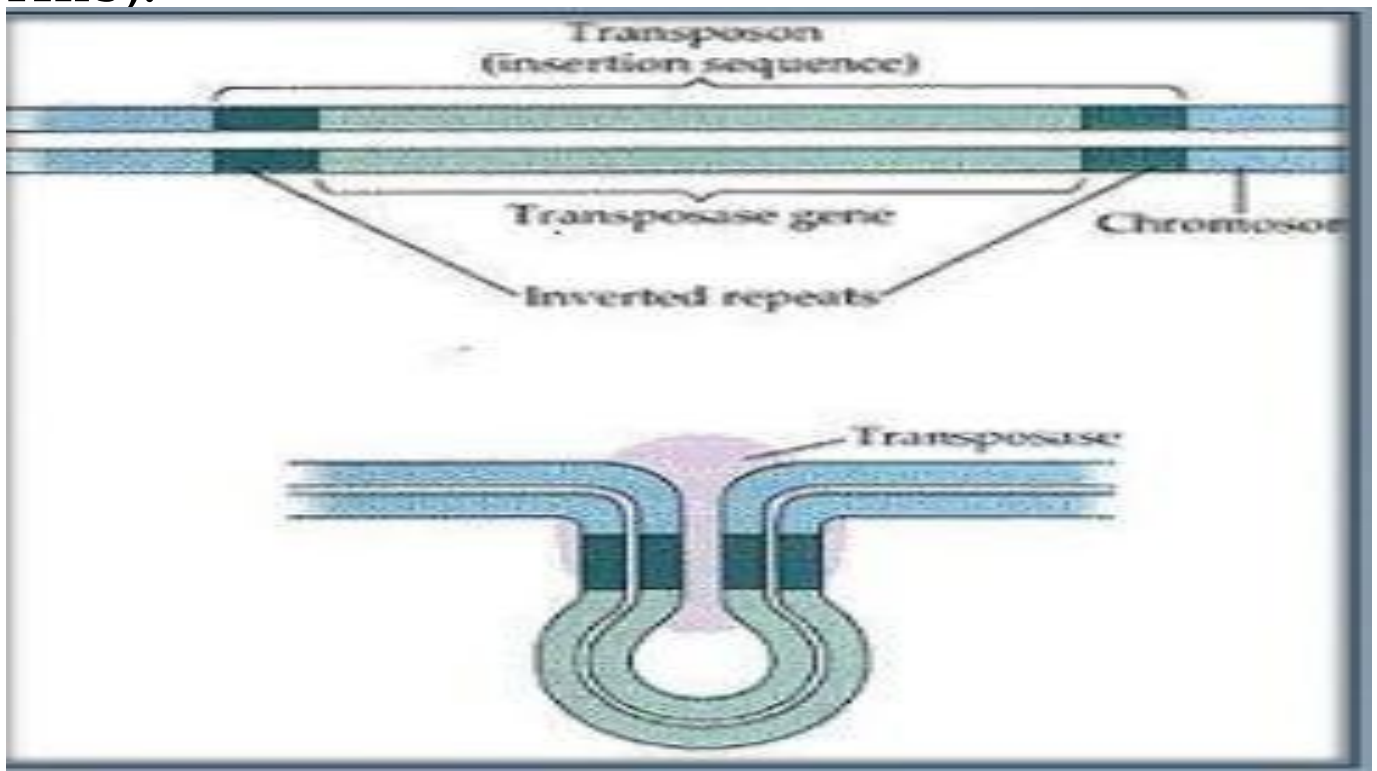
Following are the types of transposable elements described in prokaryotes.

- Insertion Sequences (IS elements)
- The IS are shorter (800 to 1500base pairs) and do not code for proteins.In fact, IS carry the geneticinformation necessary for their transposition (the gene for the enzyme transposase).There are different IS such asIS1, IS2, IS3 and IS4 and so on in E.coli.
- IS elements are relatively small transposable elements that range in size from 760 to less than 2,500 base pairs (bp).
- They can insert at many different sites in bacterial and viral chromosomes and plasmids and episomes, and they contain genes whose products are involved in promoting and regulating transposition. One of the genes is a transposase that functions in excision of the element from a chromosome, plasmid, or episome.
- IS elements typically generate unstable mutants that revert to wild-type at a detectable frequency. For that reason, IS elements originally were called "mutable" genes.

