

# **TRANSPOSABLE ELEMENT**

**Presented by:-**

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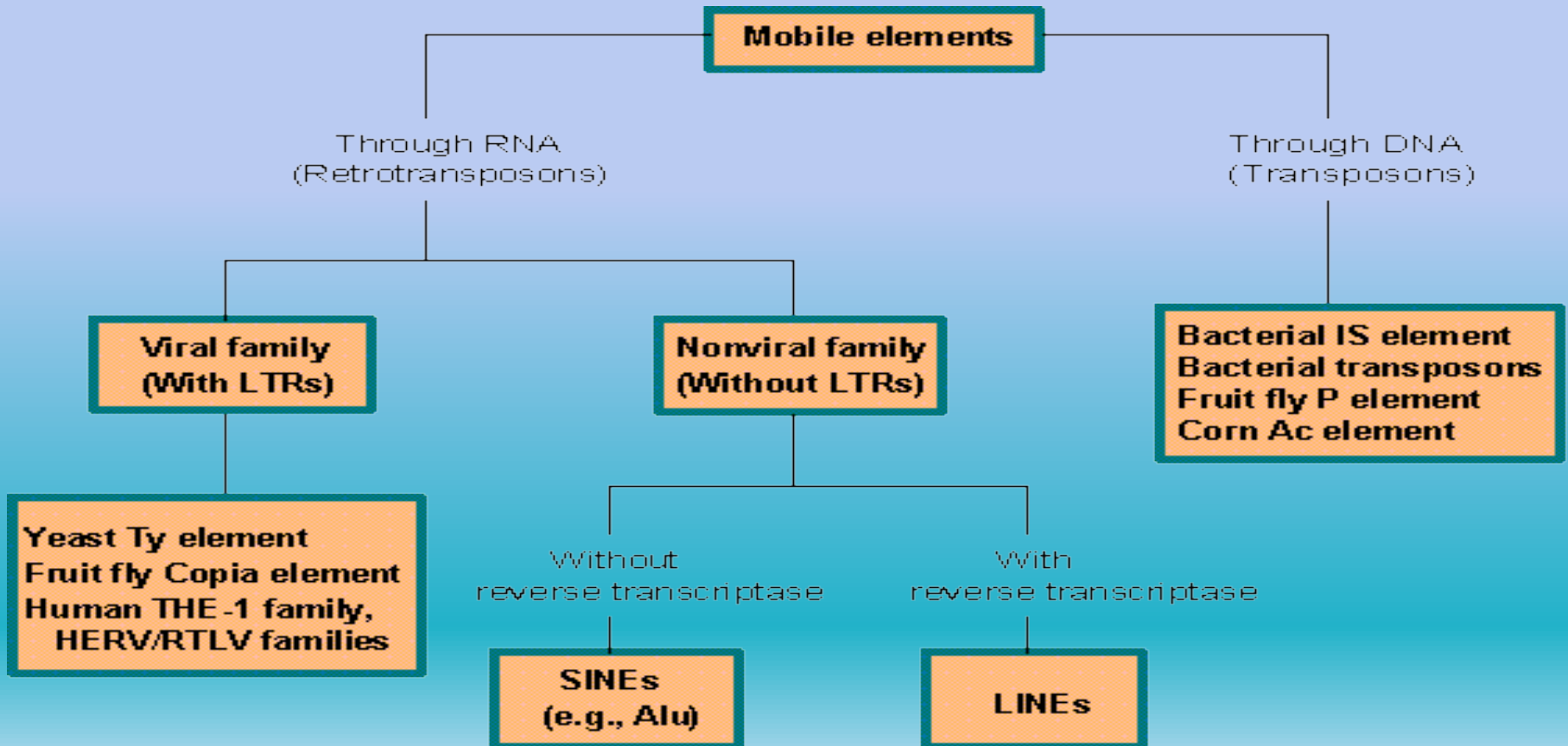
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# Defination

**Transposable element is a sequence of DNA that can move around to different positions within the genome of a single cell a process called transposition.**

- They were discovered by **Barbara McClintock** largely from cytogenetic studies in maize.
- Transposons were also called **jumping genes**.
- She was awarded a **Nobel prize** in 1983.

