




# **Neuronal Stem Cell:**

## **DNA Replication**

# Brain:

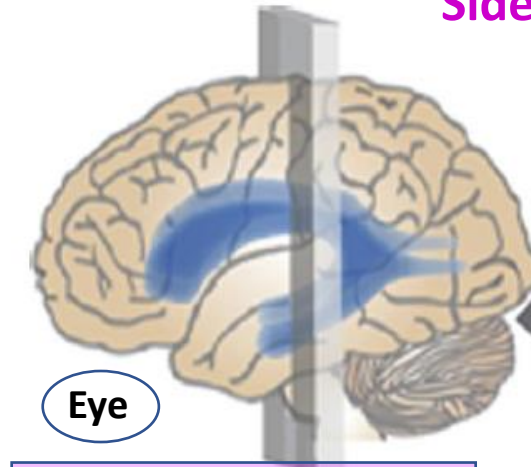
## Neural Stem Cells & Progenitor Cells

### Key

-  Lateral ventricles
-  Subventricular zone
-  Subgranular zone

 Oligodendrocyte progenitor cell

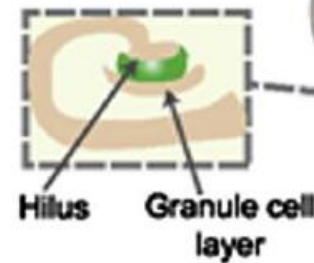
Side View: Brain



Eye

Coronal plane of section

Front View: Brain



Hippocampus  
(Brain Region)

