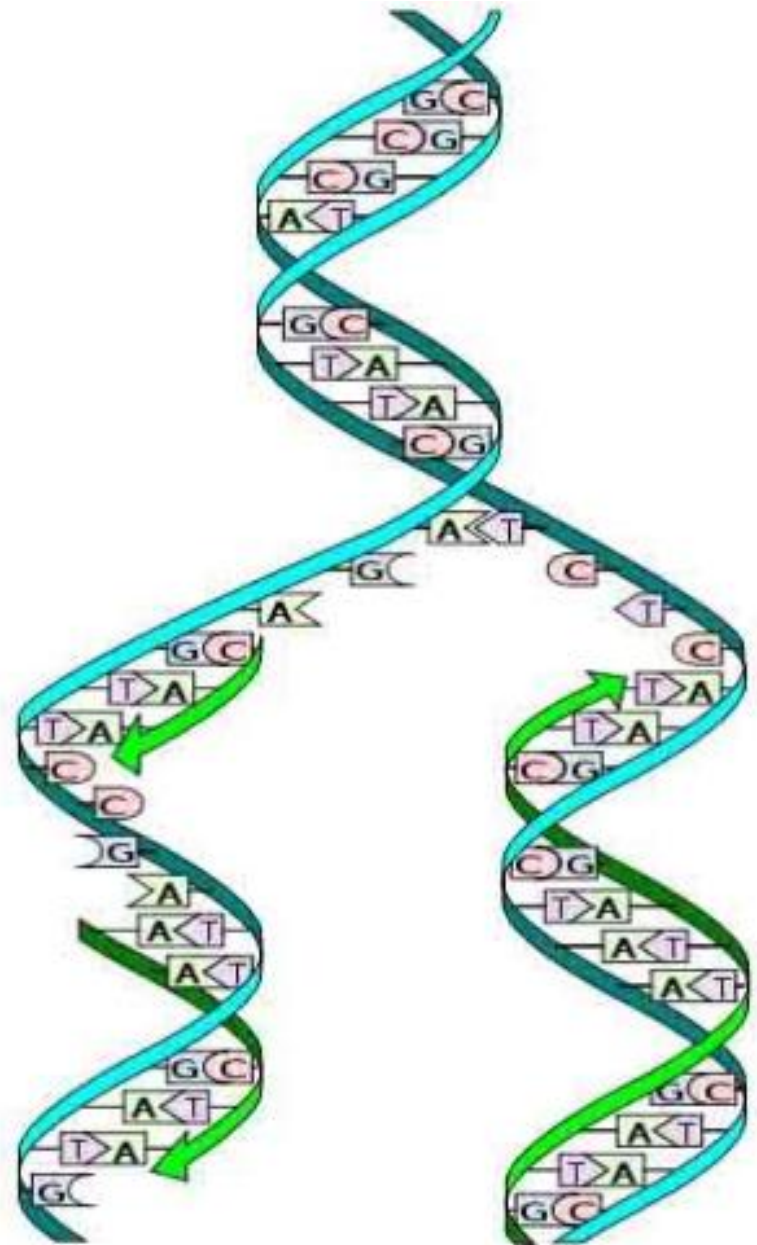
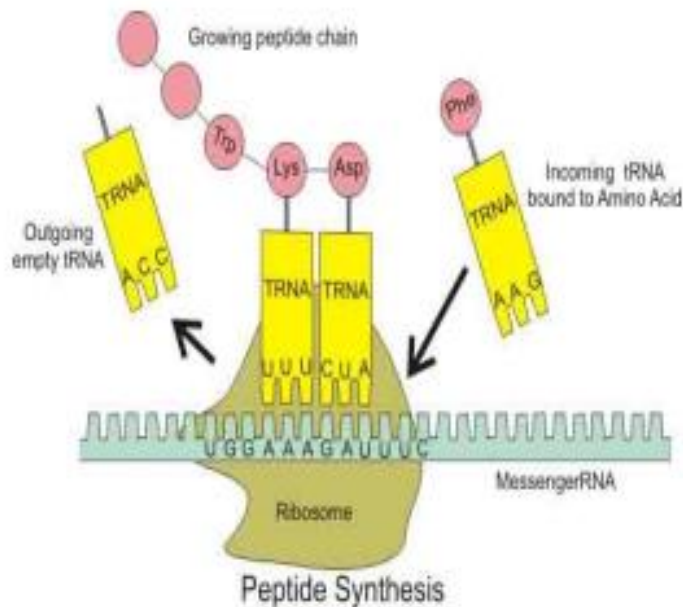