# Types of Transposons

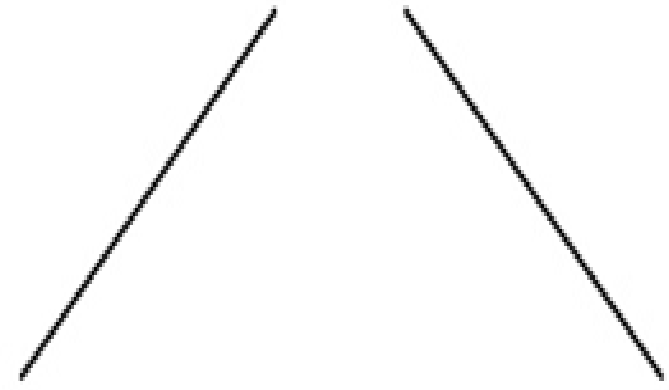
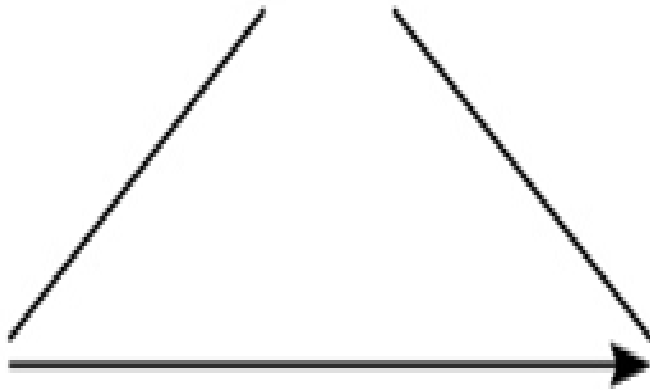
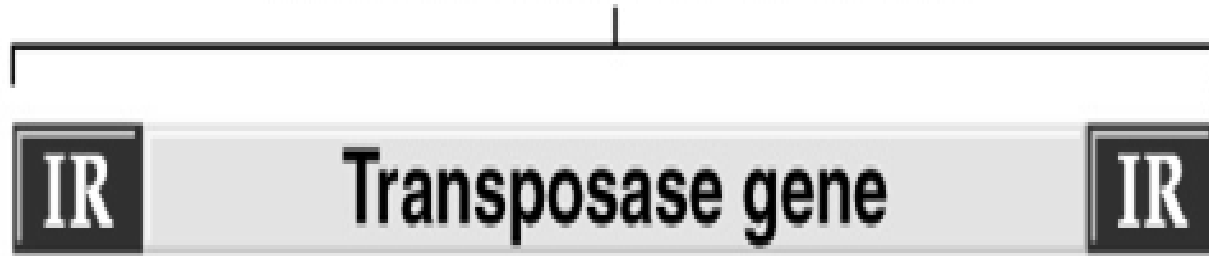


