



Transposable Elements

Carl Andersen Tan – February 5 Textbook Presentation
Transposition and Conservative Site Specific Recombination
(The presentation covers the Transposition part)



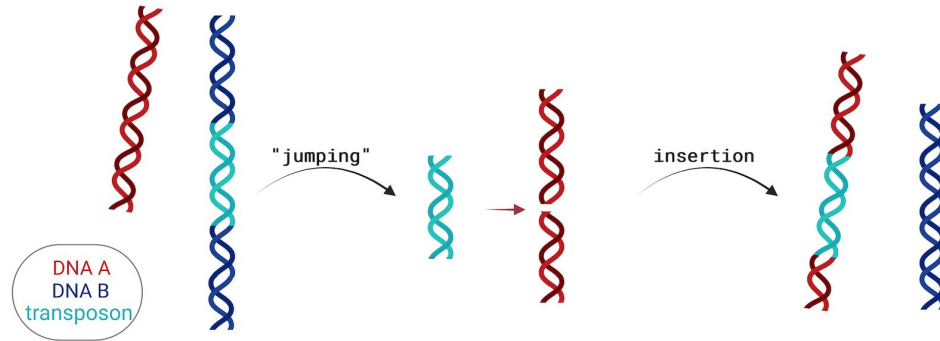
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Transposons– “Mobile Genetic Elements”

- Transposons are Mobile genetic elements that move via transposition.
- Encode a transposase enzyme that facilitates their movement.



Three Major Classes of Transposable Elements

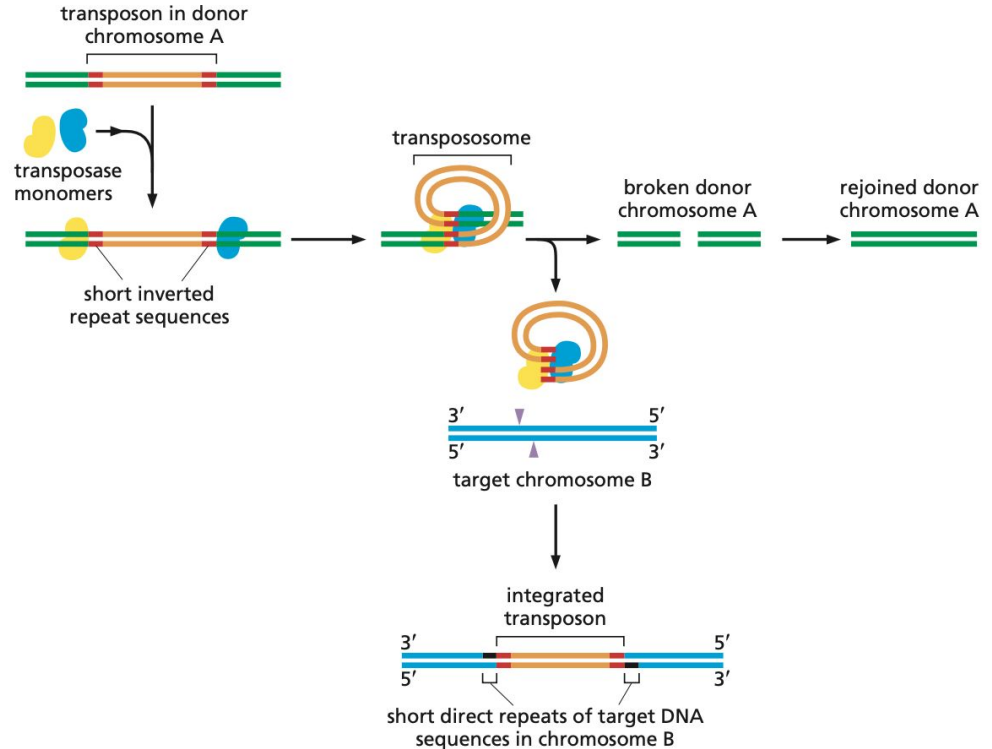
TABLE 5-4 Three Major Classes of Transposable Elements

Class description and structure	Specialized enzymes required for movement	Mode of movement	Examples
DNA-only transposons			
 Short inverted repeats at each end	Transposase	Moves as DNA, either by cut-and-paste or replicative pathways	P element (<i>Drosophila</i>), Ac-Ds (maize), Tn3 (<i>E. coli</i>), Tam3 (snapdragon), Helraiser (bat)
Retroviral-like retrotransposons			
 Directly repeated long terminal repeats (LTRs) at each end	Reverse transcriptase and integrase	Moves via an RNA intermediate whose production is driven by a promoter in the LTR	Copia and Gypsy (<i>Drosophila</i>), Ty1 (yeast), HERVK (human), Bs1 (maize), EVADE (<i>Arabidopsis</i>)
Nonretroviral retrotransposons			
 Poly A at 3' end of RNA transcript; 5' end is often truncated	Reverse transcriptase and endonuclease	Moves via an RNA intermediate that is often synthesized from a neighboring promoter	I element (<i>Drosophila</i>), L1 (human), Cin4 (maize), Karma (rice)

