Nucleic Acids & Proteins

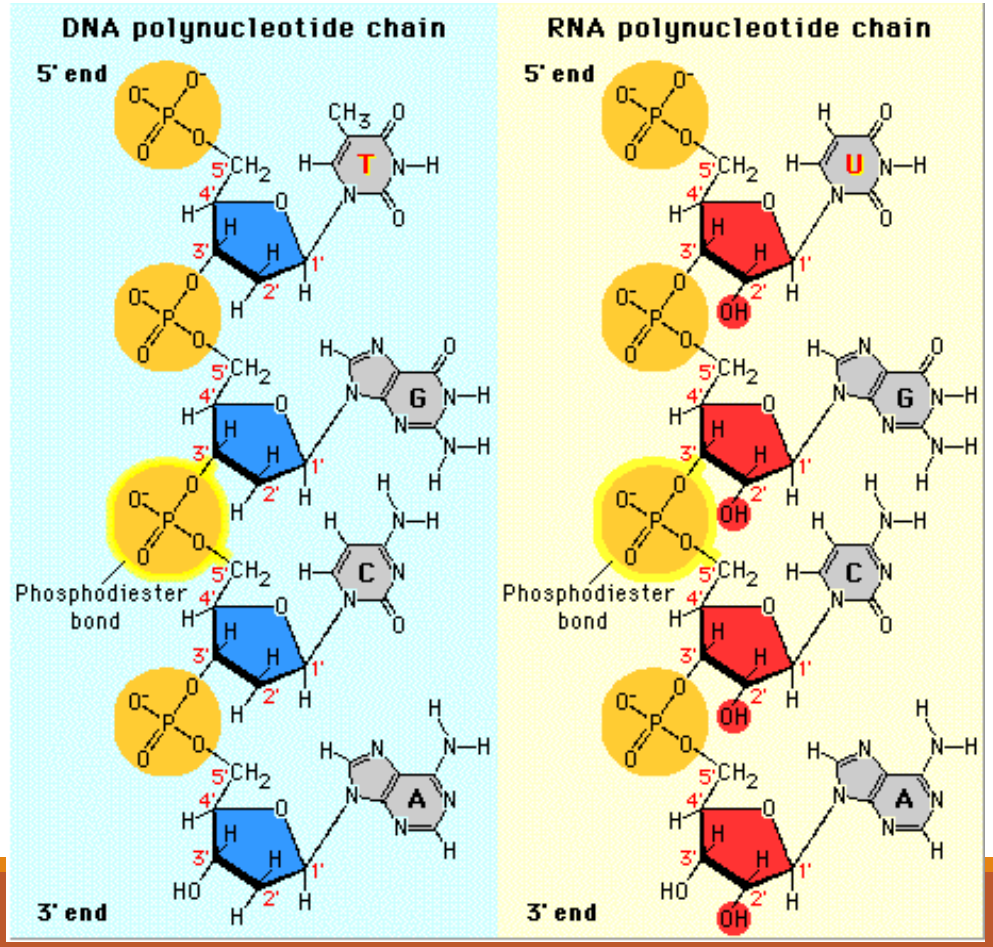
SBI4U

MRS. FRANLIN

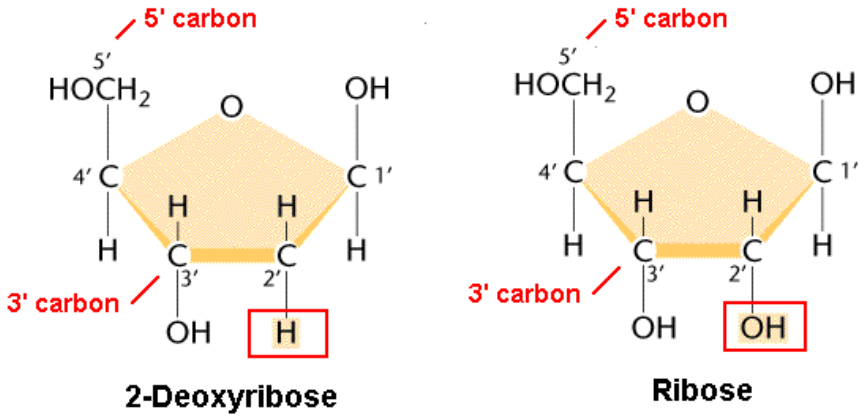
3. Nucleic Acids

Nucleic Acids contain hereditary information.

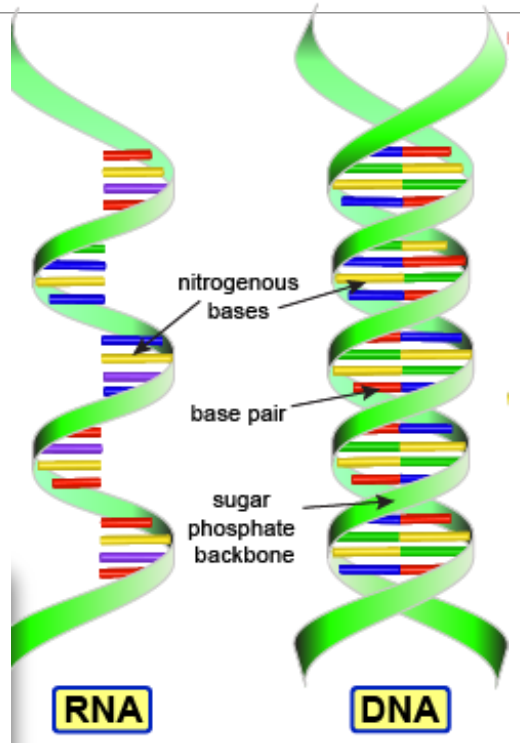
There are two main types of nucleic acids: RNA and DNA.



3. Nucleic Acids

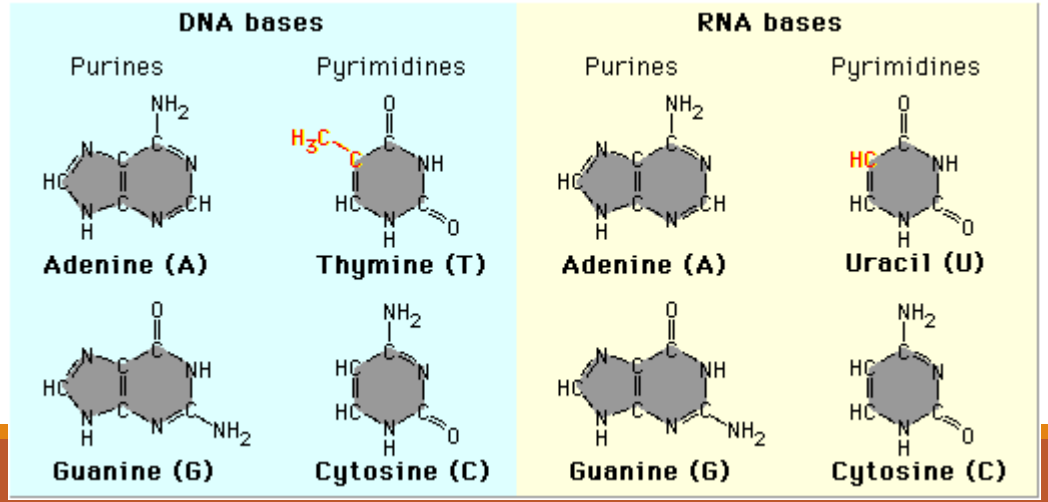


DNA does not contain an –OH group on the 2'C.

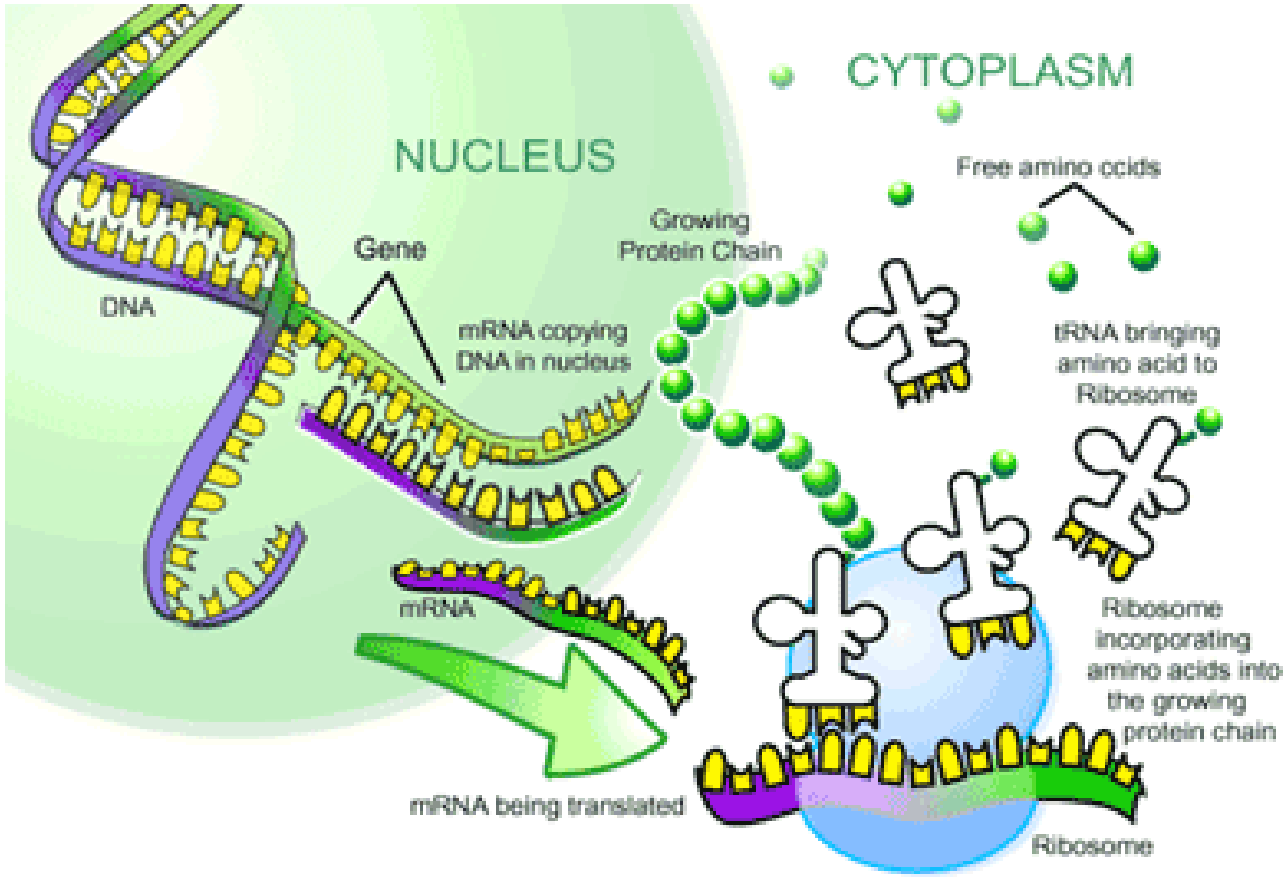


RNA is single stranded and DNA is double stranded.

