Chapter = 01

Biological Molecules

BIOCHEMISTRY:

The branch of biology which explains the biochemical basis of life is called biochemistry.

BIOMOLECULES:

The elements which occur in a particular organism are called bio elements biomolecules,

FUNDAMENTAL TYPES OF BIOMOLECULES:

Biomolecules can be divided into following groups according to variability in them structure and functions in cells and organism i.e.

1. Carbohydrates
2. Proteins
3. Lipids
4. Nucleic Acids
5. Conjugated Molecules

Biomolecules	Units	Linkages
Carbohydrates (oligo & polysaccharide)	Monosaccharides	Glycoside linkage
protein	Amino acids	Peptide linkage
Lipids Fats & Oils Phospholipids Terpenoids	 Glycerol & Fatty Acids. Glycerol, Fatty acids Phosphate & choline. Isoprenoids Units.	 Ester linkages Ester & c-c linkages c-c linkages
Nucleic Acids **DNA** **RNA**	 Deoxyribonucleotides Ribonucleotides	 Phosphoester linkage Phosphoester linkage
Conjugated molecules	Different biomolecules	Different linkages

POLYMERS/MACROMOLECULES:

A macromolecule is a giant molecule made from many small repeating units (macromolecules/monomers). Molecules built like this are known as polymers (macromolecules), e.g., starch, protein, lipid, DNA etc.

MONOMERS/MICROMOLECULES:

The individual units of macromolecules are known as monomers, e.g., glucose, amino acids, nucleotides etc.

CONDENSATION:

When two micro molecules join together in which one hydroxyl (OH^-) group of one monomers bine with hydrogen (H^+) of another monomer to form water. By releasing water two monomers are joined together to form a macromolecule. This process is called condensation hydration process.

H—Monomer OH + H — Monomer — OH

↓ H_2O

H — Monomer — Monomer — OH

Condensation Process (Dehydration)

HYDROLYSIS:

The process in which macromolecule or polymers are broken down into a smaller monomers by the addition of water is called hydrolysis. The breakdown of water molecules takes place by the activity of enzymes called as hydrolytic enzymes.

H —Monomer—Monomer —OH

↓

H — Monomer— OH + H —Monomer—OH

Hydrolysis Process

DEFFERENCIATE BETWEEN CONDENSATION & HYDROLYSIS :

CONDENSATION	HYDROLYSIS
In this process micro molecules join together to form macromolecule (polymers).	In this process macromolecules (polymers) are broken down into small (monomers moecules)
In this process water molecule is released.	In this process water molecule is added.
Condensation reactions make chemical bonds.	Hydrolysis reactions break chemical bonds.
Energy is used in condensation reaction.	Energy is liberated in hydrolysis reaction

WATER:

1. Water is the most abundant component of cell and it is 70% to 90% of cell protoplasm.
2. All biochemical reactions occur in the presence of water.
3. Water is the polar molecule and it has two end one is partially negative oxygen and another is partially positive hydrogen.
4. Water is purely covalent compound but due to difference of electronegativities b/w hydrogen and oxygen,it become charged or polar molecule.

HYDROGEN BOND:

. It is an intermolecular force o attraction b/w partially positive hydrogen(H+) and partially negative oxygen or any other molecule.

. Due to hydrogen bond, water molecule have two types of properties:

COHESIVE FORCE:

It is an attractive force b/w similar molecule, due to this force of attraction, water molecule attract each other and form long chain molecule which help to flow water freely.

ADHESIVE FORCE:

. It is an attractive force b/w dissimilar molecule.

. Due to this force of attraction, water molecule attract other charged molecule and help to prevent the backward flow of water In vessels.

EG:

Rising of water during ascent of sap.

HIGH SPECIFIC HEAT:

Specific heat is the amount of heat energy required to raise the temperature of 1 gram of substance by 1 'C.

Water has high heat capacity due to its polar nature and hydrogen bonding b/w there molecule.

Due to this nature, water required high heat to make change its temperature so it protect the protoplasm against sudden thermal change.

HIGH HEAT OF VAPORIZATION:

The amount of heat required to change liquid state of water into vapors.

Water has high heat of vaporization so it has high stability in its original state i. e 574 KCal/kg.

Due to this nature water needs high amount of energy to change its state and gives the stability of cell cytoplasm.

It play an important roll during thermoregulation of living cell.

It also provide cooling affect when evaporate during transpiration and perspiration.

HYDROPHOBIC EXCLUSION:

It is the tendency of water molecule to combine with oil drop into large droplet.

When water molecule mix with oil drop, its hydrogen bonding breaks due to the presence of hydrophobic oil and form new bonds so water molecule form clumps with non polar molecule and this exclude hydrophobic substance from water.

IONIZATION OF WATER OR AMPHOTERIC OR BUFFER NATURE:

Water molecule ionize into H' and OH ion.

Due to this ionization property, water may act as acid and base, this property is called amphoteric character and it is also served as buffer solution.

Due to this nature, it maintains the pH of enzymatic activities of cells and organs.

ANOMALOUS BEHAVIOR:

Due to the presence of hydrogen bond below 4°C water expend which decrease its density.

So at 0°C water expend maximumly in ice condition.

So due to less density, ice float on the surface of water and makes a life possible under frozen water.

CARBOHYDRATES:

Carbohydrates are polyhydroxy aldehydes or ketones, or complex substance which on hydrolysis produce polyhydroxy aldehyde or ketone subunits.

They are sweet in taste in feels, therefore called saccharum or saccharide. They are also called sugars.

The general formula of carbohydrate molecules in $C_nH_{2n}O_n$.

CLASSIFICATION OF CARBOHYDRATES:

MONOSACCHARIDES:

They consist of single saccharide unit

OLIGOSACCHARIDES:

They are composed of 2 to 10 saccharide units.