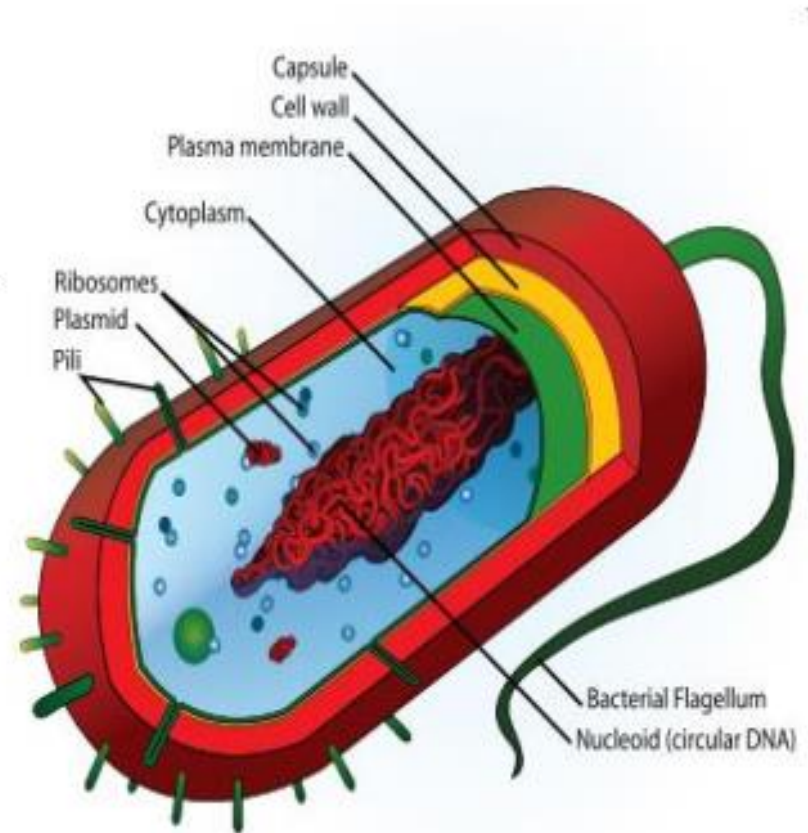
Molecular Genetics Basics



Prokaryotic Genomes

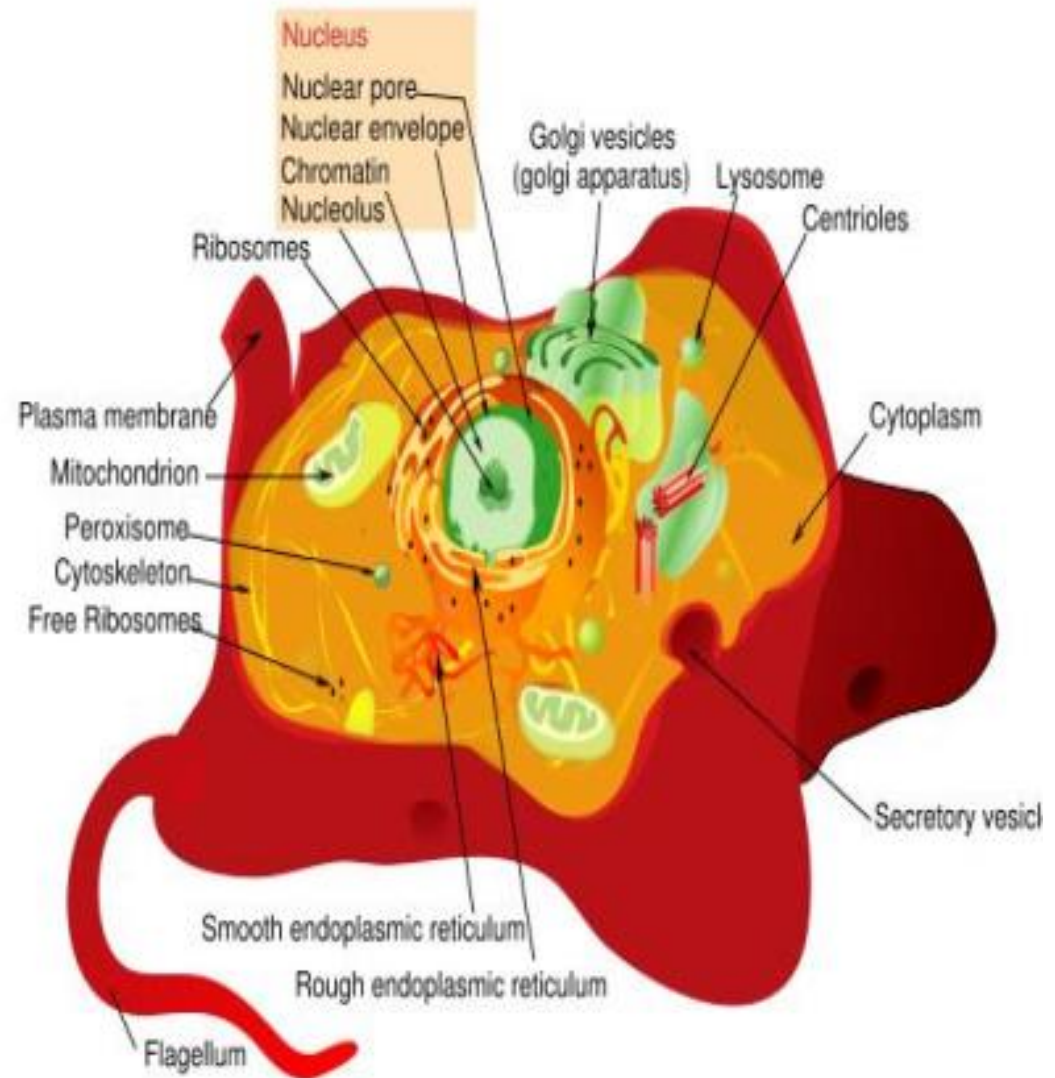
- Made of DNA
- Chromosomes can be circular or linear
- Genome floats freely within cytoplasm
- **Q:** Where is DNA found in prokaryotes?

- _____
- _____



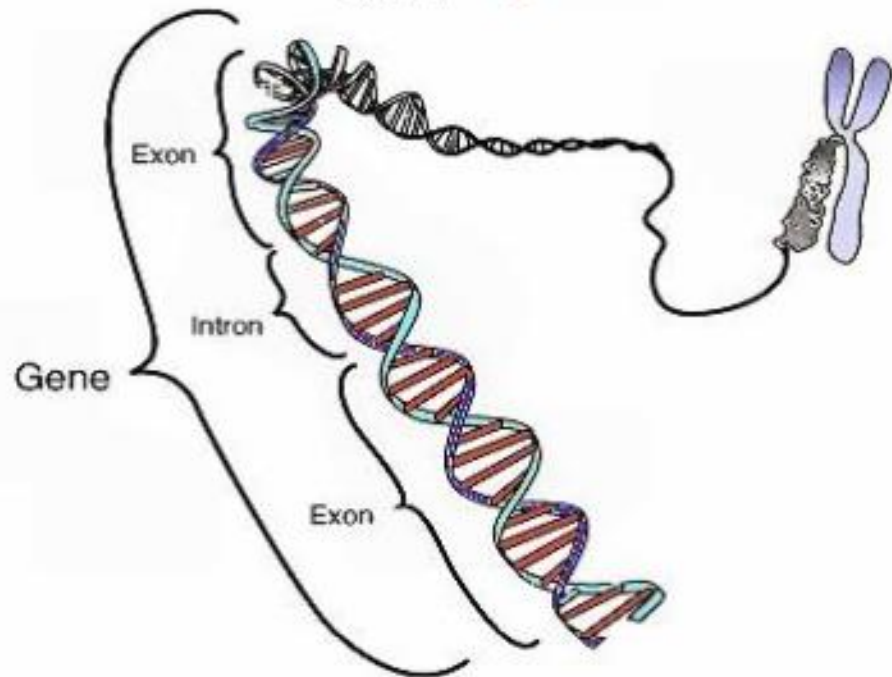
Eukaryotic Genomes

- Genomes of eukaryotic organisms made of DNA.
- Eukaryotic genomes frequently include many linear chromosomes within a membrane-bound nucleus
(Q: How many do we have?).
- Where is DNA found in eukaryotes?
 - Nuclear DNA
 - Extranuclear DNA(Q: What is extranuclear DNA?)

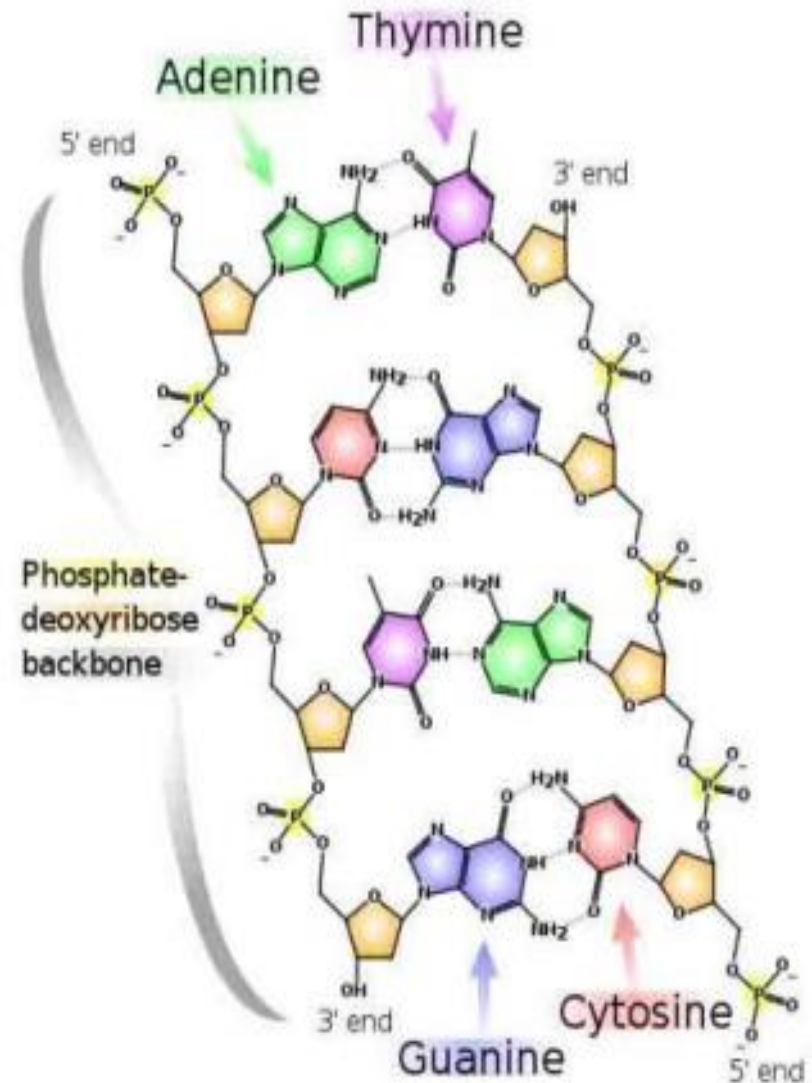


Chromosomes & Genes

- **Genome** - Complete complement of an organism's DNA.
- Cellular **DNA** is organized in **chromosomes**.
- **Genes** have specific places on chromosomes.

