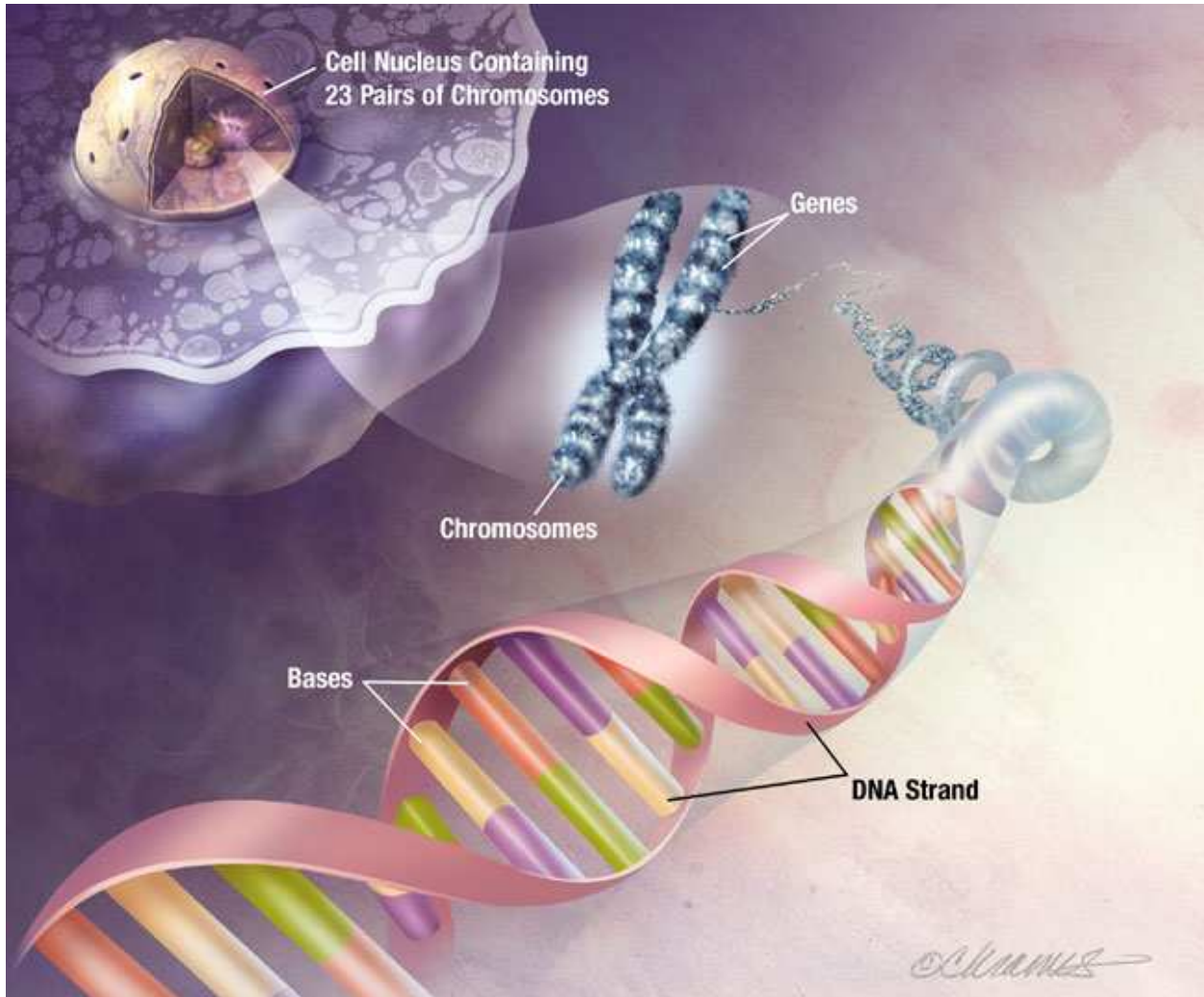


DNA, RNA, AND PROTEIN SYNTHESIS

DNA – Deoxyribonucleic Acid

- Enables cells to have different forms and perform different functions
- Primary functions of DNA: Store and transmit genetic information that tells cells which proteins to make and when to make them



