TRANSPOSABLE ELEMENTS

Transposons are segments of DNA that can move around to different positions in the genome of a single cell. In the process, they may cause mutations

increase (or decrease) the amount of DNA in the genome.

These mobile segments of DNA are sometimes called **"jumping genes"**.

There are three distinct types: **Class II Transposons** consisting only of DNA that moves directly from place to place.

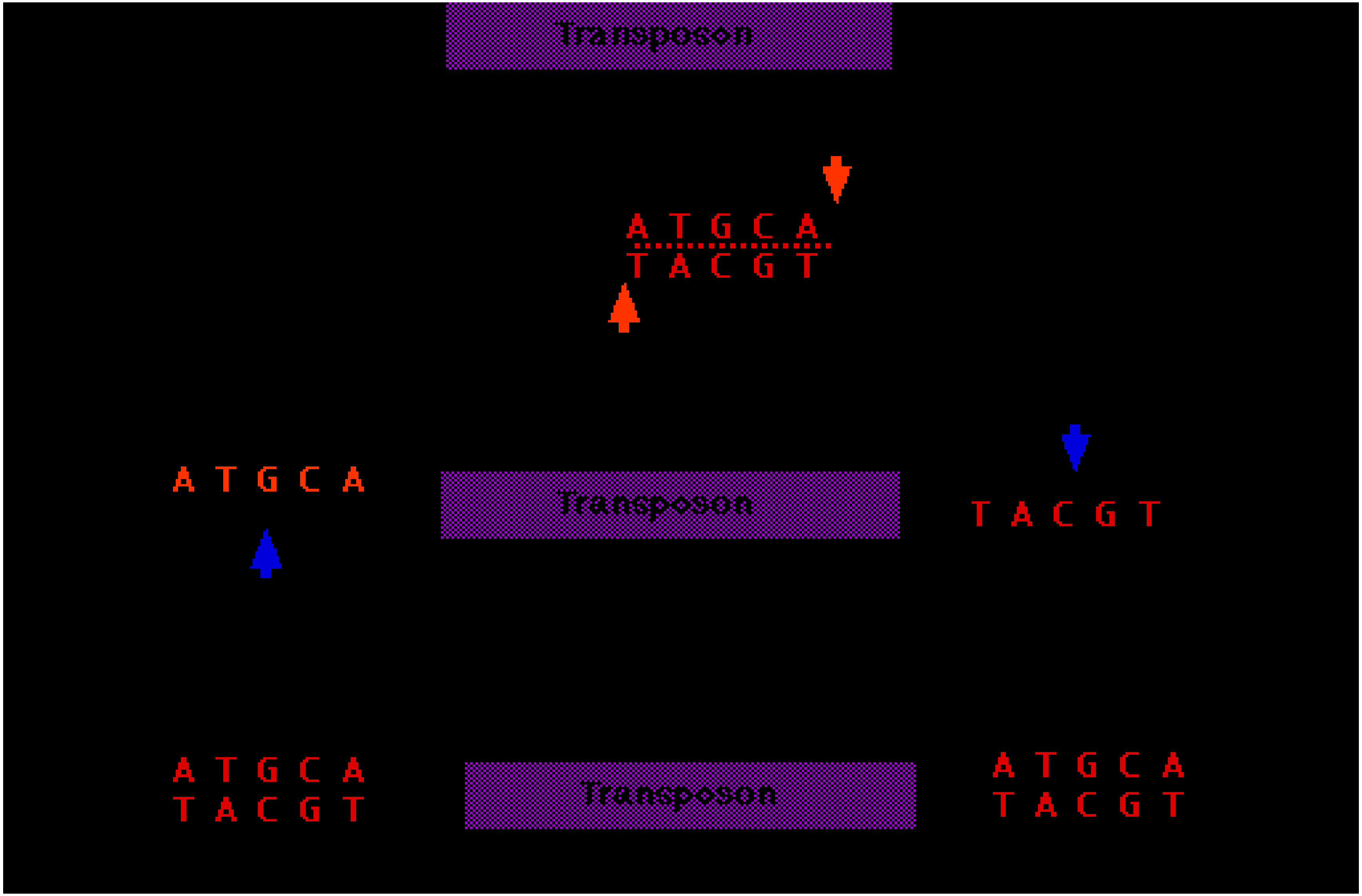
Class III Transposons; also known as **M**iniature **I**nverted-repeats **T**ransposable **E**lements or **MITE**s.

Retrotransposons (Class I) that

first transcribe the DNA into RNA and then use reverse transcriptase to make a DNA copy of the RNA to insert in a new location.

Class II Transposons

Many transposons move by a "cut and paste" process: the transposon is cut out of its location (like **command/control-X** on your computer) and inserted into a new location (**command/control-V**). This process requires an enzyme — a **transposase** — that is encoded within some of these transposons.