POLYSACCHARIDES:

They are composed of more than 10 saccharide units.

MONOSACCHARIDES:

• These are True carbohydrates with general formula $C_nH_{2n}O_n$. Where n is the number of carbon atoms.

• The cannot be further hydrolysed into simpler sugars .

• All monosaccharides are reducing sugar

•They are either polyhydroxy aldehydes or ketones.

• The sugar with aldehyde group is called aldo-sugar, and with the ketone group as keto-sugar.

For example:

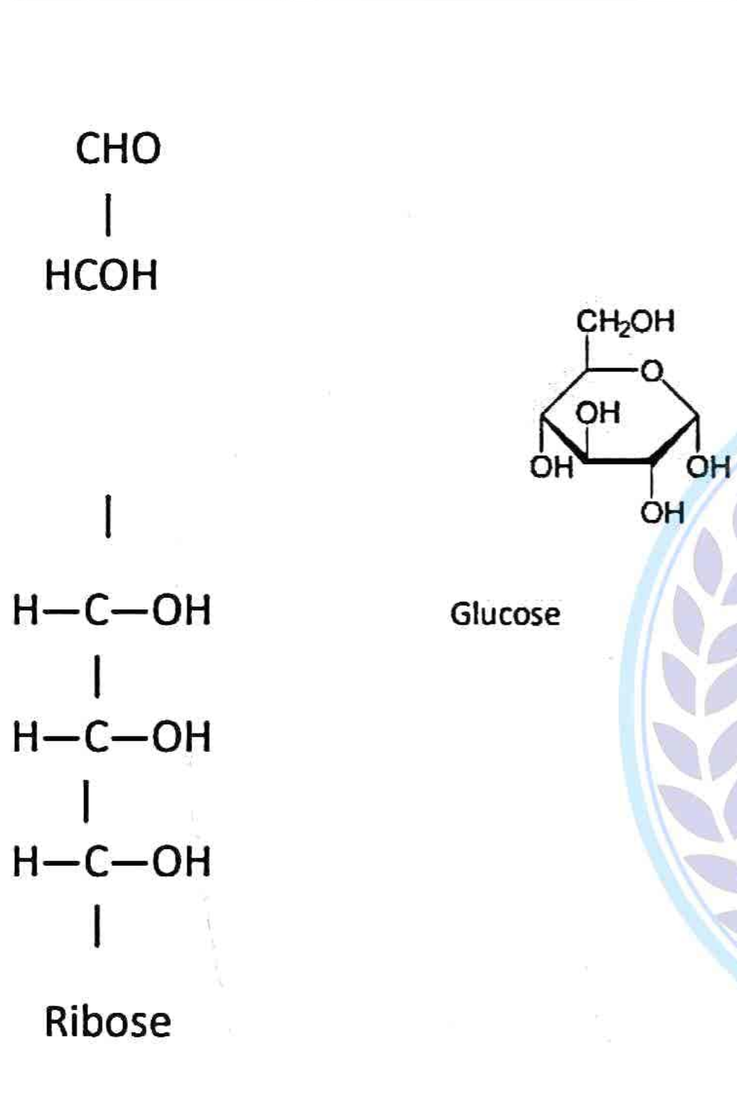
• Glycerose and Dihydroxy acetone are produced during respiration.

• Tetrose are present in bacteria.

• Glucose found in ripe fruits, sweet corn and honey.

• Fructose is found in fruits and sweetest sugar among all monosaccharides.

CLASS	FORMULA	EXAMPLE
Triose	$C_3H_6O_3$	Glycerose (Glycer aldehy) Dihydroxy acetone etc.
Tetrose	$C_4H_8O_4$	Erythrose, Erythrulose etc.
Pentose	$C_5H_{10}O_5$	Ribose, Ribulose etc,
Hexose	$C_6H_{12}O_6$	Glucose, Fructose, Galactose etc.
Heptose	$C_7H_{14}O_7$	Glucoheptose



Glucose

OLIGOSACCHARIDES:

Oligosaccharides are a class of carbohydrates consisting of 2-10 mono saccharides linked together. If two mono saccharide combine they form a disaccharides.

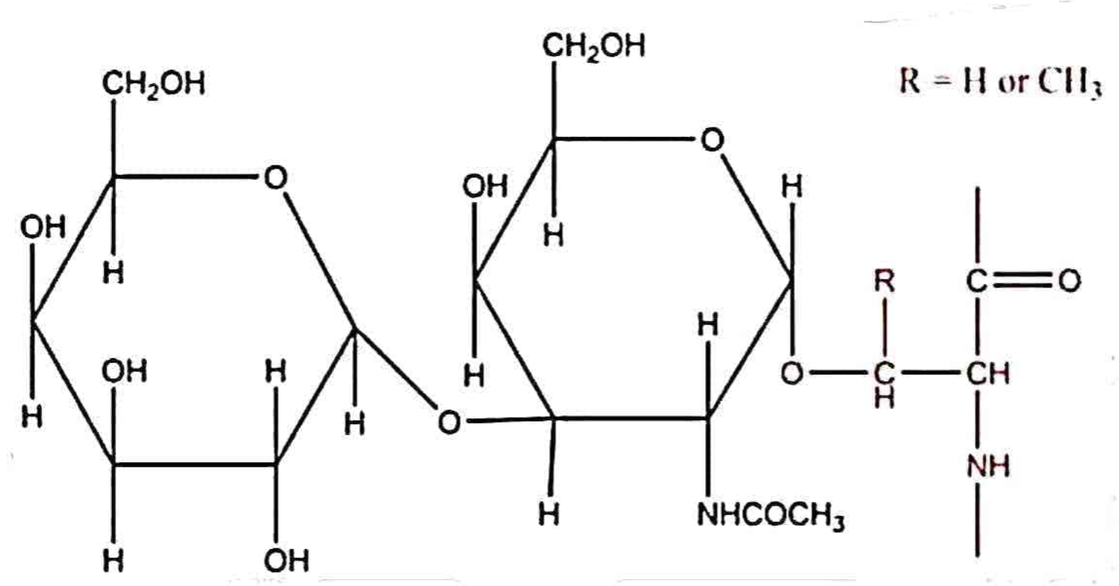
PROPERTIES:

• These are less sweet in taste than mono saccharides. These are less soluble in water than mono saccharide.

