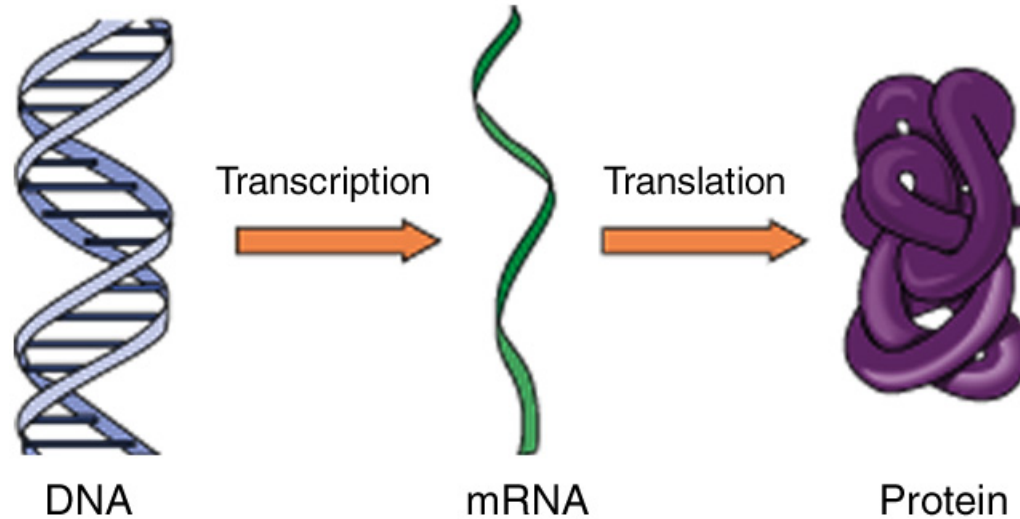


# Central Dogma

## Protein Synthesis

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What does the term “Central Dogma” mean?

Flow of Genetic Information

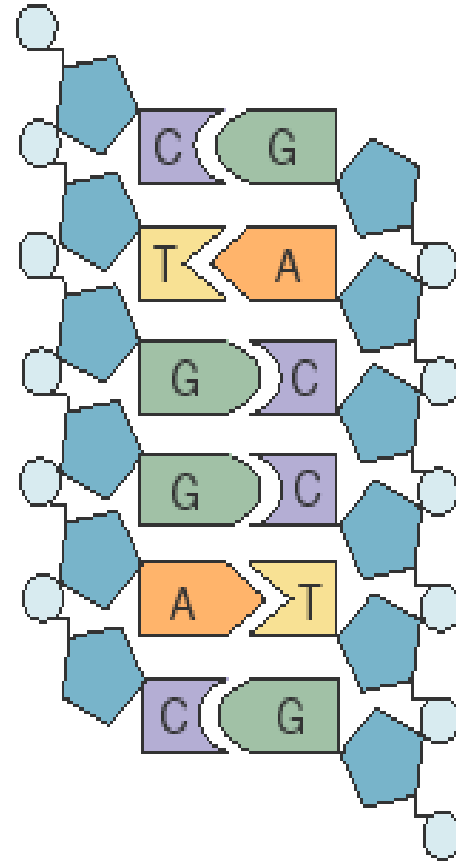
DNA  RNA  PROTEIN

# Explanation of Flow

- DNA is transcribed to RNA which is translated to protein.
- Protein is never back-translated to RNA or DNA; DNA is never created from RNA.
- Furthermore, DNA is never directly translated to protein.

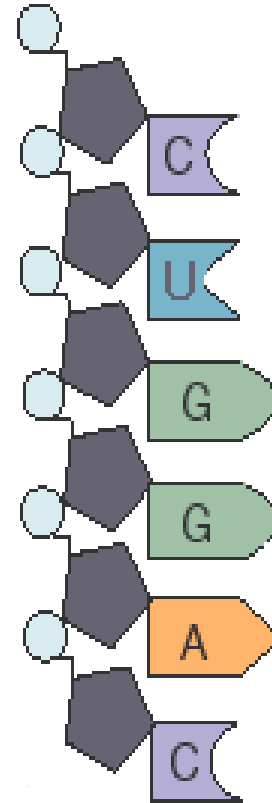
# Deoxyribonucleic Acid DNA

Capacity to store genetic information, copy it, and pass it from generation to generation.