RNA contains Uracil instead of Thymine.

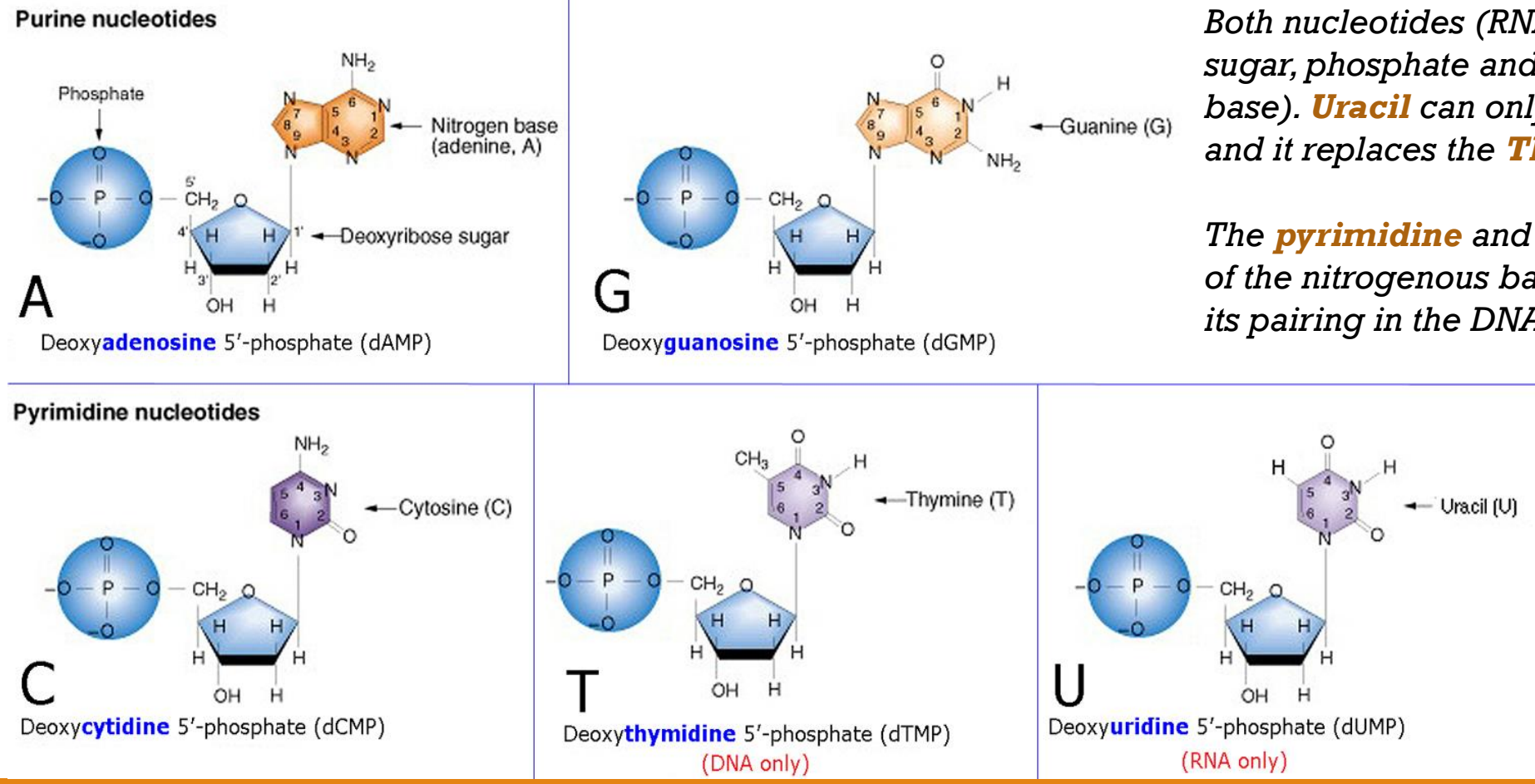


3. Nucleic Acids



RNA is made in the nucleus of the cell. When transported into the cytoplasm it is essential in the process of transcription whereby the genetic code is translated into an amino acid sequence.

3. Nucleic Acids



Both nucleotides (RNA/DNA) contain a sugar, phosphate and nitrogenous base). ***Uracil*** *can only be found in RNA and it replaces the* ***Thymine*** *base.*

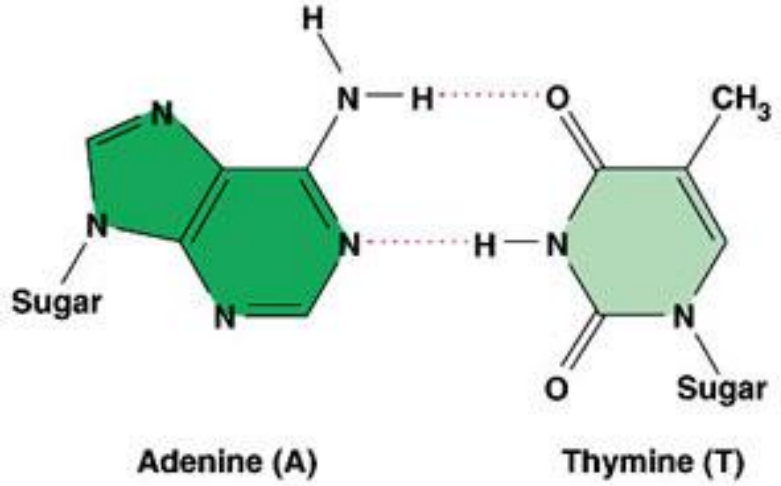
The ***pyrimidine*** *and* ***purine*** *structure of the nitrogenous base also influences its pairing in the DNA and RNA strands.*

3. Nucleic Acids

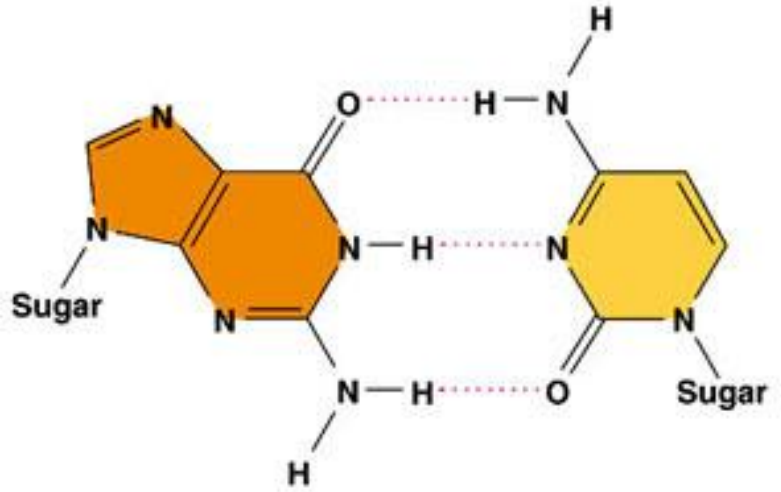
Due to the DNA structure, ***purines*** always bind with ***pyrimidines***.