- All IS elements contain inverted terminal repeats that range in size (length) from 9 to 40 base pairs. At the site of integration there invariably is a target site duplication of from 2-13 base pairs.

Note: Inverted terminal repeats are characteristic of most (but not all) transposons, whereas target site duplications are found in nearly all "integrated" molecules (e.g., prophages).

- Plasmids harbor IS elements, and when a plasmid and chromosome harbor the same IS elements there can be homologous recombination between chromosome and plasmid. By definition, this makes the plasmid an episome that can promote high frequency exchange or recombination (e.g., Hfrs).



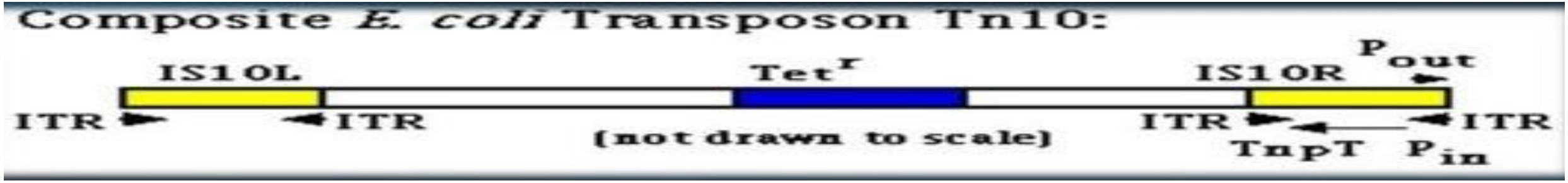
Transposons:

- Transposons are similar to IS elements but carry additional genes.
- Tn are several thousands base pair long and have genes coding for one or more proteins. On either side of a transposon is a short direct repeat. The sequence into which the transposable element insert is called target sequence.
- Tn elements stem from two IS elements that insert near one other. The regions (sequences) between the two elements can be "mobilized" by the joint action of the two IS elements.
- This is of significance in that many Tn elements possess genes that confer resistance to antibiotics between the two IS elements. b) Tn transposition is regulated by a "repressor" that appears to exist to keep the elements somewhat quiescent.
- Tn3 elements are simply large transposable elements that are not generated by flanking IS elements (as in Tn elements). They are generally ~5,000 bp, have ~386 bp inverted repeats at both ends, and carry antibiotic resistant genes.
- Two types of transposons are found

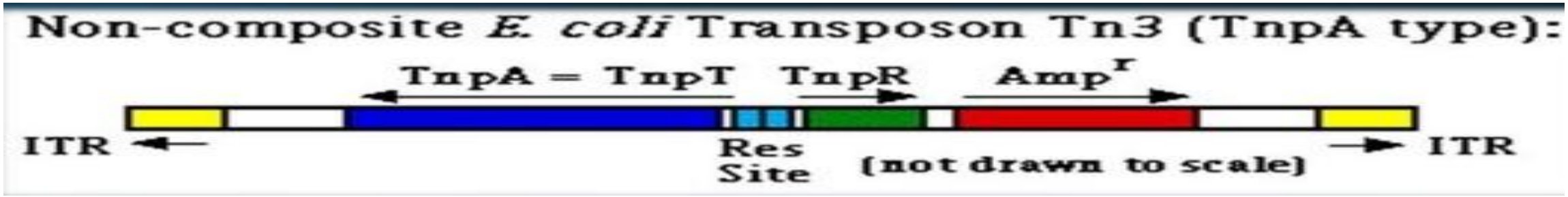
a) Composite transposonb)

b) Noncomposite transposon

- Composite transposon: Any segment of DNA that flanked by two copies of an IS and central coding region with antibiotic resistant gene and nomarker gene. Designated by the Tn.



- Noncomposite transposon: Do not terminate with IS elements but contain terminal inverted repeats. Has three genes at central region-
- 1.bla-beta-lactamase-breaks ampicilin
- 2.tnpA-Transposase-for insertion
- 3.tnpB-resolvase-recombinational events



- Bacteriophage Mu
- The longest transposon knows so far.
- Caries numerous genes for viral head and tail formation.
- The vegetative replication of mu produces about 100viral chromosomes in a cell arises from the transposition of Mu to about 100 different target sites. Therefore considered as giant mutat or transposon.