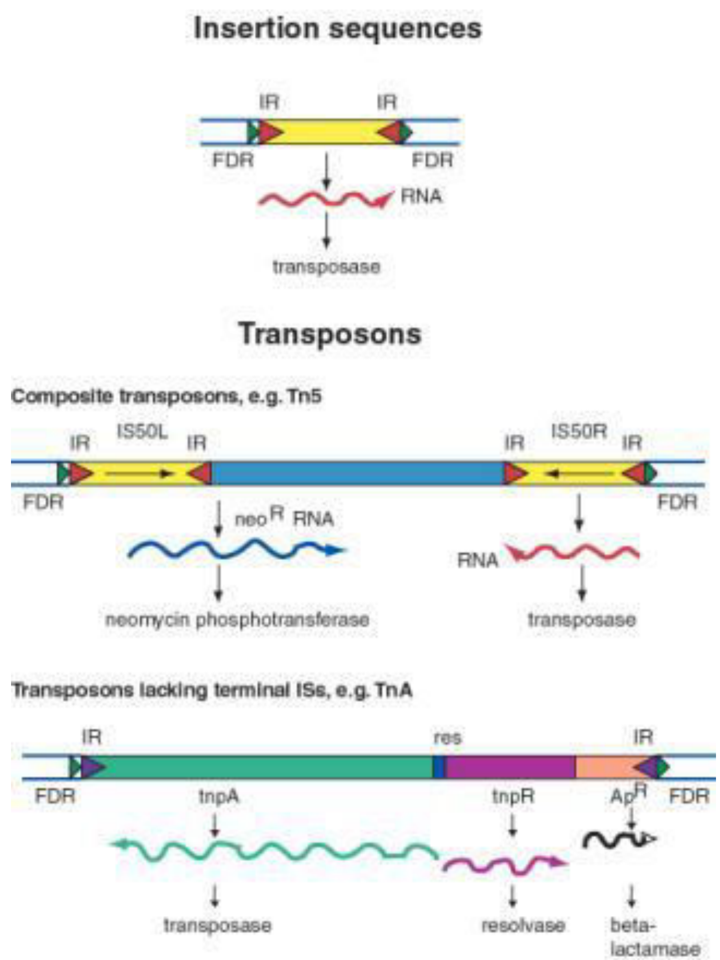
Transposon
A T G C A
T A C G T
A T G C A
Transposon
T A C G T
A T G C A
T A C G T
Transposon
A T G C A
T A C G T

Transposase binds to: both ends of the transposon, which consist of **inverted repeats**; that is, identical sequences reading in opposite directions.

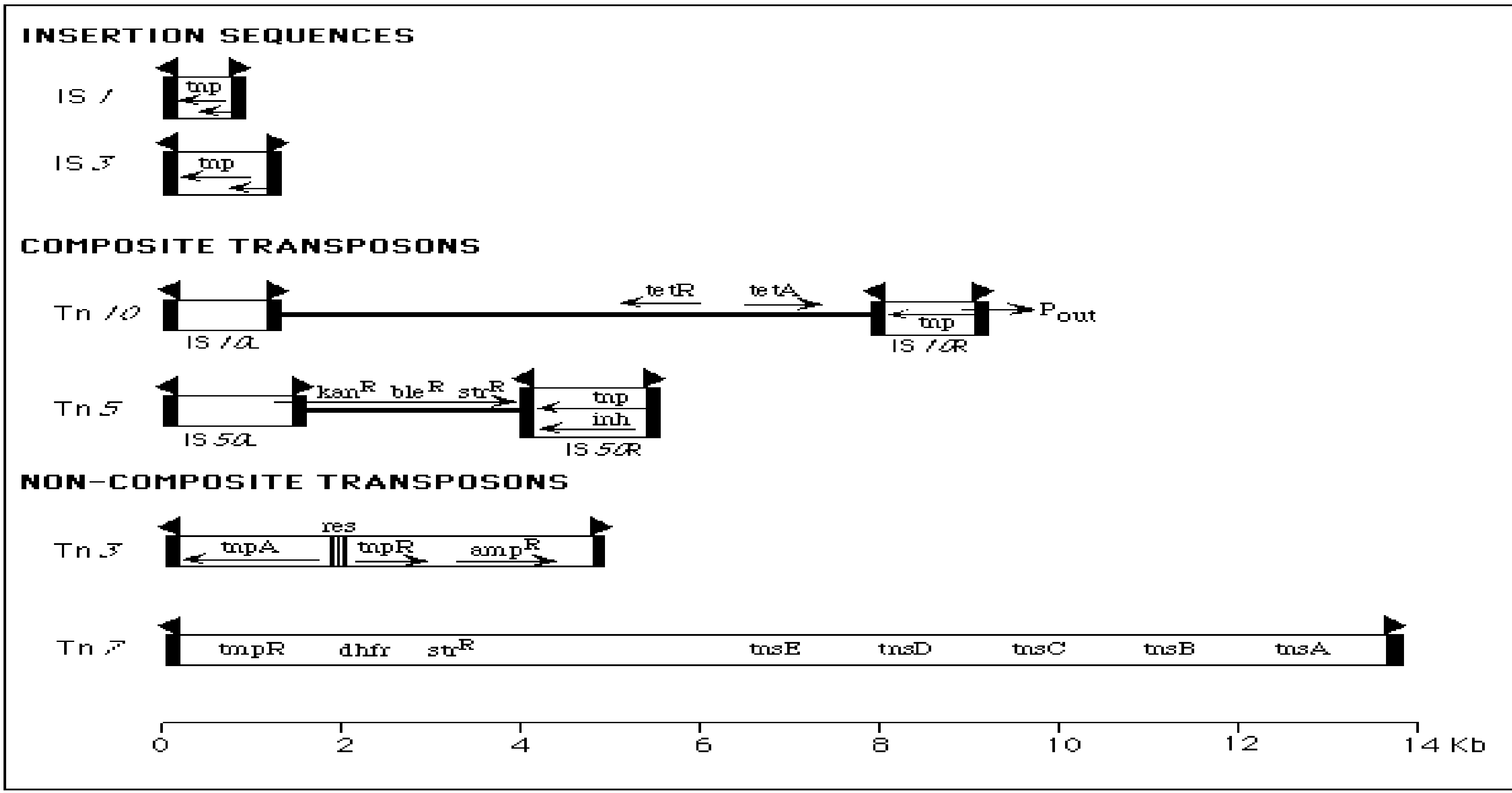
a sequence of DNA that makes up the target site. Some transposases require a specific sequence as their target site; other can insert the transposon anywhere in the genome.