Adenine ⟹ Thymine

Guanine ⟹ Cytosine

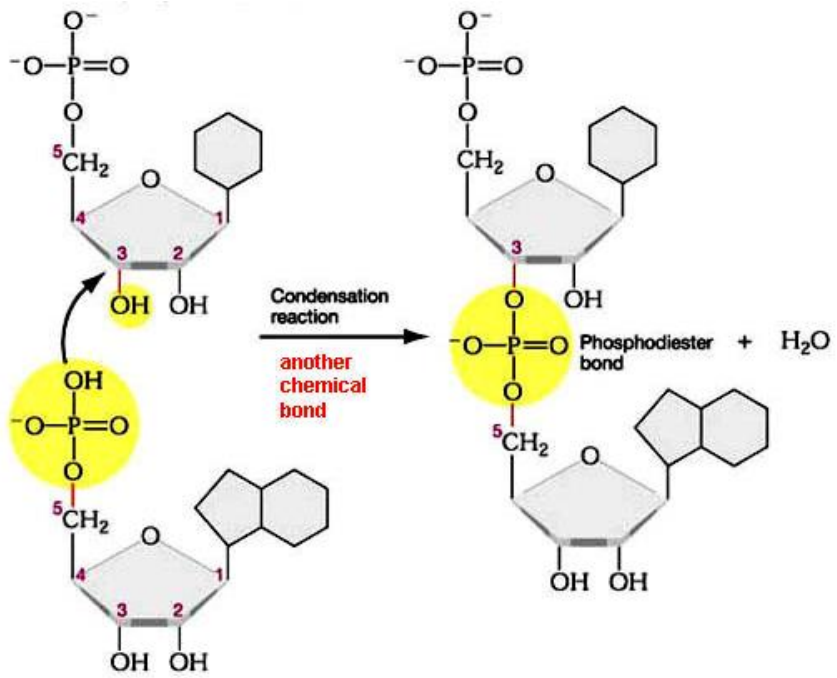


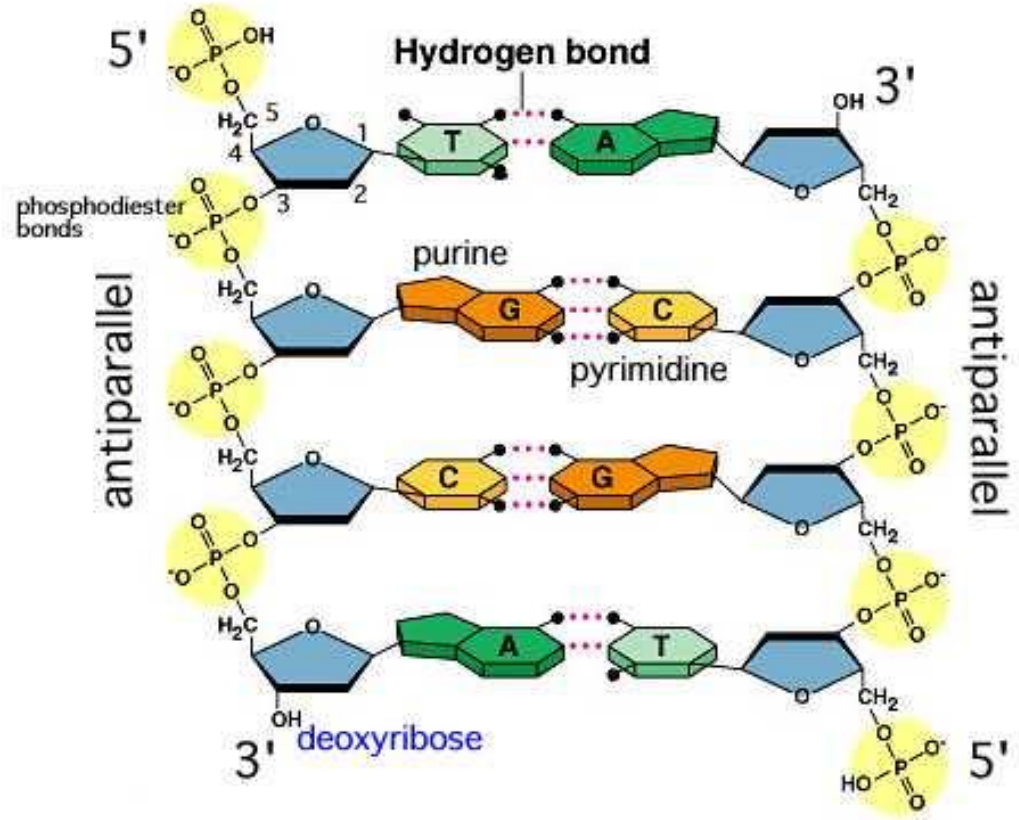
Adenine (A) Thymine (T)



Guanine (G) Cytosine (C)

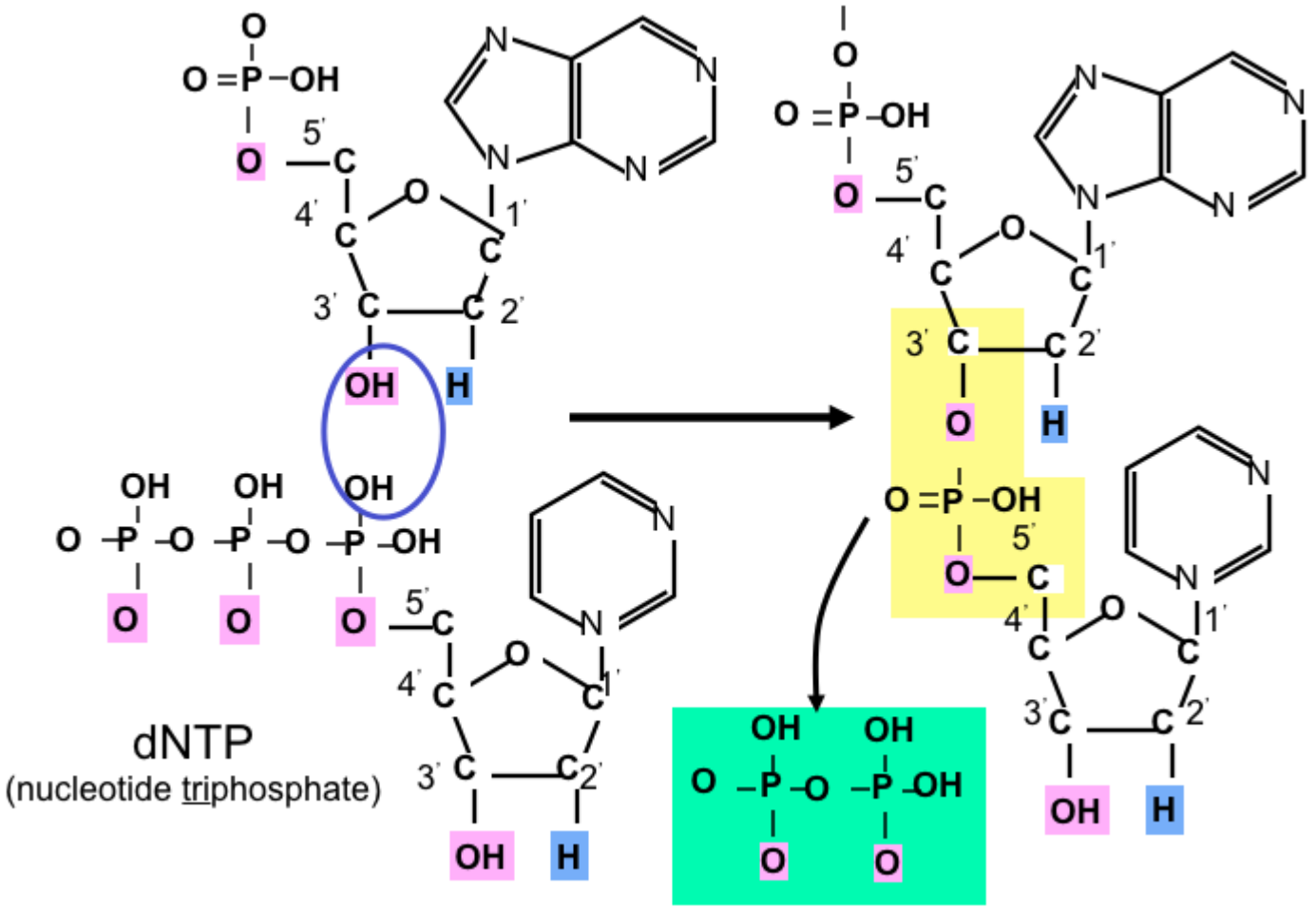
3. Nucleic Acids





A nucleotide strand is formed when a series of nucleotide monomers bind through the formation of ***'phosphodiester bonds'.***

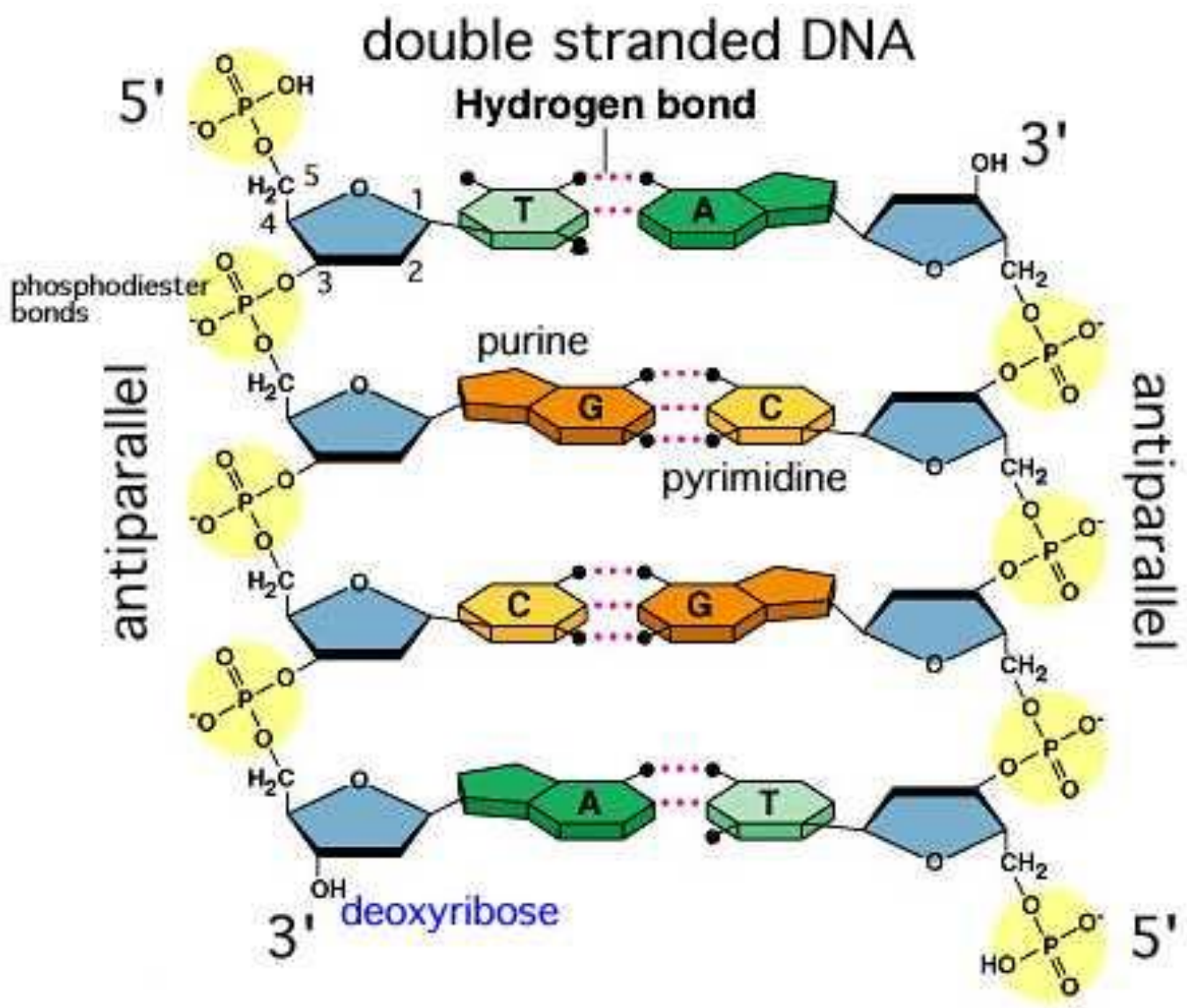
3. Nucleic Acids



Two phosphate groups are always removed from the nucleotide as a result of the condensation reaction and formation of the phosphodiester bond.

