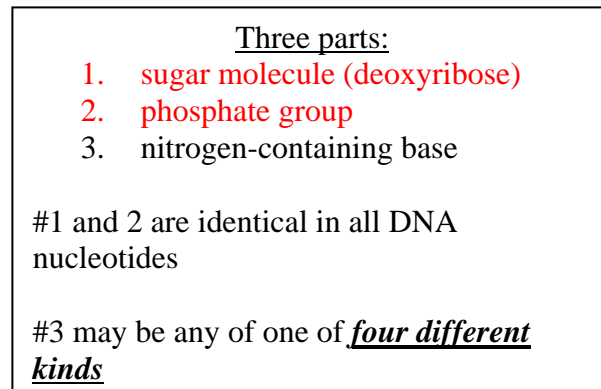


DEOXYRIBONUCLEIC ACID (DNA)

- ☑ DNA allows cells to have different forms & perform different functions. It is the genetic source of diversity among organisms
- ☑ Its primary function is to store & transmit genetic info. that tells RNA which proteins to make and when to make them
- ☑ Proteins form the structural units of cells & help control chemical processes within cells

STRUCTURE OF DNA

- ⊛ Made up of repeating subunits called nucleotides
- ⊛ Each DNA molecule consists of two long chains of nucleotides



The 4 nitrogen-containing bases found in DNA



Called nucleotide bases

Adenine → A

Guanine → G

Thymine → T

Cytosine → C

The Double Helix

- ☺ Discovered in 1953 by James Watson and Francis Crick
- ☺ DNA is composed of two nucleotide chains
- ☺ These chains wrap around each other to form a double spiral – similar to a spiral staircase
- ☺ This shape is called a **DOUBLE HELIX**

- Alternating deoxyribose sugar and phosphate molecules form a backbone
- Individual nucleotide bases are connected to the backbone by covalent bonds
- Nucleotide bases face toward the center of the helix
- The bases on one chain of DNA face the bases on the other chain of DNA
- Base pairing rules:
 - adenine pairs with thymine
 - cytosine pairs with guanine
- This is known as COMPLEMENTARY BASE PAIRING
- Nucleotide sequence in one chain is an exact complement of the nucleotide sequence in the other chain
- Hydrogen bonds form between the nucleotide bases of each chain
 - 2 bonds between adenine and thymine A T
 - 3 bonds between cytosine and guanine C G



Replication of DNA

- ♣ Two nucleotide chains separate by unwinding
 - point where they separate is called the replication fork
 - ♣ Chains are separated by enzymes called helicases
 - ♣ Then enzymes called DNA polymerases bind to the separated chains
 - ♣ They build new chains of DNA
 - ♣ When replication is completed, two new exact copies of the original DNA molecule are produced
- a) During DNA replication, helicase enzymes separate DNA's two chains of nucleotides.
 - b) DNA polymerases bind to the separated chains of nucleotides. One nucleotide at a time, the enzyme builds a new complementary chain of nucleotides.
 - c) At the end of replication, there are two identical copies of the original DNA molecule. Each DNA molecule is made of one chain of nucleotides from the original DNA molecule and one new chain of nucleotides.

RIBONUCLEIC ACID (RNA)

- ☑ RNA is 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

- ⊛ Like DNA, RNA is made up of repeating subunits called nucleotides
- ⊛ The sugar molecule of every RNA nucleotide is a ribose
- ⊛ The nitrogen base thymine is rarely a part of RNA molecules
- ⊛ Uracil, a nitrogen-containing pyrimidine base usually replaces thymine in RNA
- ⊛ As a result, uracil pairs with adenine in RNA
- ⊛ Some forms of RNA are made up of a single chain of nucleotides

Types of RNA

1. Messenger RNA (mRNA)
 - ➔ Single uncoiled chain
 - ➔ Carries genetic information from the DNA in the nucleus to the cytosol of a eukaryotic cell
 - ➔ Directs the synthesis of proteins

2. Transfer RNA (tRNA)

- Single chain of about 80 RNA nucleotides
- Folded into a hairpin shape
- Binds to specific amino acids
- There are about 45 varieties of tRNA

3. Ribosomal RNA (rRNA)

- Most abundant form
- Consists of RNA nucleotides in a globular form
- Along with proteins, rRNA makes up the ribosomes where proteins are made

TRANSCRIPTION

The process where genetic information is copied from DNA to RNA is called TRANSCRIPTION.