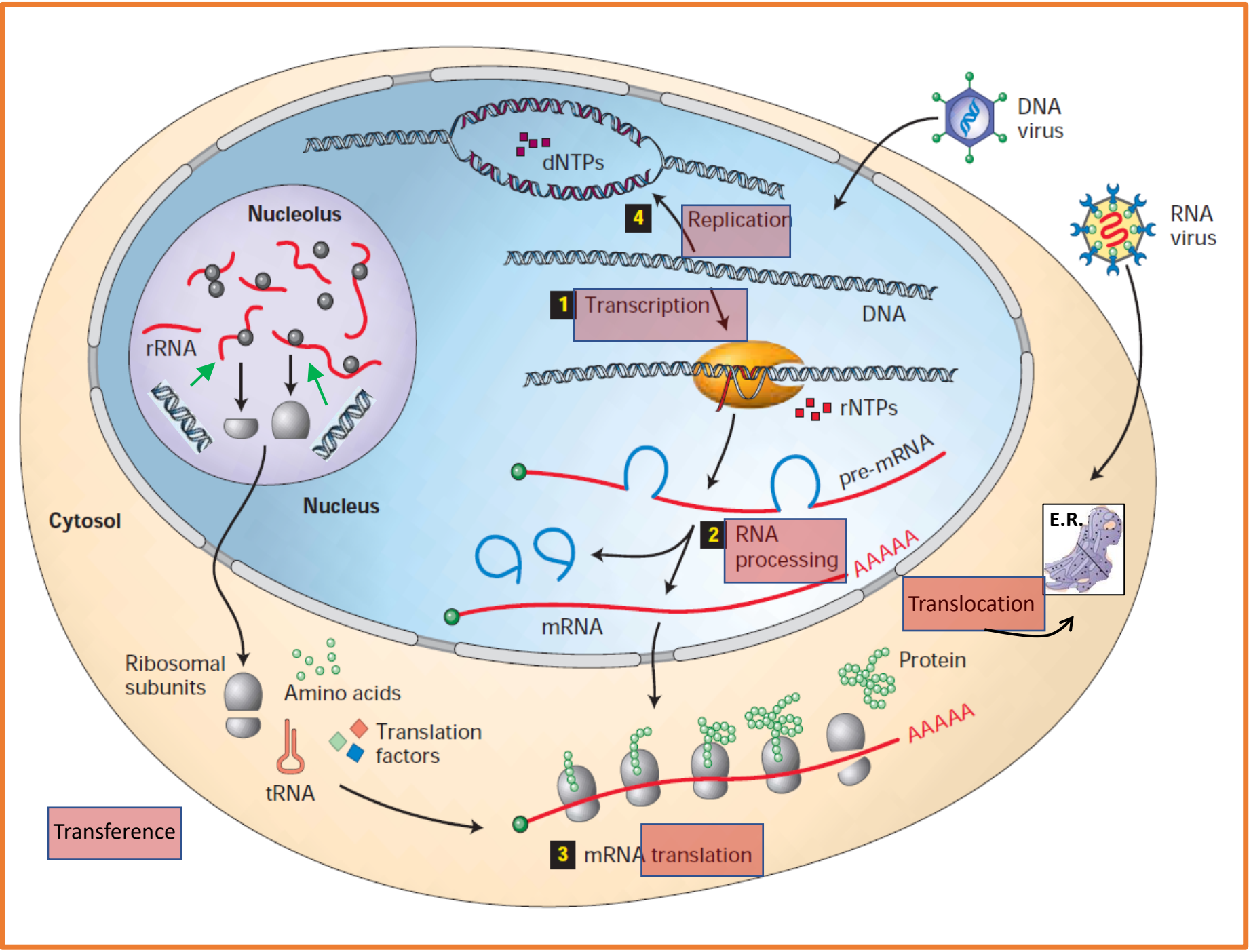
Frontal view of coronal section

Basic Genetic Processes:  
 $R^2 T^5$

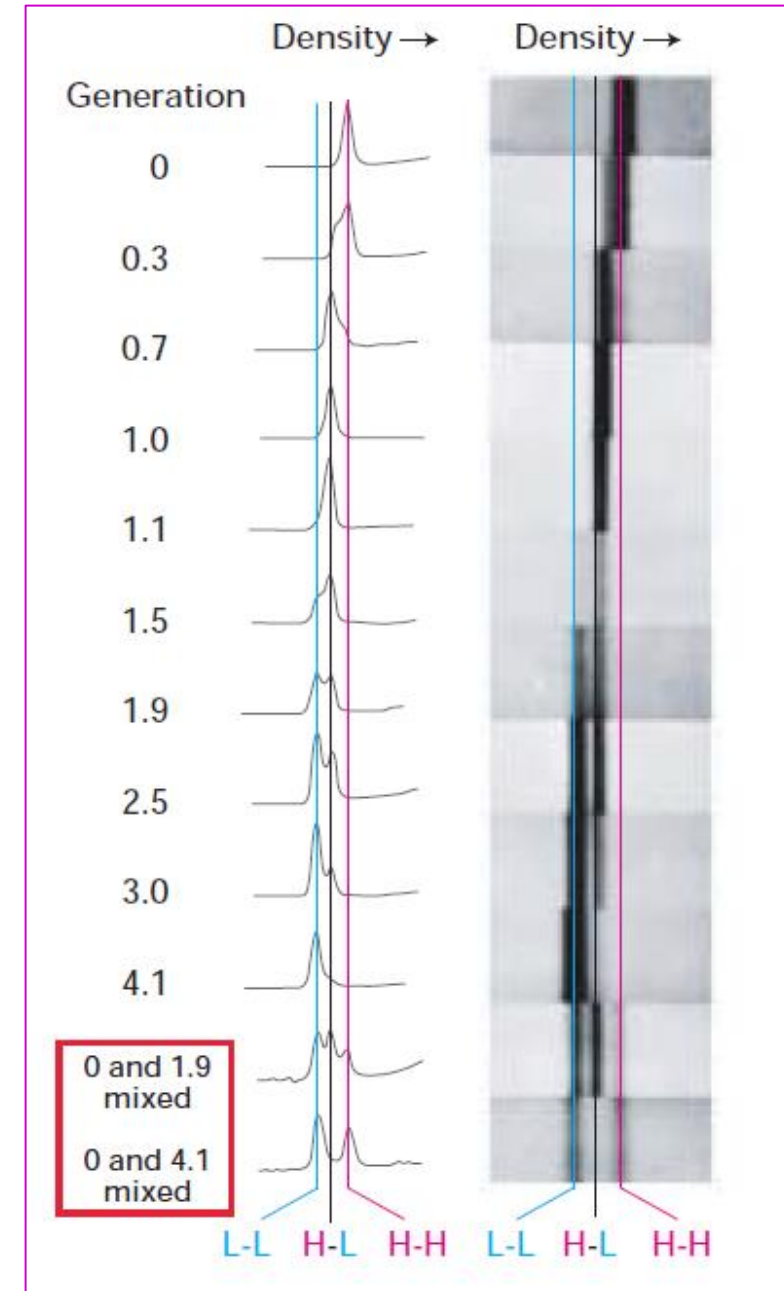
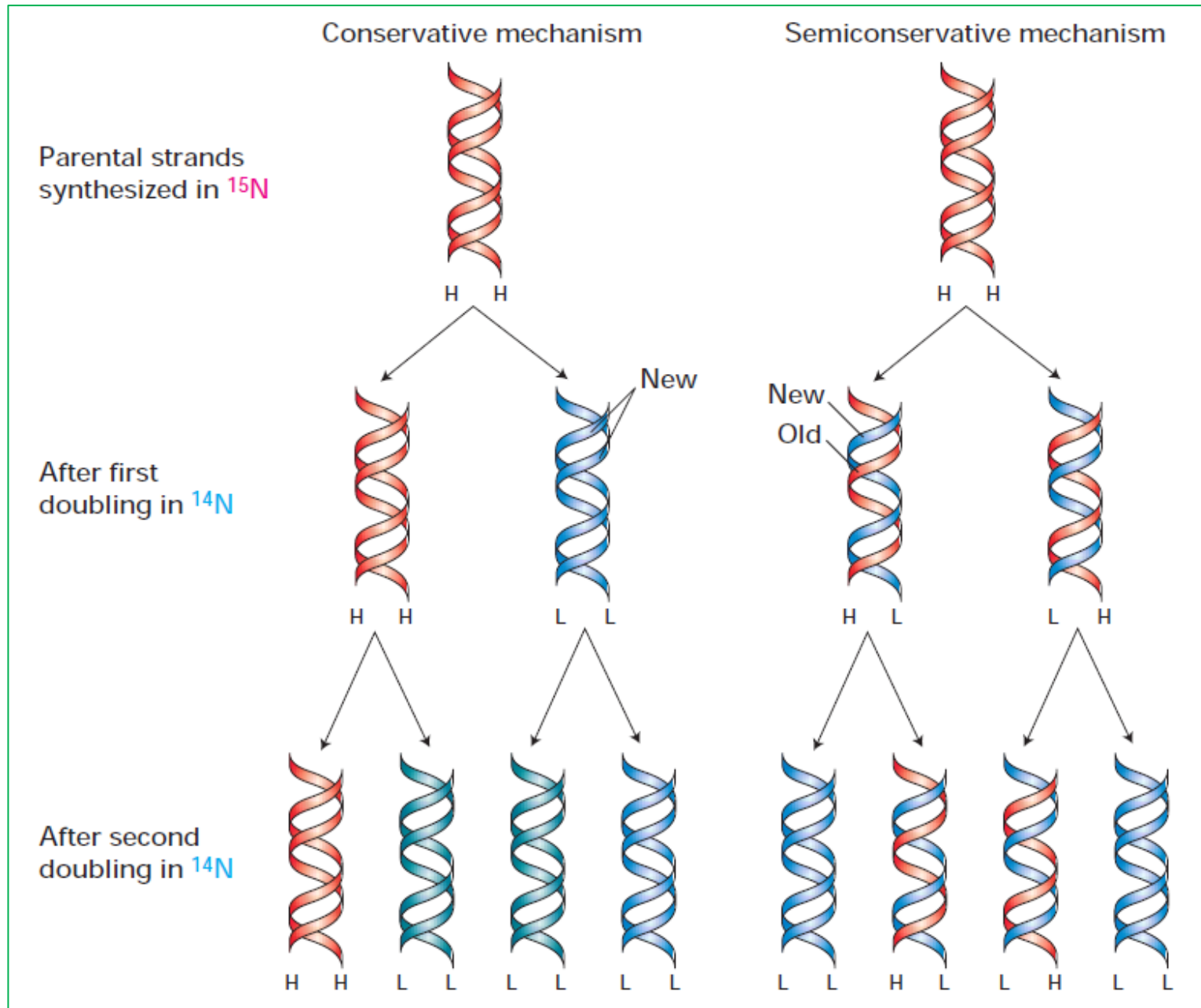
Replication of DNA  
(during Cell Division)

Protein Formation Steps:

- Transcription,
- RNA processing,
- Transference,
- Translation
- Translocation



# DNA Reproduces Semi-Conservatively (Meselson-Stahl Expt.)

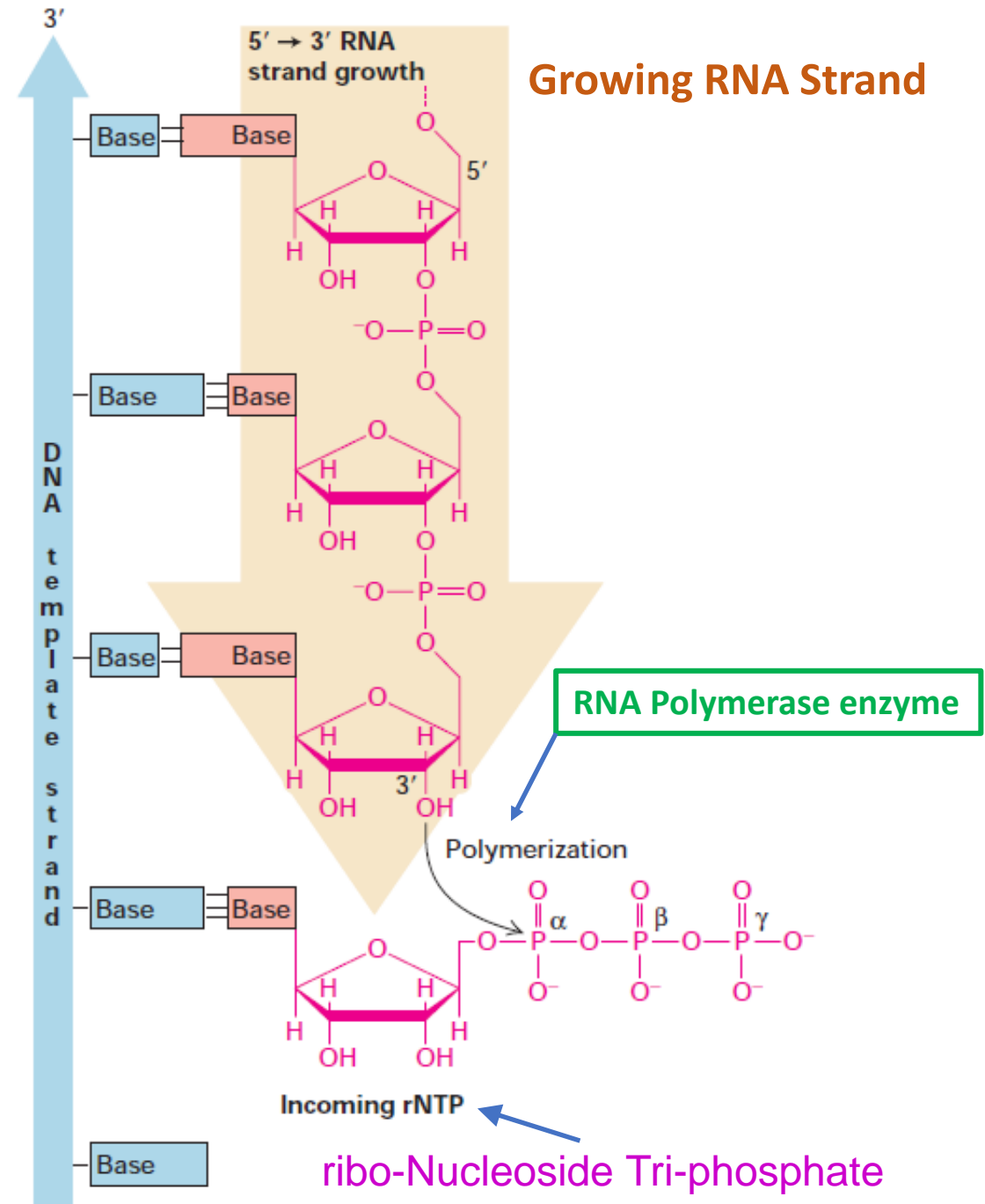
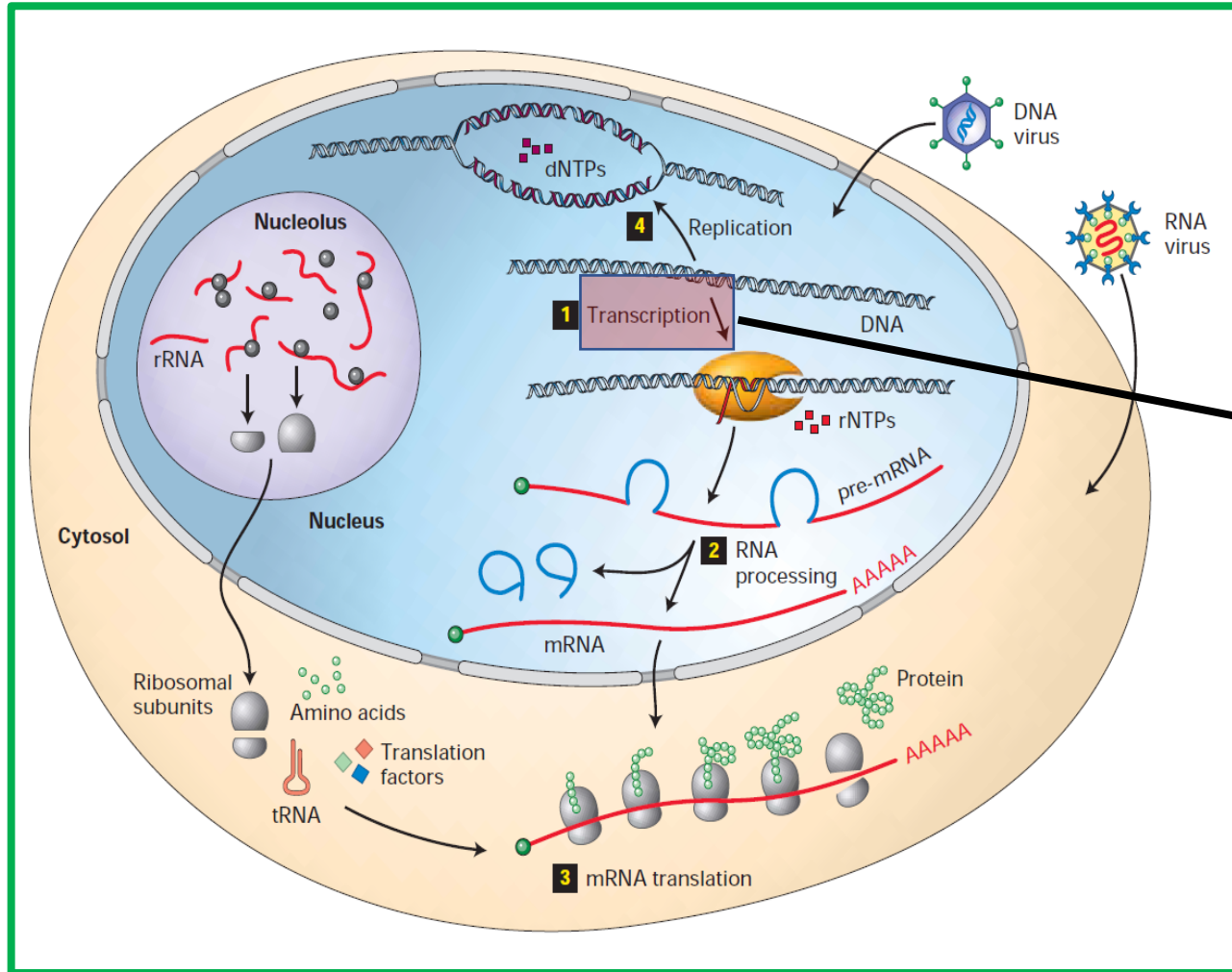




# Stage 1: Translation

## Forming Pre-mRNA

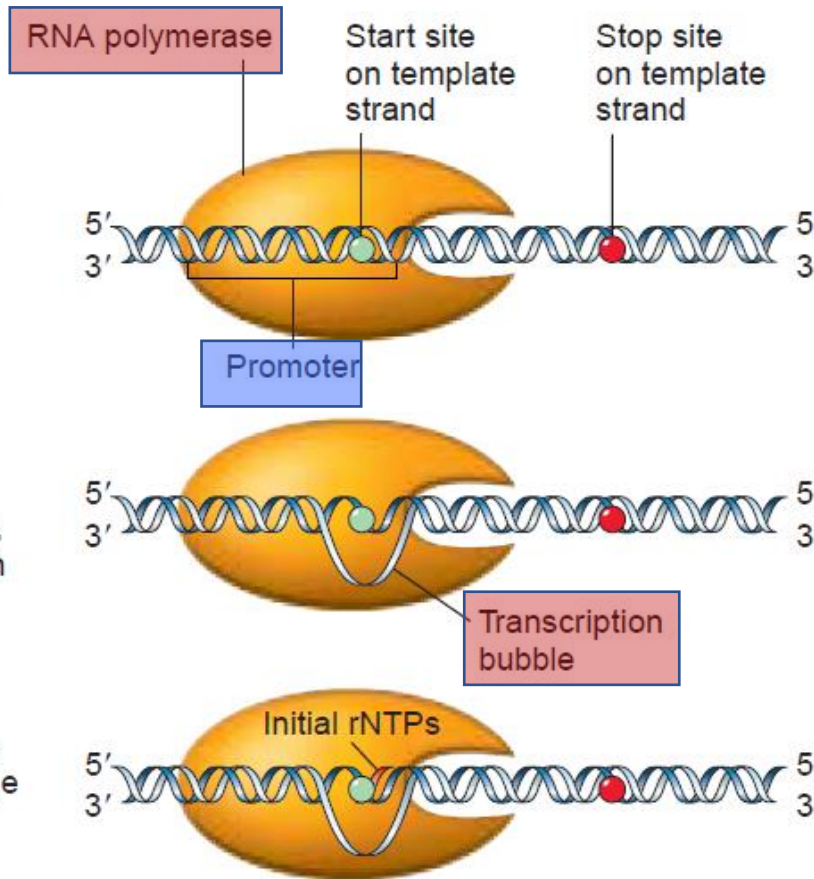
DNA Template Strand



# Three Stages of Transcription

## INITIATION

- 1** Polymerase binds to promoter sequence in duplex DNA. "Closed complex"
- 2** Polymerase melts duplex DNA near transcription start site, forming a transcription bubble. "Open complex"
- 3** Polymerase catalyzes phosphodiester linkage of two initial rNTPs.