3. Nucleic Acids

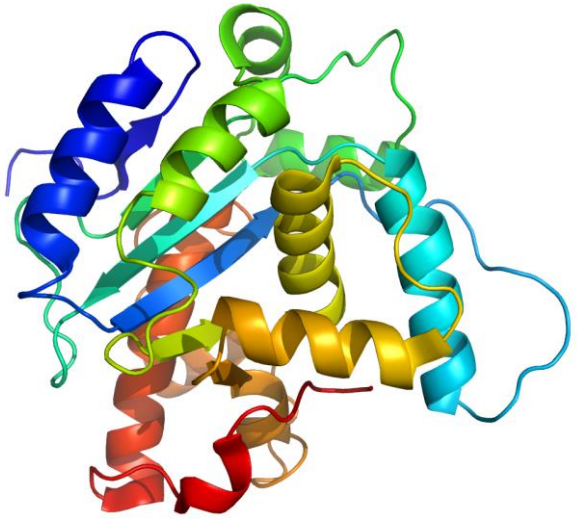
Both DNA strands are antiparallel to another, such that one strand will begin with a **phosphate group (5')** and the opposite end with begin with a **sugar (3').**



4. Proteins

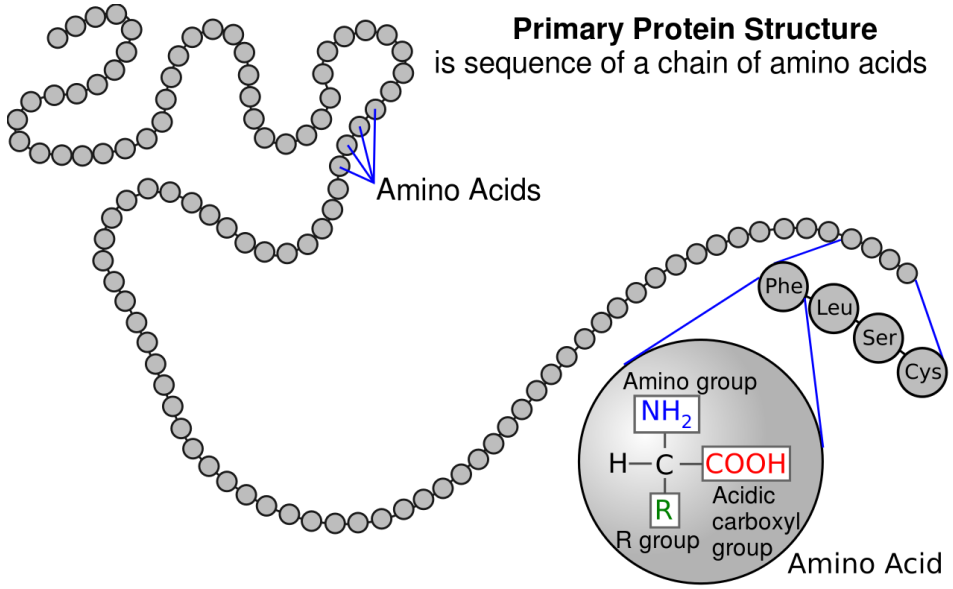
Roles of Proteins:

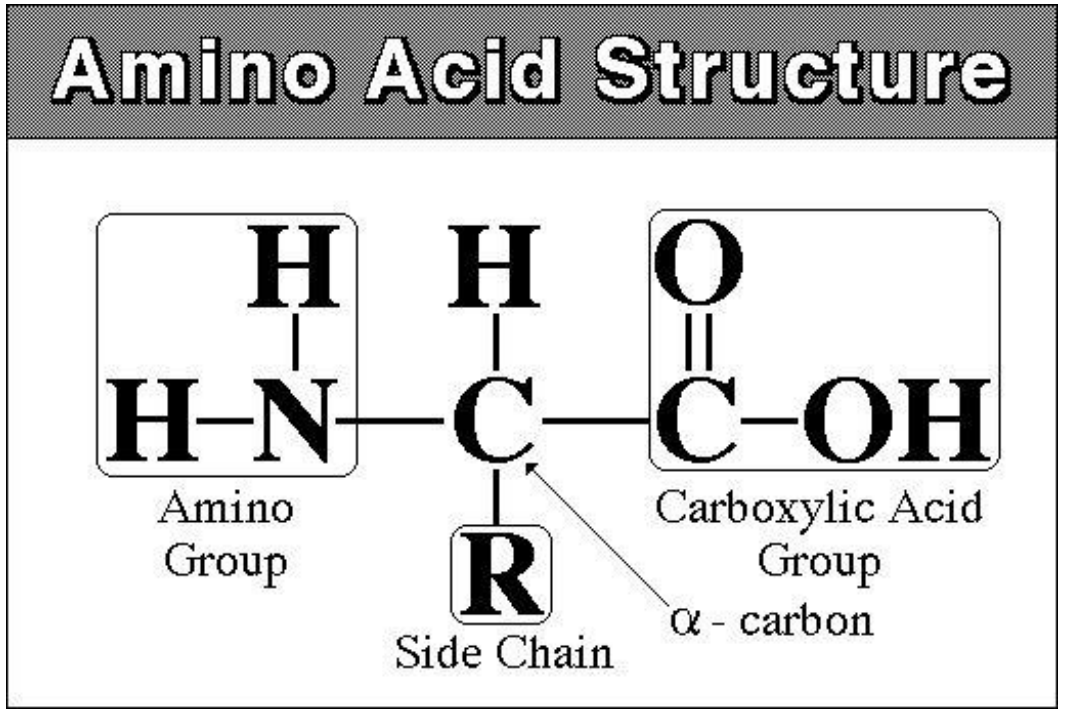
1. Catalyzing Chemical Reactions
2. Structural support
3. Transporting substances
4. Enabling organisms to move
5. Regulating cellular processes
6. Defends against disease



The structure differs between every protein thus allowing it to undergo various functions.