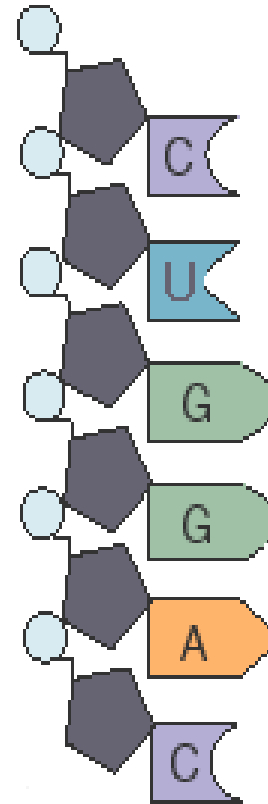
# Ribonucleic Acid RNA

- *RNA* is a temporary intermediary between DNA and the protein making factories, the ribosomes.



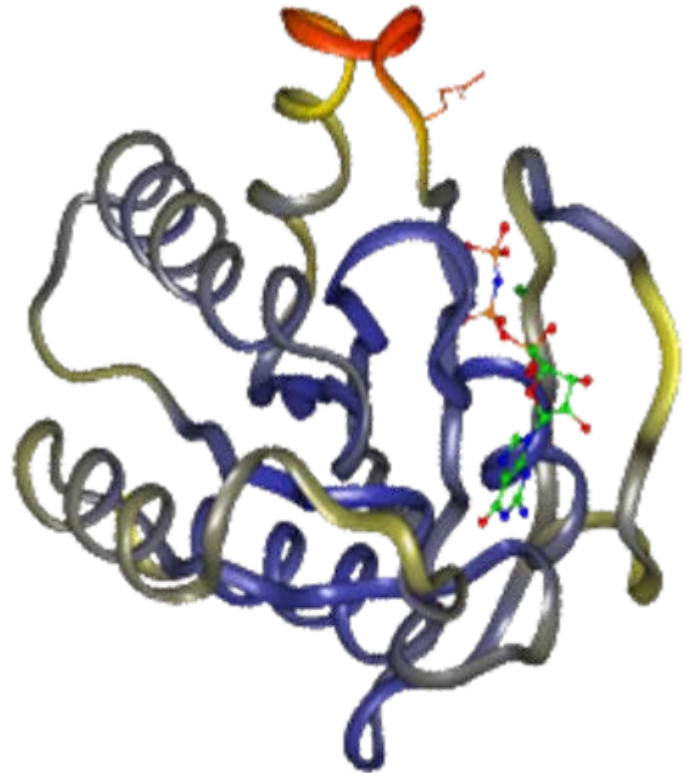
# Ribonucleic Acid RNA

- RNA serves to carry information from the genome, located in the nucleus of the cell, to the ribosomes, which are located outside of the nucleus either in the cytosol or on the endoplasmic reticulum



# Proteins

- *Proteins* could be viewed as the programs of the cell
- They are the physical representation of the abstract information contained within the genome.