DNA Structure

DNA Nucleotide

3 Parts:

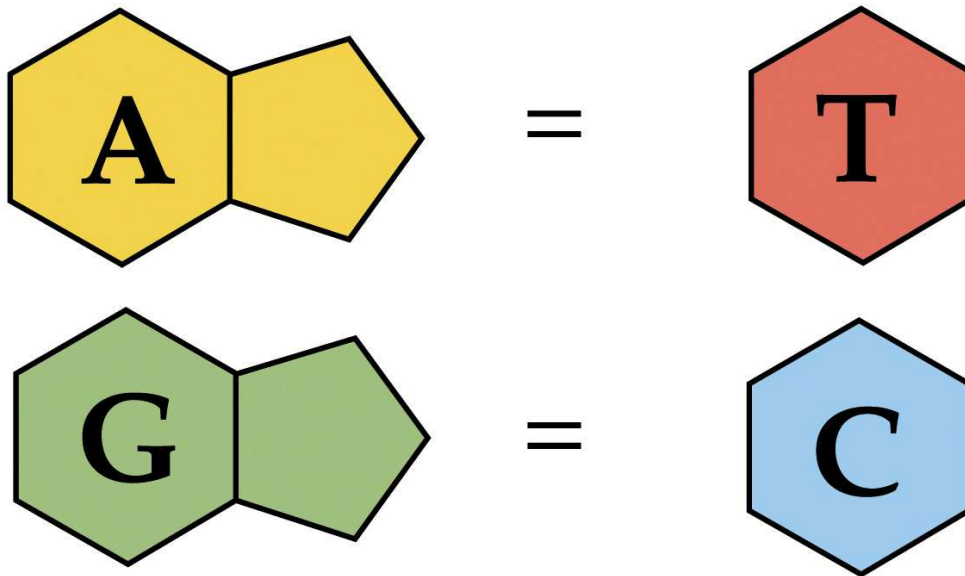
1. Phosphate Group
2. Sugar
3. Nitrogen Base

There are 4 possible nitrogen bases of DNA:

1. Adenine (A)
2. Guanine (G)
3. Cytosine (C)
4. Thymine (T)

Purines – bases with 2 carbon rings (Adenine and Guanine)

Pyrimidines – bases with 1 carbon ring (Cytosine and Thymine)



Purines = Pyrimidines

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The Double Helix

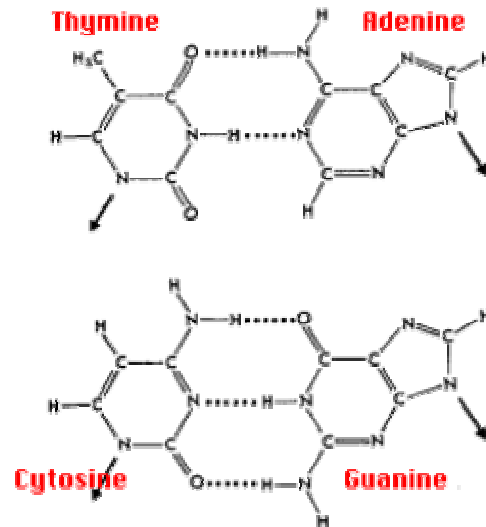
1952 – **Watson and Crick**

- Suggested the model of DNA structure
- Double helix structure (similar to a spiral staircase or twisted ladder)
 - “Rungs” of the ladder – pairs of nitrogen bases
 - “Sides” of the ladder – phosphate groups and sugar molecules

Complimentary Base Pairing:

