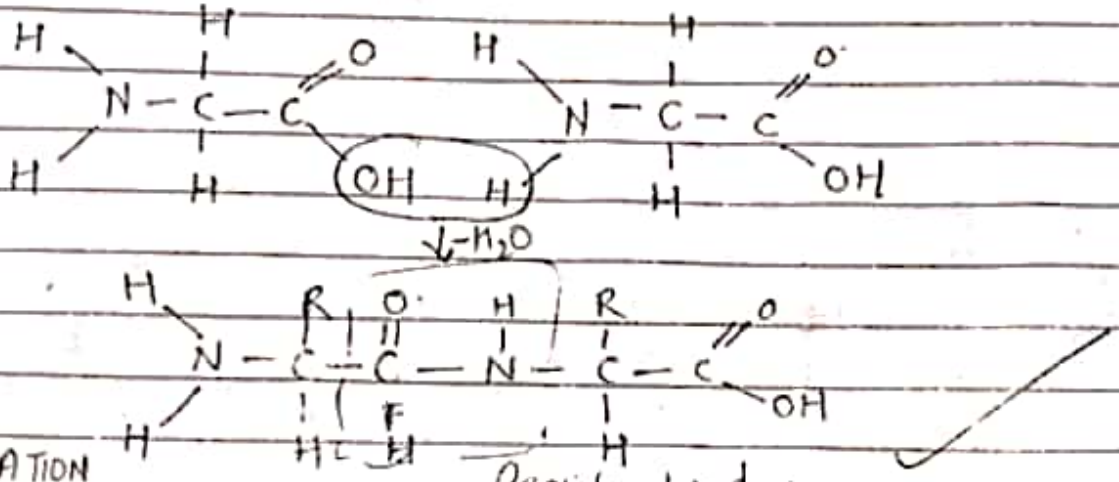
Unit-II Part-1

Proteins, Nucleic Acids, Lipids, Carbohydrates.

Name: Nav Biology Assignment S.T. 2nd (Set).

Q1. What is peptide bond? write a note on classification of protein? 4+4.

Ans. A peptide bond is a chemical bond formed between two molecules when the carboxyl group of one amino acid molecule reacts with the amino group of the other molecule, releasing the molecule of water H_2O.



CLASSIFICATION OF PROTEINS:

(A) On the basis of constitution, proteins are of three types, viz. simple, conjugate and derived proteins.

1. Simple protein :- Simple proteins are built of one or more complete polypeptides without any additional group. They are composed solely of amino acid. They are further divided into two categories.

(a) Structural & protoplasmic proteins :- They are constituents of active protoplasm. Depending upon their function, the structural proteins are 'enzymatic' & 'non-enzymatic'

(b) Reserve or Storage proteins :- These proteins are present as food reserve. They are globular and soluble in water. Some of them are heat sensitive also.

ii. Conjugated proteins :- These proteins contains in addition to amino acids other organic and inorganic materials called 'prosthetic group' of proteins.

Eg - HAEMOGLOBIN - contains Iron as additional compound
GLYCOPROTEIN - " carbohydrates " "
LIPOPROTEIN - " lipids " "

iii. Derived proteins :- They include met-proteins, albuminoses, peptones, polypeptides and other products of partial hydrolysis of protein. They are intermediate products which do not accumulate.

(B) classification of proteins : on basis of shape.
(Diagrams

i. Fibrous protein :- they are thread-like protein which may occur single or in groups to form sheets. when they occur in groups, the polypeptide chains run parallel along a single axis. F.P. are tough & insoluble in aquatic solution. They are non-enzymatic but structural proteins

ii. Globular protein :- They are proteins in which the tightly packed polypetide chains are coiled and and abundantly folded to form sphere or globes.

They may be enzymatic or non-enzymatic. They are generally soluble in aqueous solution and are capable of rapid fusion

Q2. Explain the function of protein.

Ans. i. They are the major constituents of protoplasm.
ii. They are essential for cell division, growth, repair and reproduction.
iii. Connective tissue of animals is supported by two types of protein fibres – collagen & elastin.
iv. In animals proteins form external protective structure like nails, scales hoofs, feathers etc. Eg. Keratin
v. Nucleoproteins performs an important function in controlling the working of DNA.
vi. Some proteins take part in the transport of substance. eg. oxygen by haemoglobin.
vii. Reserve protein provide amino acids for growth and repair Eg Albumin
viii. Some proteins functions as antibodies.
ix. They act as buffers, since they resist the change in pH of the cells.
(x) Toxin proteins are used as defense by organisms eg. snake venom
(xi) Some proteins acts as Enzymes and function as biocatalyst eg Amylase
x. They are major constituents of protoplasm
xi. They are essential for cell divisions, growth repair & reproduction.
xii. Nucleo proteins perform an important function in controlling the working of DNA.
(xi) Some protains act as hormones & regulate various activities in living organism eg. Growth Hormone.
(xii) Contractile protein are responsible for movements eg. Myosin

Q3. What are the various levels of structure of proteins?