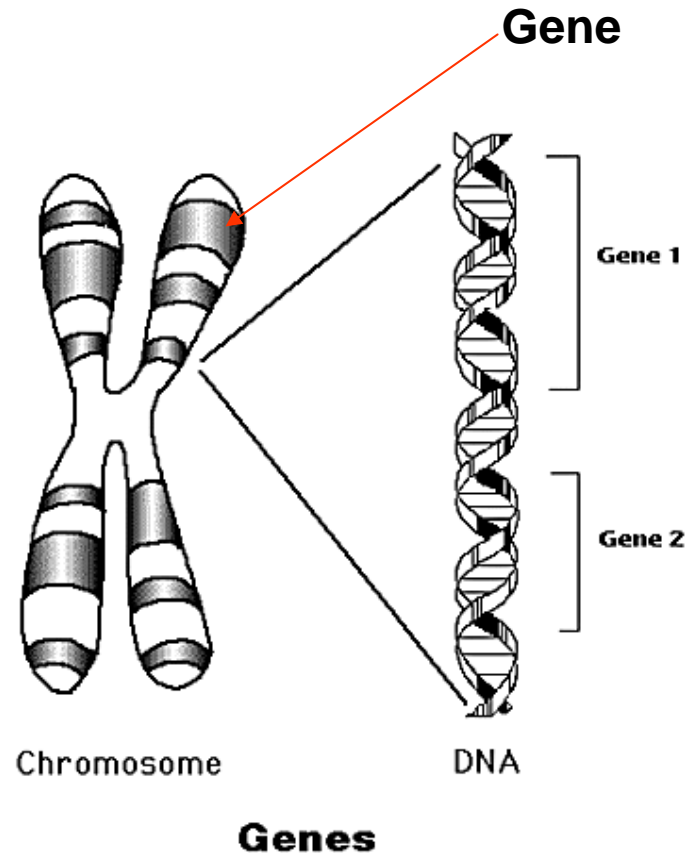


# How does DNA relate to genes?

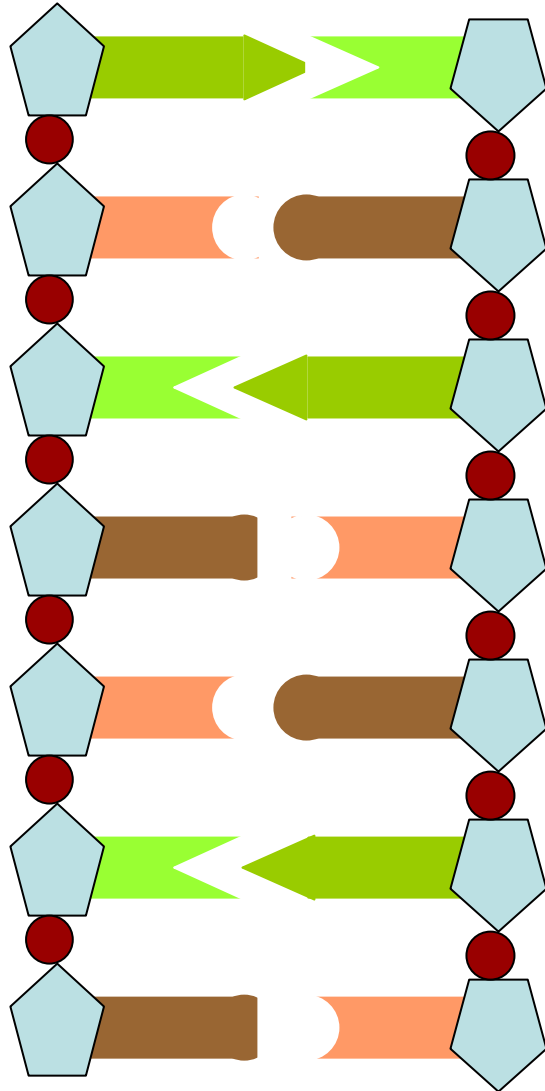
- A gene is a segment of DNA that codes for a particular protein.