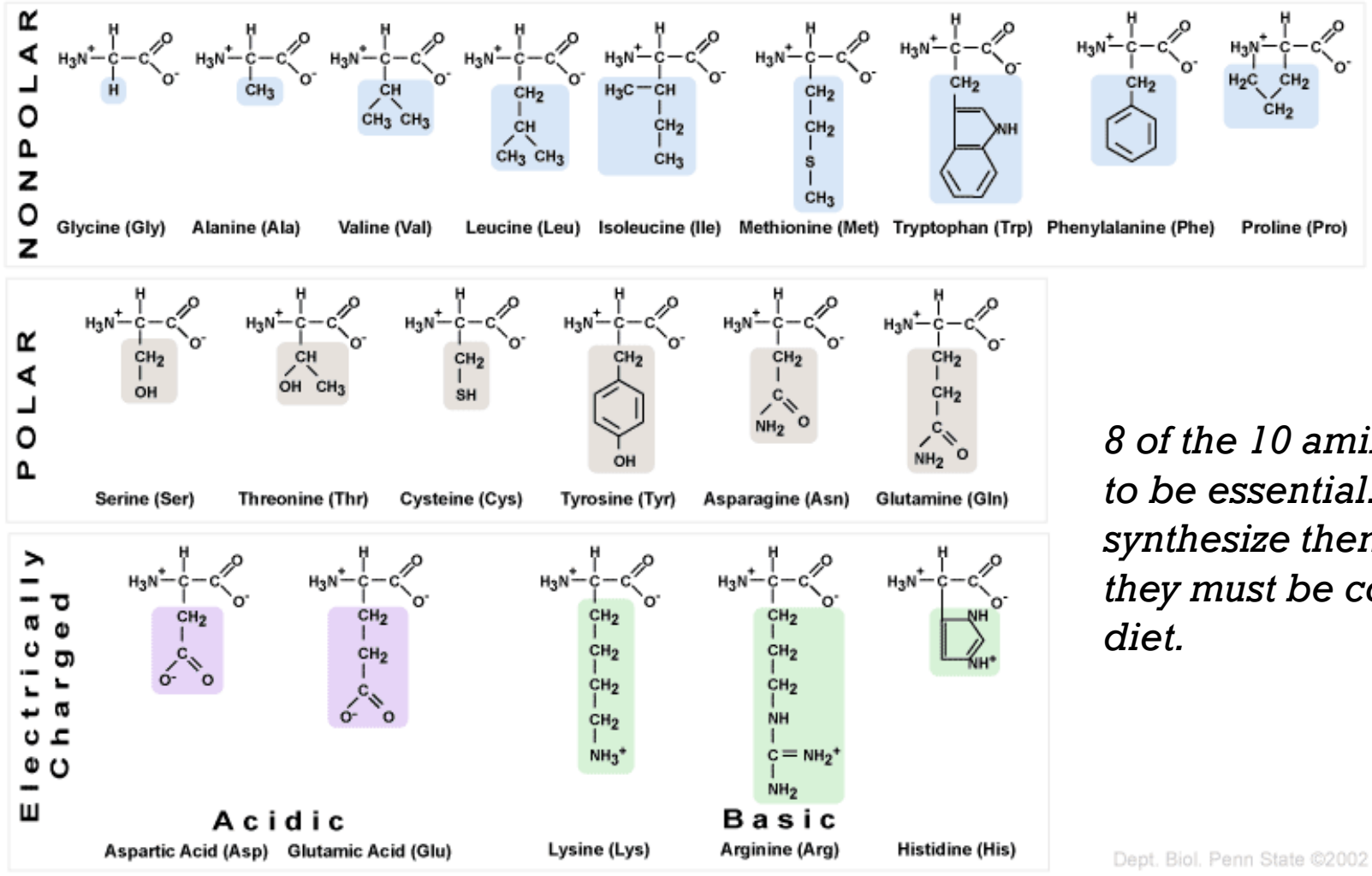
4. Proteins





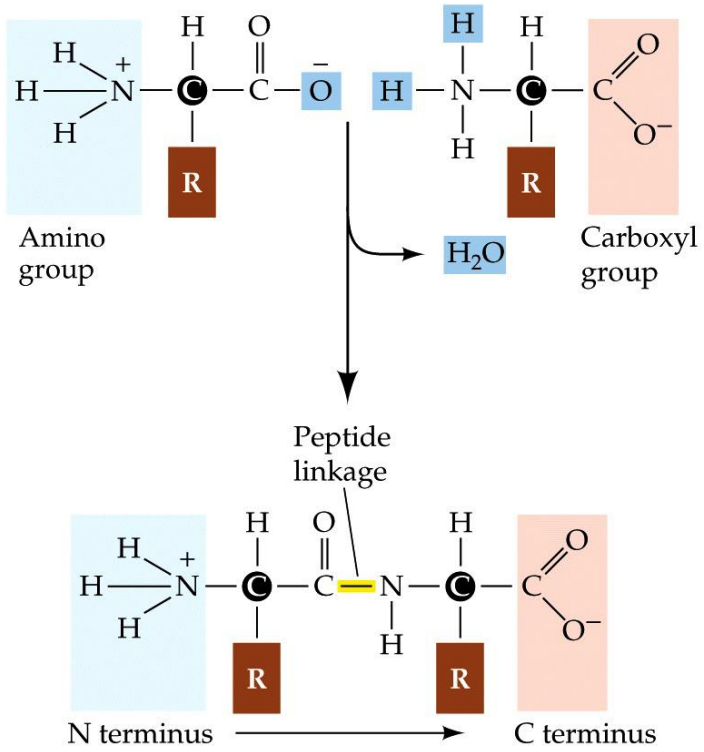
Amino acids can join through covalent bonds during a condensation reaction to form log polypeptide chains.

4. Proteins



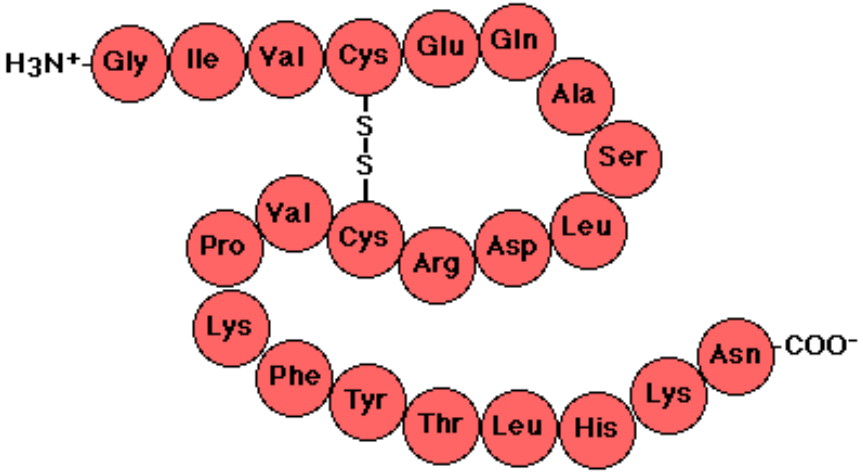
8 of the 10 amino acids are known to be essential. The body cannot synthesize them on its own, thus they must be consumed in one's diet.

4. Proteins



The bonds formed between every amino acid is known as a ***peptide bond.***

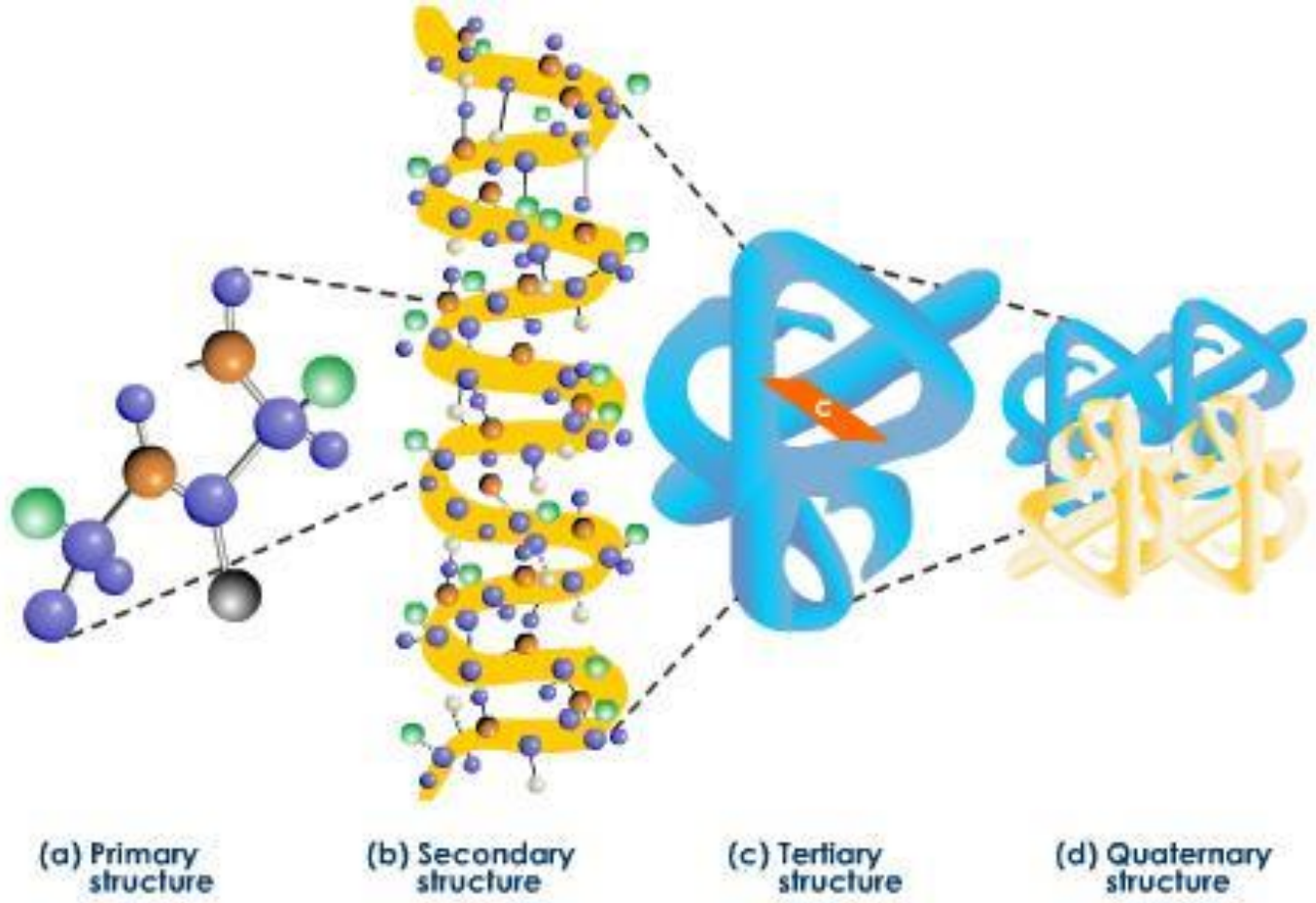
There are various combinations of amino acids that can create different polypeptide chains.



Polypeptides are formed in the cytoplasm of the cell.

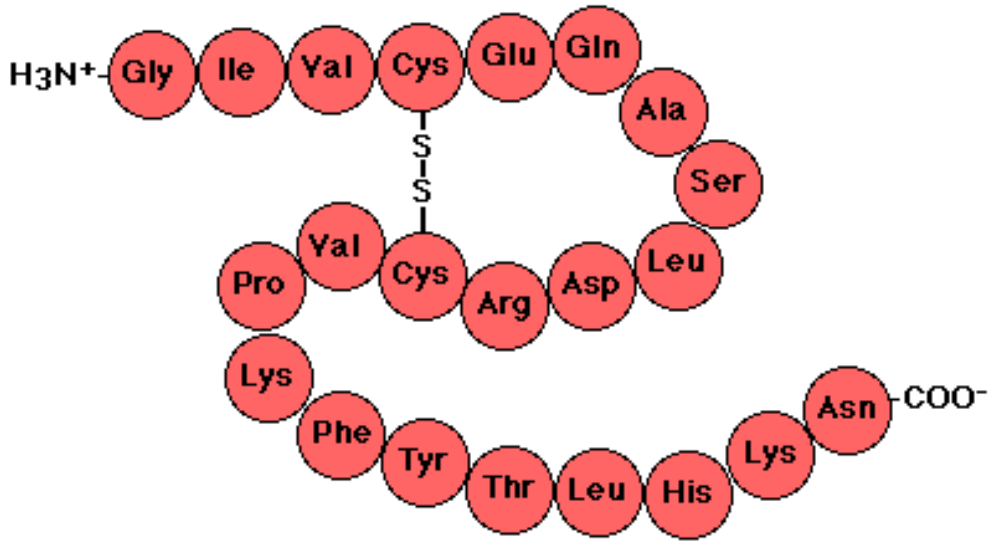
4. Proteins

The combination of amino acids and resulting polypeptide forms the primary structure of the protein.



