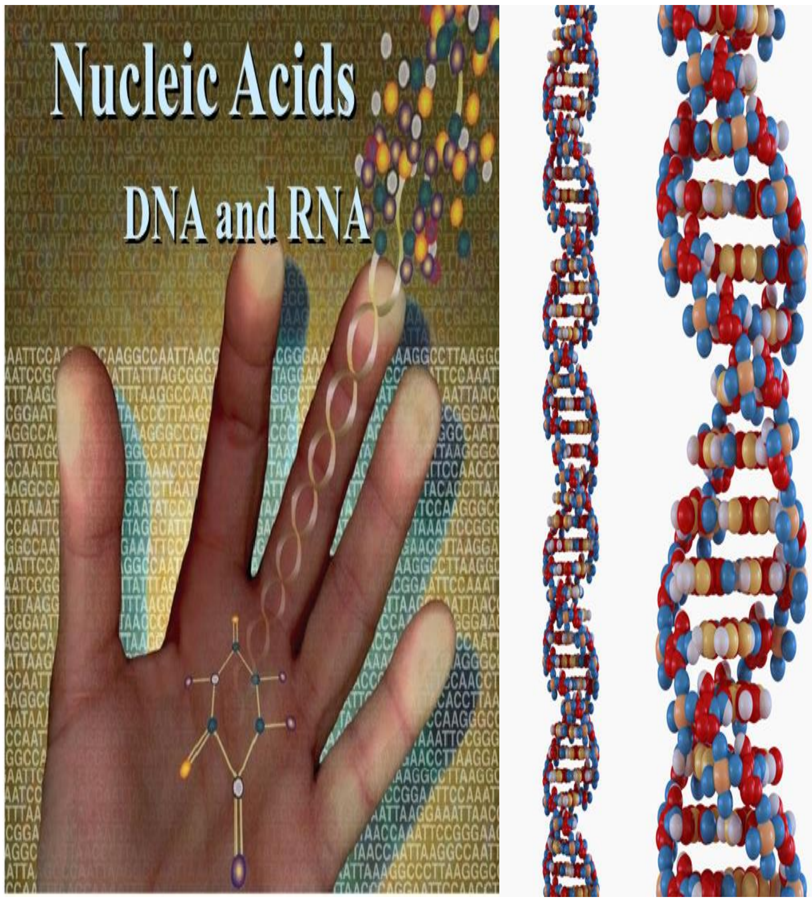
Biochemistry – Year 2



Lecture 3

By

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RNA types

Conformational variability of RNA is important for the much diverse roles of RNA in the cell , when compared to DNA.

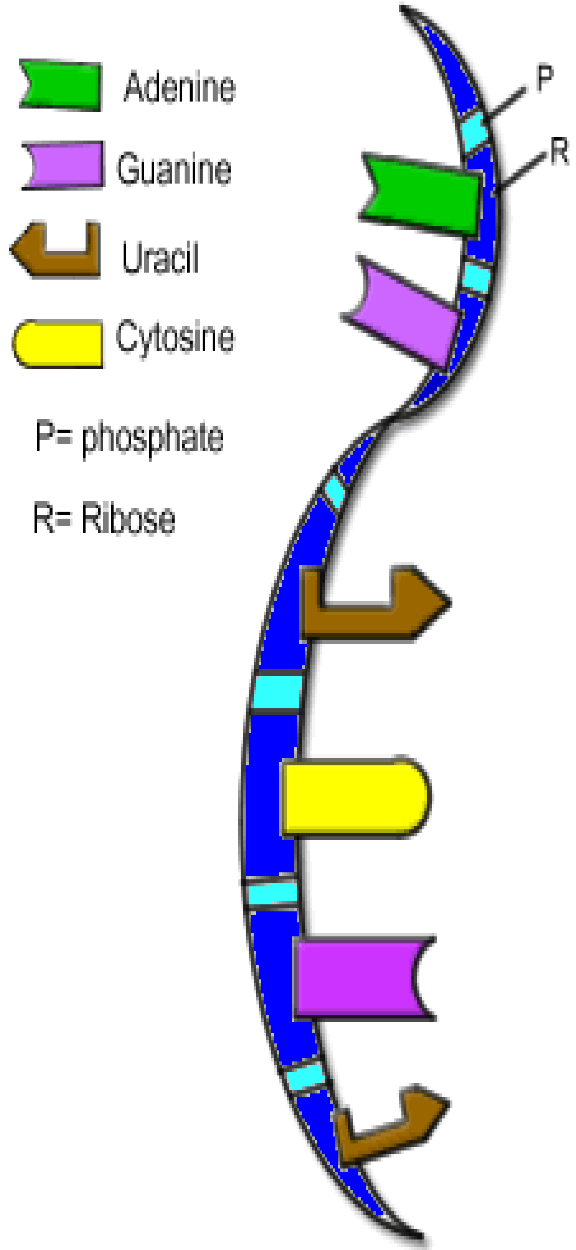
Types:

There are three types of RNA:

mRNA – Messenger RNA: single uncoiled chain that carries the genetic information from the nucleus to the cytosol .

Each three Nucleotide sequence in an mRNA strand is called a "Codon"

Each Codon codes for a particular amino acid.



The codon sequence codes for an amino acid using specific rules. These specific codon/amino acid pairings is called the Genetic Code.

SECOND POSITION

FIRST POSITION	U	C	A	G	THIRD POSITION
U	phenyl-alanine	serine	tyrosine	cysteine	U
					C
	leucine		stop	stop	A
			stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
					C
			glutamine		A
					G
A	isoleucine	threonine	asparagine	serine	U
					C
			lysine	arginine	A
	* methionine				G
G	valine	alanine	aspartic acid	glycine	U
					C
			glutamic acid		A
					G

* and start

Genetic Code

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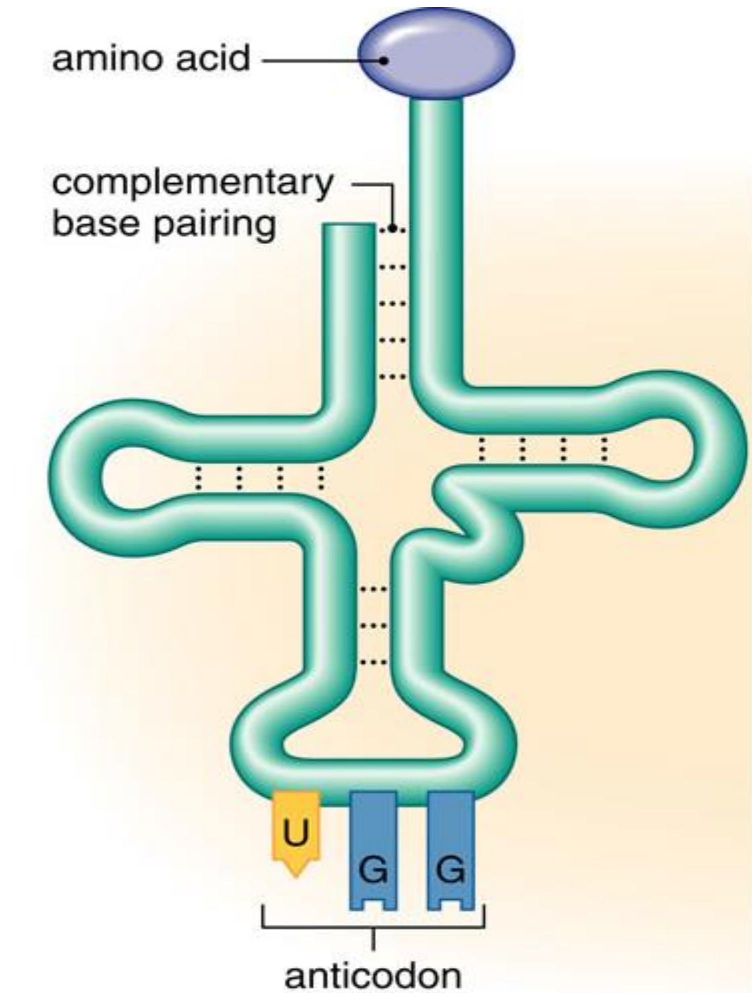
G	valine	alanine	aspartic acid	glycine	U
					C
			glutamic acid		A
					G

* and start

- Correlation between nucleotides and amino acids
- Codon: 3 mRNA nucleotides; codes for a specific amino acid
- One codons codes to start (**AUG – amino acid Methionine**) and 3 codons can **stop (UAA, UAG, UGA** – no amino acids).
- If you had a codon AAG, what amino acid would you have?
- lysine

tRNA – transports amino acids or Transfer RNA :
single chain in the formation of a hairpin shape, each piece is bound to a specific amino acid.