• The general formula of disaccharide is Cx (H2O).

• The covalent bond b/w two monosaccharide is Glycosidic bond or Linkage.

• A Glycoside is a ring shaped sugar molecule.
• The disaccharide may be reducing & non reducing. Reducing sugar are oxidized & causes reduction of other substance..
E.g (Mallose & Loctose).
• Non reducing sugar do not oxidized & do not reduced other substances.
E.g (Sucrose & Refinose)
• Plants transport their sugar during Ascent of sap in the form of non reducing sugar i.e Sucrose



POLYSACCHRIDE:

It is the long chain of Carbohydrates consisting of more than 10 monosaccharides linked together. On hydrolysis they produce more than 10 sugar units E.g Starch, glycogen, cellulose, Chitin.

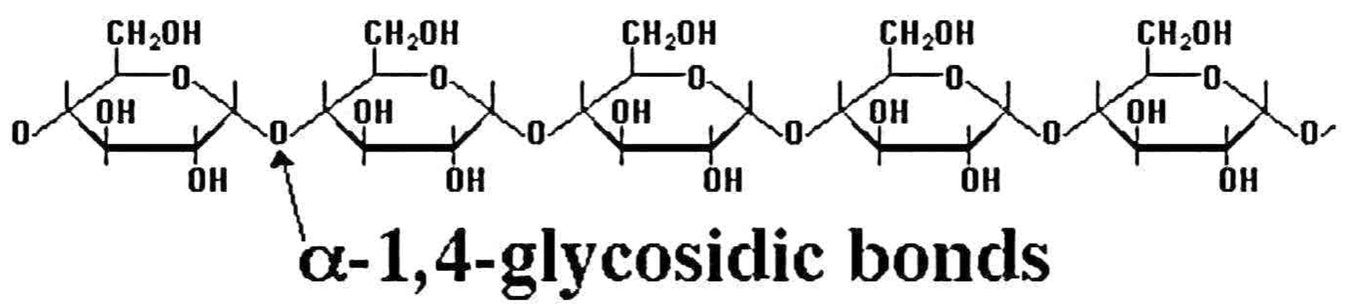
STARCH:

Starch is a polymer of alpha glucose formed by glycosidic Linkage. It is found in cereals, Legumes, tubers & other vegetables.
• It is made of straight chain glucose molecules called Amyslose & when branched chain Amylopectin.
• It gives blue color with iodine.

GLYCOGEN:

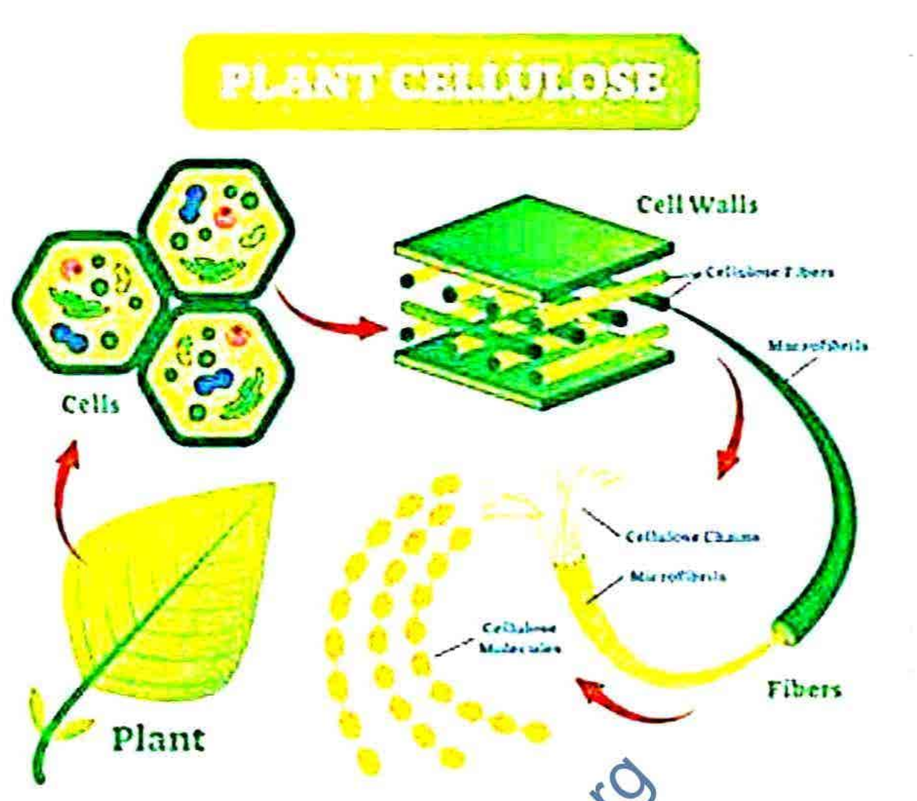
• It is homopolysaccharides & composed of alpha glucose.
• It is found in animals & also known as animal starch.
• It is present in all animal cells and fungi but abundant in the liver & Muscles.
• It gives Red color with iodine.