- ☺ All forms of RNA are made by transcription (mRNA, tRNA, and rRNA)
- ☺ Transcription occurs in the nucleus of the cell
- ☺ RNA polymerase is the primary enzyme involved in transcription

PROTEIN SYNTHESIS (The production of proteins)

- ♣ The three types of RNA work together to produce proteins
- ♣ During protein synthesis, the sequence of nucleotides in an mRNA transcript is translated into a sequence of amino acids

THE GENETIC CODE

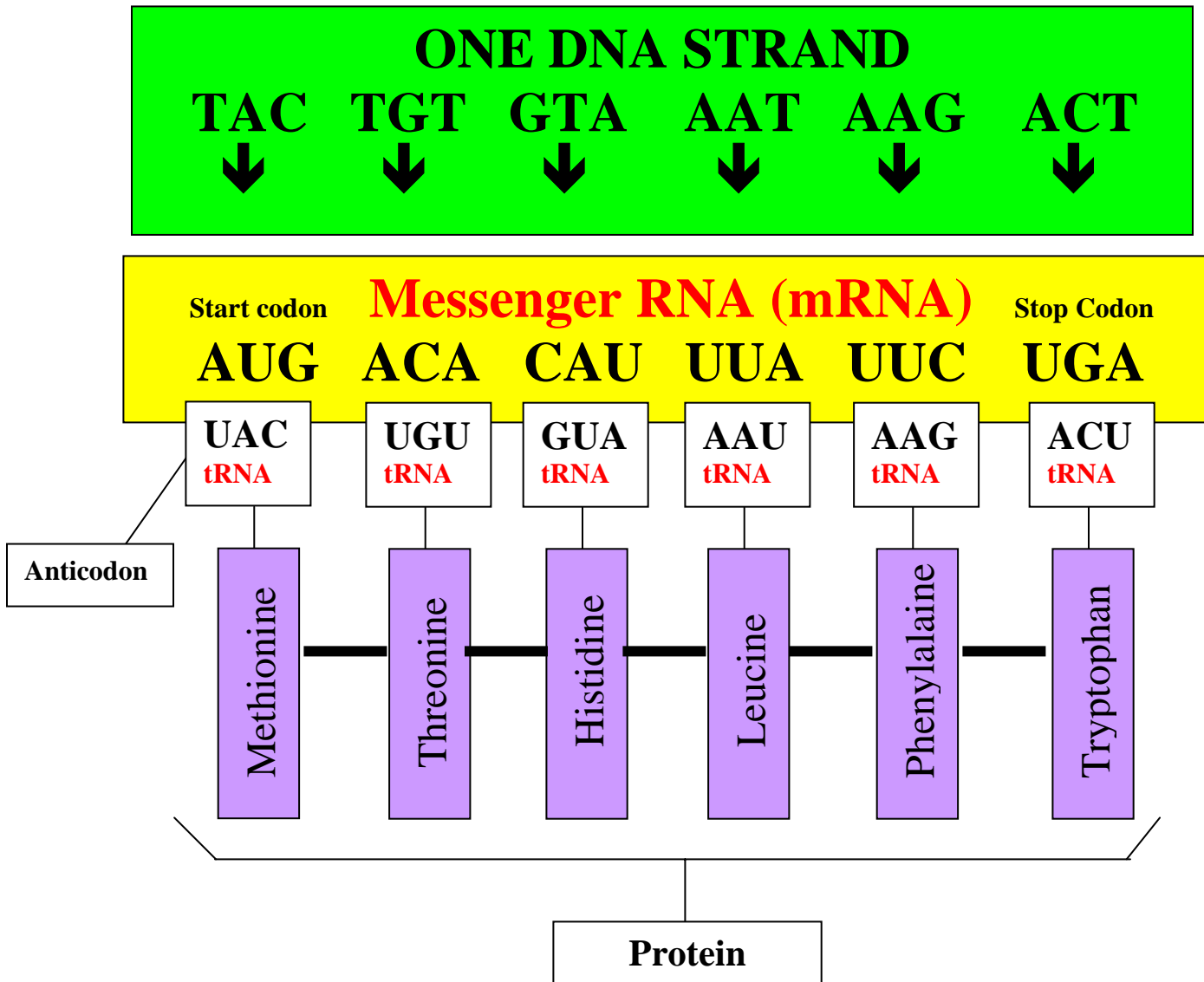
- ♣ The genetic information necessary for making proteins is encoded in a series of three mRNA nucleotides.
- ♣ Each combination of three mRNA nucleotides is called a codon
- ♣ Each codon codes for a specific amino acid
- ♣ The start codon (AUG) engages a ribosome to start translating a mRNA molecule
- ♣ Stop codons (UAA, UAG, UGA) cause the ribosome to stop translating a mRNA

TRANSLATION

The process where a protein is synthesized (made) from the genetic information contained in mRNA is called translation.

- ♣ Begins when mRNA leaves the nucleus of the cell
- ♣ The mRNA migrates to a ribosome in the cytoplasm
- ♣ The ribosome is the site of protein synthesis
- ♣ Amino acids floating in the cytoplasm are transported to the ribosomes by tRNA molecules

PROTEIN ASSEMBLY



DNA → **mRNA** = **transcription**

mRNA → **Protein** = **translation**