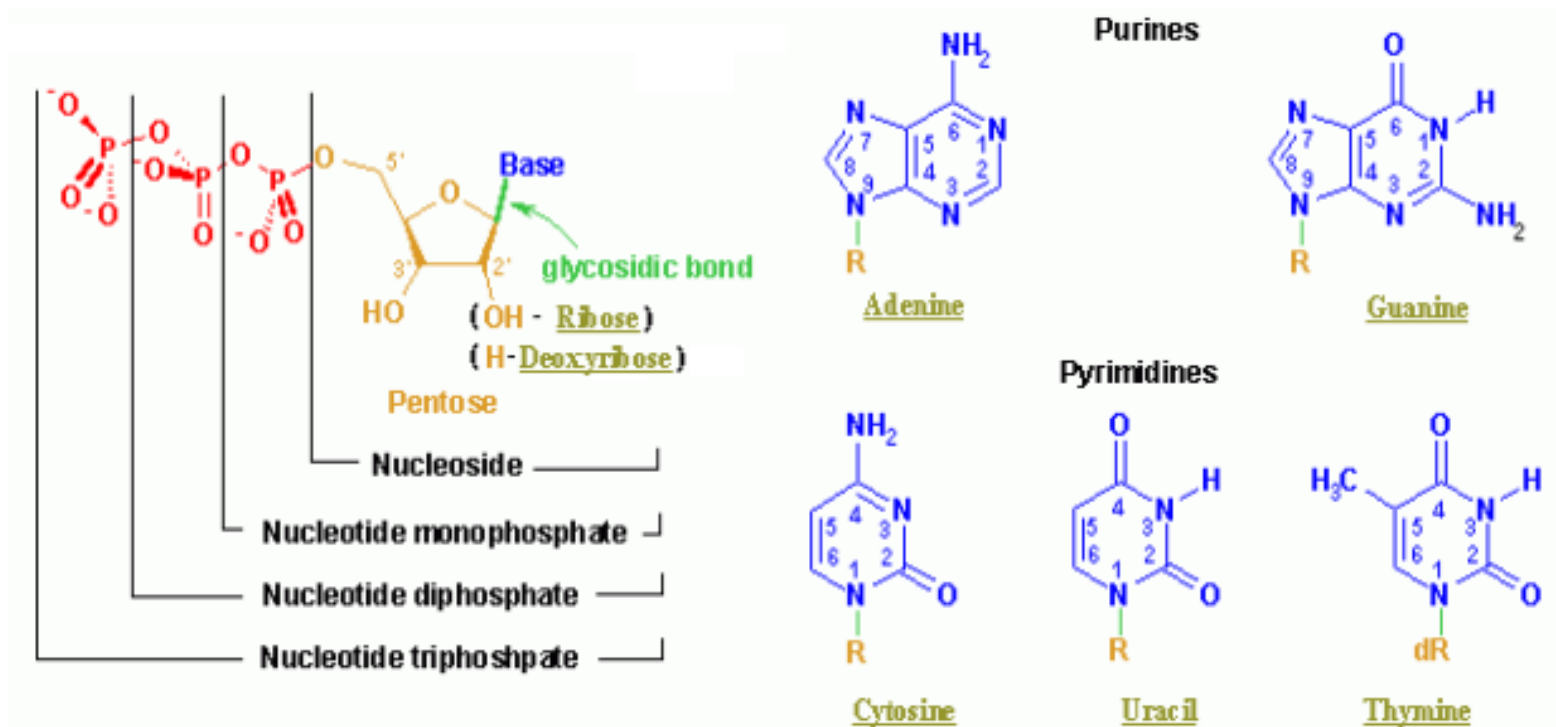


Nucleotides and Nucleic Acids



Nucleic Acids

Q: What type of monomer are nucleic acids made of?



DNA Structure

Double stranded molecule, analogous to a spiral staircase:

- two deoxyribose-phosphate chains as the "side rails"

- base pairs, linked by hydrogen bonds, are the "steps"

Purine Bases

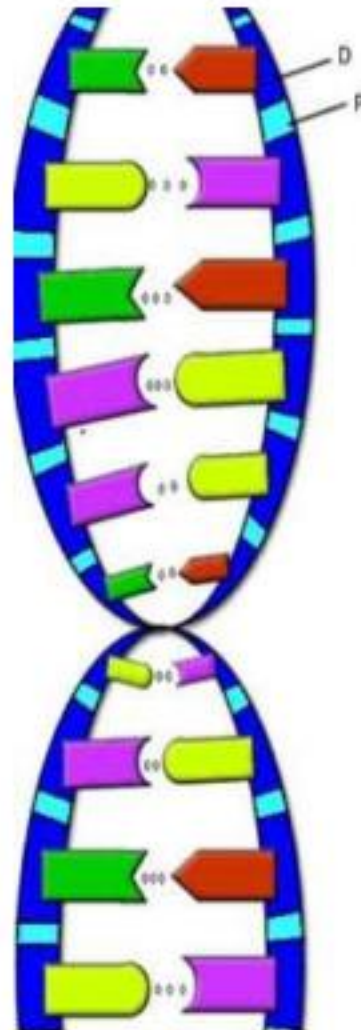
(double ring)

Adenine & Guanine

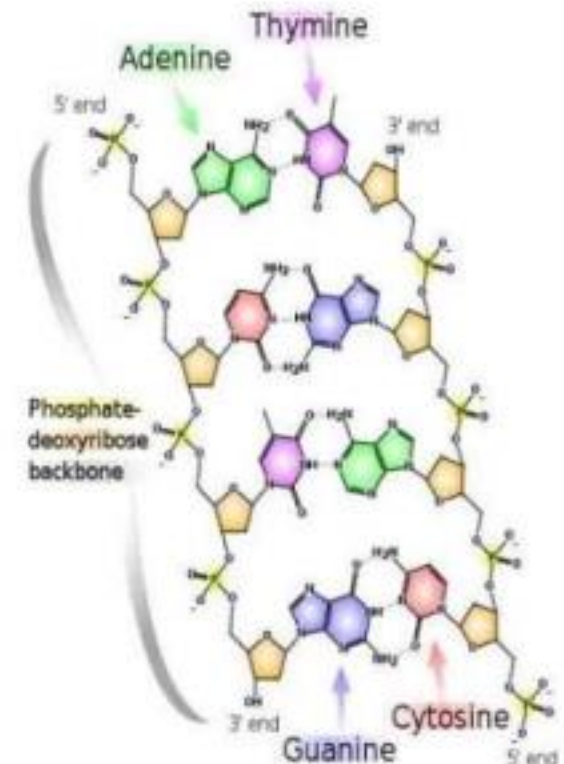
Pyrimidine Bases

(single ring)