al-4 glycosidic linkage



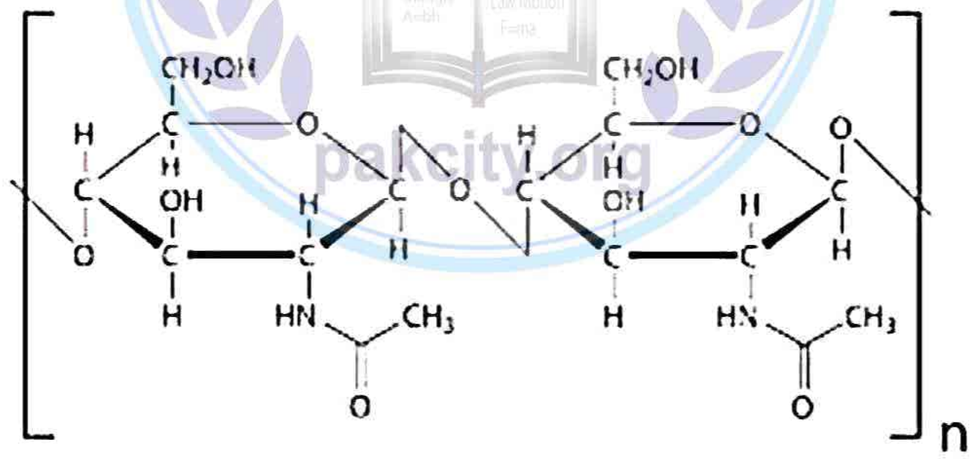
CELLULOSE:

- It is also homopolysaccharide, but is formed by the condensation of ß-glucose.
- It is the main component of cell wall of plants & most abundant carbohydrates in nature.
- It is highly insoluble in water & not digested in human body.
- In cellulose glucose arranged in straight chain & form cell wall of plant cell.
- Cellulose gives no color with iodine.



CHITIN ($C_8H_{13}O_5N$):

- It is a long chain polymer of N-acetyl glucosamine, an amide derivates of glucose.
- It is modified polysaccharide, contain nitrogen which allows for increased hydrogen bond & give more strength.
- The structure of chitin is similar to cellulose.
- Functionally it is comparable of Keratin protein
- In its pure & unmodified form it is quit tough in arthropods.
- Its modified form (Proteineceous matrix) form exoskeleton of insects.



STEREOISOMERS:

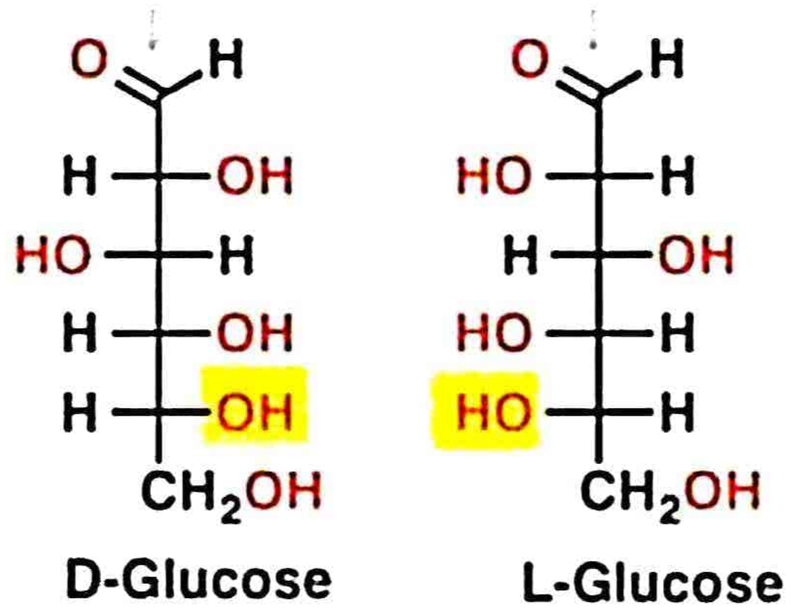
Stereoisomers are the molecules that have identical molecular formula but they different in how atoms are arranged in 3D space.

They are the mirror images of each other.

AS ARTIFICIAL SWEETNESS:

- The enzyme in our stomach can digest right handed sugar & are unable to digest left handed sugar.

- The taste of right & Left handed sugar are same.
- So diabetic patients used Left handed sugar b/c they are same sweetness but Zero calories.
- These sugar cannot digested by body b/c all enzyme are right handed & not digest the left hand sugar, so sugar level maintain in diabetic patient.



DEFINITION:

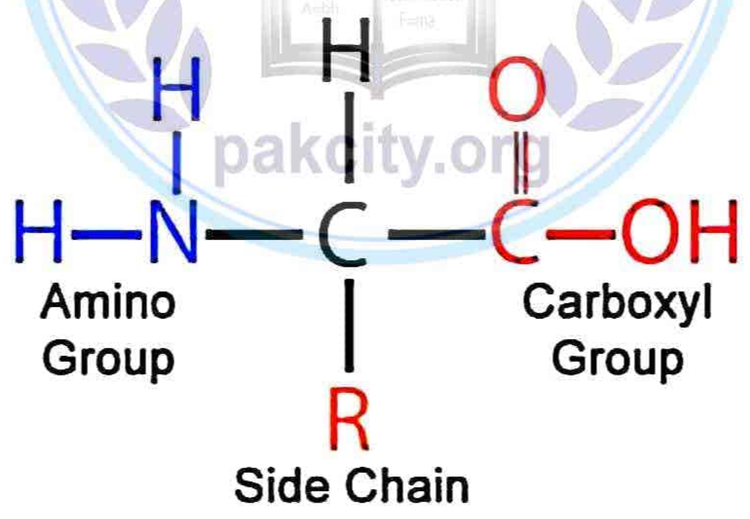
Proteins are polymers of amino acids, these compounds containing carbon, nitrogen, oxygen and hydrogen. (Amino acids are the building blocks of protein molecules).