# Transposable Element In Prokaryotes

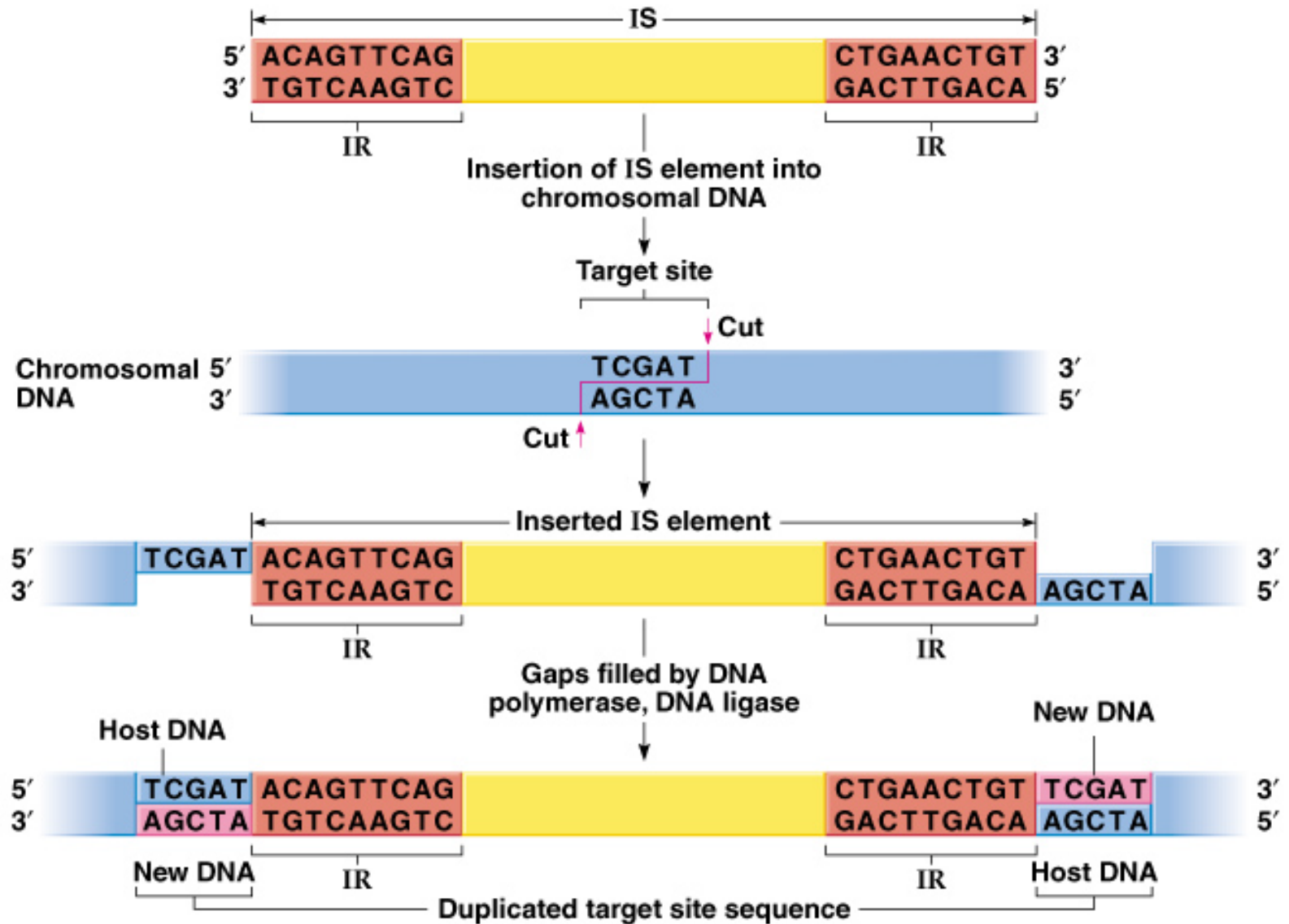
## Insertion sequence (IS) elements

- Simplest type of transposable element found in bacterial chromosomes and plasmids.
- Encode gene (transposase) for mobilization and insertion.
- Range in size from 768 bp .
- IS<sub>1</sub> first identified in *E. coli*'s galactose operon is 768 bp long and is present with 4-19 copies in the *E. coli* chromosome.
- Ends of all known IS elements show inverted terminal repeats (ITR).