1 Gene = 1000's of  
base pairs

$4^{1000}$  possibilities of  
combinations

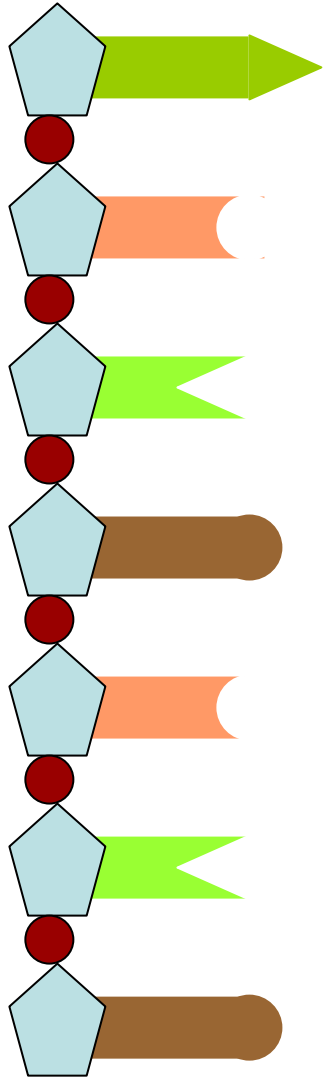


# Overview of DNA Replication

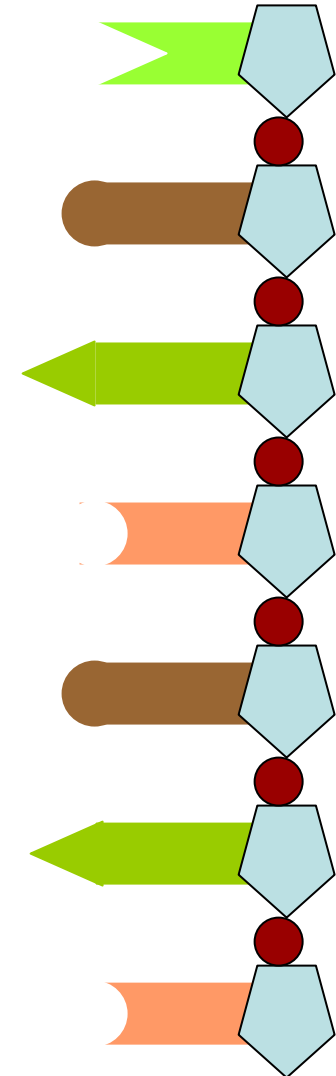


**Step 1:** Hydrogen bonds between complimentary bases break and the DNA molecule “unzips”.

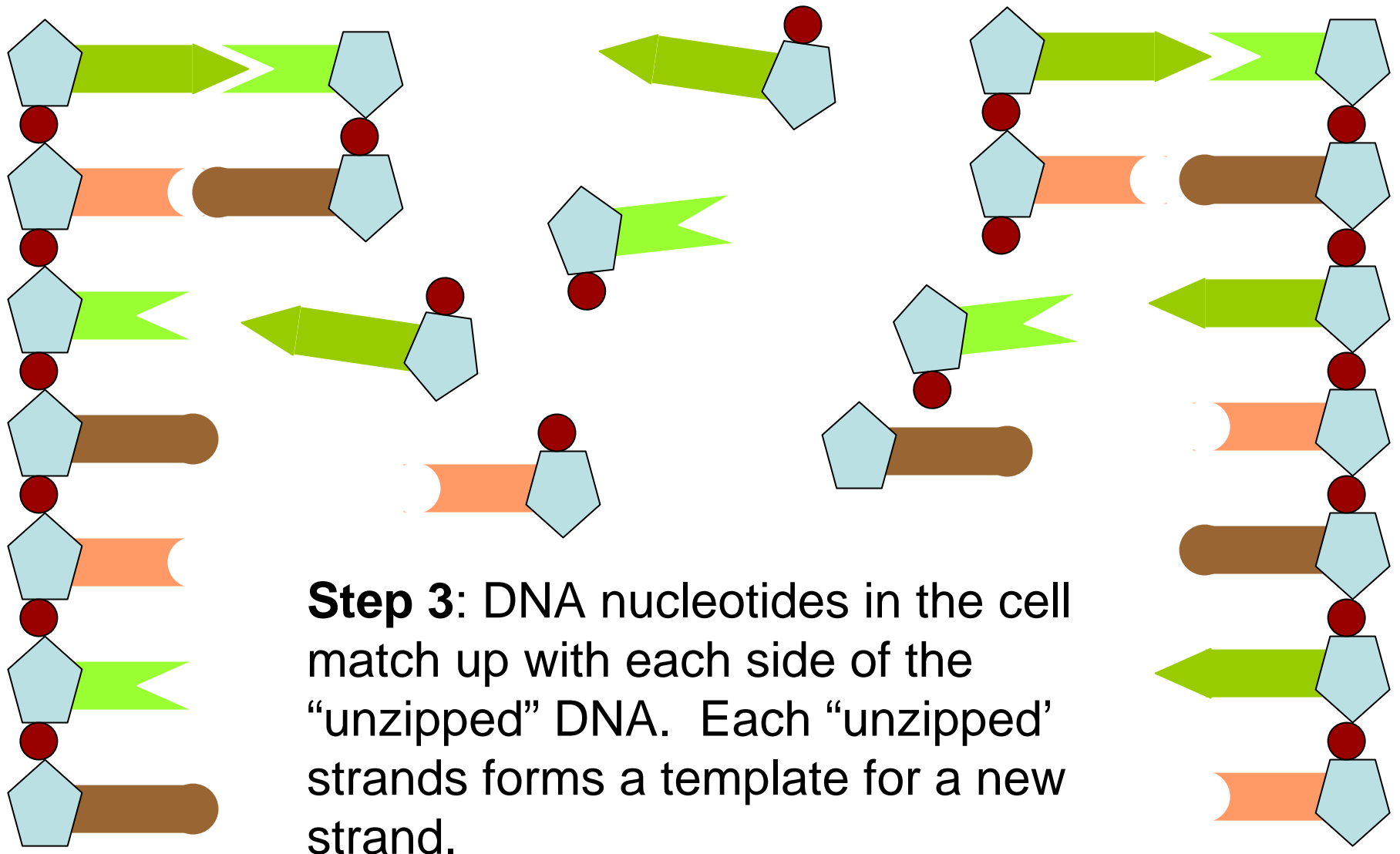
# DNA Replication



**Step 2:** DNA strands pull apart from each other.



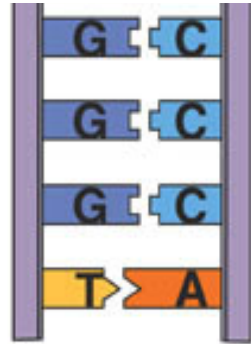
# DNA Replication



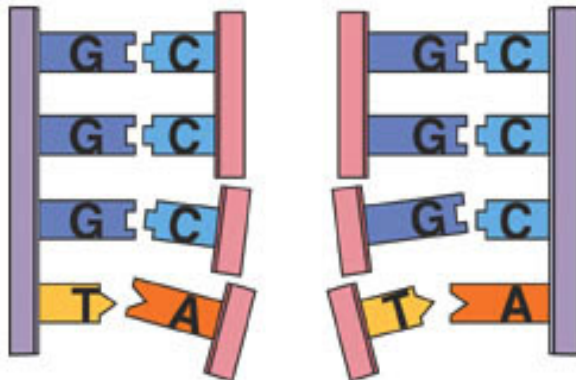
**Step 3:** DNA nucleotides in the cell match up with each side of the “unzipped” DNA. Each “unzipped” strands forms a template for a new strand.