OR

Chemically proteins can be defined as polymers of amino acids or polypeptide chains. A protein may consist of a single polypeptide or more than one polypeptide.

STRUCTURE OF AMINO ACIDS:

- The amino acids are built on a common plan.
- All the amino acids have an amino group ($-NH_2$) and a carboxyl group (-COOH) attached to the same carbon (alpha carbon).
- The general formula of an amino acid is as follows:
- The amino acids differ due to the type of R group (variable group). Due to difference in R group amino acids are of 20 types.



PEPTIDE/AMIDE BOND:

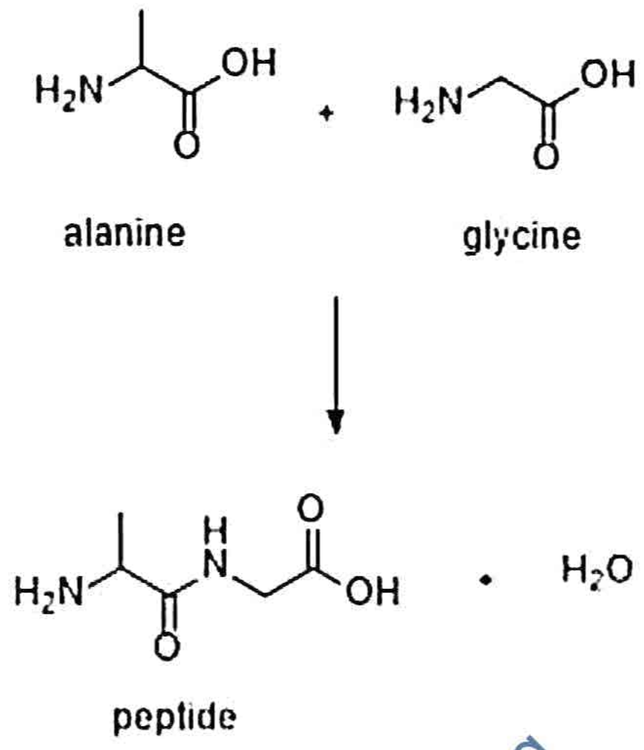
The dehydration linkage between C of carboxyl group (C=O) of one amino acid nd N of amino group of next amino acid is called peptide/amide bond.

- The protein or polypeptide chain is formed by linkage amino acids by peptide bond.
- The peptide bonds are formed by linkage amino group of one amino acid with carboxylic acid of another amino acid

Amino Acid —Amino Acid —Amino Acid —Amino acid
1 2 3 4

EXAMPLE:

- Glycin and alanine combine to form glyclalanine (dipeptide).
- Glycylalanine has two amino acids and is called dipeptide.



PEPTONE:

The protein chain can be broken into small chain of more than 10 amino acids called peptone.

PEPTIDE:

When peptone can be hydrolysis further into small units of few amino acid called peptide which are further hydrolyzed into amino acids.

CLASSIFICATION OF PROTIEN:

On the basis of shape protein classified in two groups.

1. Fibrous Protein ii. Globular Protein

FIBROUS PROTEIN:

- These are Long fibers of proteins.
- In secondary protein they are folded.
- In the form of fibrils they consist of more polypeptide chain.
- They are insoluble in water.
- They are non crystalline & elastic in nature.
- They perform structural role in cells & organism.

EXAMPLE:

- Silk fiber (From silk worm & spider's web)
- Actin/Myosin (In Muscles cells).
- Collagen & keratin (In nails & hairs).

GLOBULAR PROTEIN:

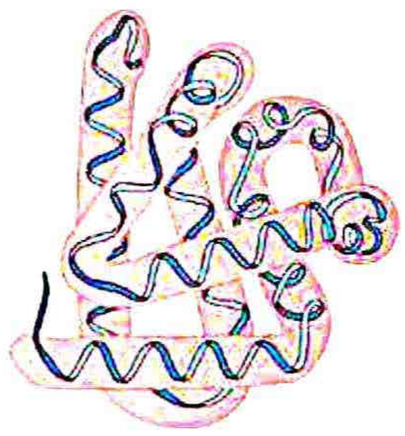
When secondary protein three dimensionally arranged & form spherical or ellipsoidal shape called globular protein.

- They exist in tertiary & quaternary structure during function.
- They are soluble in salt, acid or base aqueous solution.
- They can be crystalized.

FUNCTION:

These protein work on antibodies, hormones
Myoglobin & hemoglobin.

Fibrous Protein



Globular Protein

	Fibrous protiens	Globular Protien
Nature/Shape	These proteins consist of one or more polypeptide chains in form of fibrils.	Polypeptide chains are tightly folded to form spherical or ellipsoidal or globular due to multiple folding of polypeptide chains.
Structure	Secondary structure is very important in them. So they exist in secondary structure during function.	They exist in tertiary or quaternary structure during function.
Solubility	They are insoluble in aqueous media.	They are soluble in aqueous media such as salt solution, solution of acids or bases, or aqueous alcohol.

SIGNIFICANCE OF AMINO ACIDS SEQUENCE:

- A protein molecule may have 51 to 3000 amino acids.
- All the amino acids must be in proper position in the polypeptide chain. Protein consists of chain of amino acids arranges in definite and specific order/sequence.
- If the sequence of any amino acids will be change the protein fails to carry its normal function.

EXAMPLE:

In sickle cell anaemia i.e. abnormality in haemoglobin due to change in one amino acid out of 574 amino acid. Only glutamic acid is replaced by valine at 6th position.
Due to this little change the haemoglobin fails to carry sufficient Oxygen which leads to death of the person.