After the transposon is ligated to the host DNA, the gaps are filled in by Watson-Crick base pairing. This creates identical **direct repeats** at each end of the transposon. Often transposons lose their gene for transposase; but as long as somewhere in the cell there is a transposon that can synthesize the enzyme, their inverted repeats are recognized and they, too, can be moved to a new location.

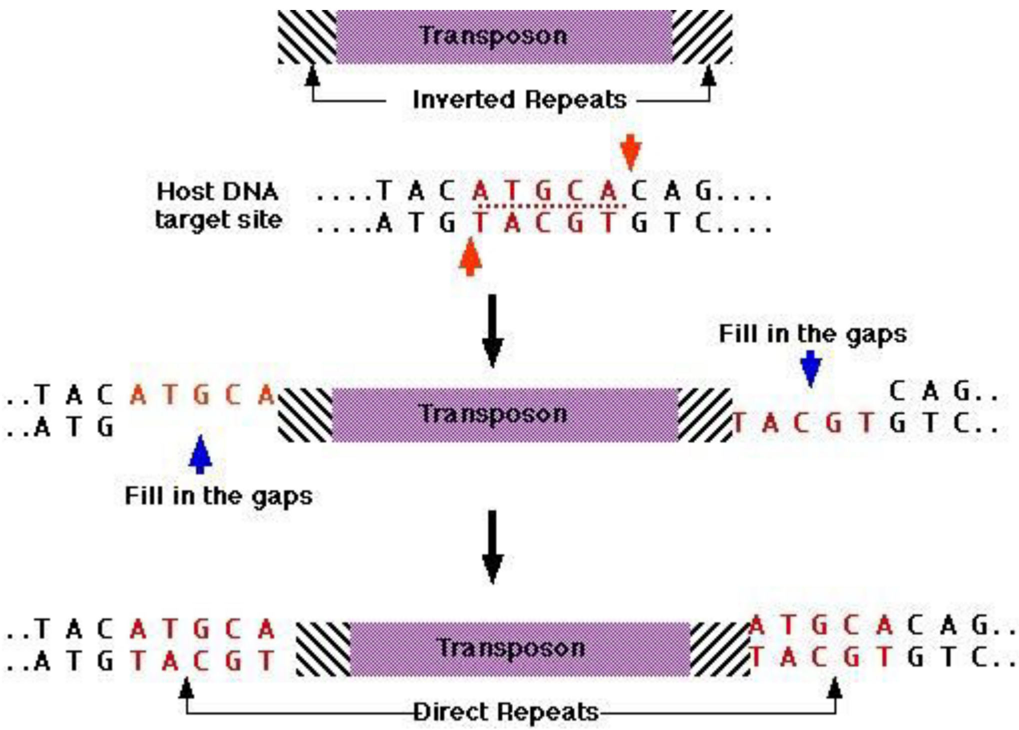
TYPES OF TRANSPOSABLE ELEMENTS

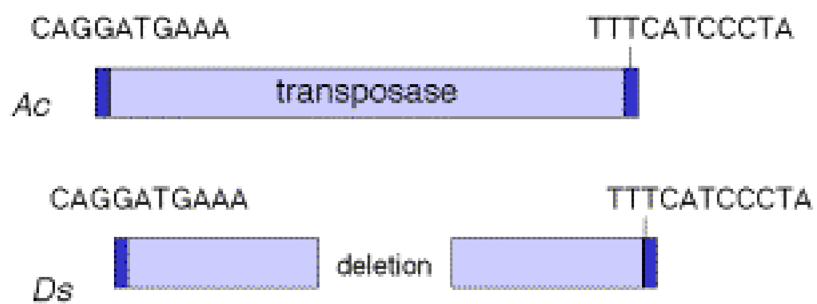


A Few Examples of Insertion Sequences and Transposons:



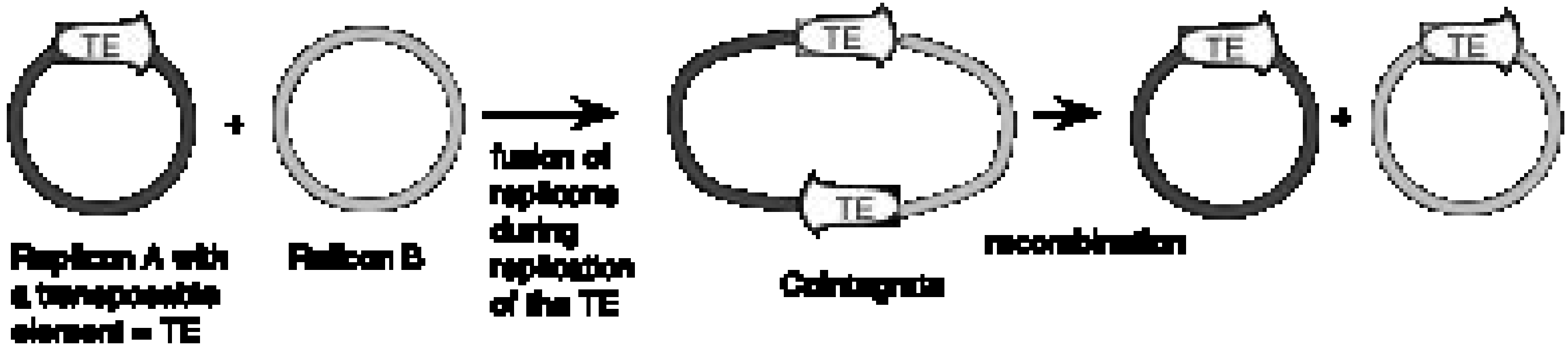
Transposition

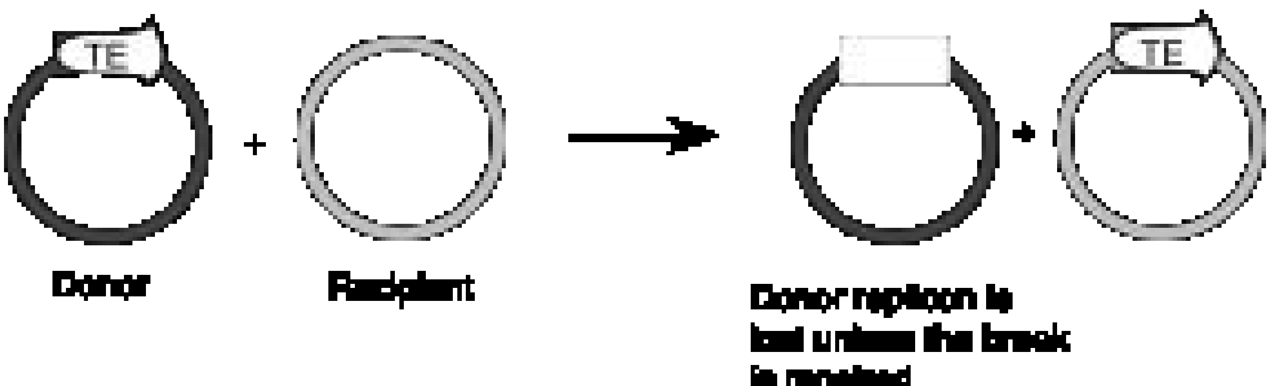


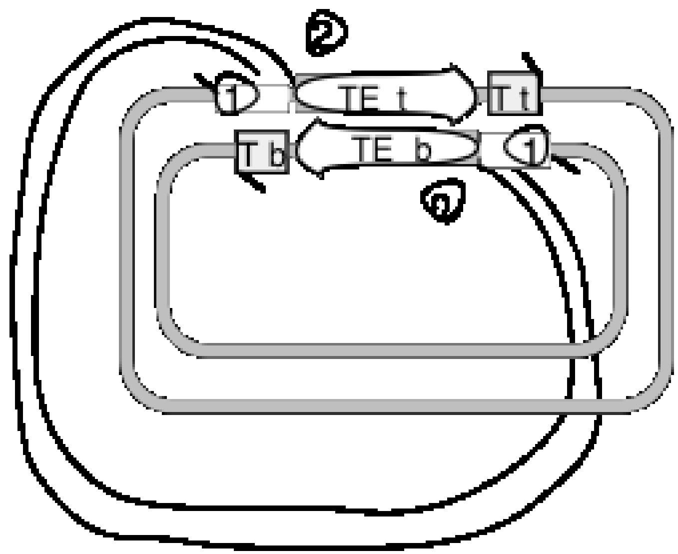


Nonfunctional transposase