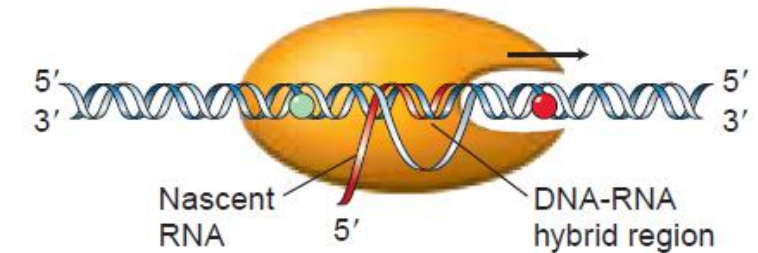


14 base pairs

1000 nucleotides per minute

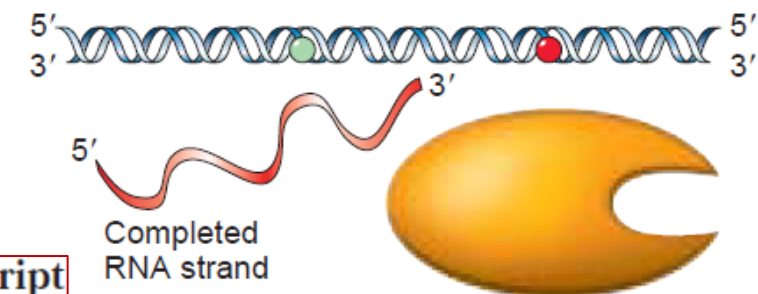
## ELONGATION

- 4** Polymerase advances 3' → 5' down template strand, melting duplex DNA and adding rNTPs to growing RNA.



## TERMINATION

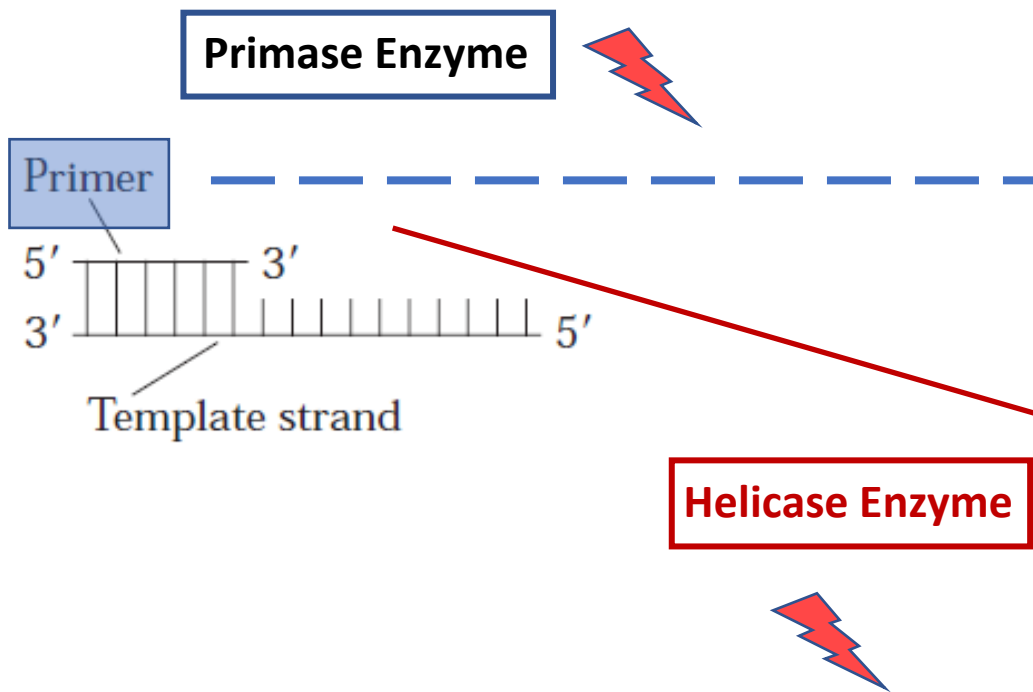
- 5** At transcription stop site, polymerase releases completed RNA and dissociates from DNA.



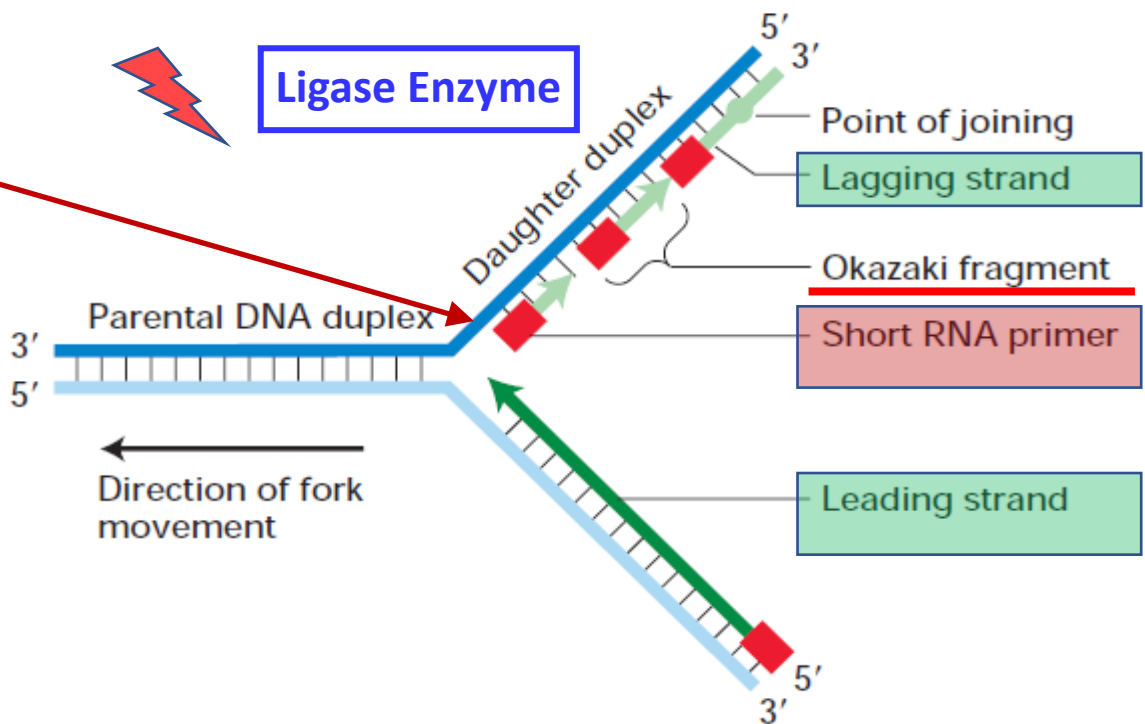
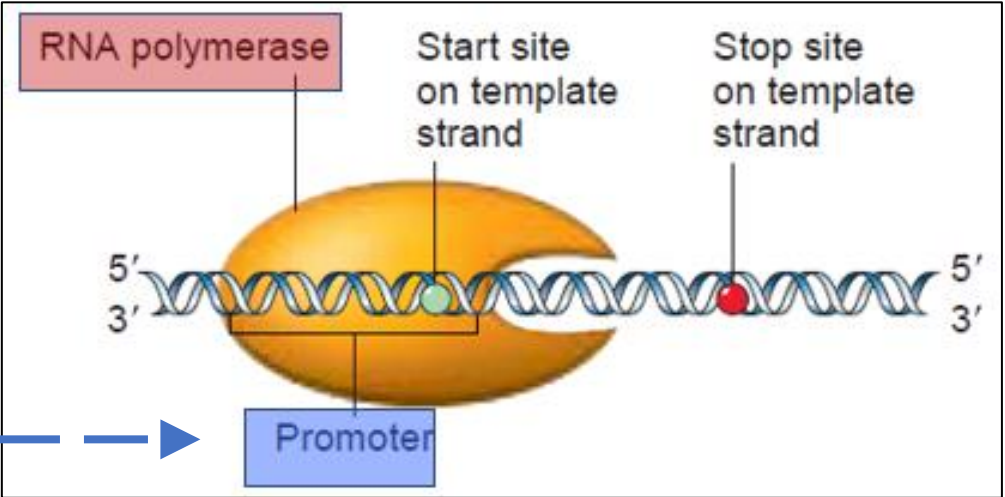
primary transcript