# DNA Replication

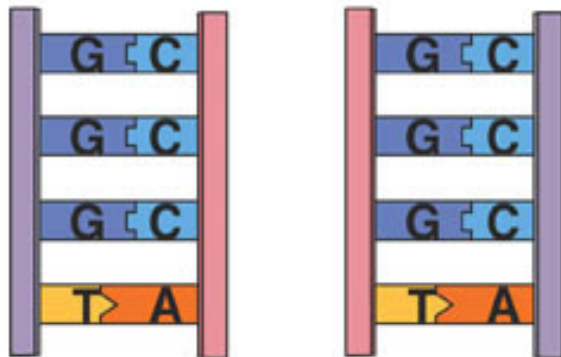
## Start and Finish



Parental DNA molecule contains so-called old strands hydrogen-bonded by complementary base pairing.



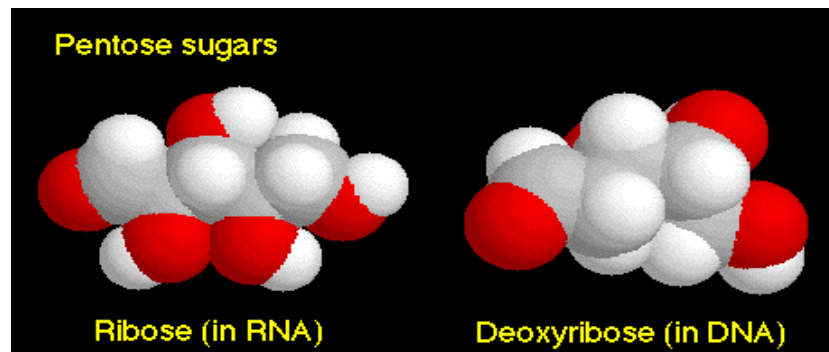
Region of replication. Parental DNA is unwound and unzipped. New nucleotides are pairing with those in old strands.



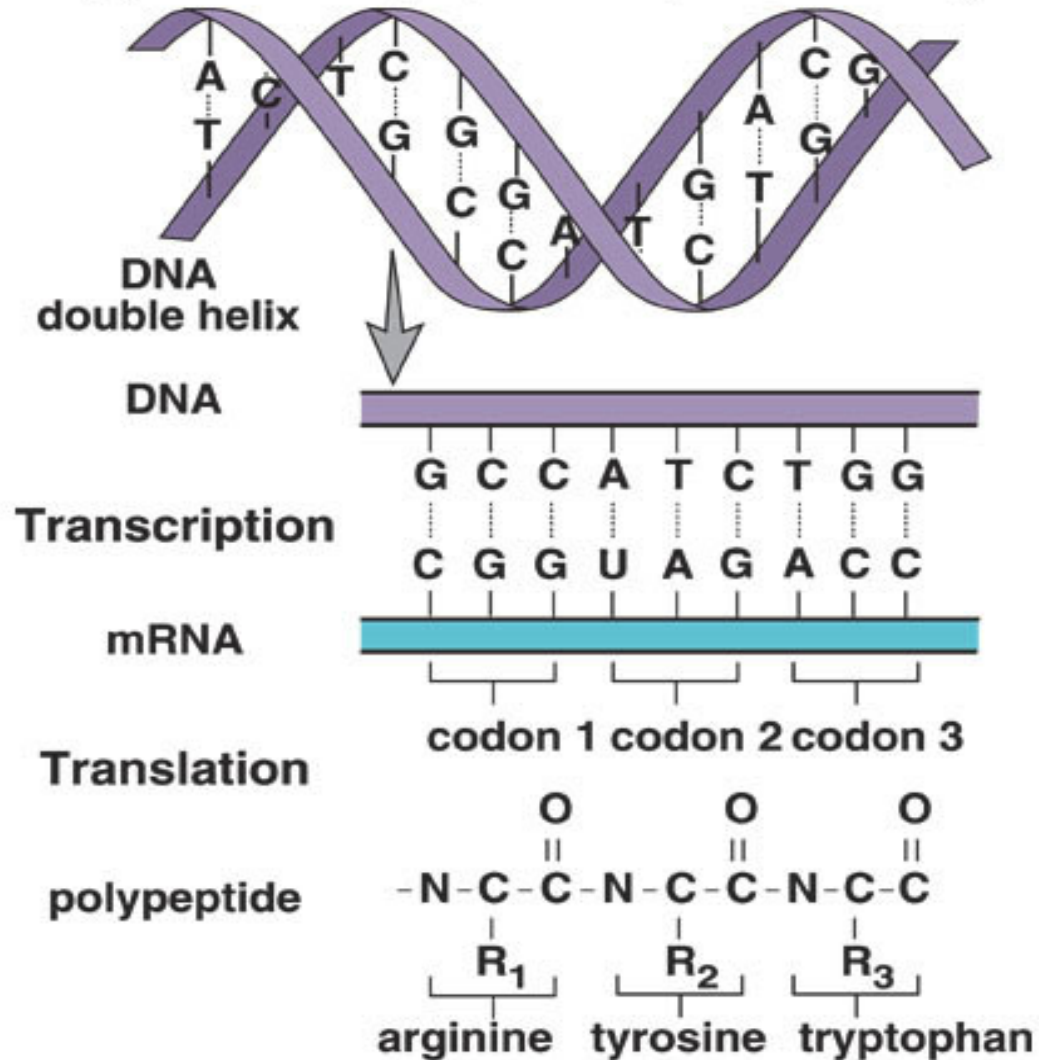
Replication is complete. Each double helix is composed of an old (parental) strand and a new (daughter) strand.