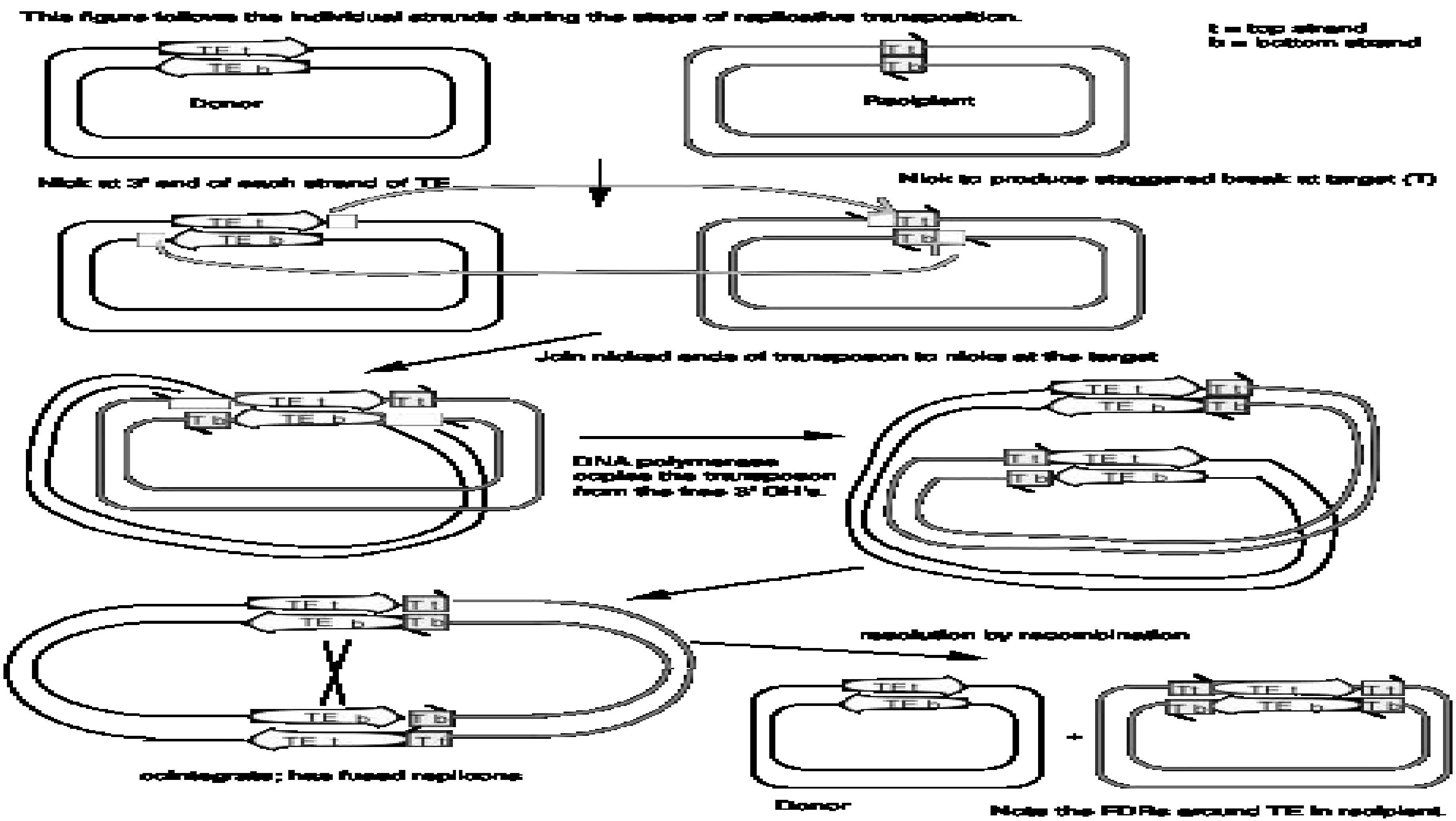
REPLICATIVE & NON REPLICATIVE TRANSPOSITION



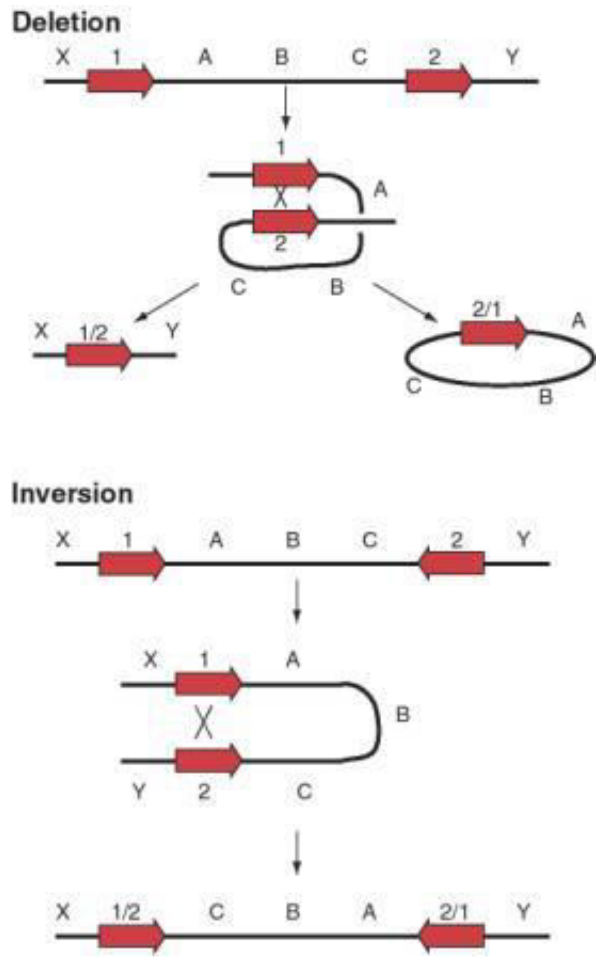


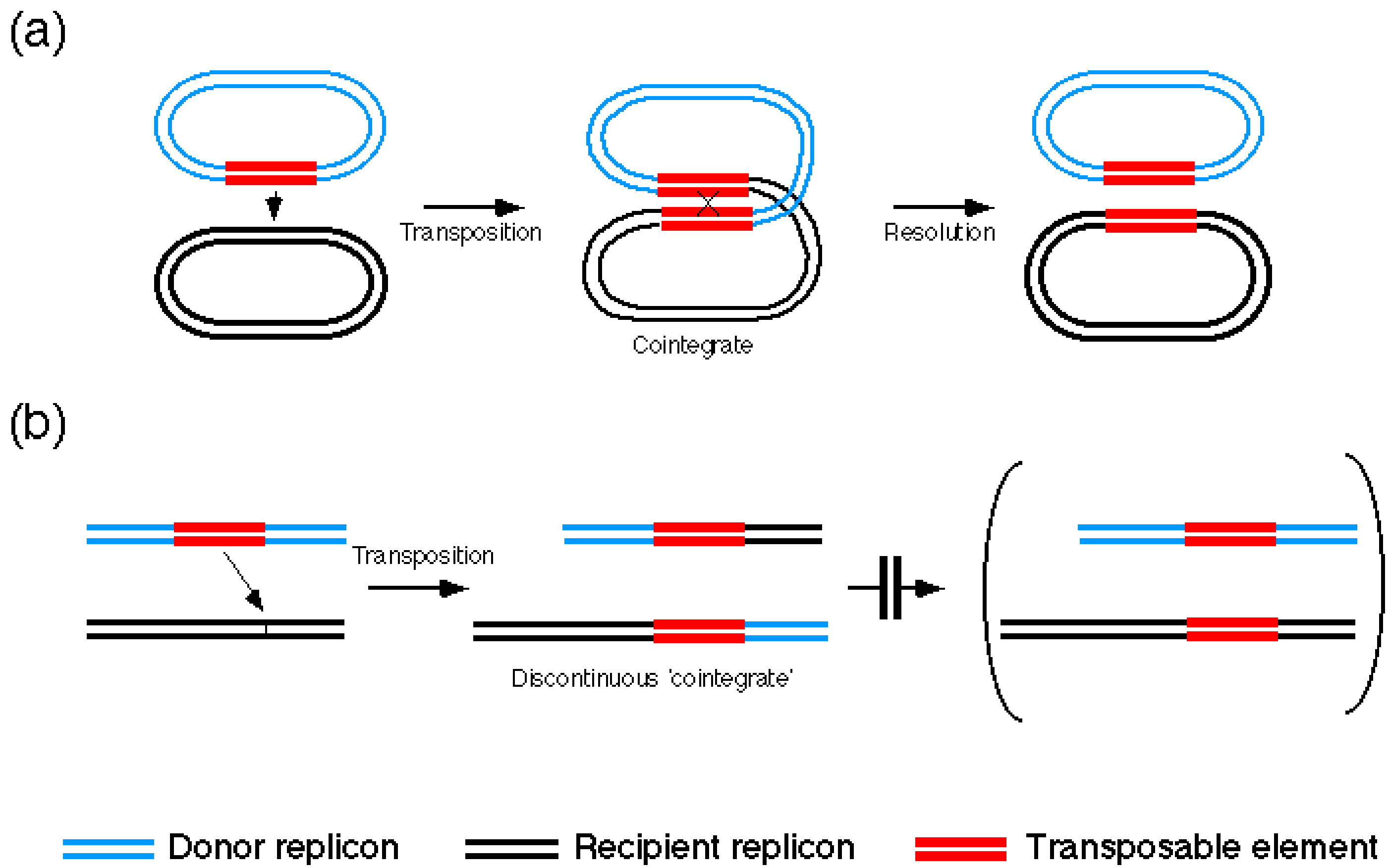

1
TE t
T t
T b