Cut and Paste Mechanism

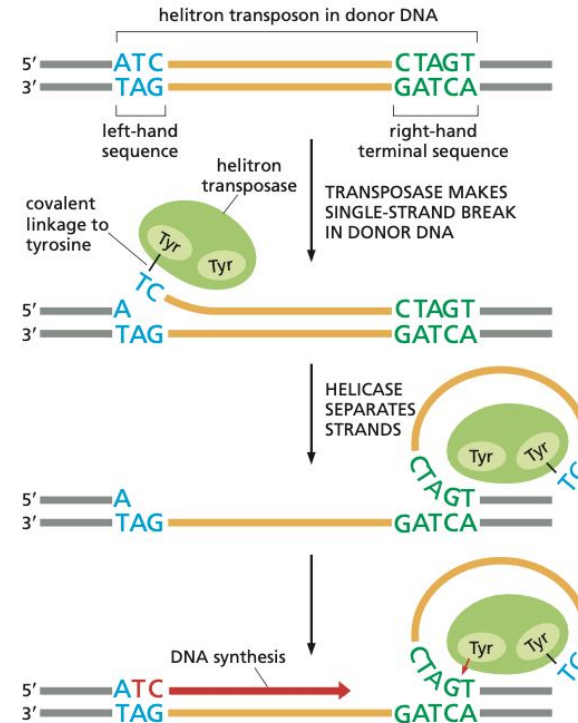
DNA-only transposons:

- Move directly as DNA without an RNA intermediate.
- Predominantly use a "cut-and-paste" mechanism
- Usually carry genes for antibiotic resistance, spread via horizontal gene transfer

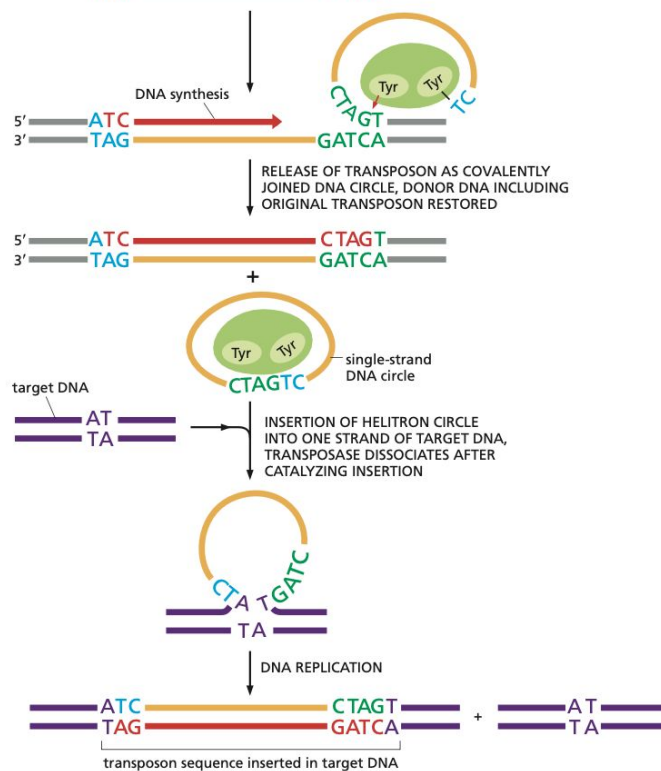


Helitrons and Mechanism of Transposition

- Some DNA-only transposons can move by replicating themselves
- **Helitrons**: class of DNA-only transposons that replicate and move
- They carry a transposase with both nuclease and helicase functions.