# RNA Differs from DNA

- **RNA** has a sugar **ribose**
- **DNA** has a sugar **deoxyribose**
- **RNA** contains the base **uracil (U)**
- **DNA** has **thymine (T)**
- **RNA** molecule is **single-stranded**
- **DNA** is **double-stranded**



# Protein Synthesis



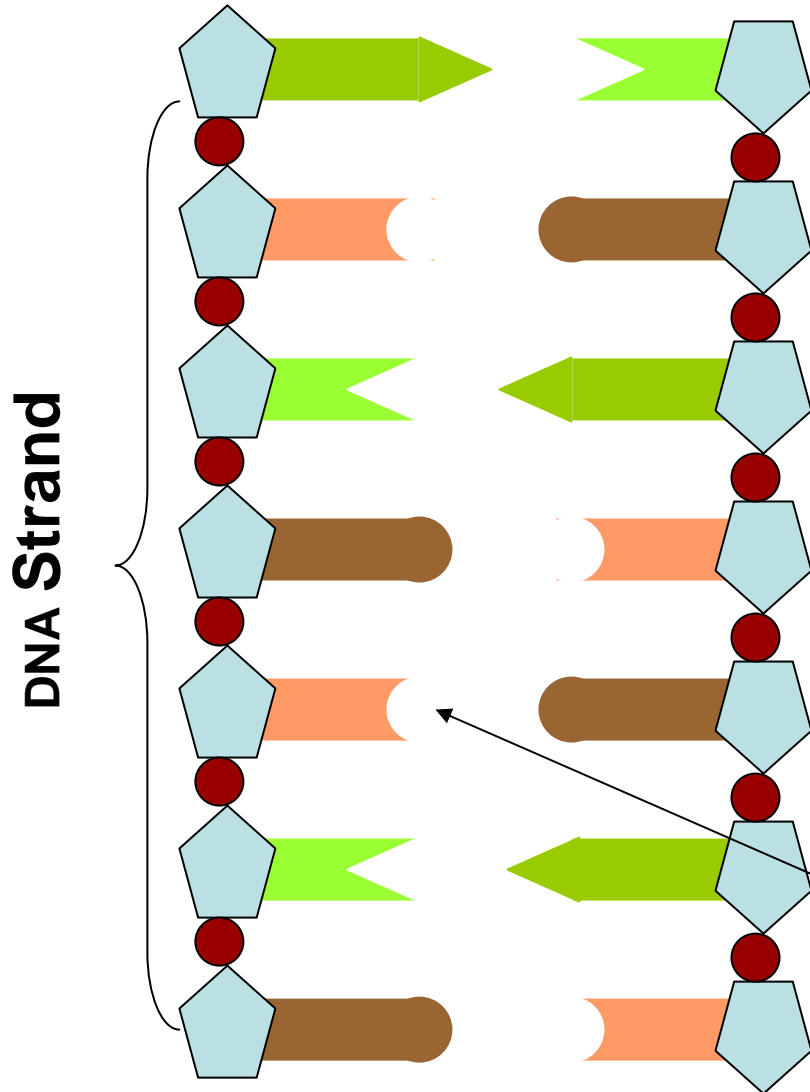
# What happens to DNA during Protein Synthesis?