- Each tRNA has a 3 Nucleotide sequence on one end which is known as the "Anitcodon"
- This Anticodon sequence is complimentary to the Codon sequence found on the strand of mRNA
- Each tRNA can bind specifically with a particular amino acid.



a. tRNA–amino acid

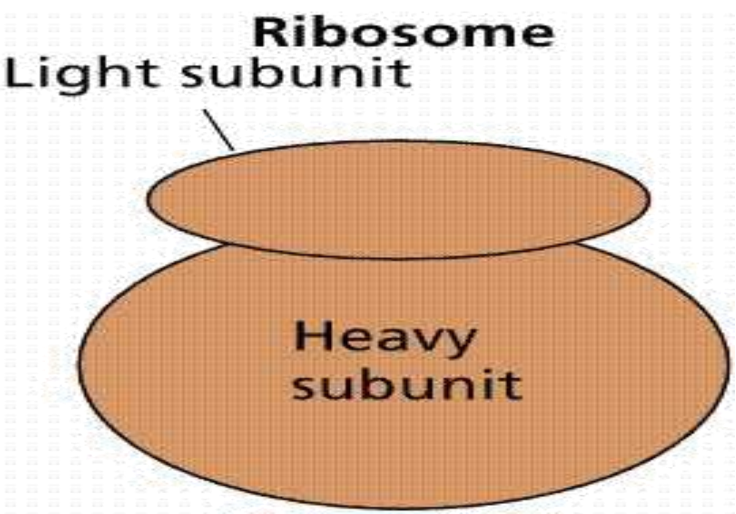
rRNA – Ribosomal RNA : most abundant form, wraps around ribosomal proteins to make up the ribosomes where proteins are made .

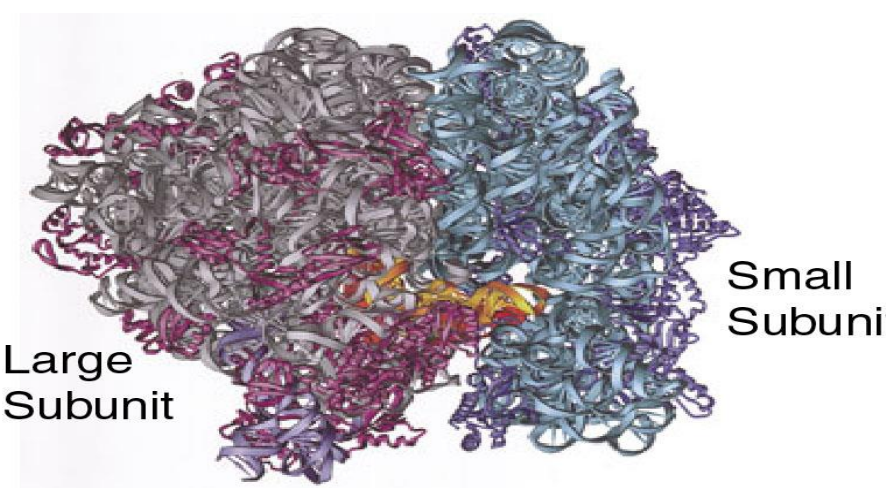
Consists of two subunits made of protein & rRNA

Large subunit

Small subunit

Serves as a template or "work station" where protein synthesis can occur.