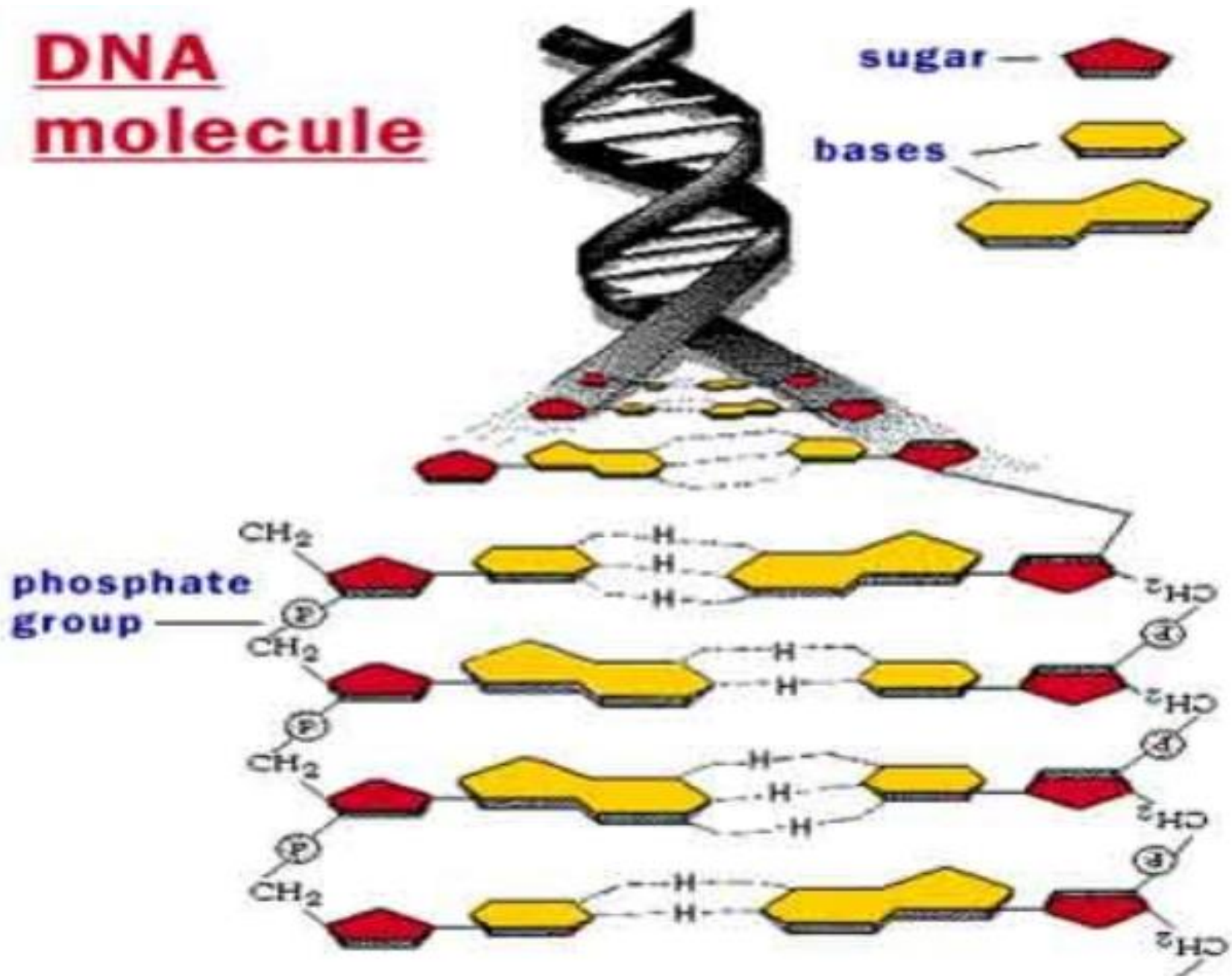
Cytosine & Thymine



D = Deoxyribose (sugar)
P = Phosphate
--- Hydrogen Bond

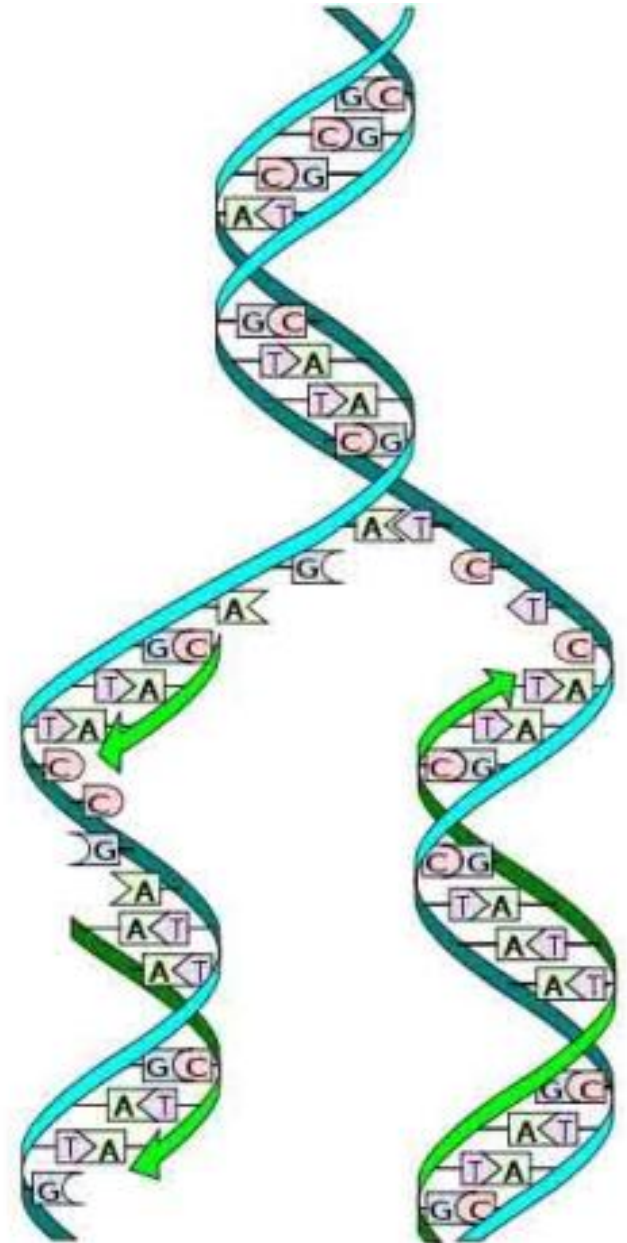


DNA molecule



DNA Replication

- **Copying** of a double-stranded DNA molecule.
- Each **DNA** strand holds the same genetic information, so each strand can serve as a template for the new, opposite strand.
- The **parent** (a.k.a. _____) strand is preserved and the **daughter** (a.k.a. _____) strand is assembled from nucleotides.
- This is called **semi-conservative** replication.
- Resulting double-stranded DNA molecules are identical.
- **Q: Why would a cell need to copy its DNA?**

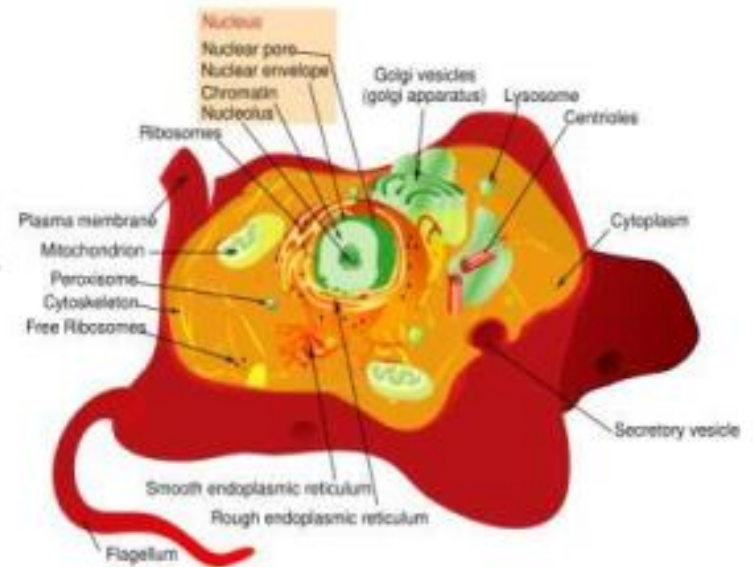
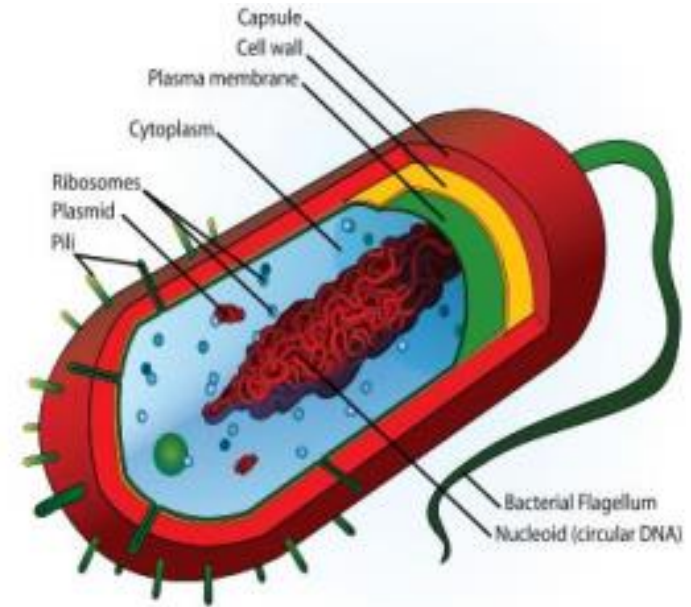