Lipids:

Lipids are heterogeneous compounds related to fatty acids. Lipids includes fats, oils, waxes, Cholesterol & related compound (steroids).

PROPERTIES:

They are hydrophobic compounds, insoluble in water but soluble in organic solvent like ether & alcohol.
Lipids are high stores compounds b/c properties of C-H bonds are high & low properties of oxygen, Therefore they store double amount of energy as compound to same amount of carbohydrates e,g: Stearin (M.formula $C_{57}H_{110}O_6$)

CLASSIFICATION:

Acylglycerol (Fats & oil)

DEFINITION:

"These are the condensations product of glycerol & three fatty acid, commonly called Fats & Oils".

GLYCEROL:

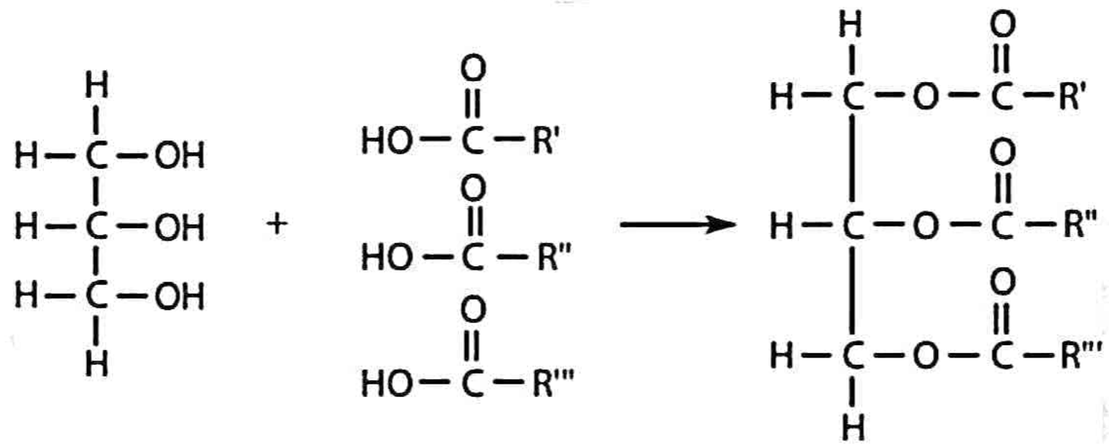
Glycerol is a trihydroxy alcohol, made of three carbon atom each contain on (OH) group.

Fatty Acids,

It's a type of organic acid containing one carboxylic group (-COOH) with Long chain hydrocarbon.

TRIGLYCEROL:

When three fatty acid combine with glycerol each at one -OH. They form three ester bond. This compound is called Triglycerol or triester of glycerol.



TYPES OF ACYLGLYCEROL:

a) Saturated acylglycerol (Fats)

- Fatty acids having no double bond are called saturated fatty acid.
- They are solid as room temperature e,g: Stearine.

b) Unsaturated acylglycerol (Oil).

- Fatty acids haring double bonds b/w carbon atoms are called unsaturated fatty acids.
- They have stable physical state & liquid at room temperature. e,g: Linolin oil in seeds.

Saturated acylglycerol (Fats)	Unsaturated acylglycerol (Oils)
They do not posses any double bond in their carbon chains.	They posses one or more double bond in their carbon chains.
They are straight chains.	They have bend or link at the double bond.
They have higher melting point than oils.	Lower melting point.
They are solid at ordinary temperature	They are liquid at ordinary temperature
They occur in most animals fats.	They occur in most plant fats.

PHOSPHOLIPID:

"These type of lipids are the condensation product of Glycerol, two fatty cids one choline & one Phosphate group"

PROPERTIES:

- Phospholipid is a similar to acyl glycerol, except that one fatty acid is replaced by phosphate which attached with a nitrogen compound choline.
- Phospholipid contain two ends.

HYDROPHOBIC:

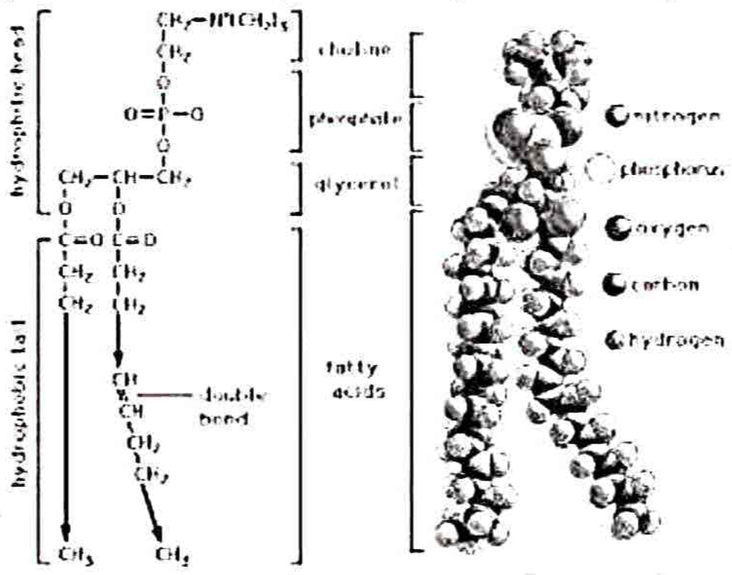
It is non polar & made up of fatty acid & behave as water repellent end.

HYDROPHILIC:

It is polar end & mad up of phosphate & chlorine end. They attract water & behave as water Loving end.