# DNA Replication

RNA Polymerase Enzyme → DNA Polymerase Enzyme

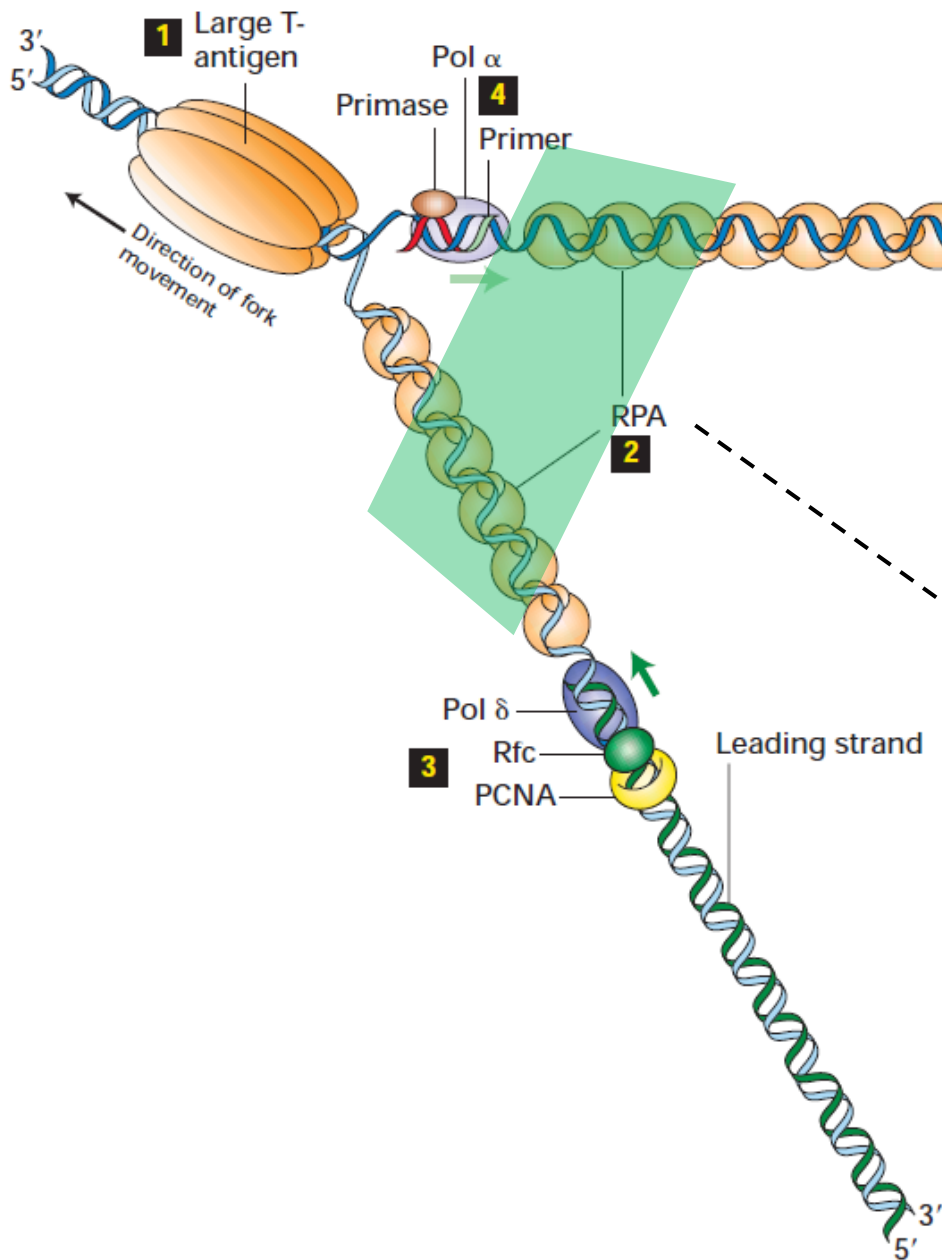


# Like RNA Transcription

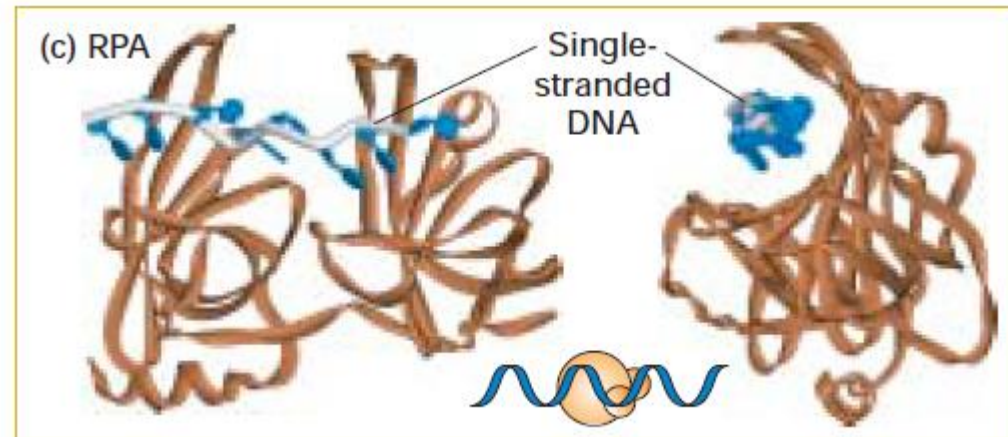
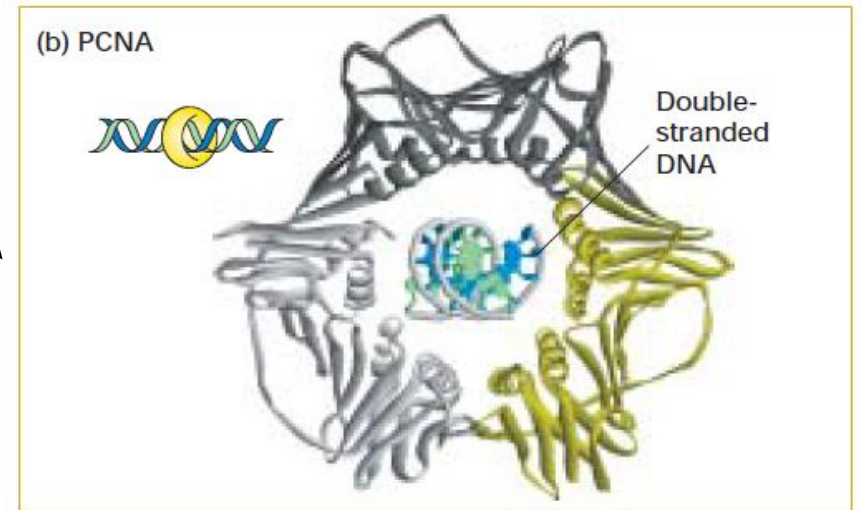