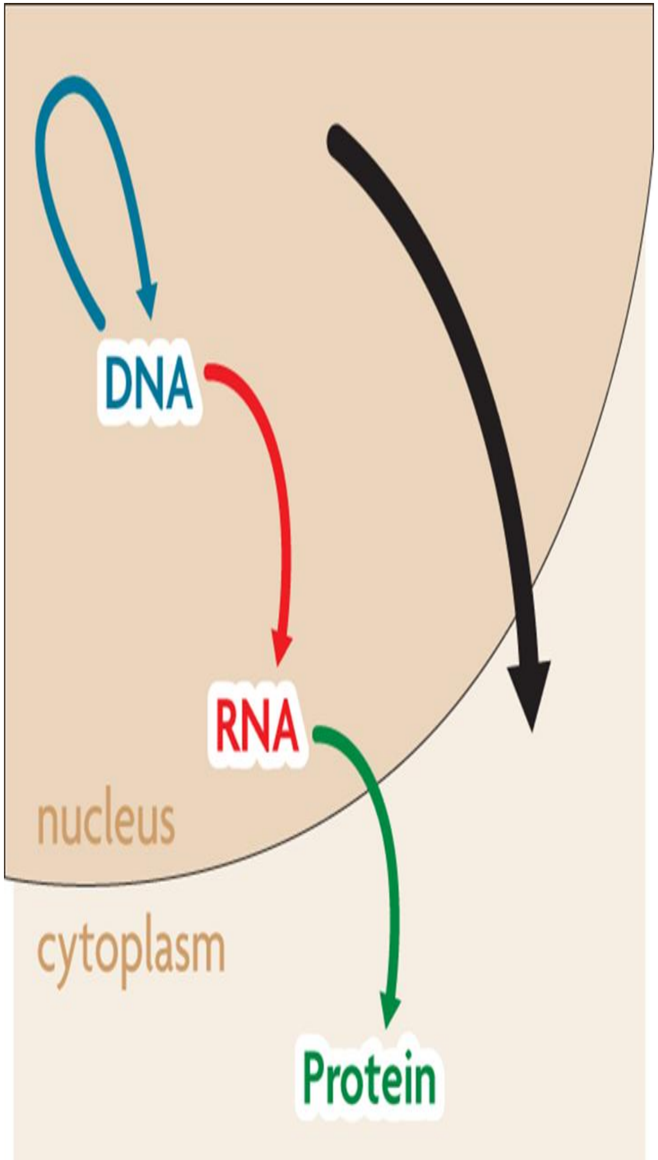
comparison of RNA and DNA

	RNA	DNA
Shape	**single stranded**	**double stranded**
Specific Base	contains uracil	contains thymine
Sugar	ribose	deoxyribose
Size	relatively small	big (chromosomes)
Location	moves to cytoplasm	stays in nucleus
Types	3 types: mRNA, tRNA, rRNA	generally 1 type

The Central Dogma of molecular Biology

Central Dogma : The central dogma states that information flows in one direction from DNA to RNA to proteins.

- **Replication**
  - **DNA making a copy of itself**
    - **Making a replica**
- **Transcription**
  - **DNA being made into RNA**
    - **Still in nucleotide language**
- **Translation**
  - **RNA being made into protein**
    - **Change to amino acid language**

