Transposon

Transposable elements are the specific sequence of DNA which is mobile in nature and have capacity to transport from one position to another position in the chromosome by themselves. Therefore, they are also known as mobile sequence or transposable sequence or jumping genes.
Barbara McClintock (1940) discovered the first transposable element in Eukaryotes (maize) and earned a Nobel Prize in 1983.

Characteristics of transposable elements:

Transposable elements are specific sequence of DNA that codes for enzymes for their transposition from one position to another position in the chromosome.
Such mobile transposable elements is commonly known as **transposons** or **jumping genes** and the phenomenon is known as **transposition**.
Transposable elements undergoes both replication and recombination process. However, they lacks the site for origin of replication. So, they have to **depend upon host DNA or plasmid for their replication**.

All transposable elements are commonly known as transposons or mobile gene or jumping genes that changes their location and insert into different location in a chromosome or into other chromosome.

Transposable elements contributes to the repetitive sequences in the genome of the organisms. Human genome contains 50% repetitive sequences.

The transposable elements are broadly classified as- **Insertion sequences (IS)** and **transposons**.

Insertion sequences are the simplest type of transposable element with short sequences of about 1000 base pairs, present in Bacteria.

Transposons have the longer sequences of more than several thousand base pairs.

There are different type of transposable elements depending upon structure and mechanism.

Three types:

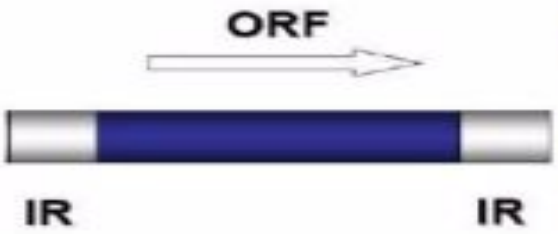
Replicative transposition

Conservative or non-replicative transposition

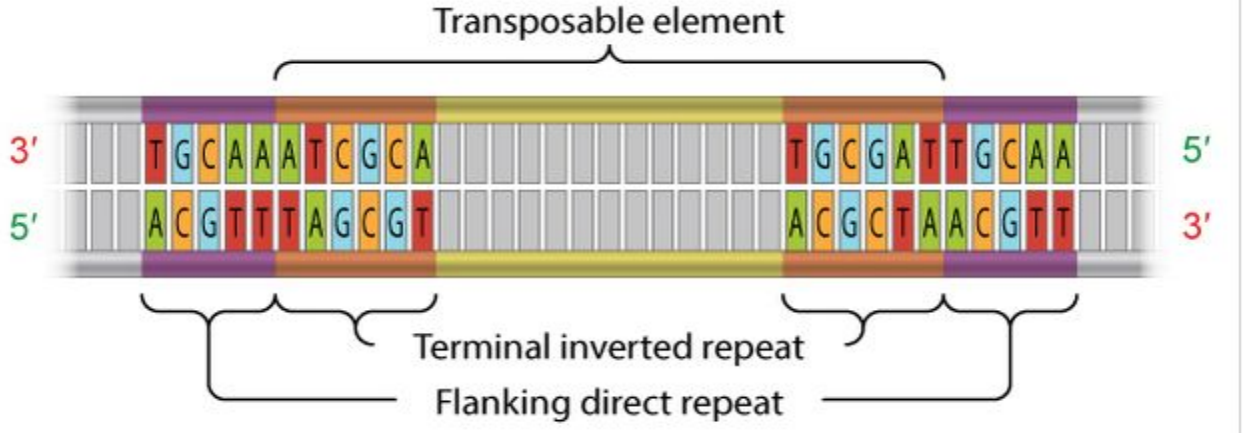
Retro-transposition

Insertion sequences (IS)

- Insertion sequences (IS) are the generic transposable element.
- They are present in large quantities in all bacterial chromosomes (the number is variable).
- It is a defined sequence of DNA (700-3000 bp long)
  - Has flanking inverted repeats and
  - Has one or two genes that encodes a transposase
    - – a protein involved in movement of this element from one location to another.



- ORF encodes the transposase
- Inverted repeats are identical and of variable length
- Different IS exist (IS1, IS2, IS50….)
- Function unknown?