FUNCTION:

Phosphides help to regulate the cell periability and transport process



WAXES:

DEFINITION:

"They are easters of long chain mono alcohol & long chain fatty acids".

$$CH_3(CH_2)_{14}-\overset{\overset{O}{\|}}{C}-O-CH_2-(CH_2)_{28}-CH_3$$

Palmitic acid Triacontanol

PROPERTIES:

- These are simple lipid and found as protective covering on stem, stalks, leaves, petals
- These are water repellent
- These are chemically inert due to its non polar nature.
- These are chemically inert & resistant to atmosphere oxidation.
- Natural waxes obtained from bee wax and cutin.
- Synthetic waxes obtained from petroleum or polyethylene.
- Sperm whole were the source of wax.

FUNCTION:

- Commercially they used as machine lubricant, sealing materials.
- Bee wax is used to make candles.

TERPENOIDS:

- These a large lipids made up of 5-C (CsHg) building blocks isoprenoid unit.
- These are found in cell membrance as cholesterol.
- Found in chlorophyll as pigment.
- Used as fragrance as menthol.

TERPENES:

- These are small size Terpenoids & are volatile in nature.
- They produce special fragrances & used as perfumes. E,g: Mycrens from oil of bay. Geranoil from rose. Some component of vitamin Al & A2 are used in the synthesis of ruber & Latex.

STEROIDS:

- Steroids are non saponifible lipids and consist of iso prenoid units contain 17 carbon atoms arranged in 4 attached ring 3 of the ring contain six carbon atom, & fourth contain five

• Cholesterol is a one type of steroid & structural component of animal cell.
• Cholesterol act as precursor of large number of steroid, which include, bile acid, male sex hormone (testosterone), female sex hormone (Progesterone and estrogen) etc.

CAROTENOIDS:

- It is polystyrenes & consist of long chain isoprenoid unit.
- Long chain contain isoprenoid ring at both ends.

FUNCTION:

- It is pigment producing compound in plants like red, orange, yellow & brown color.
- Important plant carotenoid pigments are chlorophyll, cytochromes, phytochromes, Latex etc.

PROSTGLANDIN:

"Prostaglandin are modified fatty acid, often derived from lipid in the plasma membrane".

FUNCTION:

• Prostaglandin is made by mammalian tissues at the side of damage or infection.
• They control inflammation, blood pressure.
• Also control the intensity of pain, blood clots, immunity & the induction of labour.
• Aspirin is used as anti-inflammatory, analgesic of prostaglandin synthesis.

NUCLEI ACID:

Nuclei acid (DNA/RNA) are linear & branched macro molecules which is polymer of monomers called nucleotide.

TYPES OF NUCLEI ACID:

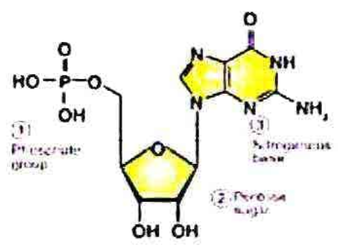
Nuclei Acid are of two types.

I. DNA ii. RNA

Both are polymer of nucleotide

COMPOSITION OF NUCLEOTIDE:

•Nuclei acid are complex substance & their repeating units are nu



• Nucleotides of DNA are called Deoxyribonucleotides.
• Nucleotides of RNA called Ribonucleotides.
• Each nucleotide is made of three subunits.
i. Pentose sugar (5-carbon).
ii. A Nitrogen base
iii. A phosphate acid.
• When pentose su. gar & nitrogenous base molecules attached at it: first carbon & Phosphate is attached with 5th carbon of pentose sugar,a nucleotide molecule is formed.
• When nucleotide without phosphate called nucleoside.

NITROGENOUS BASES OF DNA & RNA:

- Nucleotides of DNA & RNA vary on the basis of nitrogenous bases.
- There are two types of nitrogenous bases.

I. Purine ii. Pyrimidine

PURINE:

Purine are or two types.

i. Adenine (A) ii. Guanine (G)

PYRIMIDINE:

Pyrimidine are three types.

I. Cytosine ii. Thymine (T) & URACIL (U).

- In DNA Thymine is present while in RNA uracil is present.

MONONUCLEOTIDE:

- Nucleotide work independently called mono nucleotide.
- These nucleotide has extra phosphate group as in ATP. (Adenosine Tri Phosphate).
- ATP used as Energy Carrying molecule during metabolic reaction.

DINUCLEOTIDE:

- When two nucleotide are covalently bonded they form Dinucleotide.
- NAD (Nicotine amide Adenosine Dinucleotide) is Common example of dinucleotide.
- Vitamin (Nicotine) attached with NAD.
- NAD serve as co-enzyme.

POLY NUCLEOTIDE:

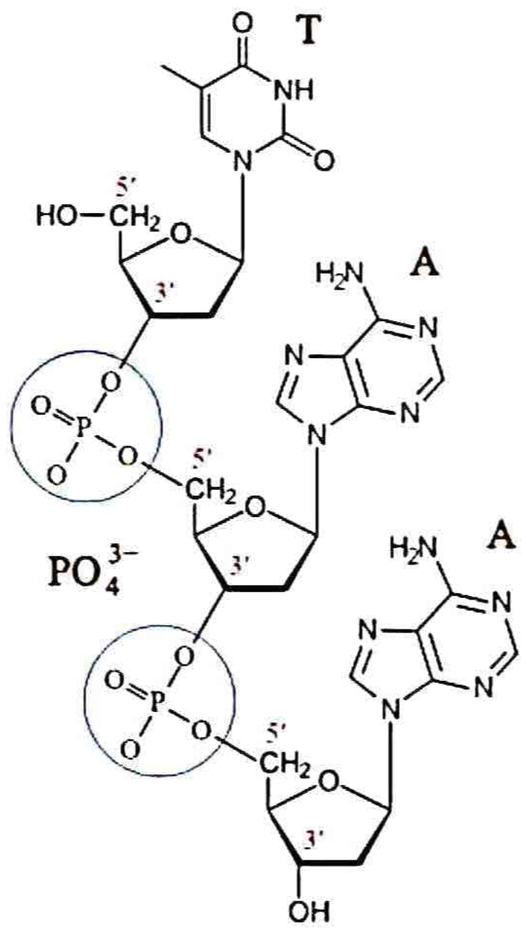
- When many nucleotide combined together by phosphodiester bond they formed polymer of polynucleotide.
- DNA & RNA are the common example of poly nucleotide.