Ans. It can be observed that a protein can have up to four levels of organisation (structure)

i. Primary structure :- It consist of the sequence of amino acid residues joined through peptide bonds in the polypeptide of a protein. The number of amino acids residues in a chain and the arrangement of amino acid are usually specific as each polypeptide is synthesised under instruction from a cistron of DNA through mRNA.

ii. Secondary structure :- It refers to the manner of extension or helical coiling of the polypeptide chain (particularly in fibrous proteins). Which results mainly from hydrogen bonding between oxygen of carboxylic group of one amino acid residue and 'NH' group of next 4th amino acid residue. It is of various types but the two main categories are (a) α-helix

(b) β pleated sheet

a) α-Helix : is a key secondary structure of proteins that consists of a peptide chain folded into a right-handed spiral conformation & stabilized by H-bonds b/w C=O of one amino acid & N-H of fourth amino acid from that position

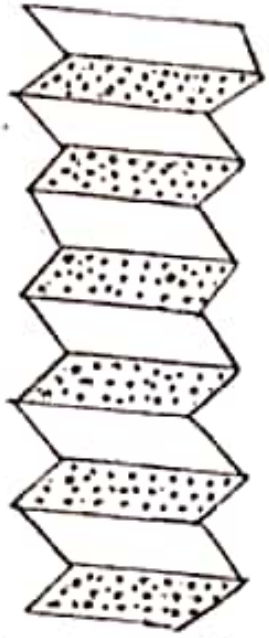
b) β-pleated sheet : are made of beta strands connected laterally by two / more H-bonds forming a backbone of twisted, pleated sheet. This structure occurs when two / more segments of polypeptide chain overlap one another & form H-bonds with each other.

Diagrams : Classification of protein on the basis of shape.
Q1-Part (B)

(A) FIBROUS PROTEIN

secondary structure

α-helix
Ans-3(a)



ANTIPARALLEL SHEET
(β-pleated sheet)
Ans-3(b)