- ***Transcription*** makes an RNA molecule complementary to a portion of DNA
- ***Translation*** occurs when the sequence of bases of mRNA DIRECTS the sequence of amino acids in a polypeptide

# Three Types of RNA

- **Messenger RNA (mRNA)** carries genetic information to the ribosomes
- **Ribosomal RNA (rRNA)**, along with protein, makes up the ribosomes
- **Transfer RNA (tRNA)** transfers amino acids to the ribosomes where proteins are synthesized

# Transcription



**Step 1:** Hydrogen bonds between complimentary bases break; DNA “unzips”

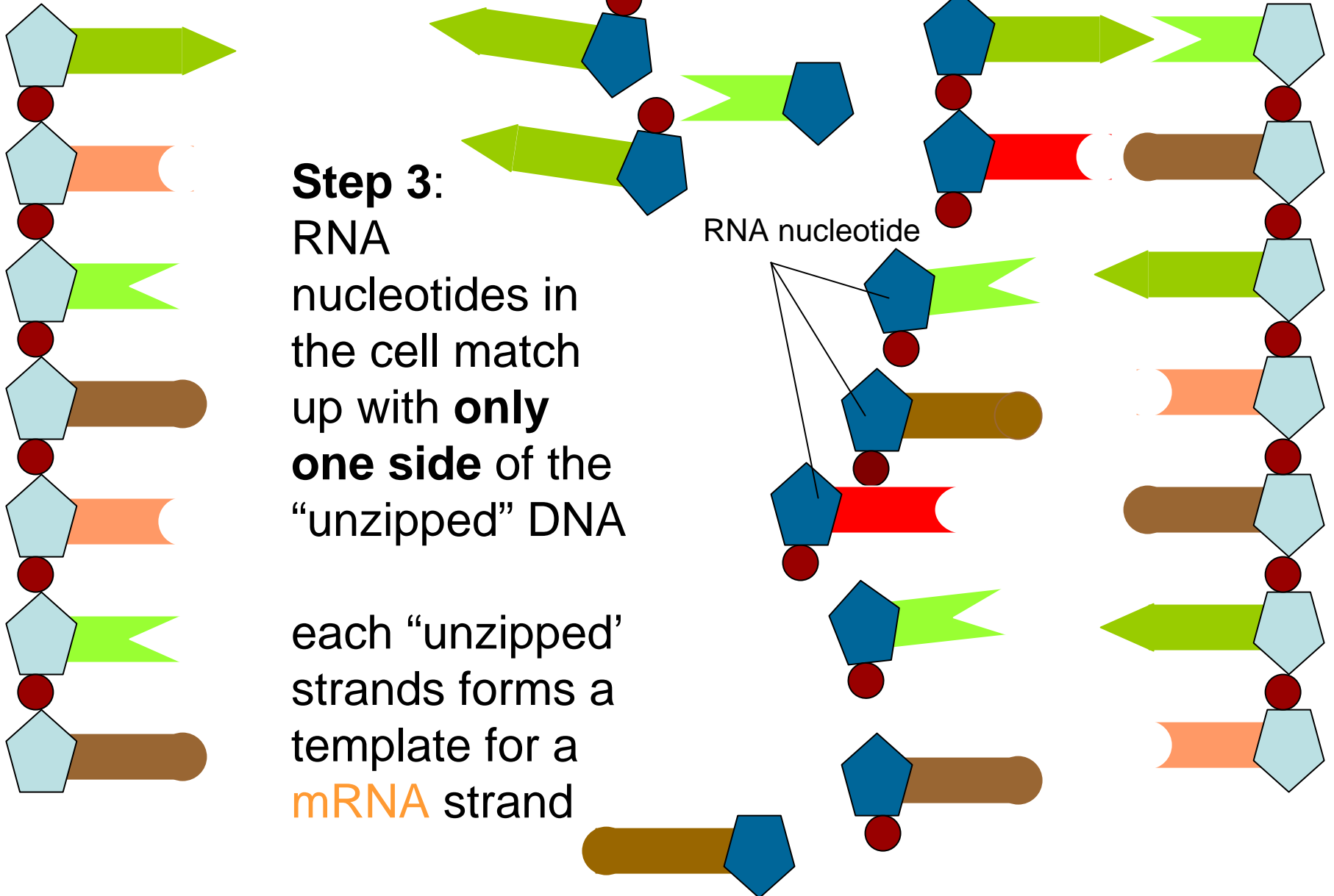
**Step 2:** DNA strands pull apart from each other