(a) SV40 DNA replication fork



## Monkey DNA Replication: Simian Virus 40

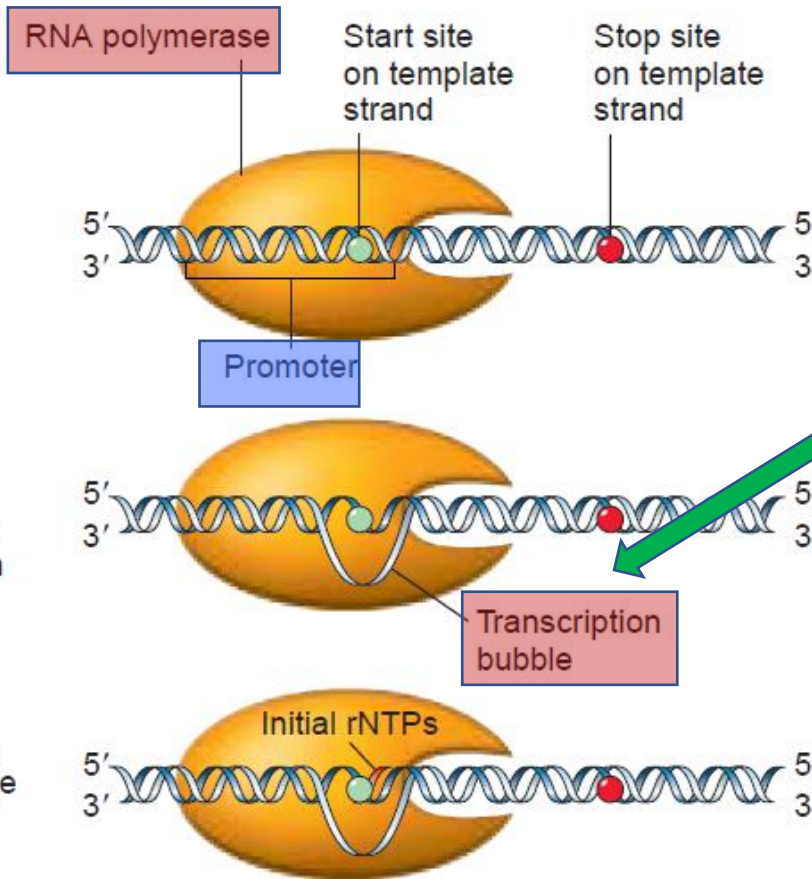




# Three Stages of Transcription

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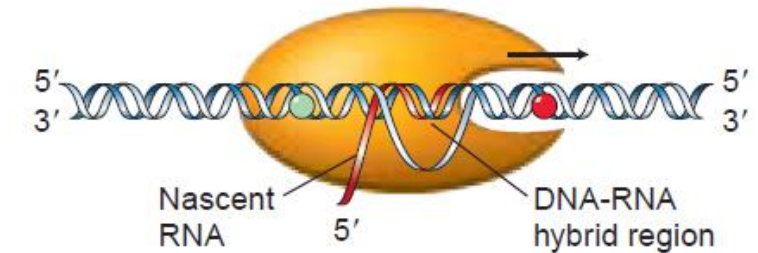


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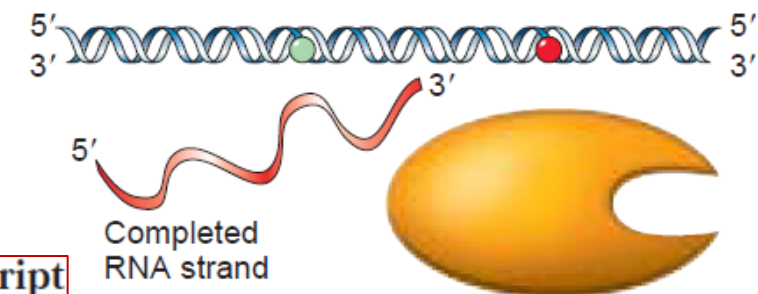
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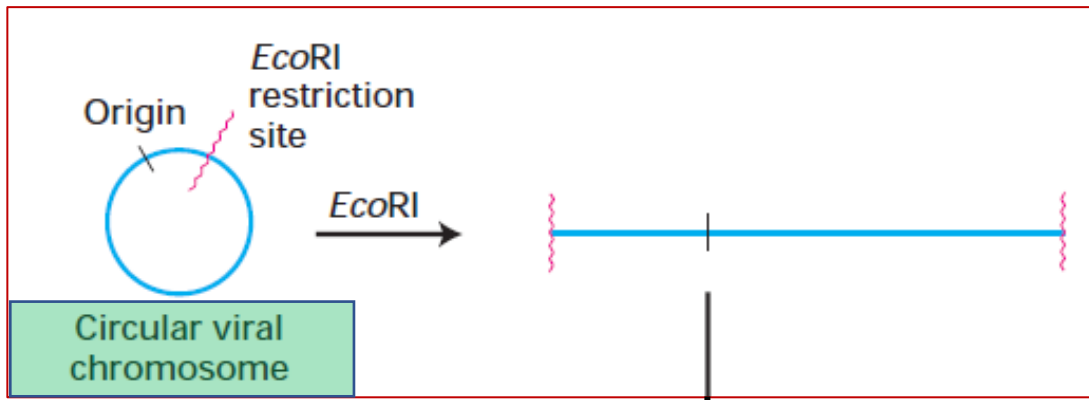


## TERMINATION

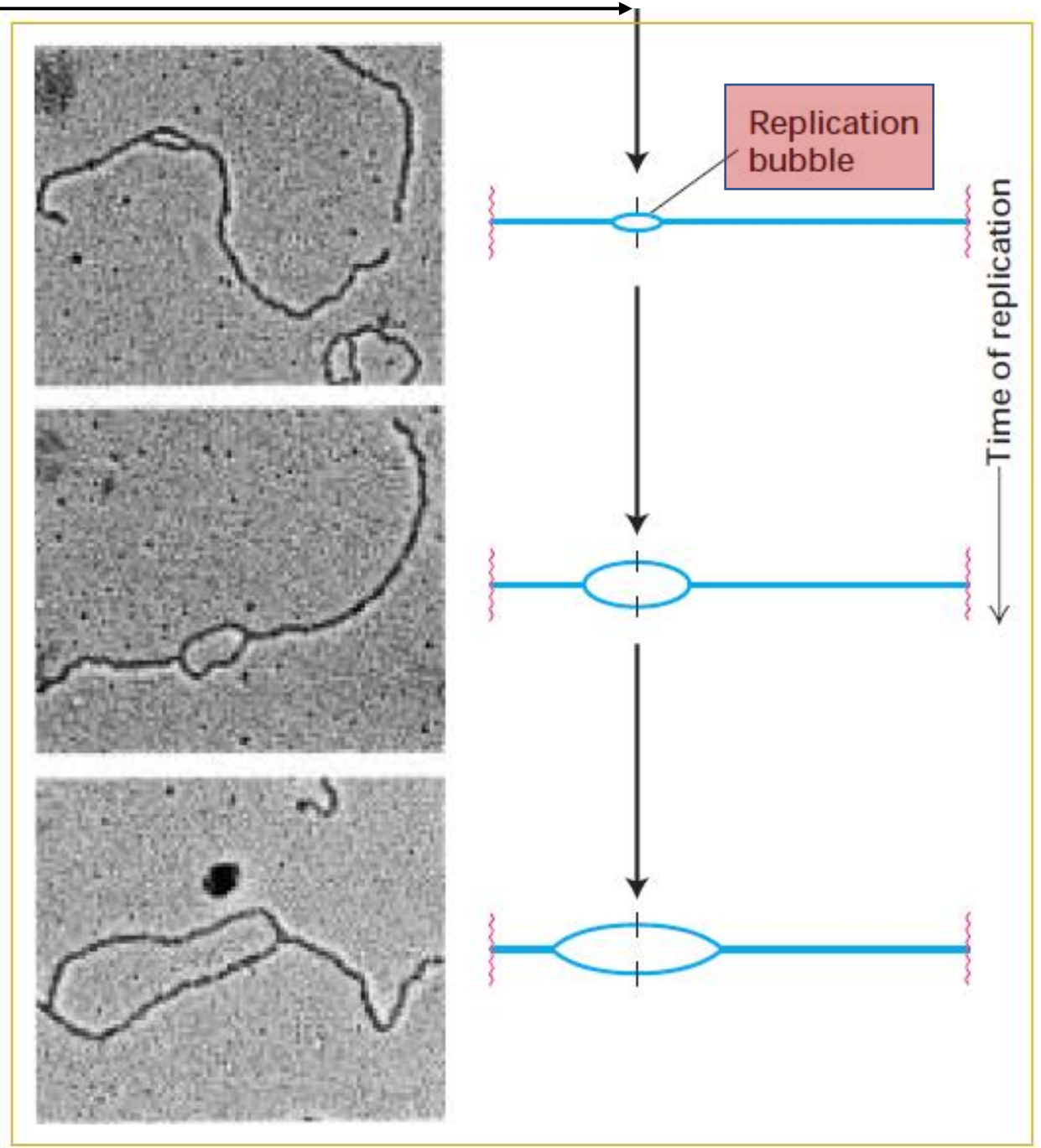
- 5** At transcription stop site, polymerase releases completed RNA and dissociates from DNA.