TE b
1

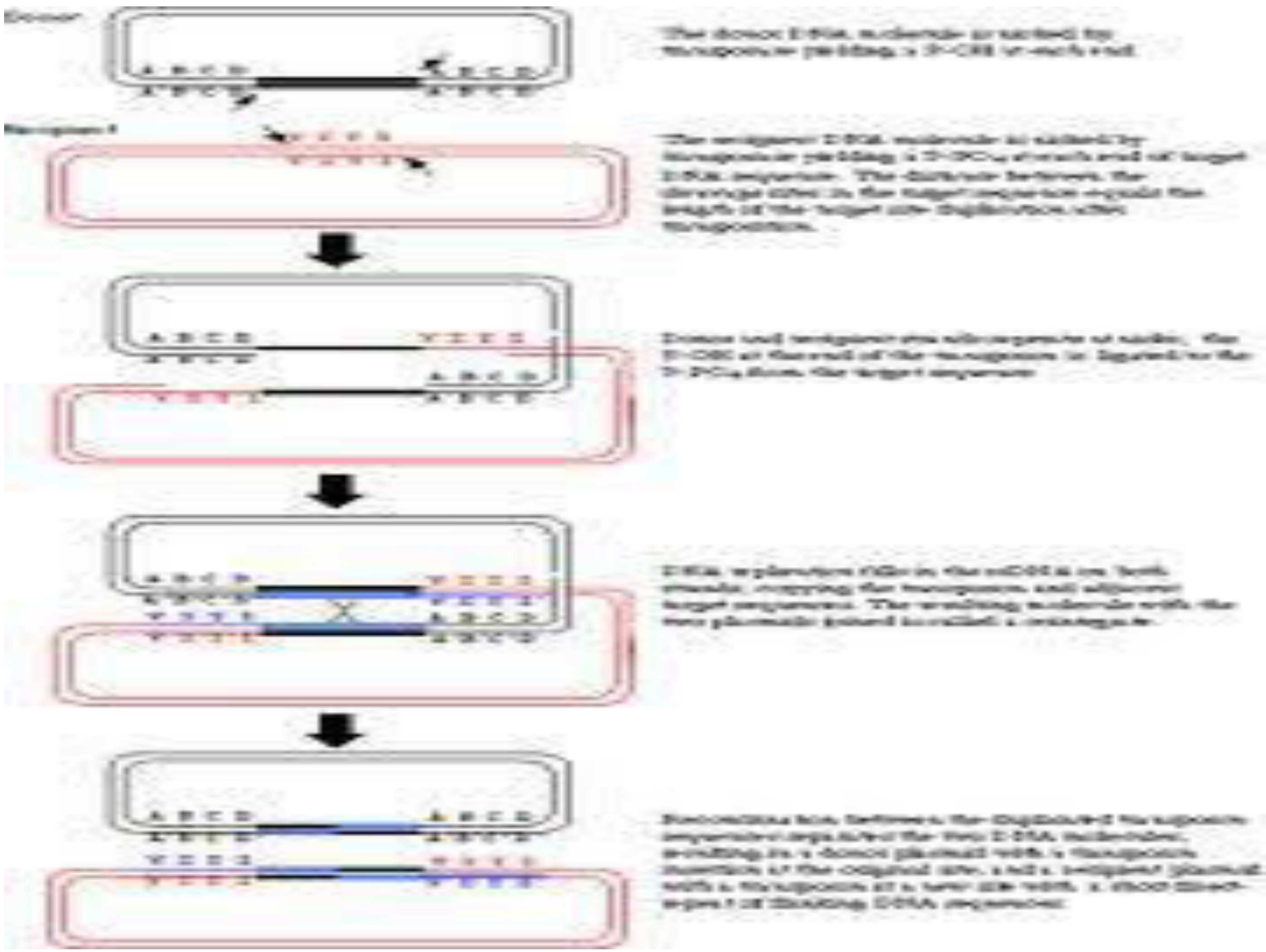
REPLICATIVE TRANSPOSITION DIFFERENT STAGES



BIOLOGICAL EFFECTS OF TRANSPOSITION

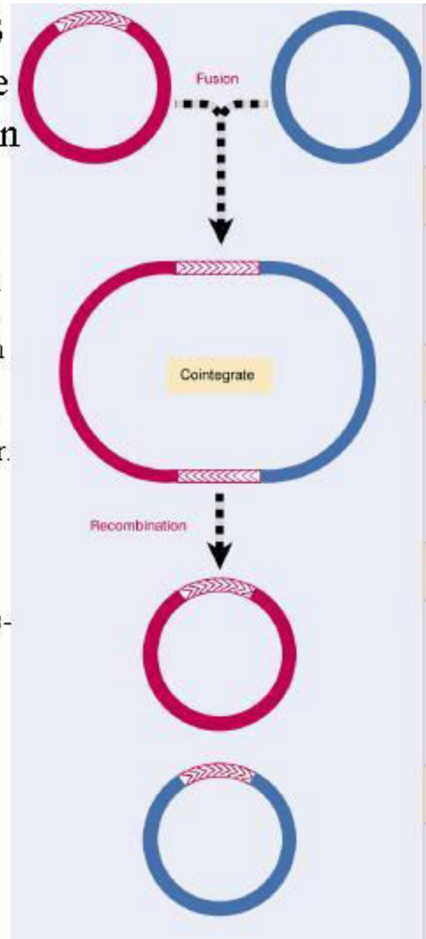