Hydrogen Bonds breaking

# Transcription

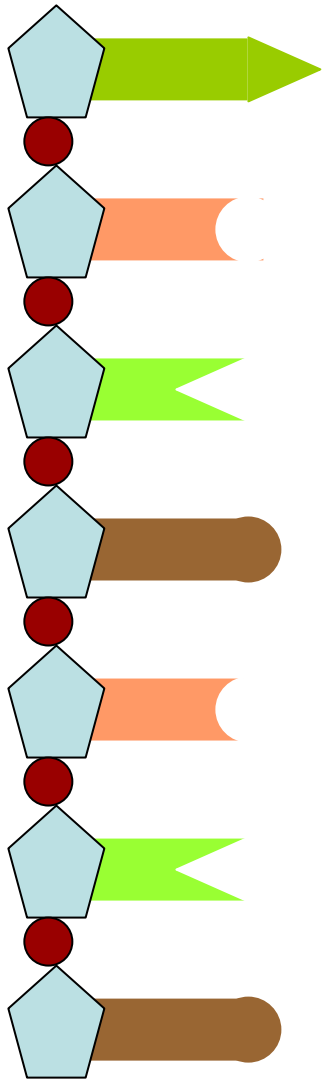
**Step 3:**  
RNA  
nucleotides in  
the cell match  
up with **only**  
**one side** of the  
“unzipped” DNA

each “unzipped”  
strands forms a  
template for a  
**mRNA** strand

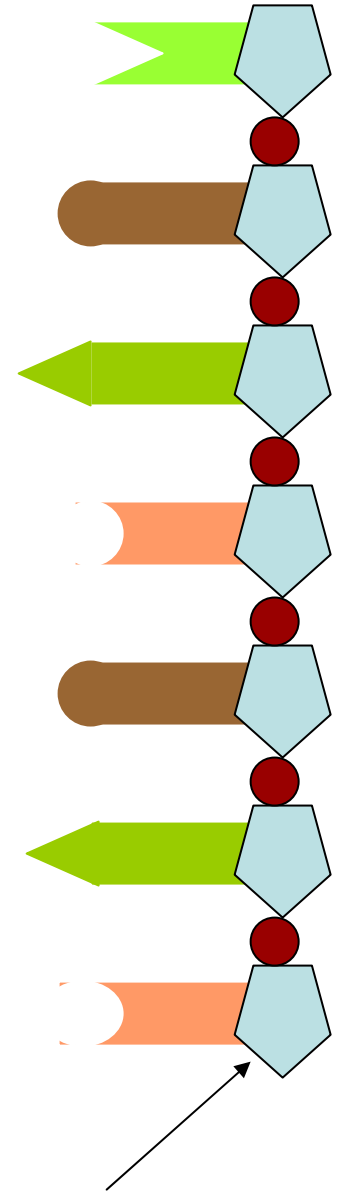
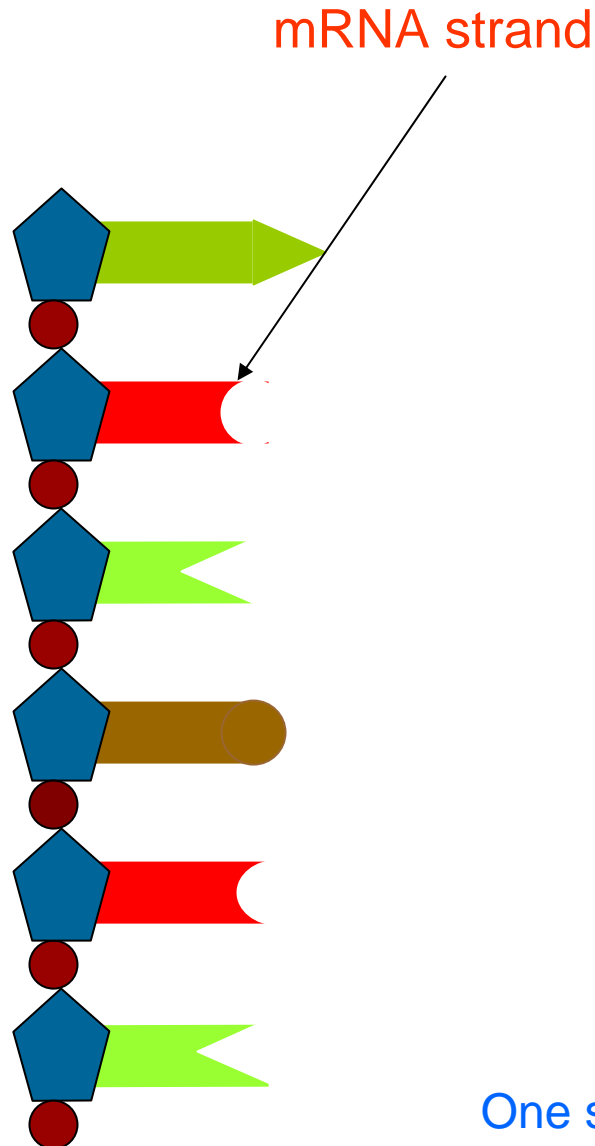




# Transcription



**Step 4:**  
mRNA  
strand  
breaks off  
from the  
DNA strand



One side of DNA strand

# Transcription

**Step 5:**  
mRNA  
strand  
leaves the  
nucleus for  
the ribosome