# Insertion sequence, IS1



# Integration of IS element in chromosomal DNA.



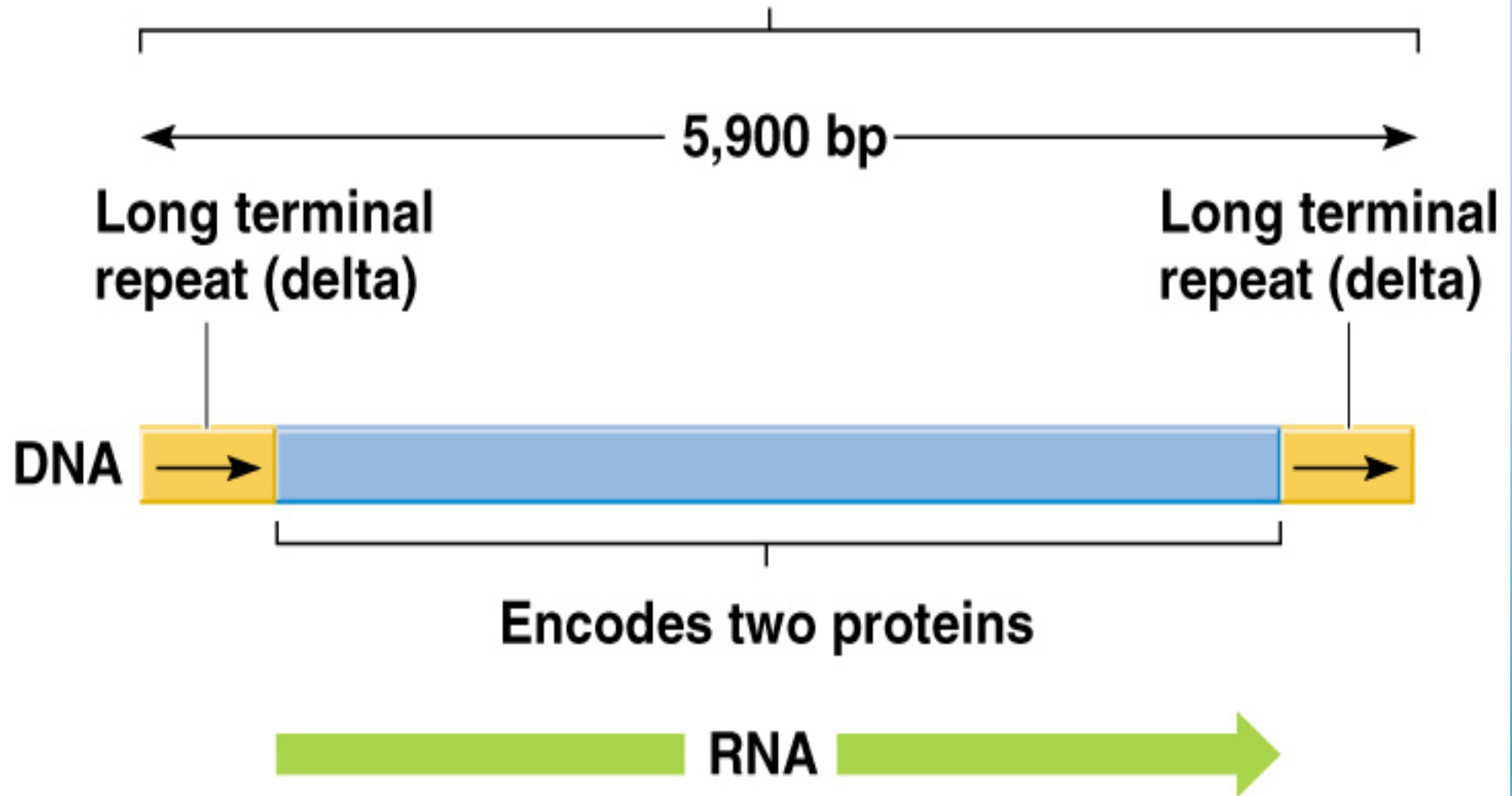
# Transposable Elements in Eukaryotes

## Ty elements in yeast:

- Similar to bacterial transposons; terminal repeated sequences, integrate at non-homologous sites, with target site duplication.
- Ty elements share properties with retroviruses, retrotransposons:
  - Synthesize RNA copy and make DNA using reverse transcriptase.
  - cDNA integrates at a new chromosomal site.



## Yeast *Ty* element



# LINEs (Long interspersed elements)

- LINEs are one of the most ancient and successful inventions in eukaryotic genomes.
- In humans, are about 6 kb long.
- encode two open reading frames (ORFs) .
- Most LINE-derived repeats are short, with an average size of 900 bp - 1,070 bp .
- The LINE machinery is believed to be responsible for most reverse transcription in the genome.




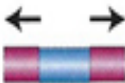
# Short interspersed nuclear elements(SINEs)

- SINEs retrotransposons are the second most abundant class of transposable element in the human genome . SINE families are the Alu elements.
- SINE are usually less than 400 base pair long and do not encode proteins.
- The reverse transcriptase required for SINE transposition is provided by a LINE-type element.

# ALU ELEMENTS

- **Alu** repeats are **interspersed** repetitive DNA elements specific to primates that are present **in** 500,000 to 1 million copies
- Alu are mainly 300bp long.
- They do not contain any coding sequence and can be recognized by restriction enzyme AuaI.
- They found in some genetic diseases and cancer and Cause of a Severe Form of Hemophilia A .