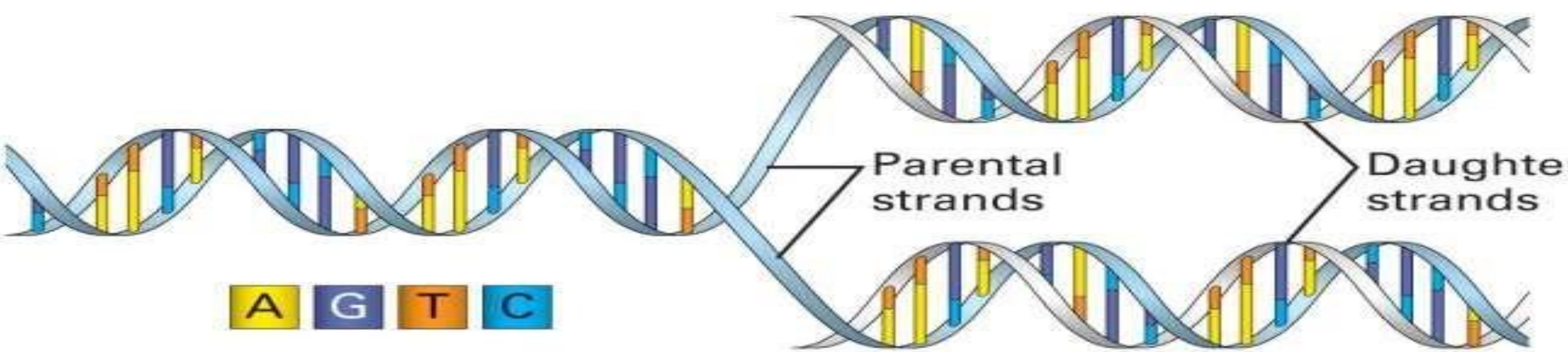


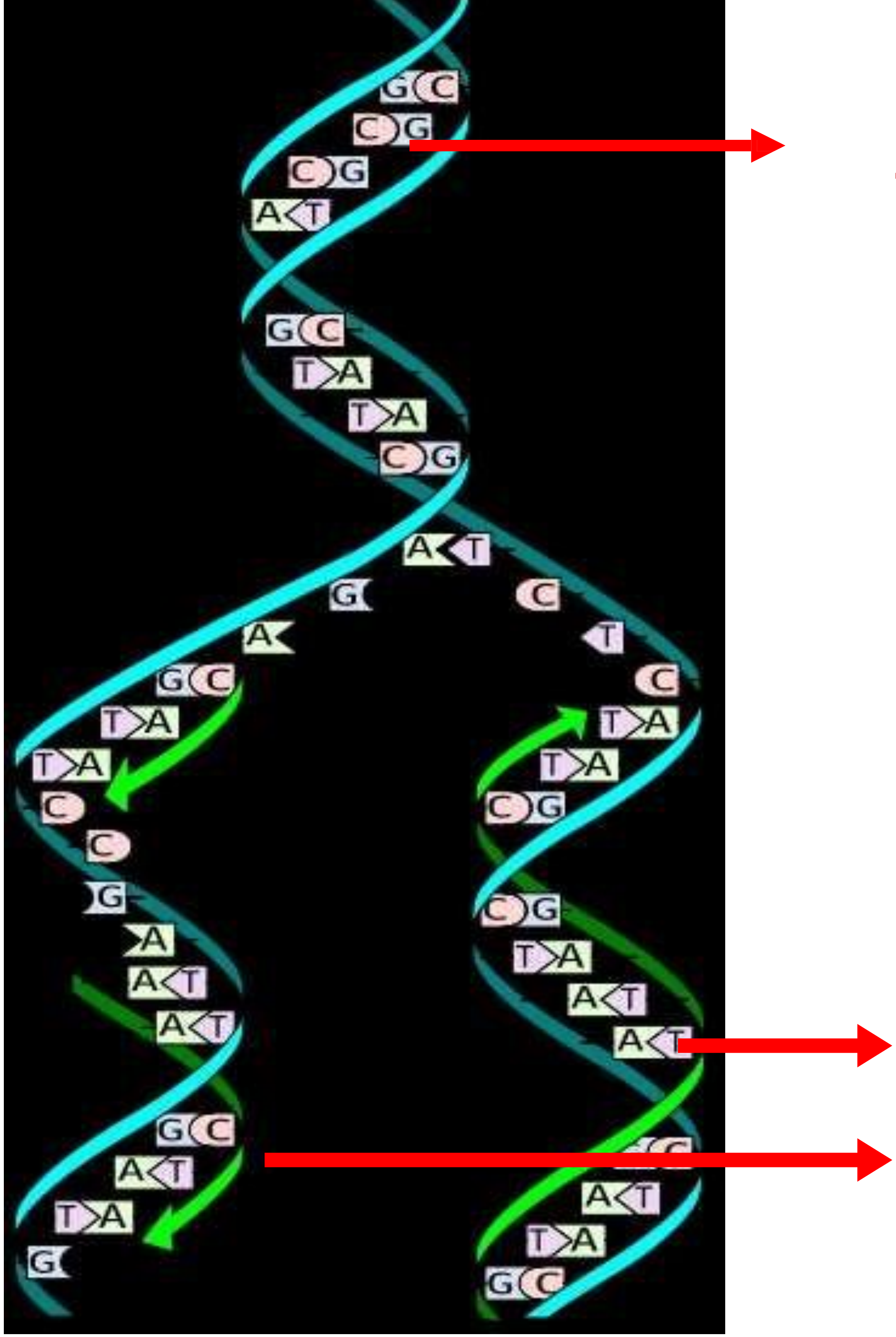
DNA replication

- --- is the process of producing two identical replicas from one original DNA molecule that occurs in all living organisms

- ---is the basis for biological inheritance

- --- is a semi conservative : means that each daughter DNA consist of the half parenter DNA and half of new DNA