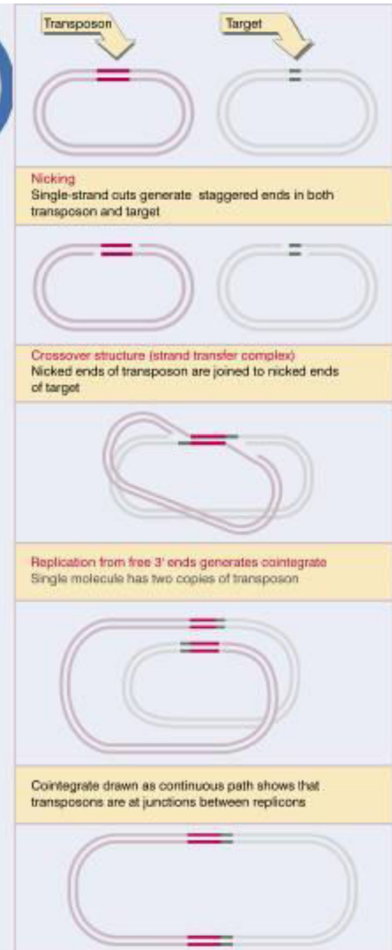

(a)
Transposition
Cointegrate
Resolution
(b)
Transposition
Discontinuous 'cointegrate'
Donor replicon
Recipient replicon
Transposable element