Cytosine – Guanine

Adenine – Thymine

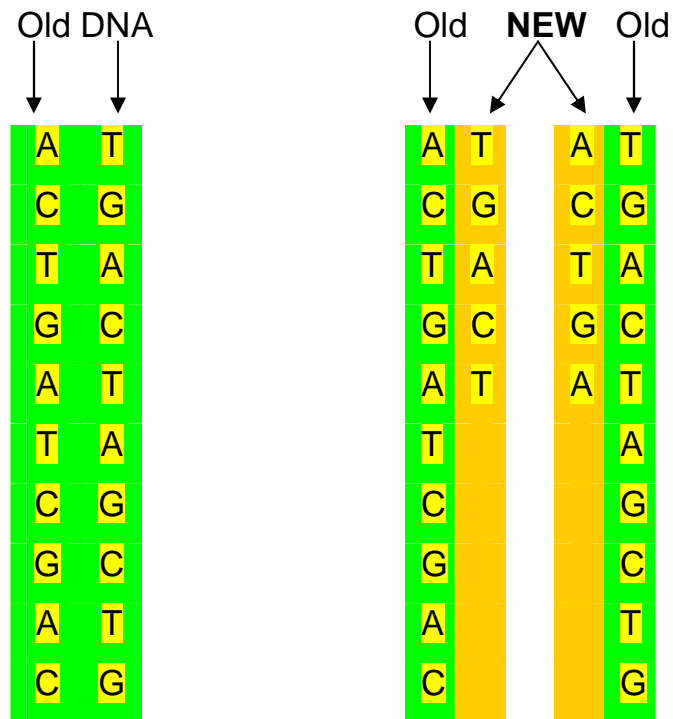


Replication of DNA:

Replication – process of DNA copying itself

- 2 nucleotides chains separate, each series as a template for new nucleotide chains
- Replication occurs simultaneously at different sites of the DNA
- **Steps of Relication:**
 - Helicase enzymes separate DNA's 2 chains of nucleotides
 - DNA Polymerase binds to the separated chains of nucleotides. This enzyme then creates a new complimentary chain of nucleotides, one nucleotides at a time.
 - At the end, there are 2 identical copies of the original DNA molecule.

EXAMPLE:

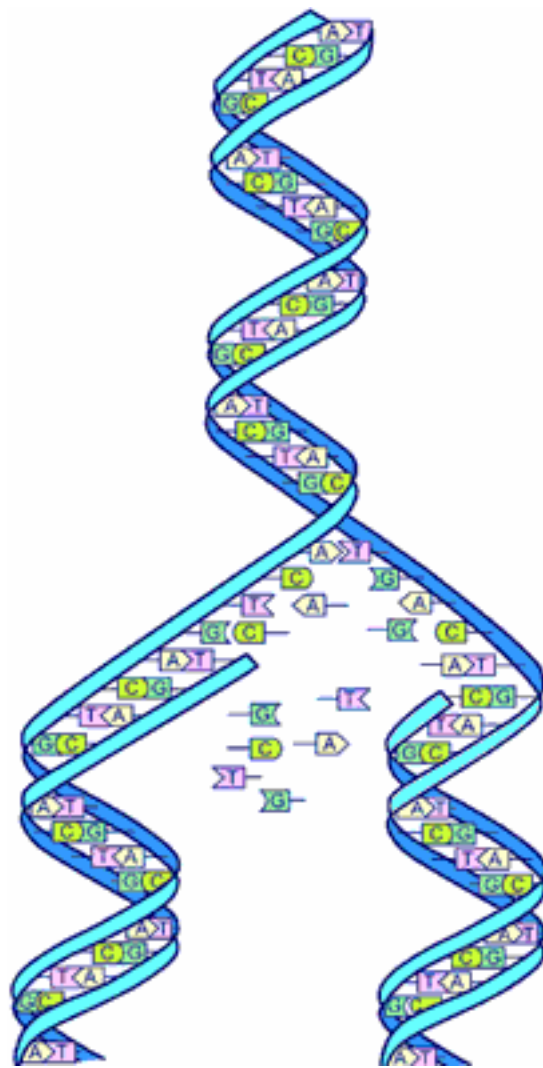


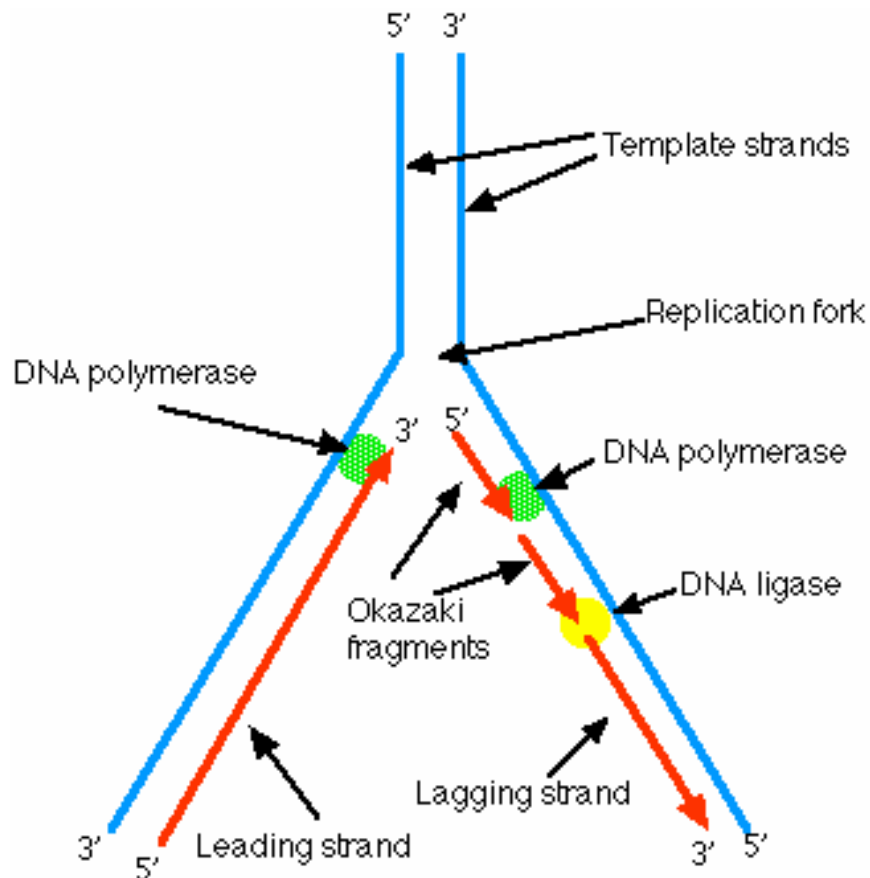
Accuracy and Repair:

High degree of accuracy, errors rarely occur.

DNA Proofreading and Repair:

After proofreading and repairs, errors only occur 1 in every 1 billion nucleotides





Mutation – change in gene, can have series of effects on cells

RNA – Ribonucleic Acid

- Responsible for the movement of genetic information from the DNA in the nucleus to the site of protein synthesis in the cytosol

Structure of RNA: Made of repeating nucleotides

Differences from DNA:

1. **Sugar – ribose**
2. **Nitrogen base – there is NO thymine, RNA has uracil instead which then pairs with adenine**

Types of RNA:

1. Messenger RNA (mRNA):

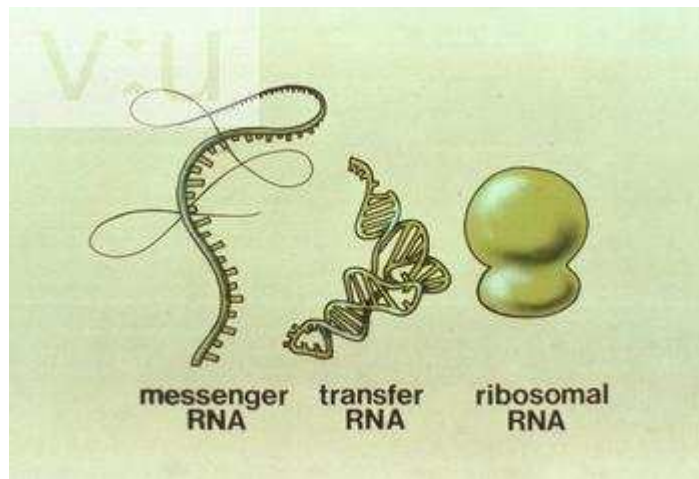
- Carries genetic information from DNA in the nucleus to the cytosol