DNA Replication

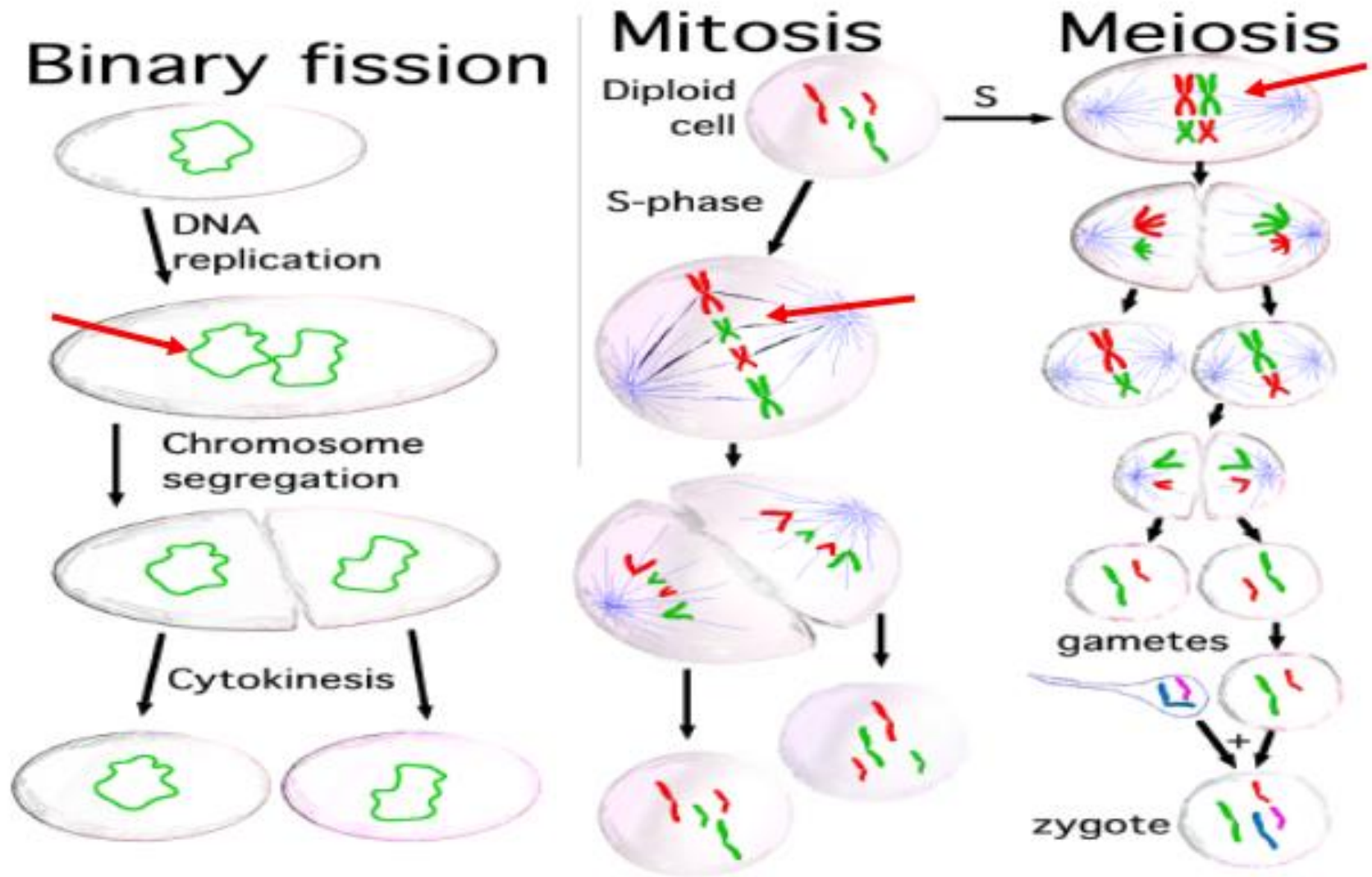
In a cell, DNA replication must happen before cell division.

- **Prokaryotes** replicate their DNA throughout the interval between cell divisions.

- In **eukaryotes**, timing of replication is highly regulated.

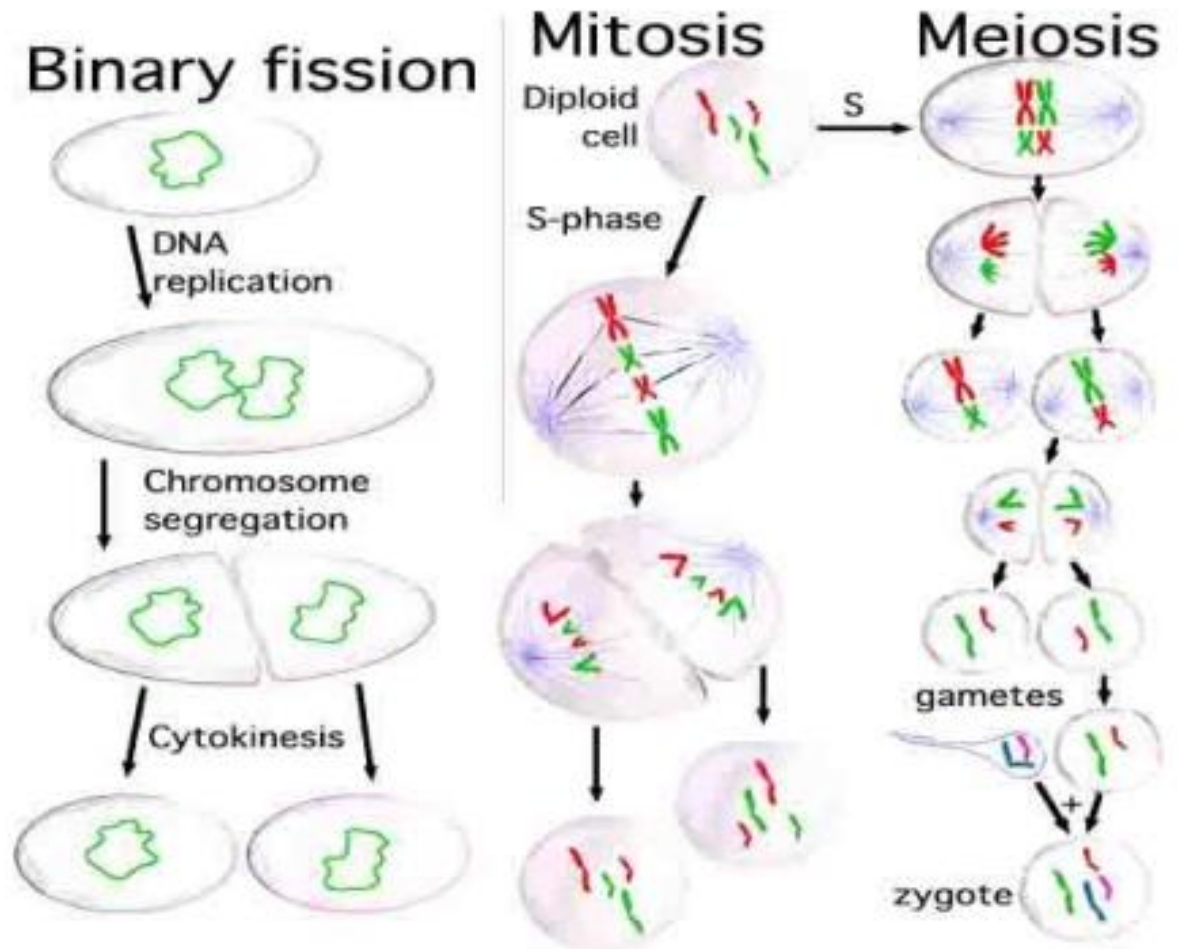


DNA Replication



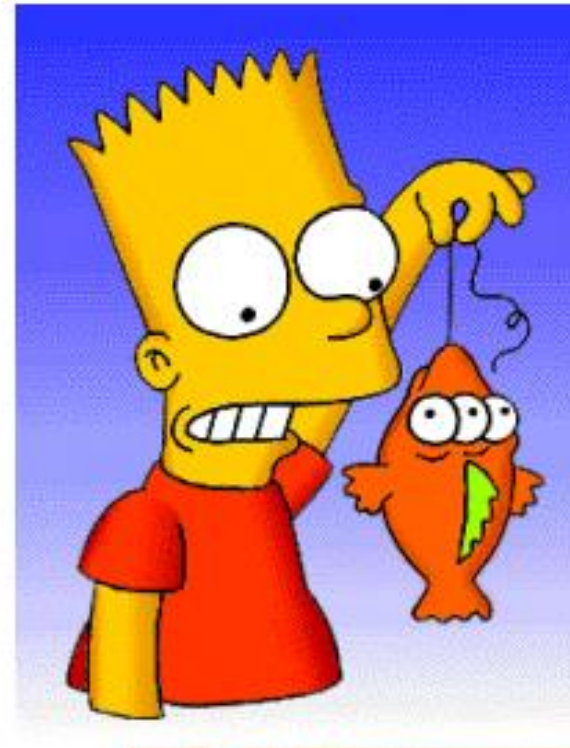
Reminder... Why is the DNA copied?

Replication occurs prior to cell division, because the new, daughter cell will also need a complete copy of cellular DNA.



Replication Mistakes: Mutations of Genes

- Change in the nucleotide base sequence of a genome; rare.
- **The problem:** Wrong amino acid may result a non-functional Protein due to improper folding
- Almost always bad news, but...
- Rarely leads to a protein having a novel property that improves ability of organism and its descendants to survive and reproduce.