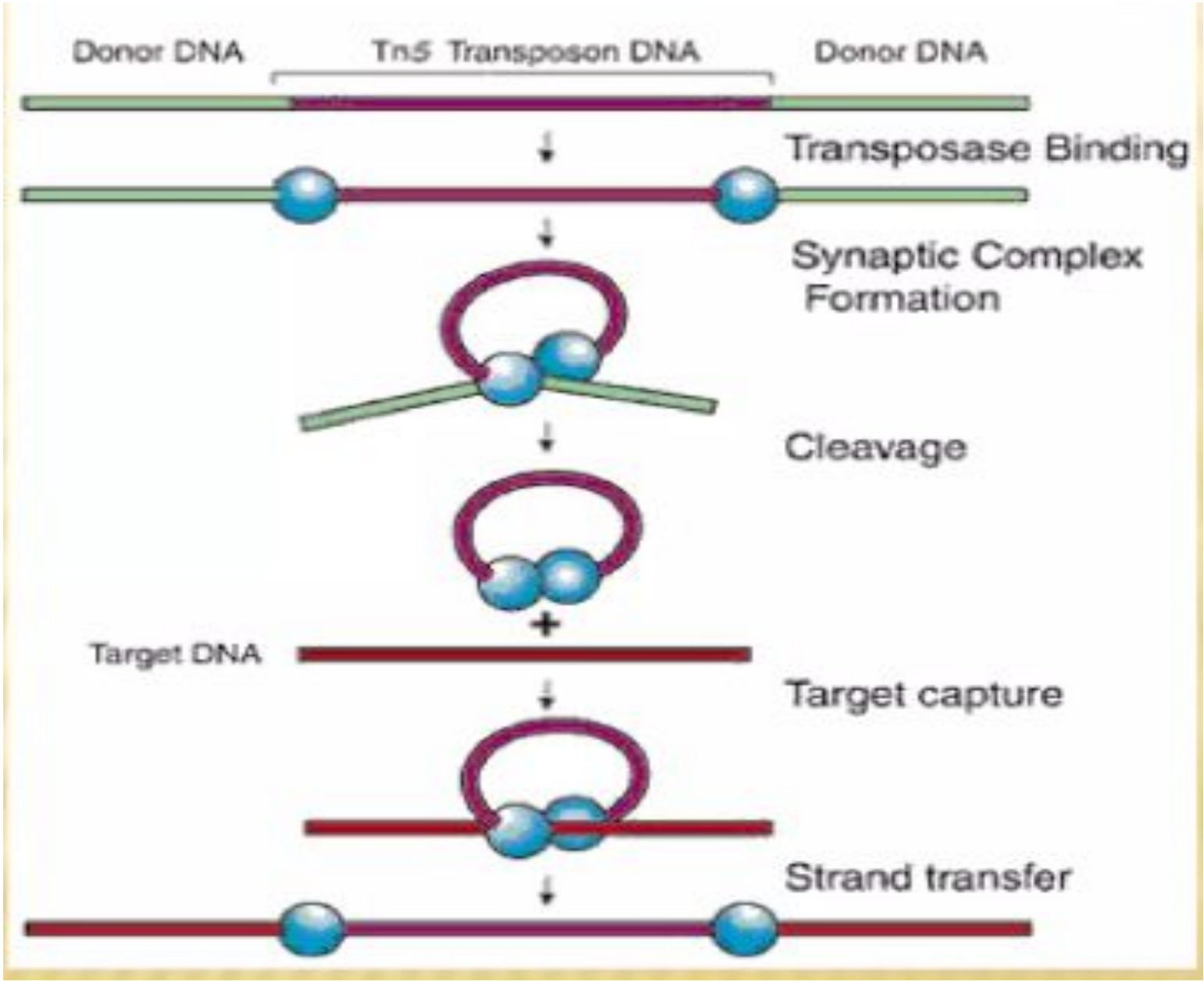
Replicative transposons

- Replicative transposons are those transposons which at first replicates itself and then insert one copy of it into new position. Therefore, during replicative transposition, the transposable elements is replicated and one copy is inserted into new position while one copy remains at original position.

- This transposition is catalyzed by an enzyme transposase which is encoded by the transposable element itself.

- It is also known as copy and paste transposition.

- Replicative transposition is present only in prokaryotic organisms.