TRIPLE HELIX

(B) GLOBULAR PROTEIN

Tertiary

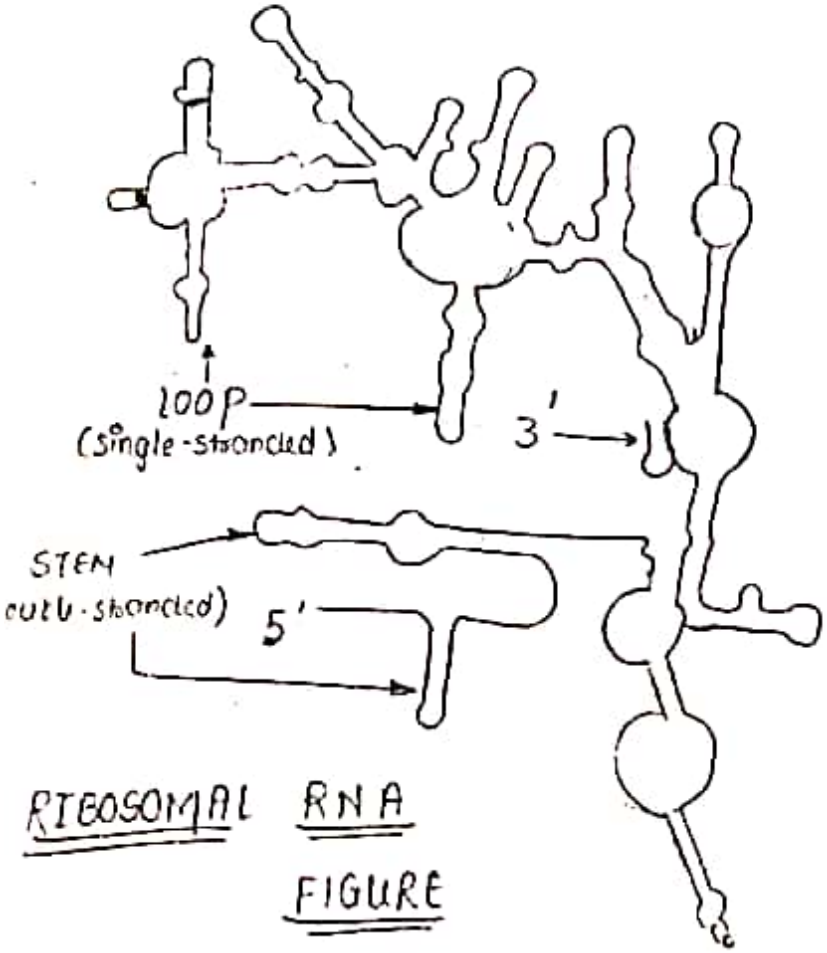
SINGLE CHAIN

Quaternary

OLIGOMETRIC PROTEIN

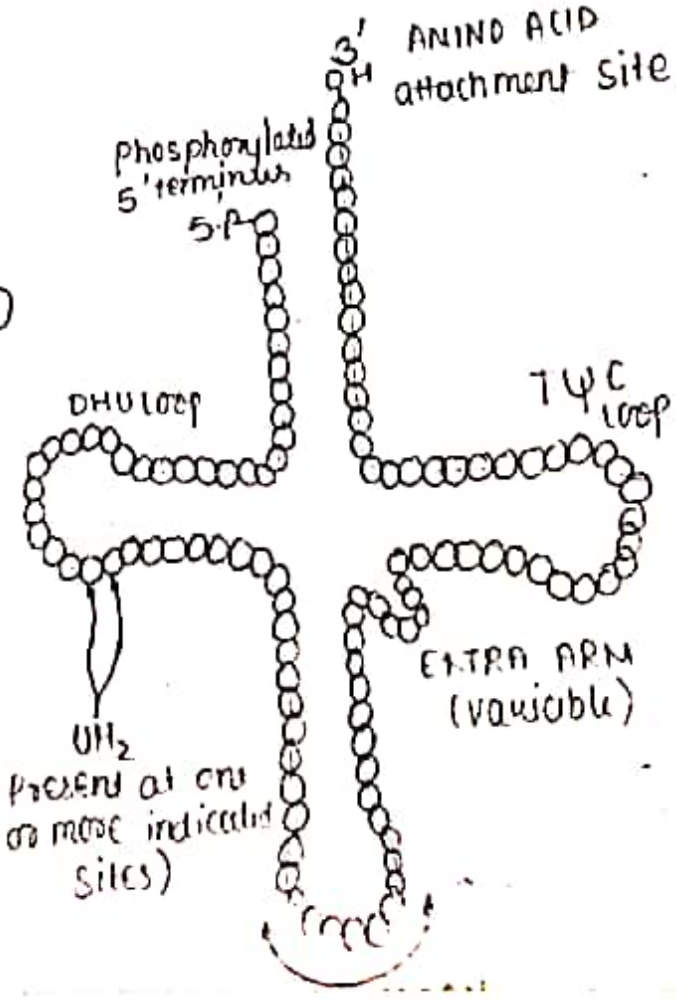
RIBOSOMAL RNA:-

- In Eukaryotes rRNA is of the three types - 28S, 18S & 5S
  In prokaryotes rRNA is of three types 23S, 5S & 16S.
- Inside the molecules rRNA and ribosomal proteins get arranged to form two subunits.
  (a) larger :- 28S rRNA + 5S rRNA + proteins
  (b) smaller :- 18S rRNA + protein.
- rRNA combine with protein in the cytoplasm to form ribosomes, which act as the sites of protein synthesis. and has the enzymes needed for the process.



RIBOSOMAL RNA FIGURE

t-RNA FIGURE



iii. Tertiary Structure :- It refers to the folding and bending of the polypeptide chain to form globular protein induced by covalent disulphide bonds (—S—S—), H_2 & salt bonds & hydrophobic / hydrophilic interaction.

iv. Quaternary structure :- It is found only in those proteins which have two or more polypeptides. It refers to the manner in which the individual polypeptide chains fit together in a multimeric or oligomeric protein. Eg - in Haemoglobin.

Qq. What are the various types of RNA? Explain? (Diagrams on LHS).