2. Transfer RNA (tRNA):

- Takes amino acids from cytosol to the ribosomes

3. Ribosomal RNA (rRNA):

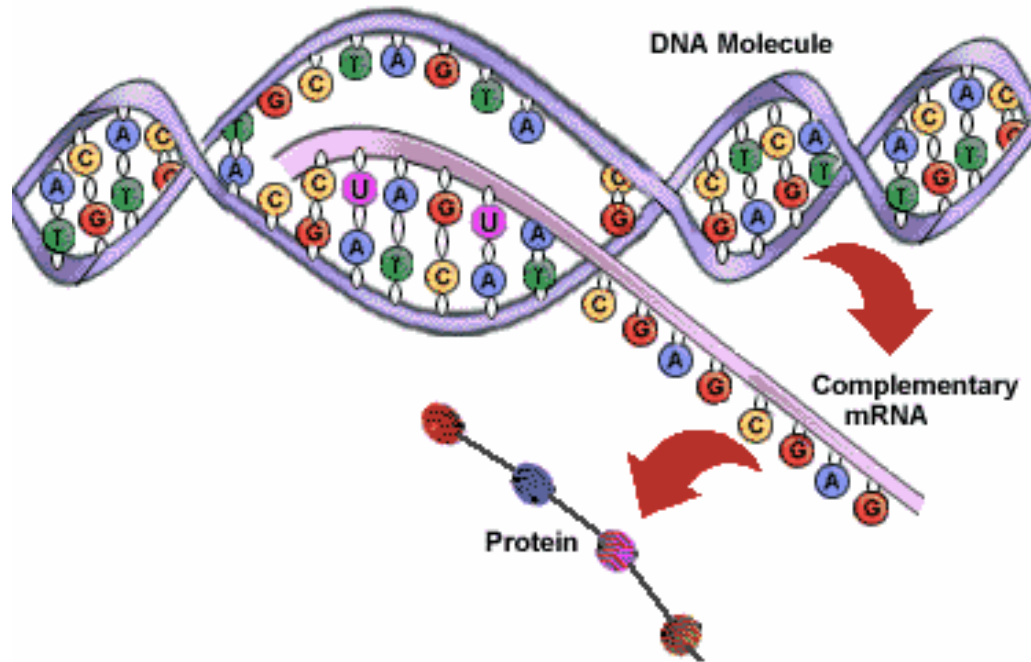
- Makes ribosomes where proteins are made



Transcription:

- Process by which genetic information is copied from DNA to RNA.
- MRNA moves through nuclear pores into the cytosol where it will direct the synthesis of proteins
- **Steps to Transcription:**
 - RNA Polymerase binds to the promoter of a specific gene
 - A complimentary copy of that gene's DNA base sequence is made by adding RNA nucleotides therefore forming the mRNA strand. (Base

pairing is the same except adenine pairs with uracil)



Protein Synthesis

Production of proteins, the 3 types of RNA work together to produce proteins

Protein Structure and Composition:

- Proteins are made of polypeptides, each of which consists of a specific sequence of **amino acids** linked together by **peptide bonds**
- There are 20 different amino acids that make up proteins

Genetic Code:

- Correlation between a nucleotide sequence and an amino acid sequence
- Used to translate mRNA transcripts into proteins

Codon- combination of 3 mRNA nucleotides

- Each codon codes for a specific amino acid
- There are **64** codons

- **Start Codon – AUG**
 - Engages ribosomes to start translating mRNA
- **Stop Codon – UAA, UAG, and UGA**
 - Causes ribosomes to stop translating mRNA

Translation: process of assembling polypeptides from information encoded in mRNA

- tRNA anticodons pair with corresponding mRNA codons and amino acids are joined together to form a polypeptides
- **STEPS to Translation:**
 - Amino Acids that float freely in the cytosol are transported to the ribosome by the tRNA
 - tRNA molecules carry an amino acid on one side and on the other side a sequence of 3 nucleotides called an anticodon (it is complimentary and pairs with the mRNA codon)
 - When the anticodon and the codon bind a specific amino acid is involved
 - EXAMPLE: Anticodon AAA and Codon UUU, the amino acid would be phenylalanine
 - (USE a codon chart to figure out the amino acids)