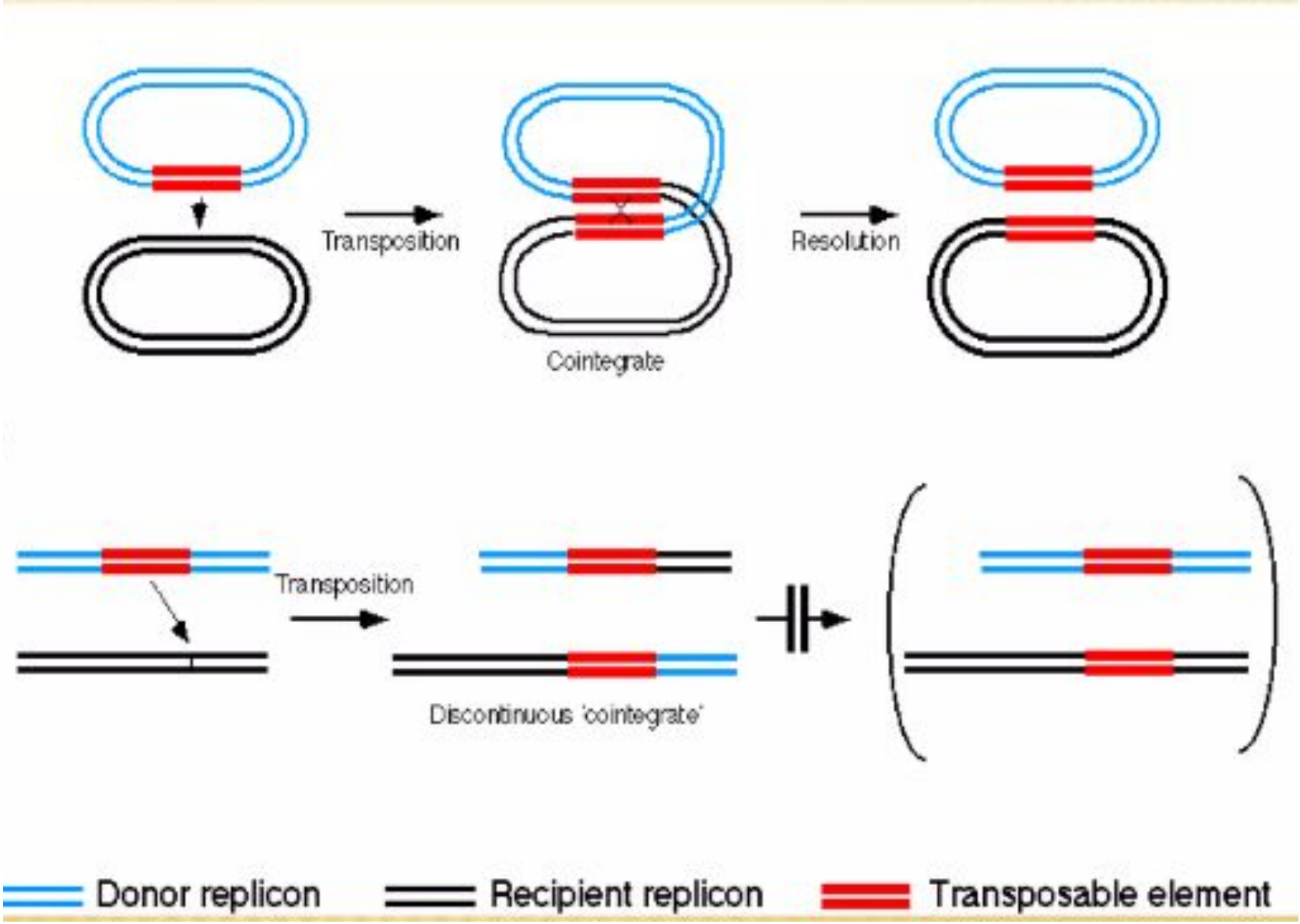

Donor DNA
Tn5 Transposon DNA
Donor DNA
Transposase Binding
Synaptic Complex Formation
Cleavage
Target DNA
Target capture
Strand transfer

Conservative or non-replicative : cut and paste transposition

- The conservative transposons are those which changes position by excision from one position and then insertion into another position within a chromosomes. Therefore, during conservative transposition, the transposable element is physically cut from its original position and paste into another position in a chromosome.

- It is also known as cut and paste transposition

- This types of transposition is catalyzed by an enzyme called transposes which is coded by such transposable element itself.