Ans. Ribosomal RNA (rRNA), Transfer RNA (tRNA) Messenger RNA (mRNA), Genetic RNA are the four types of RNAs.

i. Ribosomal RNA (rRNA) :- It constitute 70 to 80% of the total RNA content of the cell. It is a single stranded polyribonucleotide which is constituent of ribosomes. It lies coiled in between and over the protein molecules. (70S & 80S ribosomal constituents on LHS)

ii. Transfer RNA (tRNA) :- It is also called 'soluble RNA' or sRNA. There are over hundred types of tRNA. They constitute about 15% of total RNA. It is the smallest RNA with 70 to 85 nucleotide.

It participates in carrying specific amino acids to ribosome for protein synthesis.

iii. Messenger RNA (mRNA) :- It is the longest of all RNAs and forms only 5% of the total RNA content. It brings instructions from the DNA for the formation of a particular type of polypeptide. The instruction are present in the base sequence of its nucleotides. called 'Genetic Code'

iv. Genetic RNA :- It is found in some viruses called ribovinuses. Genetic RNA may be single stranded or double stranded. Genetic RNA acts as a hereditary material.

Q.S. Difference between DNA and RNA.

Sol^n:-	Points	DNA	RNA
*	Name:-	Deoxyribo nuclei acid.	Ribonucleic acid.
*	Sugar:-	It contains deoxy-ribose sugar.	It contains ribose sugar.
*	Base:-	It contain nitrogen base thymine, adenine, cytosine and guanine.	It contains nitrogen base uracil, adenine cytosine and guanine.
*	Strands:-	It is double-stranded except in some viruses	It is single-stranded except in some viruses.
*	propagation:-	It replicates to form new DNA molecules.	It needs DNA templates for transcription.
*	function:-	stores genetic info. & transfer it to offspring.	RNA translate the transcribed message for forming polypeptides.
*	Amount:-	Its quantity is fixed for cell.	The quantity of RNA of a cell is variable.
*	UV damage:-	It is susceptible to uv rays.	It is relatively resistant to UV rays.
*	Stability:-	stable under alkaline condition	relatively unstable under alkaline cond. (reacting
*	Types-	Nuclear & Extra-nuclear DNA	* rRNA, mRNA, tRNA
*	Amount-	Fixed in a cell.	* variable in a cell at dif. times & in different cells as well
*	Renaturation-	After melting, renaturation is slower.	* faster

Q. What are different forms of DNA A, B, C, D & Z?

Ans:-

	A	B	C	D	Z
(1) Right / left handed	Right	Right	Right	Right	left
(2) No. of bases per twin	11	10	9·33	8	12
(3) width of the helix	19Å	19Å	19Å	19Å	19Å
(4) Rise per base pair	2·56Å	3·38Å	3·32Å	3·03Å	3·71Å
(5) pitch of the helix	28·15Å	34Å	31Å	–	45Å
(6) condition	75% rel humidity Na^+, K^+ cations	92% rel humidity low ions	66% rel humidity Li^+ ions	—	low high salt concentration.

Q: Explain the functions of DNA.

(1) DNA is the genetic material which carries all the hereditary information. The genetic information is coded in the sequence of nitrogenous base.

(2) DNA has unique property of replication / production of carbon copies. This is essential for transfer of genetic information from one cell to its daughters & from one generation to the next.

(3) DNA occurs inside chromosomes. During Meiosis, crossing over gives rise to the new combination of genes called Recombination.