15-12 & 13 Replicative transposition

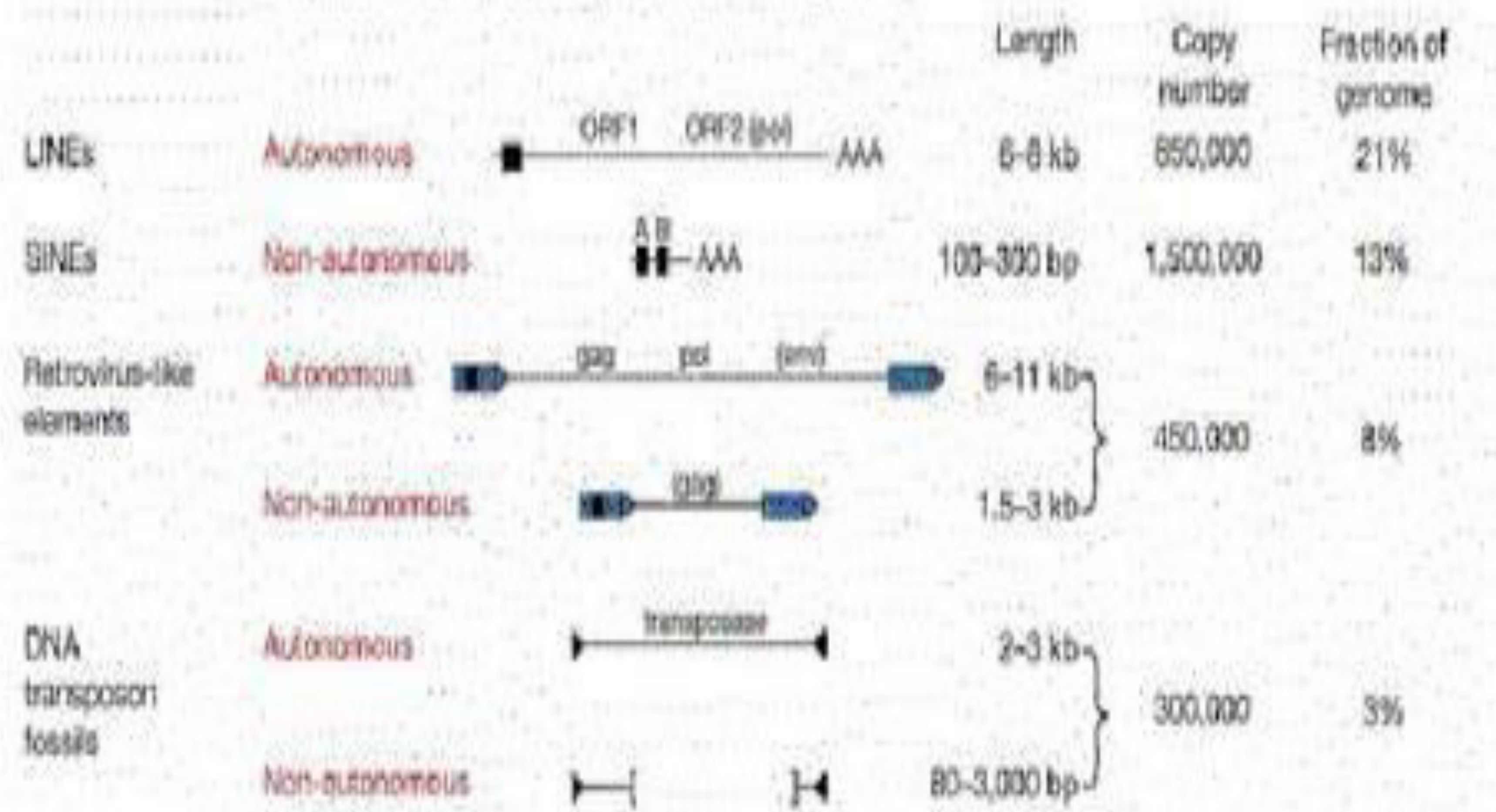
Replicative trans . probably results in formation of a co-integrant, in which the donor and re-cipient molecules are joined together. This is then split by homologous recombination involving the 2 copies of the trans-poson.





This fig. shows how rep. trans. can work at the level of the DNA strands. Single strand cuts are made on either side of the Tn and on the opposite sides of the target in the recipient. This produces 4 free ends in each DNA molecule. 2 of the ends from the donor are ligated to 2 of the ends of the target. This links the 2 molecules through the single copy of the Tn. The 2 remaining free 3' ends are used as primers for DNA Pol which uses the Tn DNA as template This replicates the Tn and leaves the conintegrate .

Classes of interspersed repeat in the human genome



Transposons in maize

- The first transposons were discovered in the 1940s by Barbara McClintock who worked with maize (**Zea mays**, called "corn" in the U.S.). She found that they were responsible for a variety of types of gene mutations, usually

- insertions
- deletions and
- translocations
- Some of the mutations (*c*, *bz*) used as examples of how gene loci are mapped on the chromosome were caused by transposons. [