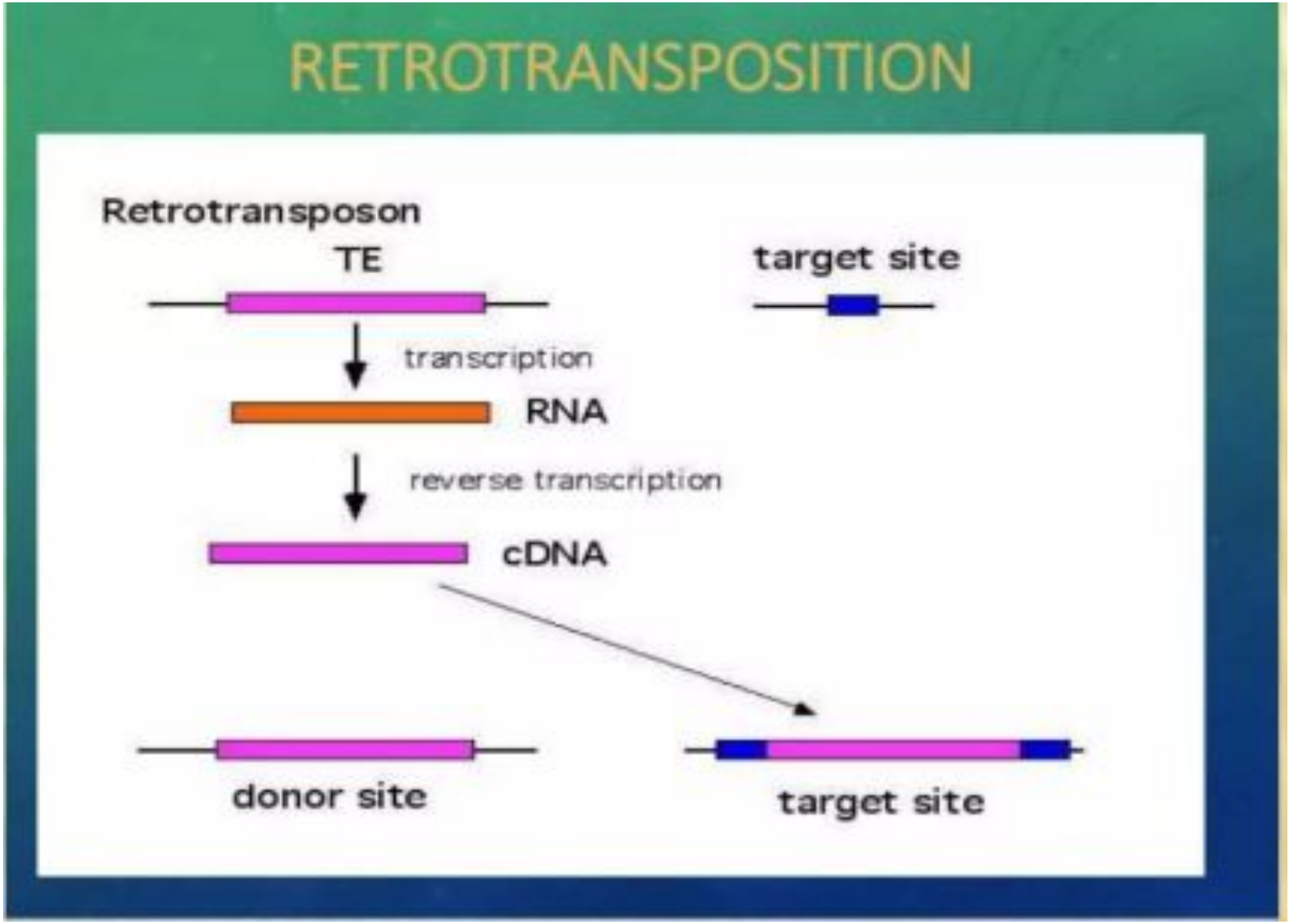

Transposition
Cointegrate
Resolution
Transposition
Discontinuous 'cointegrate'
Donor replicon
Recipient replicon
Transposable element

Retro-transposons:

- The retro-transposons are those transposons, whose RNA is reversed transcribed by reverse transcriptase enzyme into DNA and the synthesized DNA is inserted into new position in a chromosome.

- The mechanism of such transposition is known as retro-transposition Some of these retro-transposons are related to retro viruses and utilized their reverse transcriptase enzyme for transposition, such transposable elements are known as **retroposons.**

- Retro-transposons are only present in Eukaryotic organisms.


RETROTRANSPOSITION
Retrotransposon
TE
target site
transcription
RNA
reverse transcription
cDNA
donor site
target site