PHOSPHODIESTER BOND:

"The two nucleotides are linked together by bond called phosphodiester bond".

The chemical bond that forms when exactly two hydroxyl group in a phosphoric acid react with hydroxyl another molecules of sugar forming ester bond.

- In this bond phosphate group (PO_4^{-3}) & Pentose sugar are linked together by condensation process.
- In this bond 3'- Carbon of pentose sugar is Linked with 5'sugar carbon by phosphodiester bond.
- These bond act as back bone & hold sugar molecule with phosphate group in Linear manner.



STRUCTURE OF DNA:

According to Watson and crick model the structure of DNA molecule is as follows:

i. Each DNA molecule consists of two strands, which are coiled together to form a double helix (screw like).

ii. On the two sides of helix sugar and phosphate groups are present.

Iii. In the middle region of helix nitrogen molecules of nucleotides are found. Each part contains purine with pyrimidine. Adenine is always attached to thymine and guanine is always linked to the Cytosine.

iv. Both strands of DNA are connected with weak hydrogen bonds. Two hydrogen bonds are present between adenine and thymine and three hydrogen bonds are present between guanine and cytosine.

V. The two polynucleotide strands of DNA are separated from each other by 20A distance.

The coiling of double helix is right handed and complete turn occurs after 3.A Each nucleotide covers 3.4A° distance, so 10 mono-nucleotides are found per complete turn.

The Watson and Crick model of DNA has explained the chargaff's rules. When one strand has Adenine(A), the opposite strands has Thymine(T). When one strands has Guanine(G), the other strand has Cytosine(C). In the DNA of as organism the amounts of Guanine (G) and Cytosine(C) are equal.

The sequence of nucleotides is not restricted along each DNA strand, each gene has unique sequence of nitrogen bases.

GENE:

"A gene is a heredity unit which genetic information from parents to offspring".

- It is a part of DNA, which has information to synthesis a protein.
- It gives instruction for developing characters like eye, hair color etc.
- Genetic information flow in a cell from DNA to m RNA than to cytoplasm in two step for protien synthesis

1.Transcription 2. Translation

Transcription:

In this step the information of gene is copied into the form of RNA i.e. mRNA, Which carries information from nucleus to the ribosome in the form of genetic code.

Translation:

In this step mRNA attach to ribosome. Two other types of RNAs i.e. tRNA (transfer) and rRNA (ribosomal) translate the information of mRNA into specific sequence of amino acid which help to synthesize the protein.

TYPES OF RNA:

There are three types of RNA.

1.MESSENGER OF RNA (mRNA):

It consists of single strand. Its length depends on the size of gene. It contains information in the form of Genetic codes, CODON. These codons are basically triples of Nucleotides of mRNA which encode one amino acid. It is about 3 to 4% of total RNA in the cell.

2.TRANSFER RNA (tRNA):

The smallest sized RNA consist of only 70 to 90 nucleotides. Basically it is single stranded RNA but it shows duplex at some regions where complementary bases are present.

It has anticodons of genetic codes as its complementary form. It transfer related amino acid from cytosol to ribosome, they are sixty in numbers, while human cell contain only 45 different types of tRNA. It is about 10 to 20% of total RNA.

RIBOSOMAL RNA (rRNA):

Ribosomal RNA is present in ribosome. It has largest size among all three RNA i.e. 80% of total of RNA in a cell is rRNA. It is involved in peptide linkages during protein synthesis.

Difference between DNA and RNA are:

DNA	RNA
It is double stranded nucleic acid.	It is single stranded nucleic acid.
It contains deoxyribise sugar.	It contains ribose sugar.
It contains Thymine (T) as a nitrogenous base.	It contains Uracil (U) instead of Thymine.
It is the genetic and hereditary material of the cells.	It is involved in synthesis of proteins.
It is present in the nucleus of the cells.	It is present in both nucleus and cytoplasm.

CONJUGATED MOLECULES:

Conjugated molecules are formed when biomolecules of two different groups combine chemically with each other, acting as one unit.

These are glycolipids, glycoproteins, lipoproteins and Nucleoproteins

i. GLYCOLIPIDS OR CEREBROSIDES:

• These are conjugates of lipids and carbohydrates. They are also called cerebrosider because they are present in white matter of brain and myelin sheath of nerve fiber.
• They are also found in the inner membrane of chloroplast.

Ii. <u>GLYCOPROTEINS OR MUCOIDS:</u>
• Glycoproteins are formed by combining a molecule of carbohydrate with a protein molecule.
• Most of the oligo and polysaccharide in animal and plant cell are linked covalently to protein molecules.
• They perform function as, transport proteins, receptors, antigens of blood group etc.
• It is one of the part of egg albumin, and gonadotropins.

<u>iii. LIPOPROTEIN:</u>
• They are conjugate of lipids and proteins. They help in the transportation of lipids in blood plasma.
• They also occur component of membrane of mitochondria, endoplasmic reticulum, nucleus, egg yolk and chloroplast membrane.

<u>iv. NUCLEOPROTEIN:</u>
• Nucleoprotein are formed by simple basic protein and nucleic acid.
• They are the main component of chromatin material, chromosomes and ribosomes.