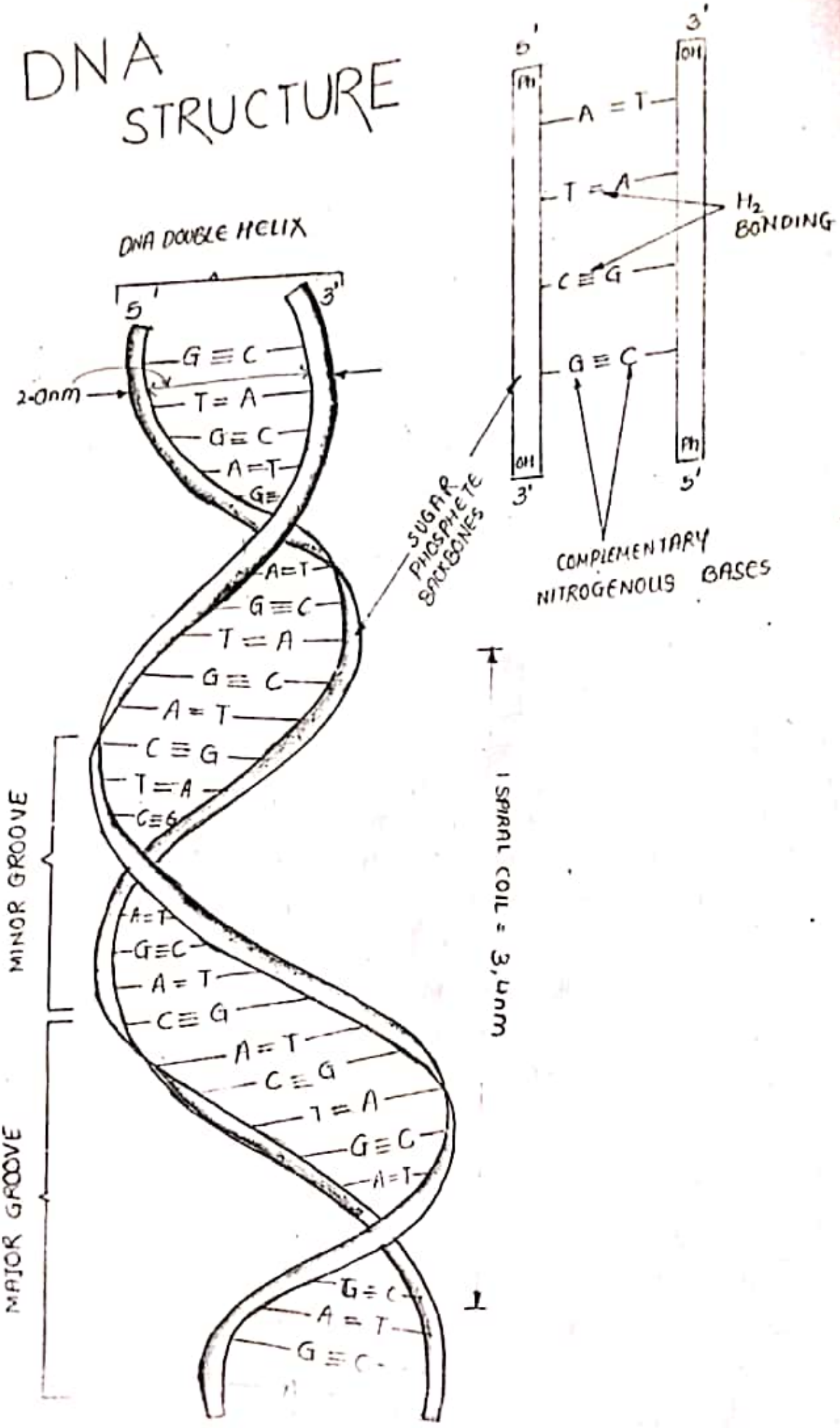
(4) Changes in the sequence of Nitrogenous base due to addition, deletion / wrong replication is called Mutation, which is the fountain head of variations & evolution.

(5) DNA forms RNA through process of replication.

(6) It controls metabolic reactions of the cell through synthesis of enzymes.

(7) Due to differential functioning of specific regions of DNA cells are differentiated to perform specific functions.

DNA STRUCTURE



Watson & Crick in 1953 proposed determined the structure of DNA using X-ray crystallography (6)
In 1953, they described the structure of DNA.

what are the main features of watson and Crick model of DNA ?/secondary str of DNA/ (Diagram on left) B-form of DNA.

The important features of watson-Crick model or double helix model of DNA are as follows:

i. The DNA molecule consists of two polynucleotide chains or strands that spirally twisted around each other and coiled around a common axis to form a right-handed double-helix ✓

ii. The two strands are antiparallel i.e they run in opposite directions so that the 3' end of one chain facing the 5' end of the other

iii. The sugar-phosphate backbones remains on the outside, while the core of helix contains the purine and pyrimidine bases.

iv. The two strands are held together by H bonds between the purine and pyrimidine bases of the opposite strands.

No. of bp per turn
width of the helix
pitch of the helix
rise per bp.

Diagram

v. The diameter of DNA is 20nm or 2 nm. (vi) Adjacent bases are separated 0.34nm or by 3.4 Å along axis. (viii) The length of complete turns of helix is 34 Å i.e there are 10 bp per turn

(ix) Adenine (A) always pairs with thymine (T) by two Hydrogen bond & guanine (G) always pairs with cytosine (C) by three Hydrogen bond. This complimentary is known as the base pairing rule. (x) There are two types of grooves in DNA - major groove & minor groove.