

ADDENDUM TO UNIT 1 LECTURE NOTES

Carbon atoms are the most versatile building blocks of molecules(4-1)

With a total of 6 electrons, a carbon atom has 2 in the first shell and 4 in the second shell (4 valence electrons)

Little tendency to form ionic bonds by losing or gaining 4 electrons.

Usually completes its valence shell by sharing electrons with other atoms in four covalent bonds.

This tetravalence by carbon makes large, complex molecules possible.

Variation in carbon skeletons contributes to the diversity of organic molecules

Geometric isomers are compounds with the same covalent partnerships that differ in their spatial arrangement around a carbon-carbon double bond.

A polypeptide is a polymer of amino acids connected in a specific sequence (5-4)

The physical and chemical characteristics of the R group determine the unique characteristics of a particular amino acid.

One group of amino acids has hydrophobic R groups

Another group of amino acids has polar R groups, making them hydrophilic.

The last group of amino acids includes those with functional groups that are charged (ionized) at cellular pH.

Some R groups are bases, others are acids.

A protein's function depends on its specific conformation

A functional protein consists of one or more polypeptides that have been precisely twisted, folded, and coiled into a unique shape.

It is the order of amino acids that determines what the three-dimensional conformation will be.

The **primary structure** of a protein is its unique sequence of amino acids.

This order is determined by DNA.

Even one amino acid difference in primary structure can affect a protein's conformation and ability to function

Quarternary structure results from the aggregation (fitting together) of two or more polypeptide subunits.

Nucleic acids store and transmit hereditary information(5-5)

There are two types of nucleic acids: **ribonucleic acid (RNA)** and **deoxyribonucleic acid (DNA)**.

ATP, the energy molecule, is closely related to RNA – we will talk more about ATP in the next chapter!

DNA provides direction for its own replication.

DNA also directs RNA synthesis and, through RNA, controls protein synthesis.

Organisms inherit DNA from their parents.

Each DNA molecule is very long and usually consists of hundreds to thousands of genes.

The sequence of nitrogen bases along a DNA or mRNA polymer is unique for each gene.

Genes are normally hundreds to thousands of nucleotides long.

The number of possible combinations of the four DNA bases is limitless.

The linear order of bases in a gene specifies the order of amino acids - the primary structure of a protein.

The primary structure in turn determines three-dimensional conformation and function.

ATP powers cellular work by coupling exergonic reactions to endergonic reactions(6-1)

In the cell the energy from the hydrolysis of ATP is coupled directly to endergonic processes by transferring the phosphate group to another molecule.

This molecule is now **phosphorylated**.

This molecule is now more reactive.

ATP is a renewable resource

continually regenerated in the cell by adding a phosphate group to ADP

Free energy + ADP + Pi → ATP + H₂O

Endergonic reaction

A cell's physical environment affects enzyme activity(6-2)

The 3-D structures of enzymes (almost all proteins) depend on environmental conditions

Changes in shape influence the reaction rate.

A cell's chemical environment affects enzyme activity(6-2)

If the inhibitor binds somewhere other than the active site, it blocks substrate binding via noncompetitive inhibition.

Binding by the inhibitor causes the enzyme to change shape

Reversible inhibition of enzymes is a natural part of the regulation of metabolism.