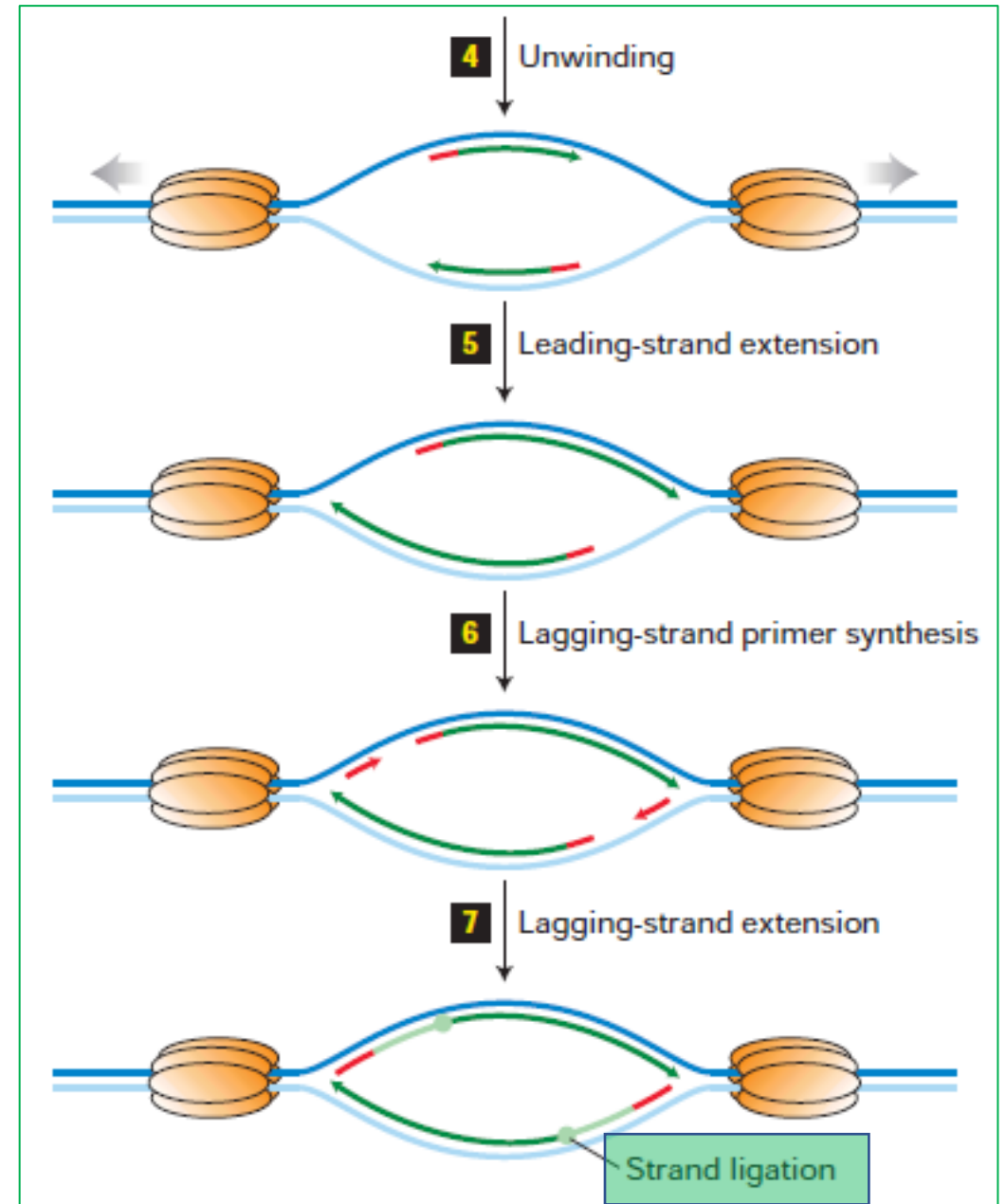
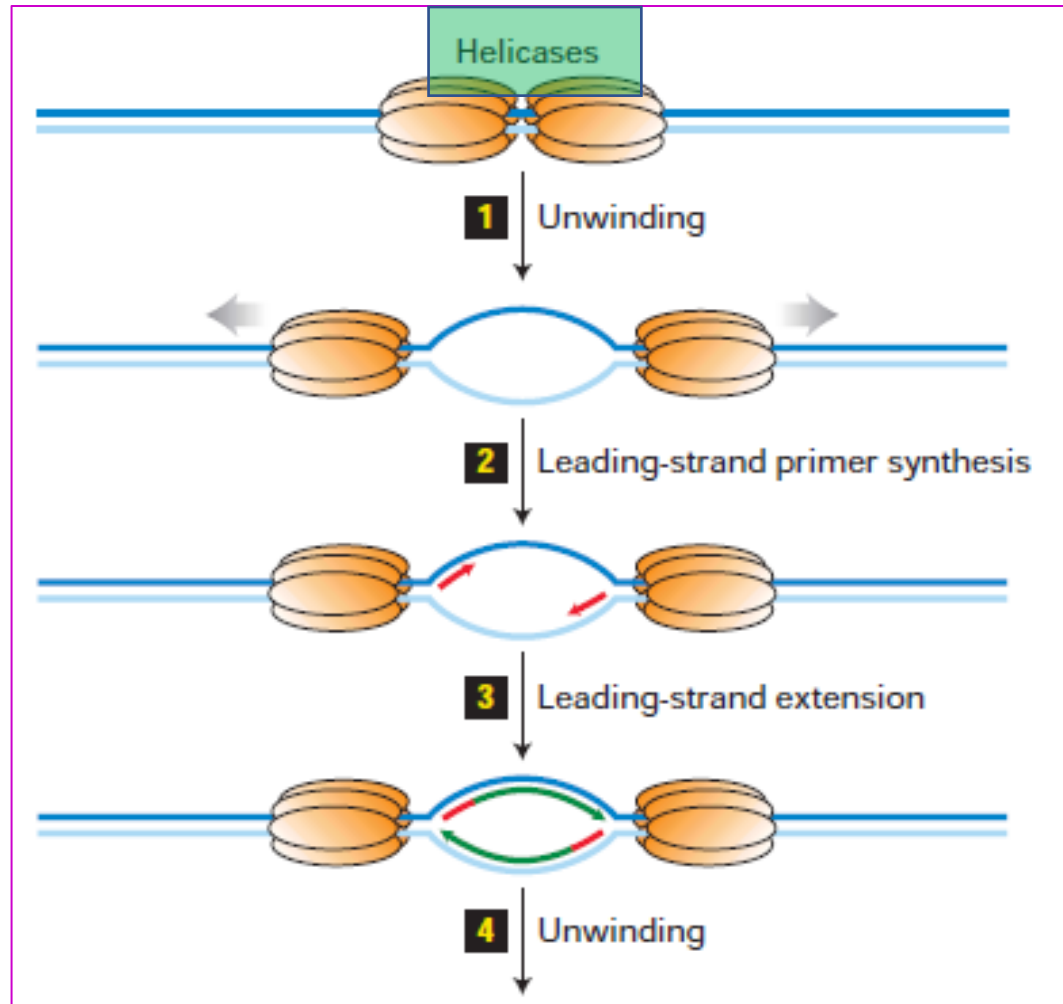
primary transcript