4. Proteins

Primary Structure:



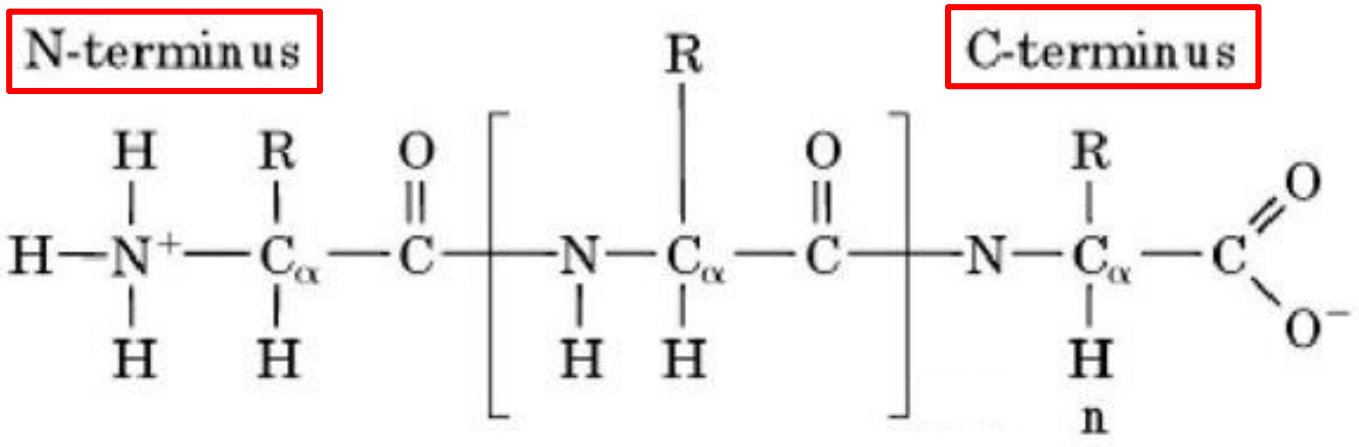
The amino acid sequence can determine the function of the protein

It influences the final conformation of the protein.

There are 20^n (n=number of a.a) possibilities in a protein.

4. Proteins

The polypeptide chain will always have an amino group on one end **(N-terminus)** and the carboxyl group on the other end **(C-terminus).**



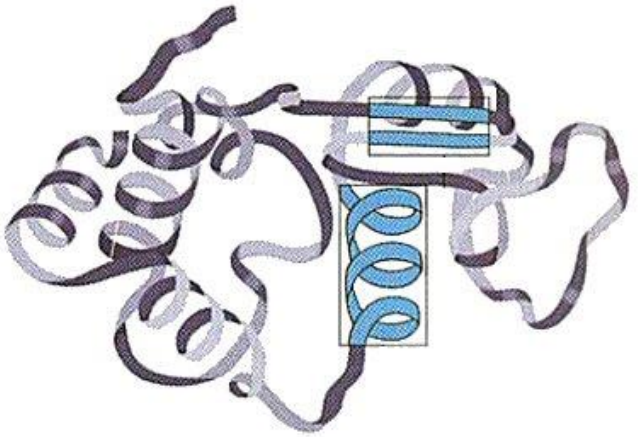
Polypeptide chain

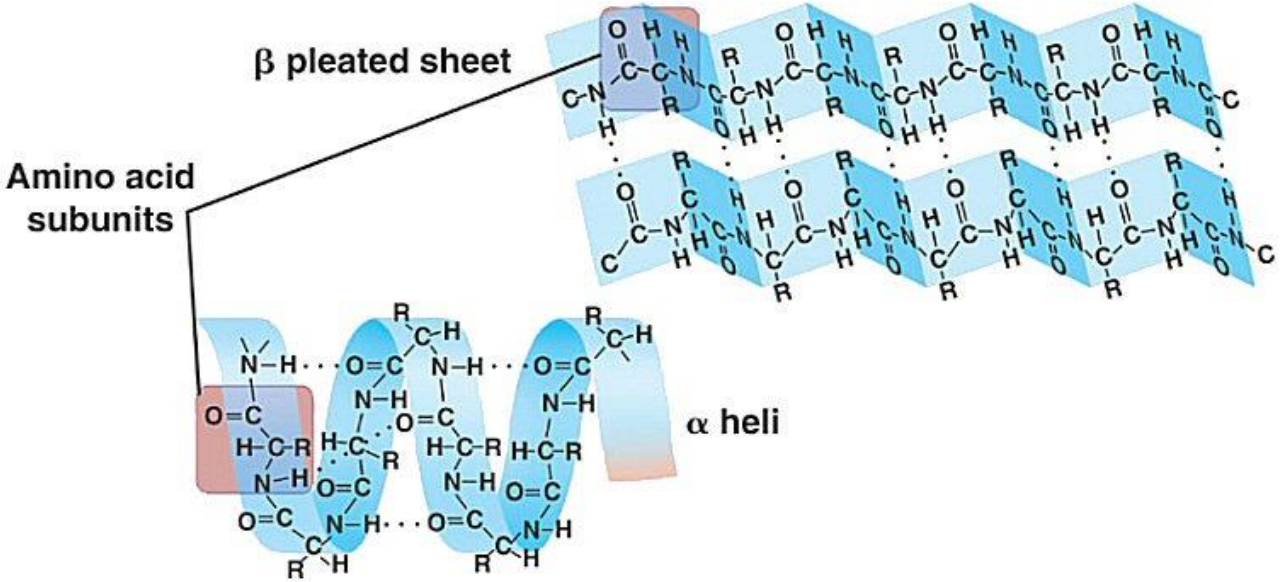
4. Proteins

Secondary Protein Structure:

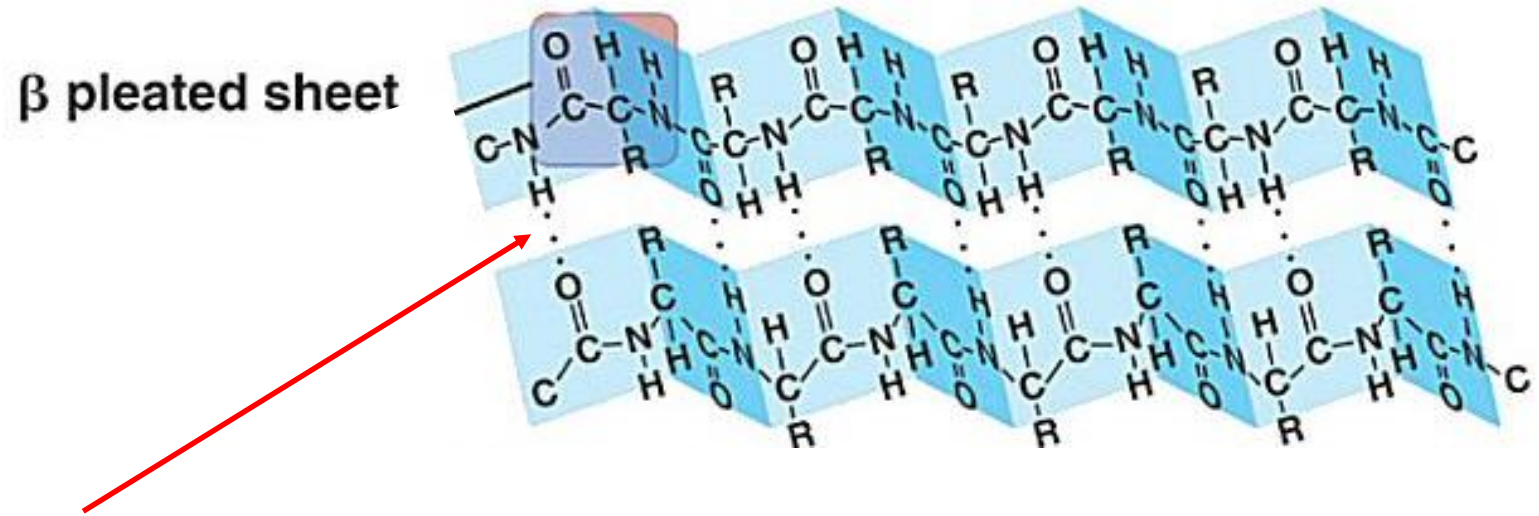
As the chain grown, it coils and folds at various locations along its length.

Hydrogen bonds are formed between the amino acids at different locations in the polypeptide chain to help maintain the structure.





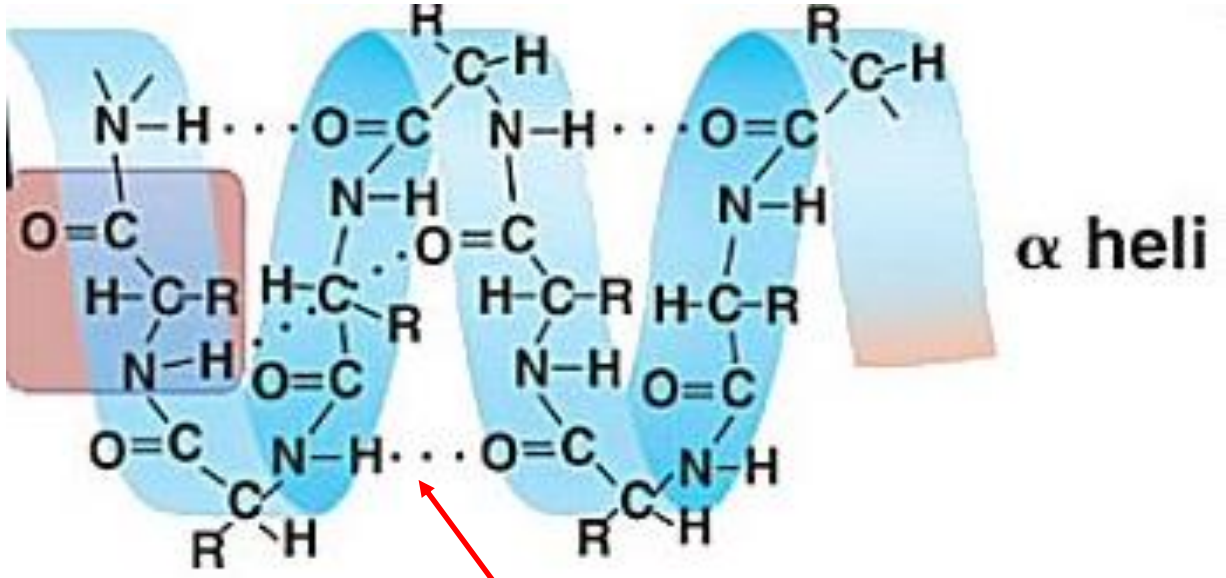
4. Proteins



Hydrogen bonds form between the two polypeptide chains that are parallel to one another.