2 old strands

Semicontinous

and

Semidiscontinous

2 new strands

Helicase and Polymerase

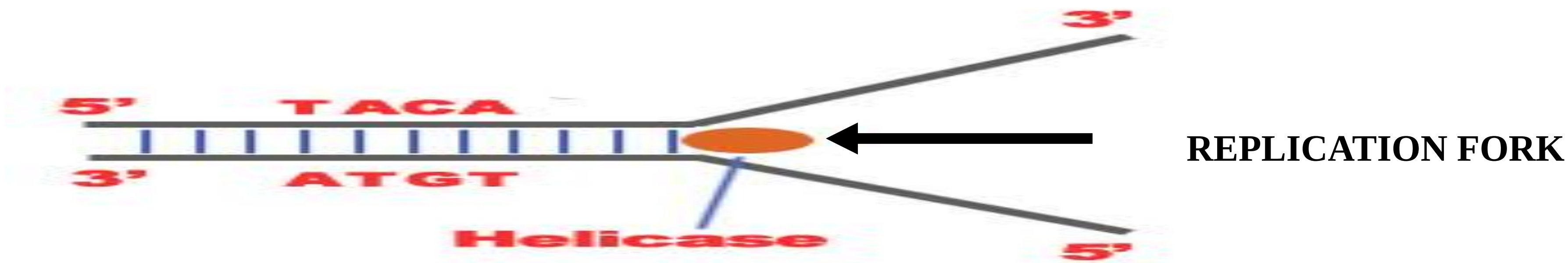
DNA replication begins as an enzyme, **DNA helicase** unwind the parental DNA **,** breaks the hydrogen bonds holding the two strands together and forms a **replication fork** .

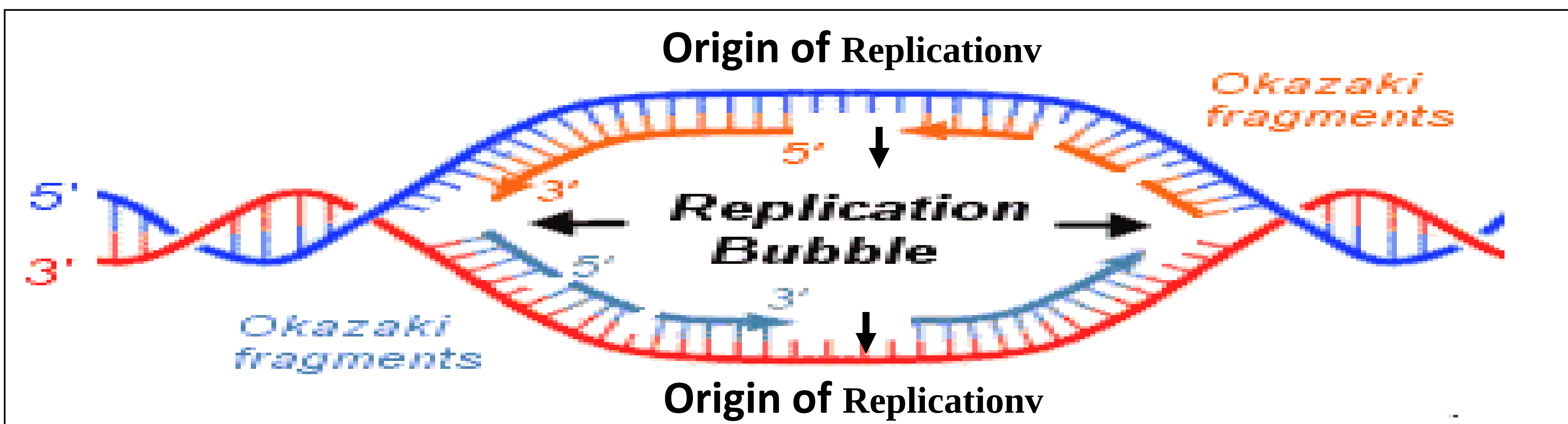
The resulting structure has two branching strands of DNA backbone **template** with exposed nucleotides.

These exposed nucleotide allow the DNA to be "read" by another enzyme, **DNA polymerase,** add complementary nucleotides and the result is an identical strand of DNA.
As DNA helicase continues to open the double helix, the replication fork grows.