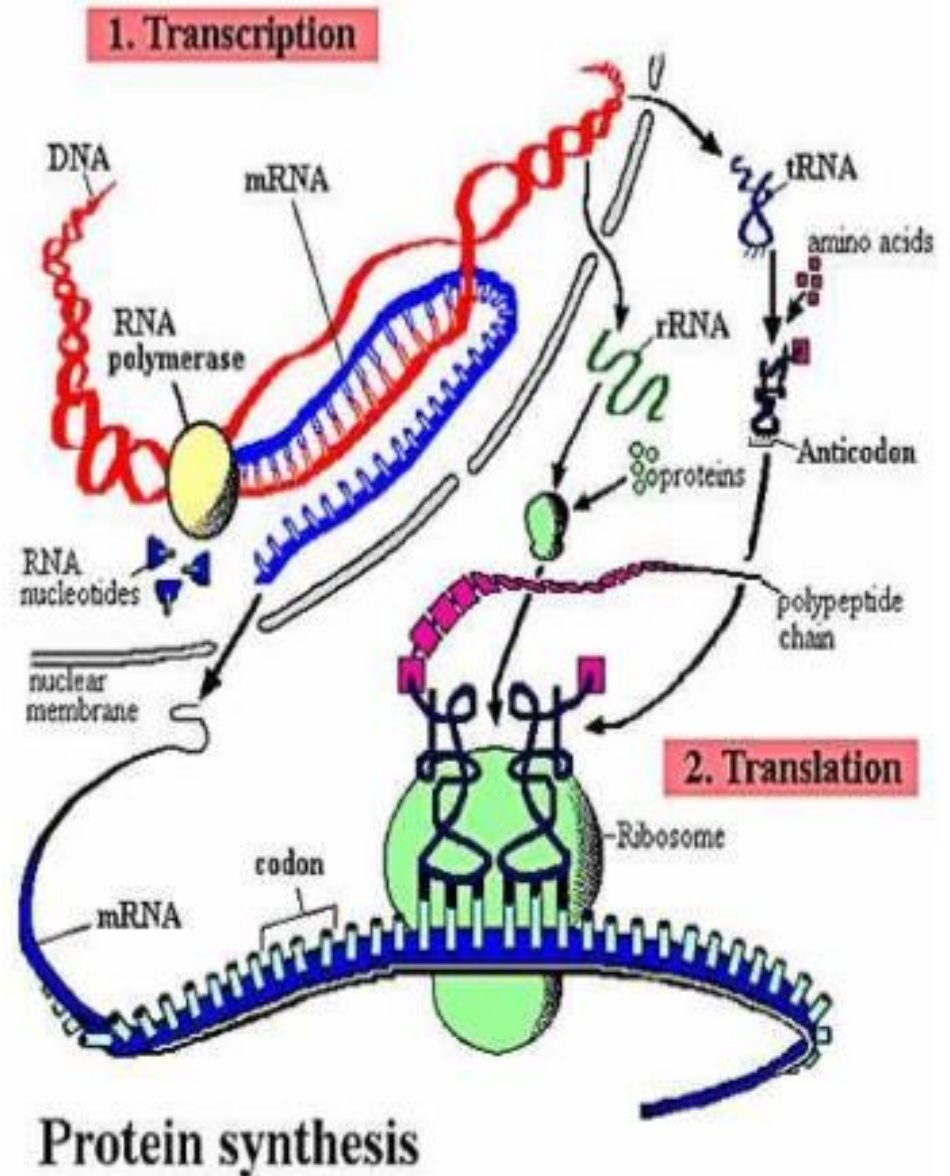


Gene Expression

Transcription

&

Translation
(Making Proteins)



Nucleic Acids: RNA Structure

RNA is typically a single-stranded molecule.

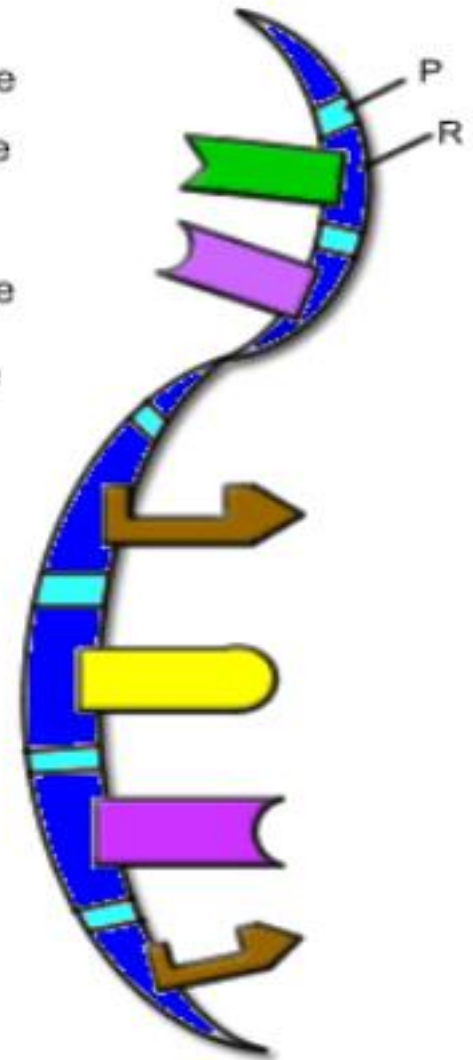
Purine Bases (double ring)
Adenine & Guanine