Helitrons and Mechanism of Transposition

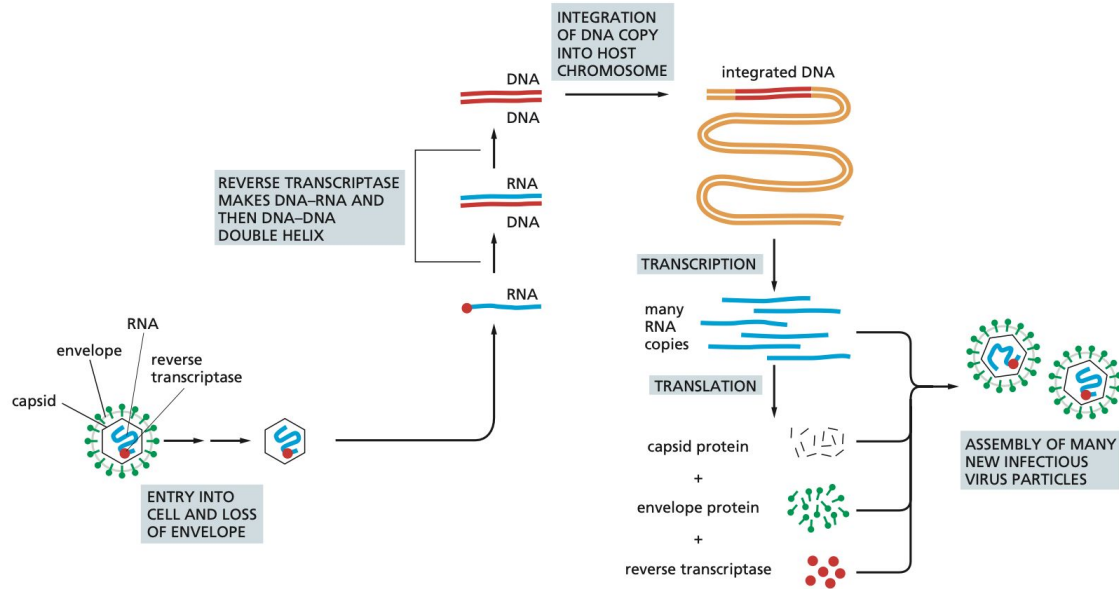


Retroviral-like retrotransposons

Retroviral-like retrotransposons

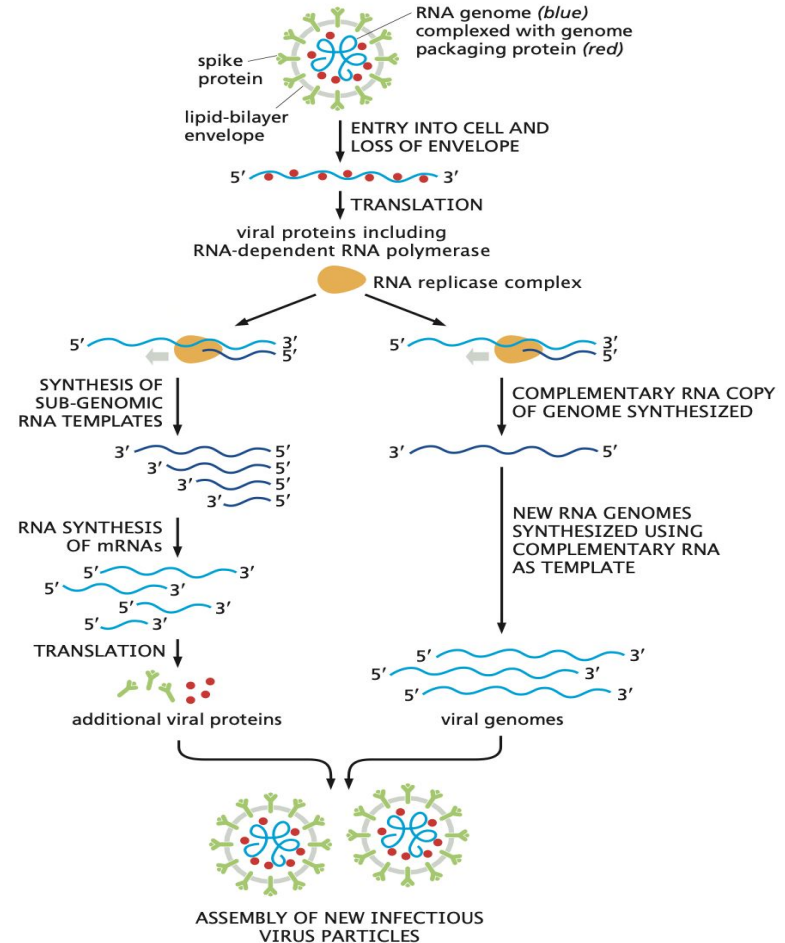
moves similar to retroviruses.

- Move via an RNA intermediate.
- Transcribed into RNA, which then reverse-transcribed back into DNA before insertion.
- Often encode reverse transcriptase and integrase enzymes.



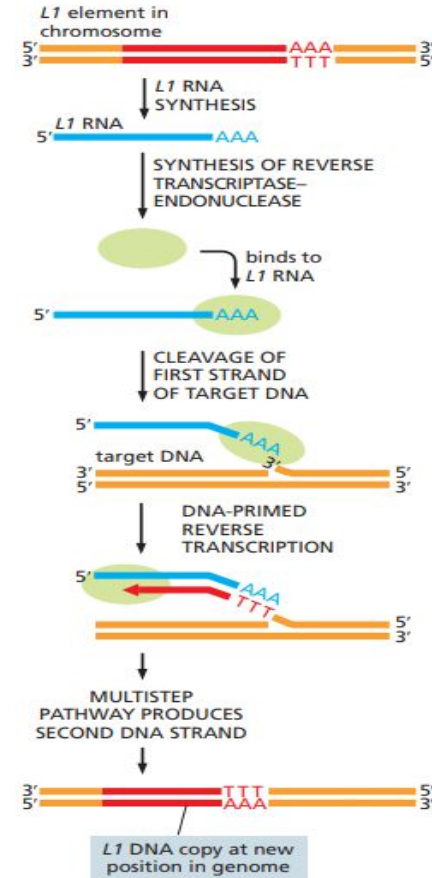
SARS-CoV-2 – Coronavirus

- Some RNA Viruses Replicate and Express Their Genomes Without Using DNA as an Intermediate
- SARS-CoV-2 has a single-strand RNA genome
- the viral genome is translated to produce RNA-dependent RNA polymerase



Nonretroviral retrotransposons

- A large portion of our genome is made up of non-retroviral like retrotransposons.
- Move using an RNA intermediate
- Require endonuclease-reverse transcriptase complex





Thank you