**Plasmid (viroid)**



# Bi-directional Mechanism of DNA Replication



**DNA Outside Nucleus:**

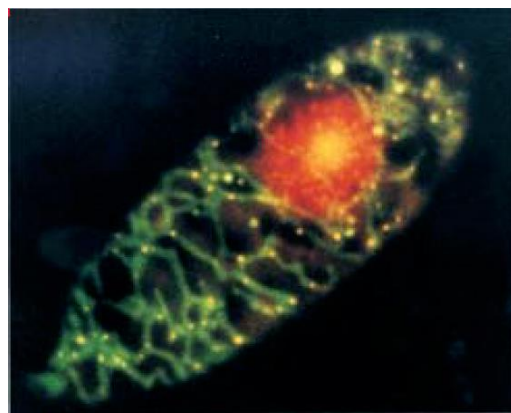
**Human Mitochondrial Clock**



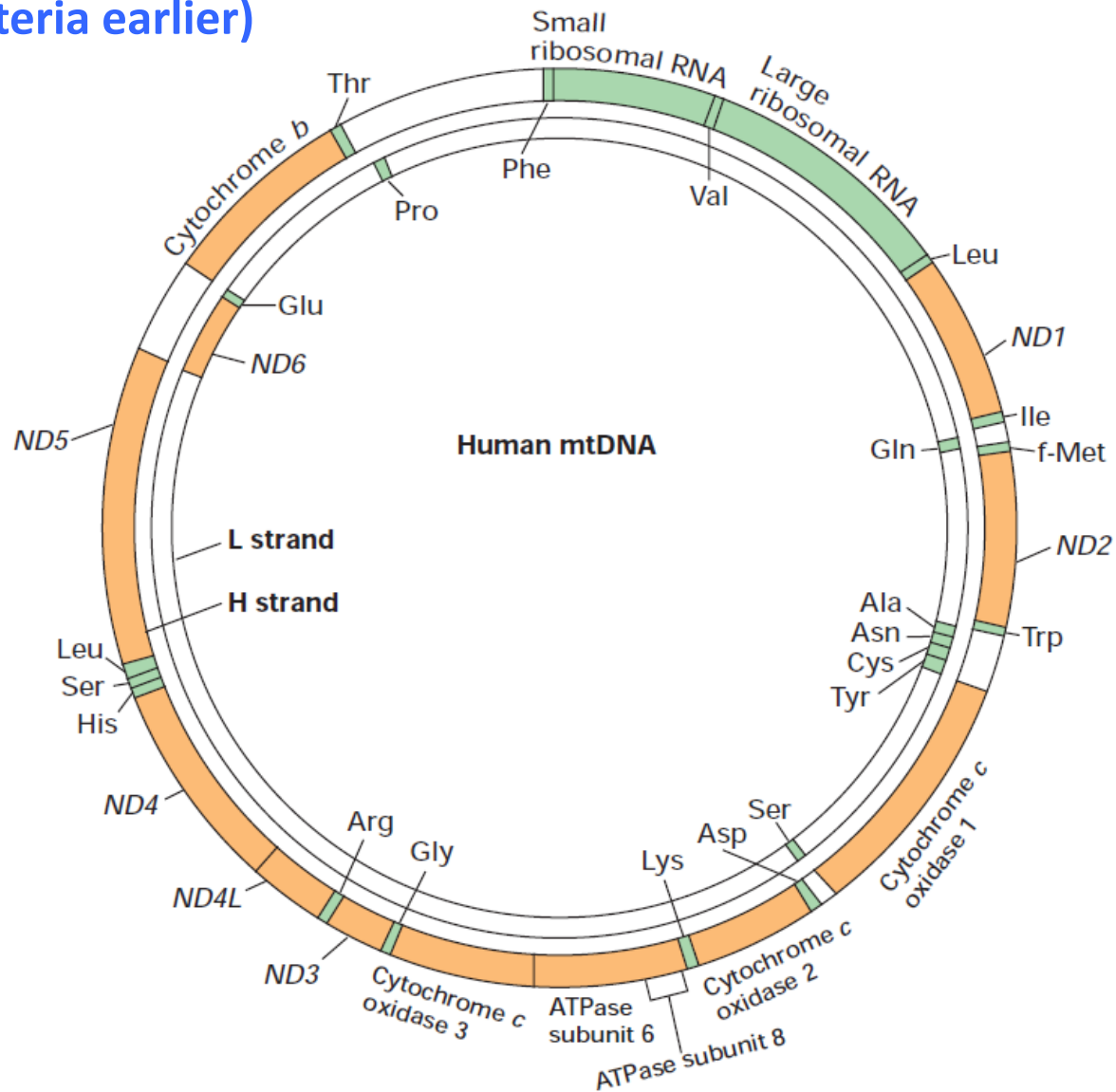
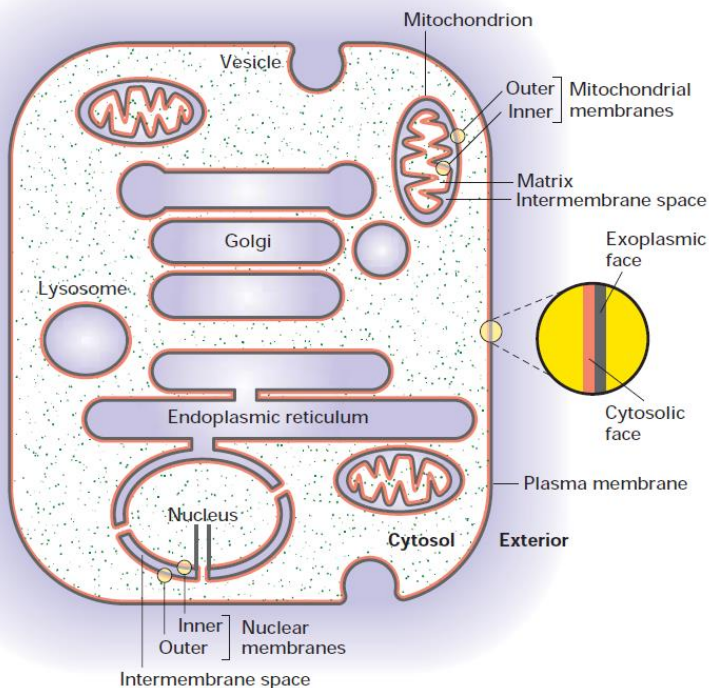
# Mitochondrial Circular DNA

## Like Plasmid

(Mitochondria: a bacteria earlier)



Annual Mutation:  
SNP Rates



Regions(s)	Subregions (or site within codon)	SNP rate (per site * year)
Control region	HVR I	$1.6 \times 10^{-7}$
	HVR II	$2.3 \times 10^{-7}$
	remaining	$1.5 \times 10^{-8}$
Protein-coding	(1st and 2nd)	$8.8 \times 10^{-9}$
	(3rd)	$1.9 \times 10^{-8}$
DNA encoding rRNA (rDNA)		$8.2 \times 10^{-9}$
DNA encoding tRNA (tDNA)		$6.9 \times 10^{-9}$
other		$2.4 \times 10^{-8}$
T <sub>CHLCA</sub> assumed 6.5 Ma, relative rate to 1st & 2nd codons		