Pyrimidine Bases (single ring)
Cytosine & _____



P= phosphate

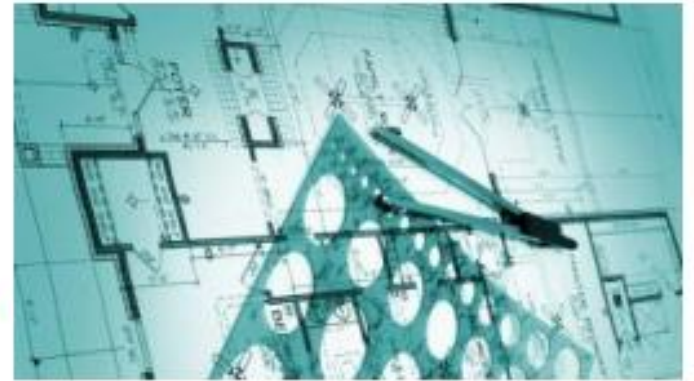
R= Ribose



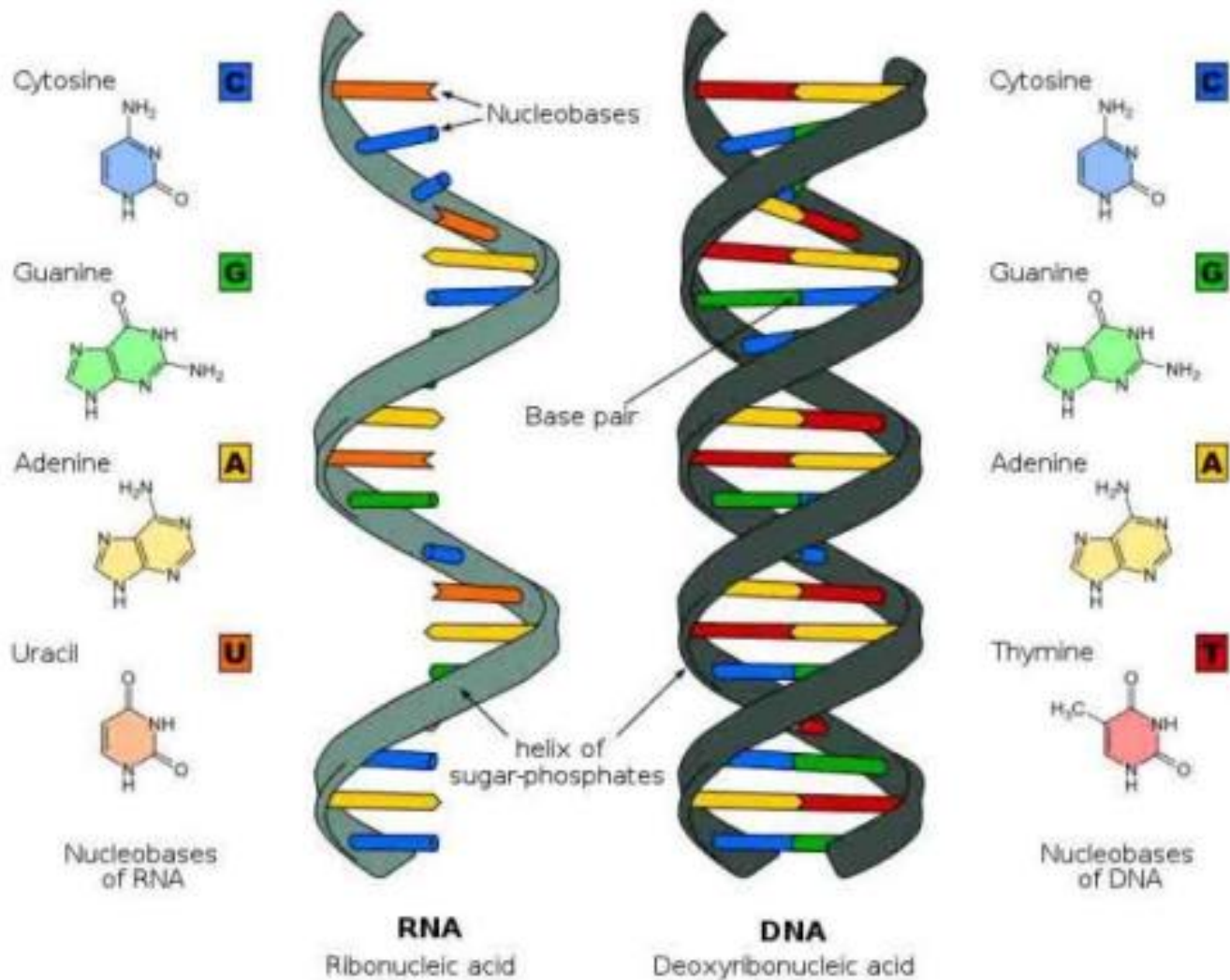
Types of RNA

Genetic information copied from DNA is transferred to 3 types of RNA:

- **messenger** (mRNA) is like a
Copy of information in DNA that is brought to the ribosome where the information is translated into a protein.
- **ribosomal** (rRNA) is like a
The protein factories of the cells.
- **transfer** (tRNA) are like a
Brings the amino acid to the ribosome.



Nucleic Acid Structure



See SPO Class Notes article on [Nucleotides & Nucleic Acids](#).

Transcription

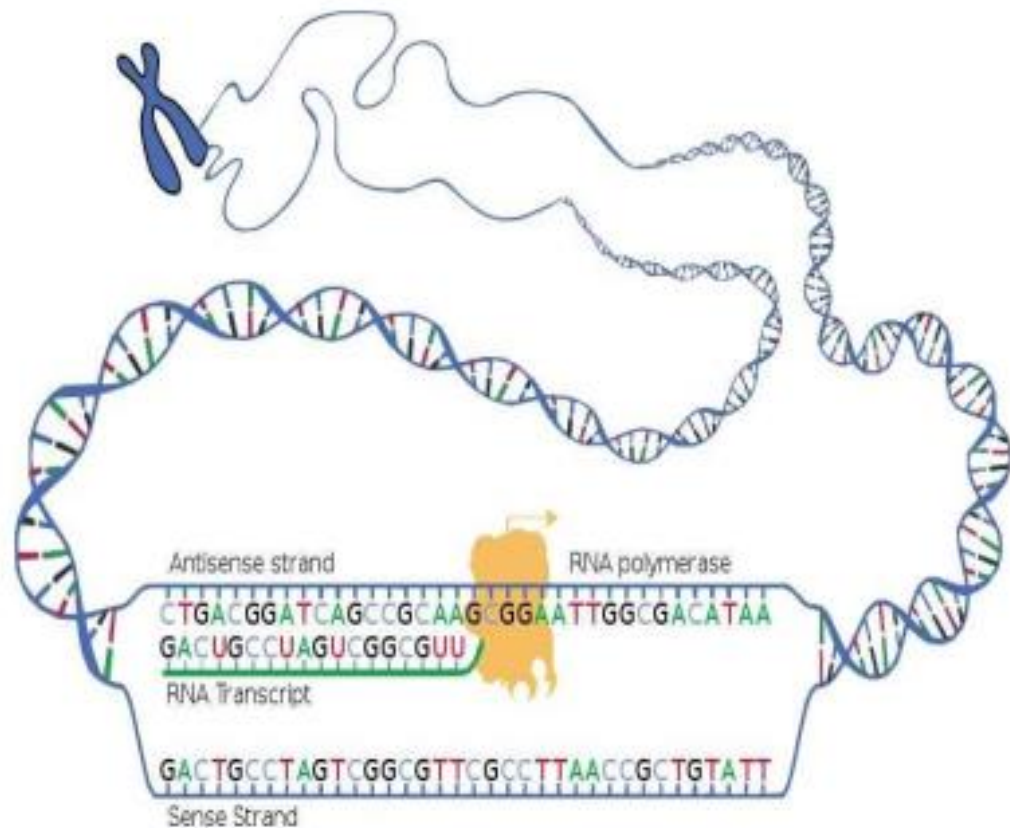
First Step of gene expression.

Process by which a DNA sequence is copied to produce a complementary mRNA strand.

In other words, it is the transfer of genetic information from DNA into RNA.

Like [replication](#), but making RNA.

Beginning of the process that ultimately leads to the translation of the genetic code (via mRNA) into a [protein](#).



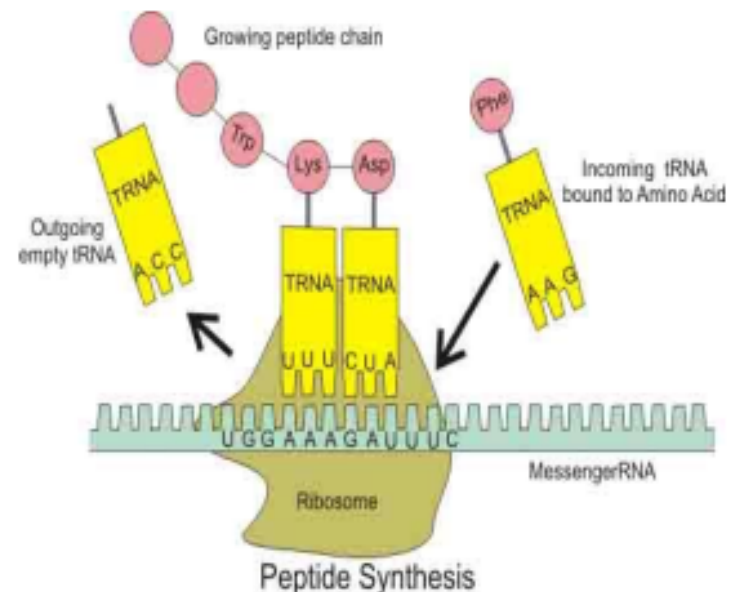
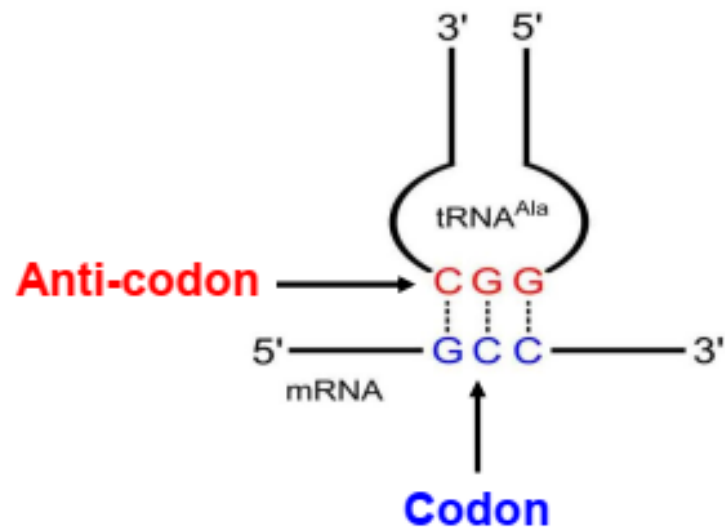
REVIEW