# Types of transposable elements in the human genome

Element	Transposition	Structure	Length	Copy number	Fraction of genome
LINEs	Autonomous		1–5 kb	20,000–40,000	21%
SINEs	Nonautonomous		100–300 bp	1,500,000	13%
DNA transposons	Autonomous		2–3 kb	300,000	3%
	Nonautonomous		80–3000 bp		

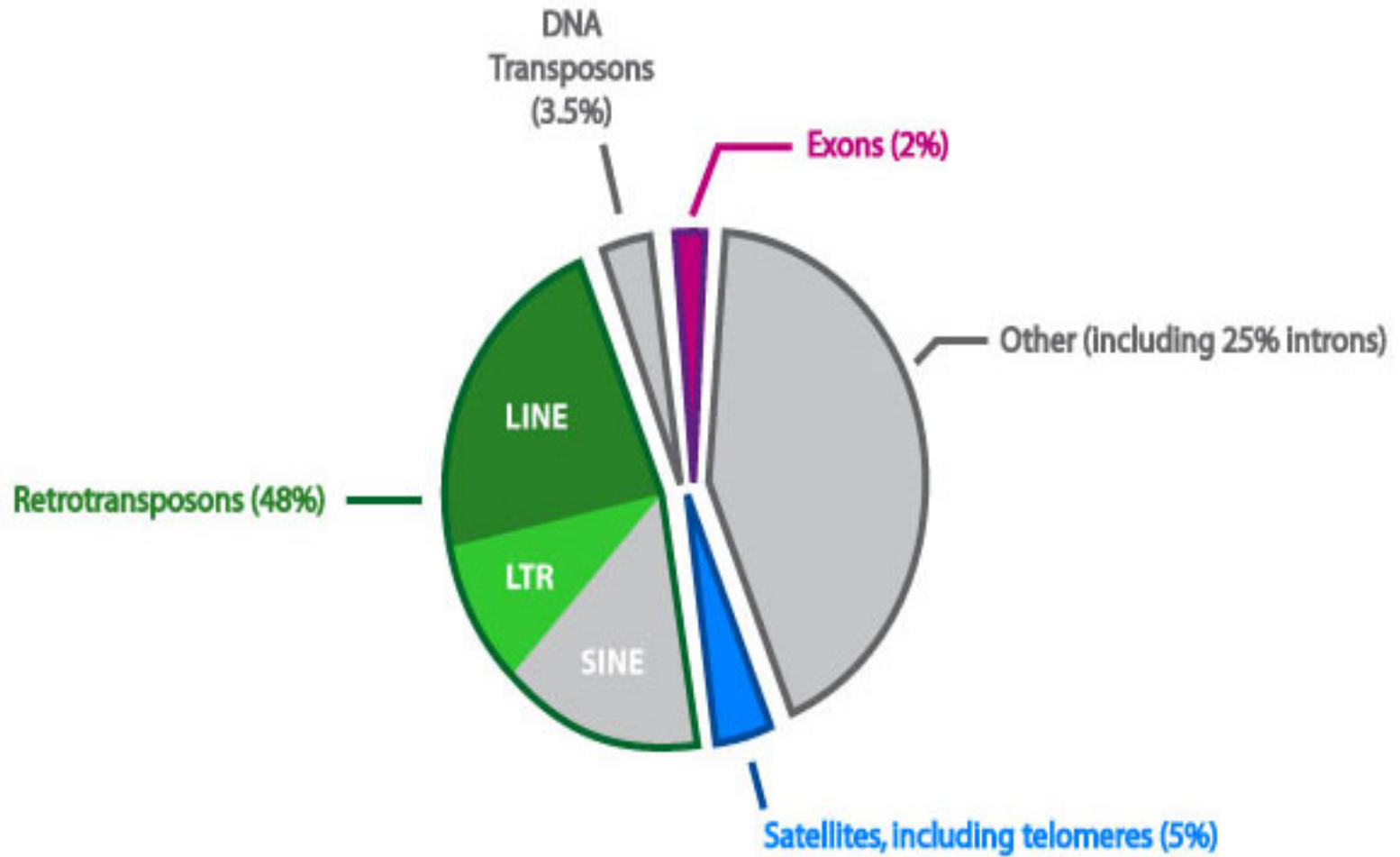


Fig. 1 - Composition of the human genome

Cristofari's lab 2010 - Adapted from Rollins *et al.* **Genome Res.** (2006)