DNA is synthesized from the Origin of Replication within a replication bubble

- Towards fork – continuous replication
- Away from fork – discontinuous replication (fragments)



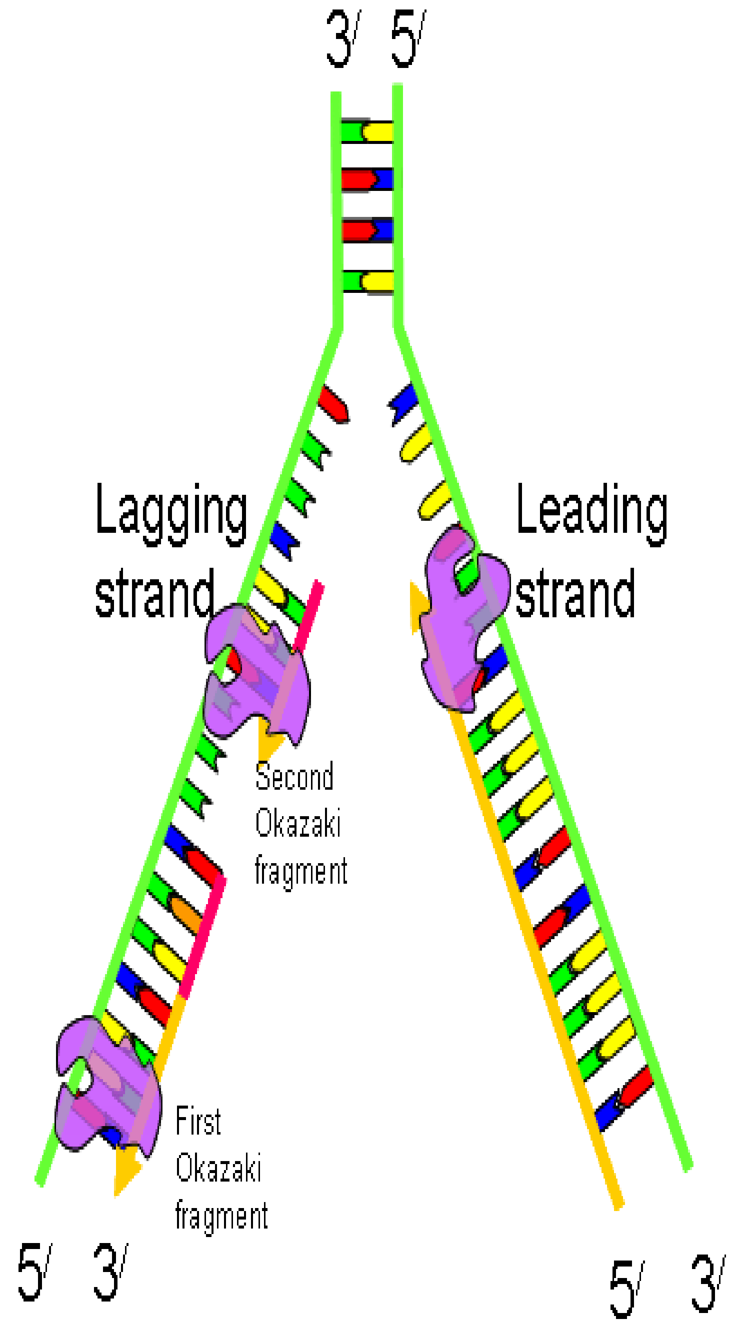


Two DNA polymerase enzymes work at a Replication fork. This enzyme can only build new DNA in the **3' - 5' direction**. It also needs a primer built by primase to start building DNA. Therefore, the two new strands, Leading strand and lagging strand, of DNA are "built" in opposite directions.

The leading strand is the DNA strand that DNA polymerase constructs in the 5' 3' direction. This strand of DNA is made in a continuous manner, moving as the replication fork grows.

The "lagging" strand is synthesized in short segments known as Okazaki fragments. On the lagging strand, **primase** builds a short RNA primer.

DNA polymerase is then able to use the free 3'-OH group on the RNA primer to make DNA in the 5' 3' direction till it reaches to end of the template strand. DNA polymerase of the lagging strand then jumps to go further into the replication fork to make another Okazaki fragment.



The RNA fragments are then degraded and new DNA nucleotides are added to fill the gaps where the RNA was present. Another enzyme, **DNA ligase**, is then able to attach (ligate) the DNA nucleotides together, completing the synthesis of the lagging strand.