Transcription Animations

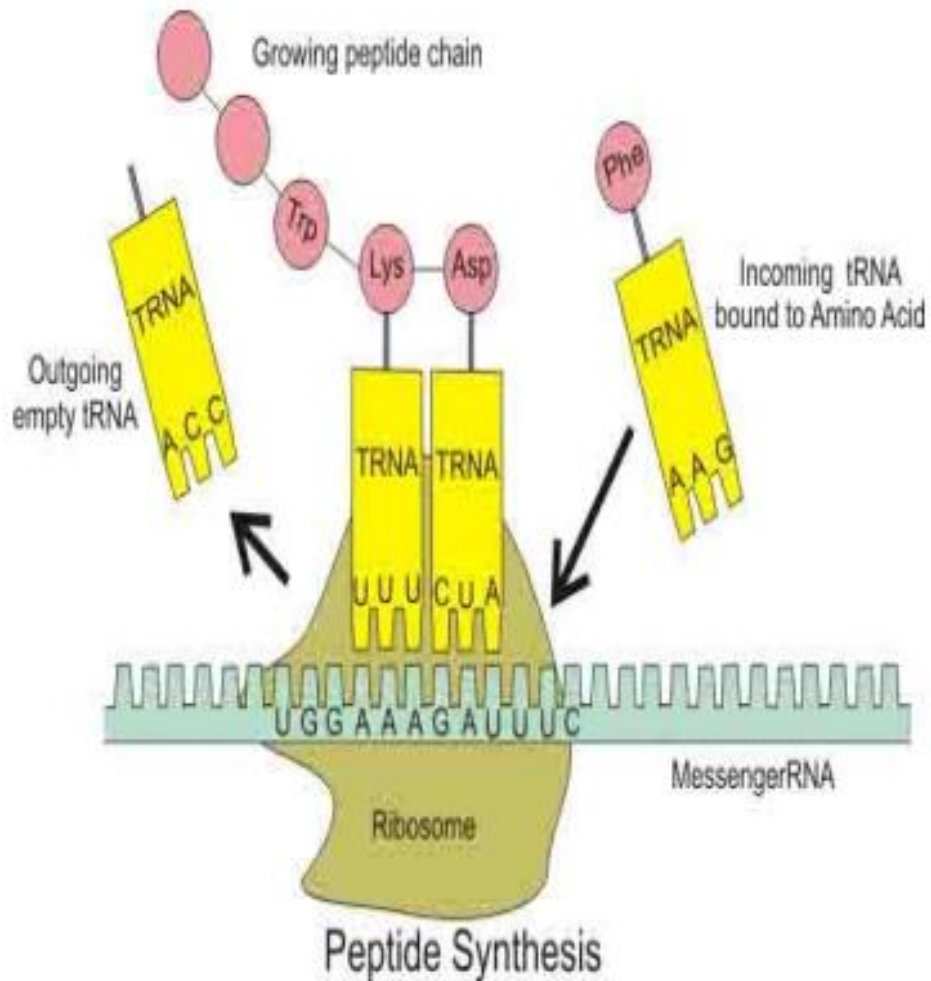
1. [mRNA Synthesis](#) from McGraw-Hill
2. [Transcription](#) from WH Freeman

Translation

- Second Step of gene expression.
- Ribosomes (which contain rRNA) make proteins from the messages encoded in mRNA.
- The genetic instructions for a polypeptide chain are 'written' in the DNA as a series of 3-nucleotide 'words.'
- _____ on mRNA
- _____ on tRNA
- 'U' (uracil) replaces 'T' in RNA
- This is the **genetic code**.



Translation

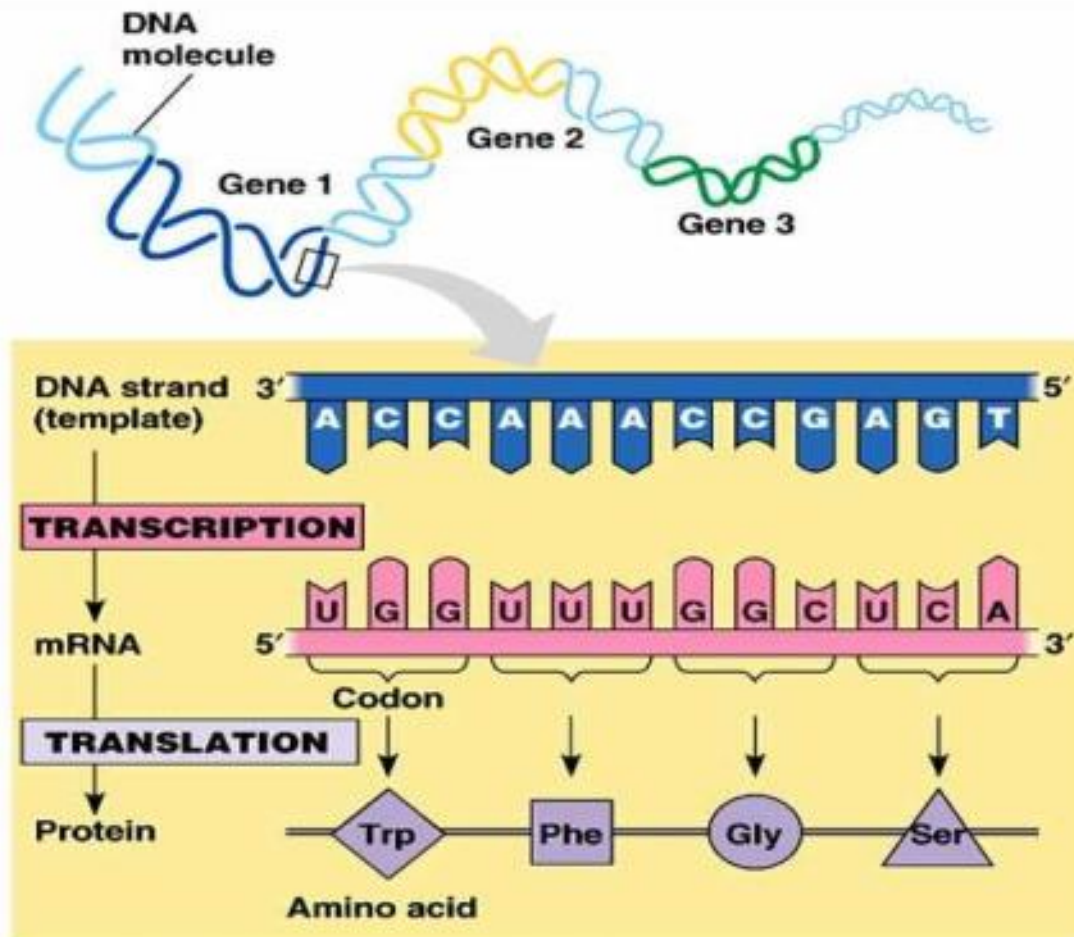


REVIEW

Translation Animations

1. [How Translation Works](#)
from McGraw-Hill
2. [Ribosome Building a Protein](#)
from Wikipedia

Transcription & Translation Overview



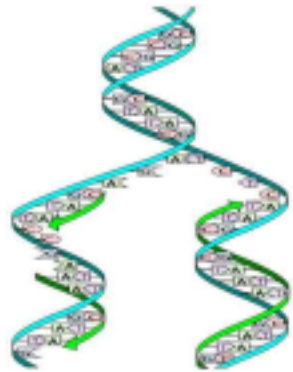
Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

REVIEW

Interactive animation that allows you to transcribe and translate a gene!

See SPO Class Notes article on [DNA Function: Transcription & Translation.](#)

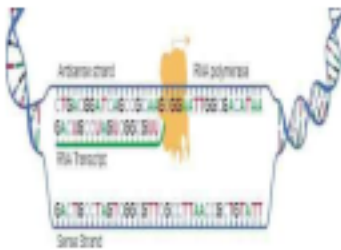
Replication, Transcription, Translation



MAKING DNA

Making a copy of the genetic material = **Replication**
When you think "replication" think "duplication"

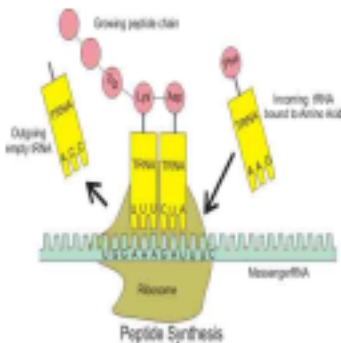
Q: Where does replication occur in [prokaryotes](#)? [Eukaryotes](#)?



MAKING RNA

Transferring genetic code (DNA) to RNA = **Transcription**
Think of a medical transcriptionist copying the physicians words into another format.

Q: Where does transcription occur in prokaryotes? Eukaryotes?



MAKING PROTEINS

Making proteins = **Translation**

Think of how translation relates to languages.

The translation of biology translates DNA information into [proteins](#).

Q: Where does translation occur in prokaryotes? Eukaryotes?