4. Proteins

The hydrogen bonds help form an alpha-helix.



Hydrogen bond *(formed between the negative carboxyl groups and the positively charged amino group) .*

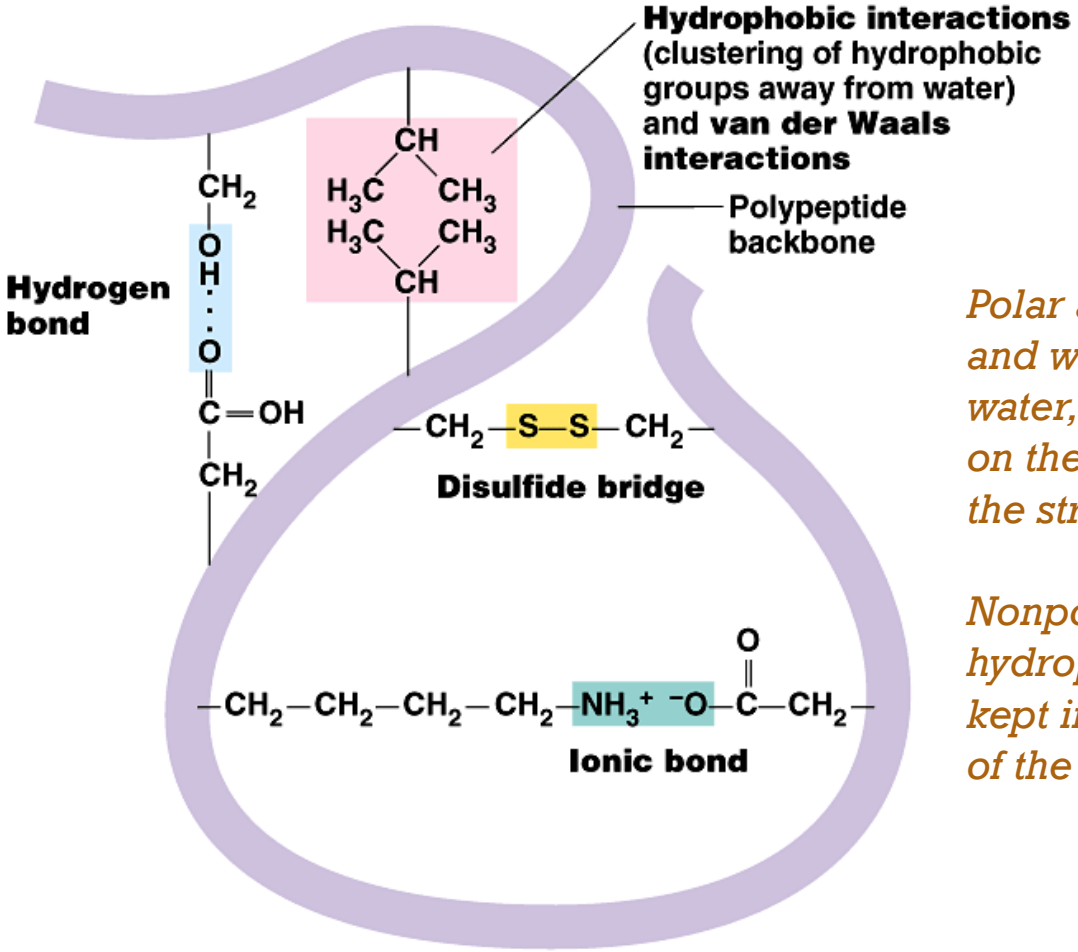
4. Proteins

Tertiary Structure:

The polypeptide chain are bend back-and-forth into a 3-D structure.

3 types of bonds have formed:

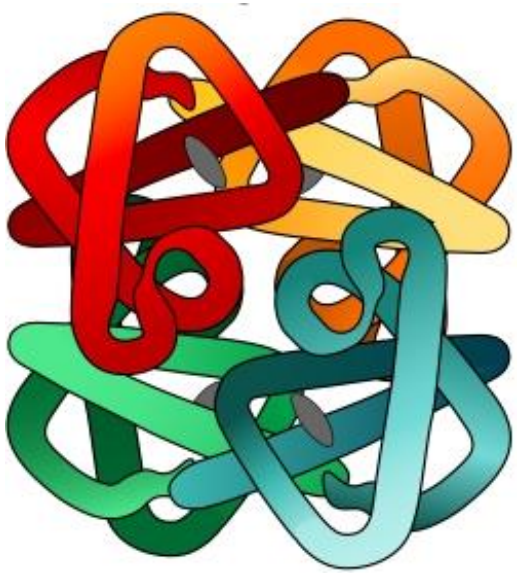
1) Hydrogen bonds
2) Ionic Bonds
3) Van Der Waals
4) Disulfide bonds



Polar a.a are hydrophilic and want to interact with water, thus they are placed on the outside portion of the structure.

Nonpolar a.a are hydrophobic and must be kept in the internal portion of the structure.

4. Proteins



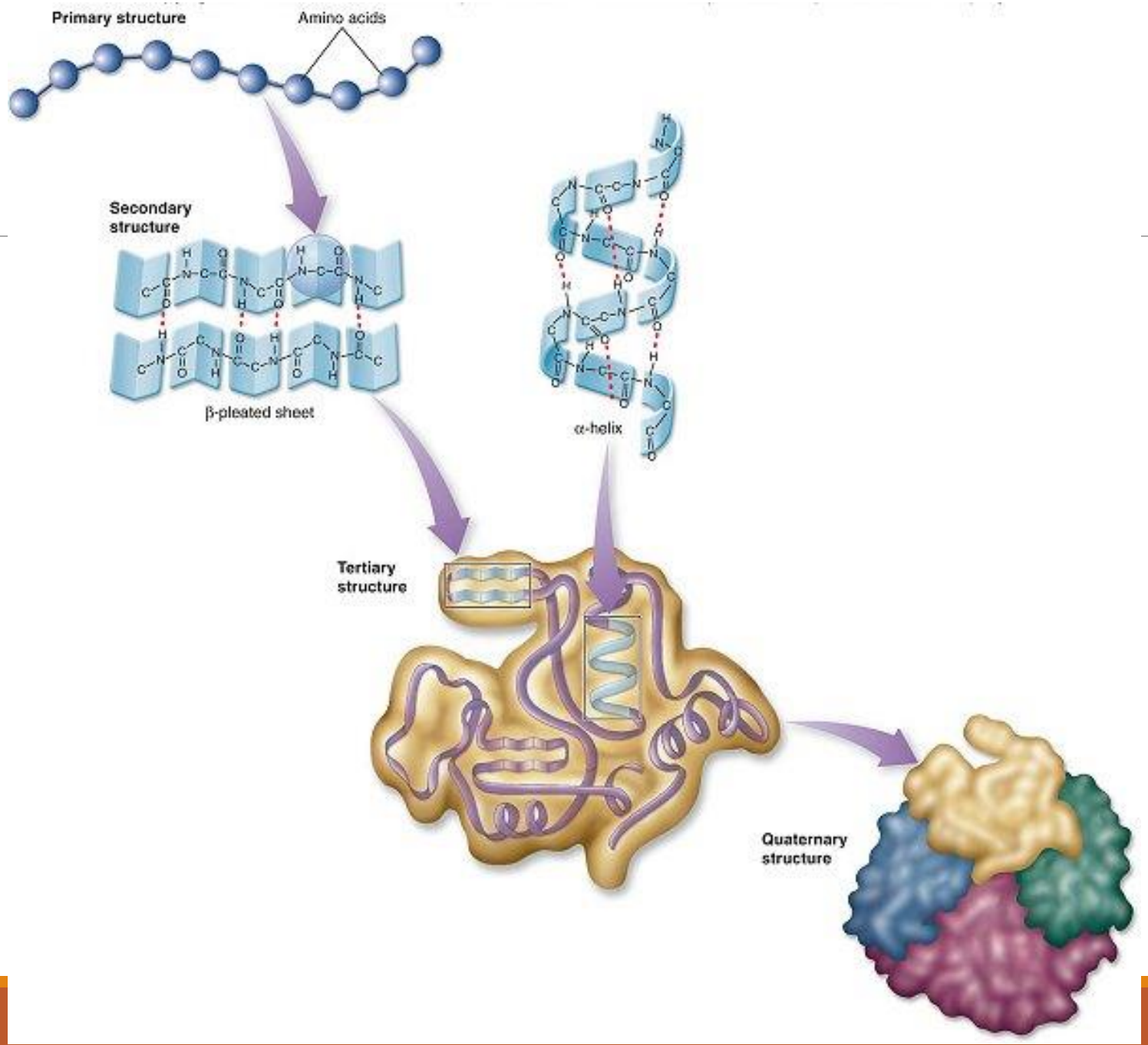
Hemoglobins are proteins that are found within the red blood cells. Their quaternary structure consists of 4 different polypeptide chains.

Quaternary Structure:

Some proteins are composed of more than one polypeptide chain.

When two or more polypeptides assemble to form a larger protein a quaternary structure is formed.