Example of DNA Replication

5' TAC CGG AAT GCA ATG CAT ATG 3' **OLD**

3' ATG GCC TTA CGT TAC GTA TAC 5' **OLD**

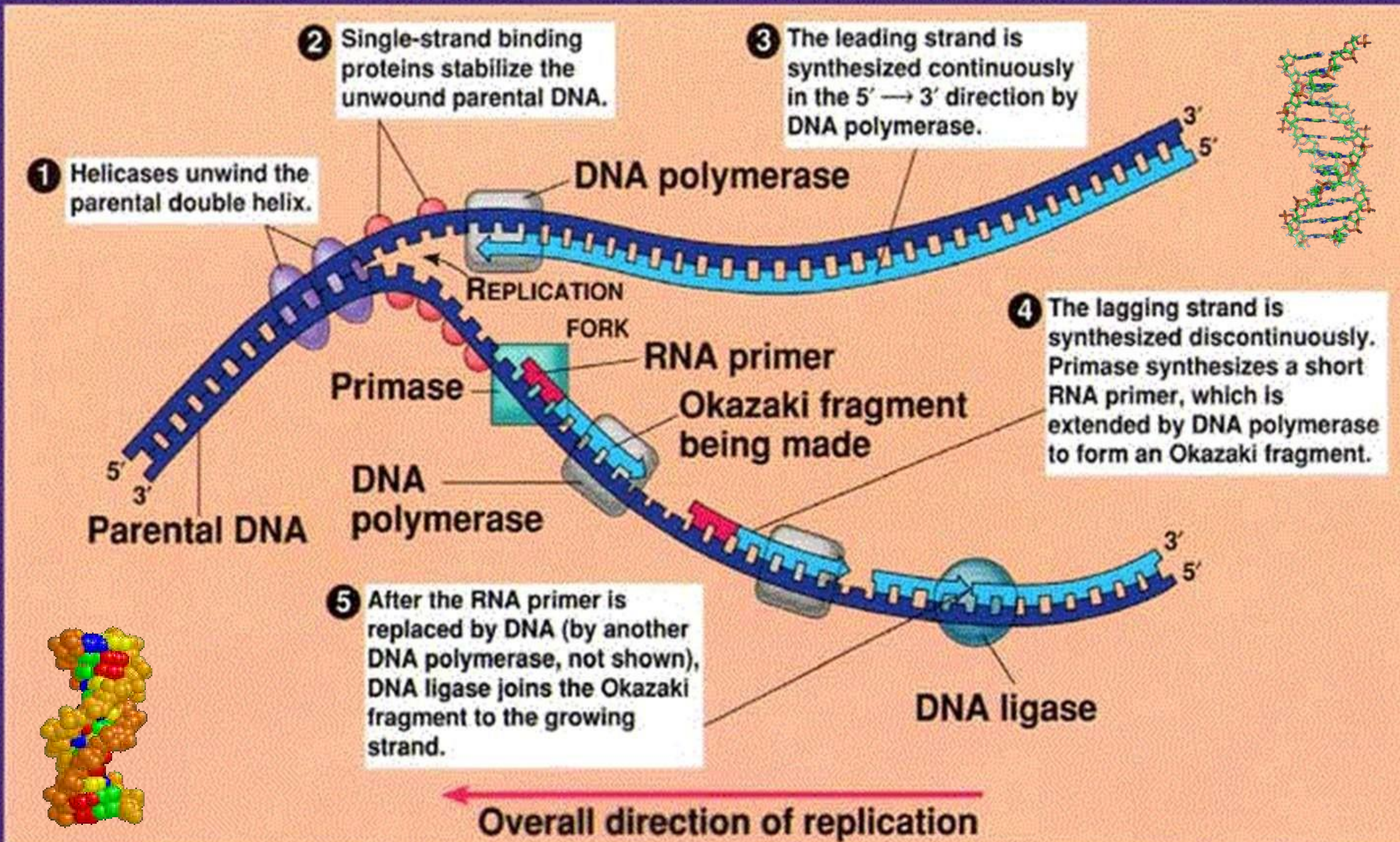
5' TAC CGG AAT GCA ATG CAT ATG 3' **OLD**

3' ATG GCC TTA CGT TAC GTA TAC 5' **NEW**

5' TAC CGG AAT GCA ATG CAT ATG 3' **NEW**

3' ATG GCC TTA CGT TAC GTA TAC 5' **OLD**

A SUMMARY OF DNA REPLICATION



thanks