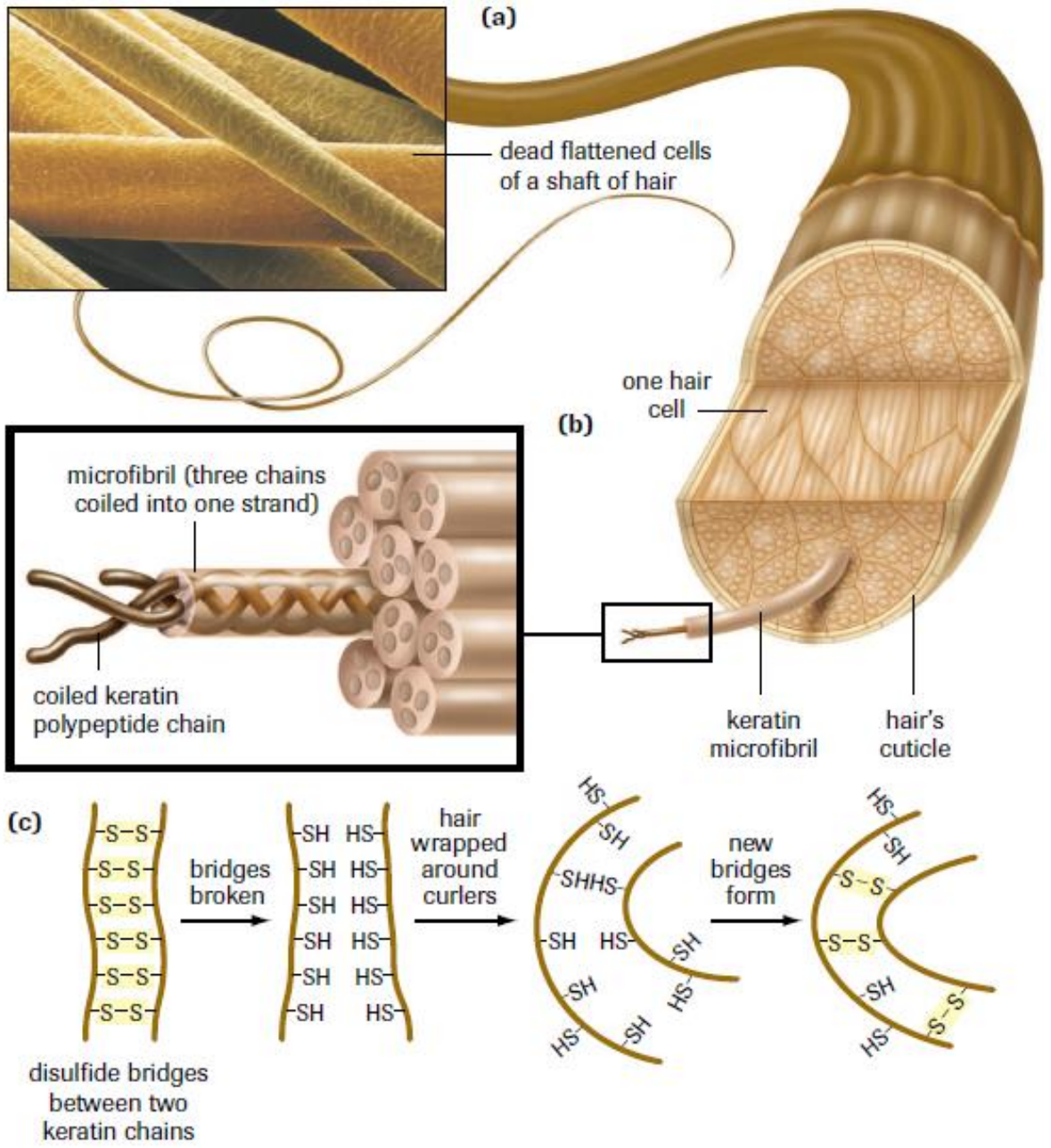
Recap


Primary structure
Amino acids
Secondary structure
β-pleated sheet
α-helix
Tertiary structure
Quaternary structure

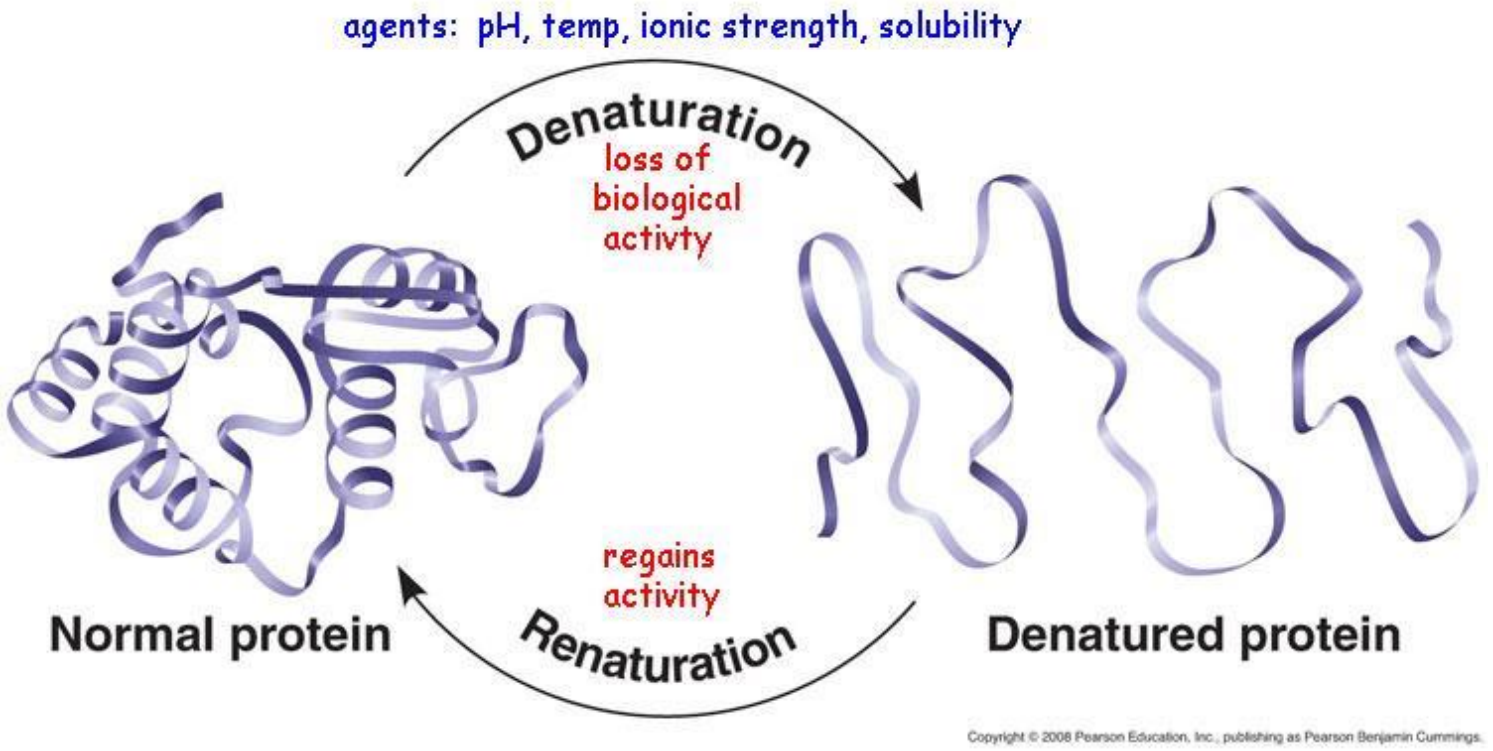
4. Proteins

Disulfide bridges link three chains together as fine fibres. These get bundled into larger, cablelike fibres.

For a permanent wave, hair is exposed to chemicals that break disulfide bridges. When hairs wrap around curlers, the polypeptide chains of the hairs are held in new positions.

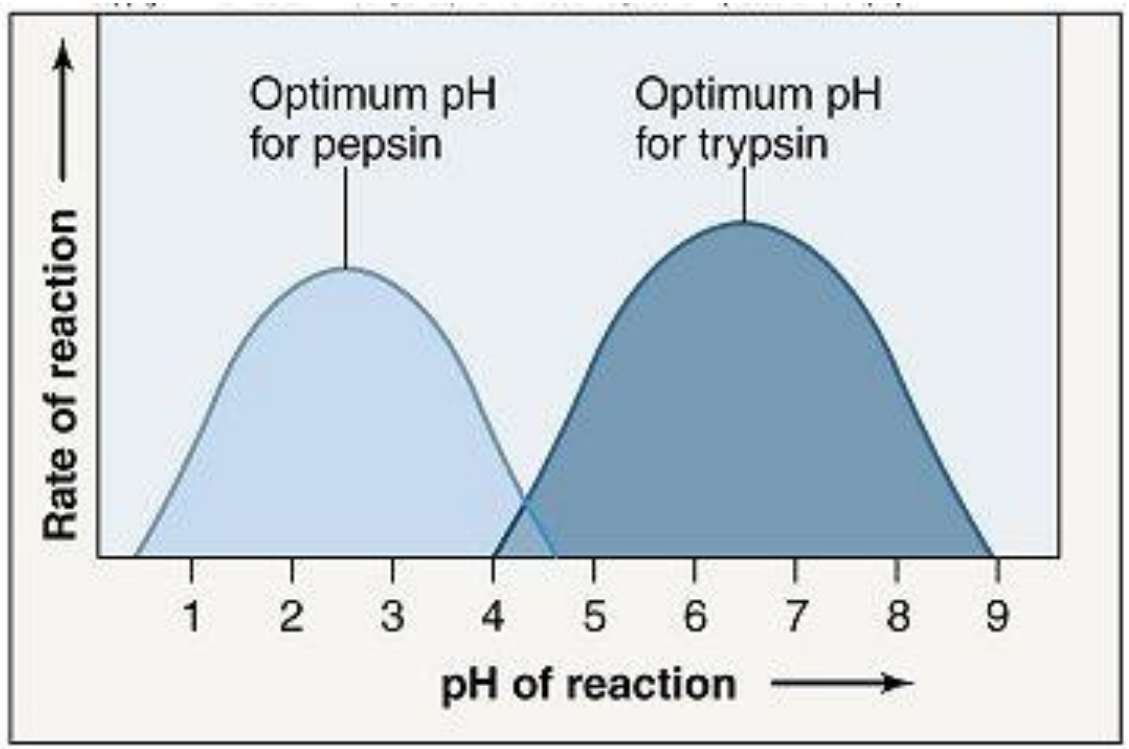


4. Proteins



The environment of the cell can influence the structure of the protein. All proteins have optimal conditions in which they work best.

4. Proteins



Enzymes are proteins that speed up chemical reactions.

Each enzyme functions at an optimal pH and temperature.

Homework

Textbook: pg. 31 # 2, 5 ,6, 11