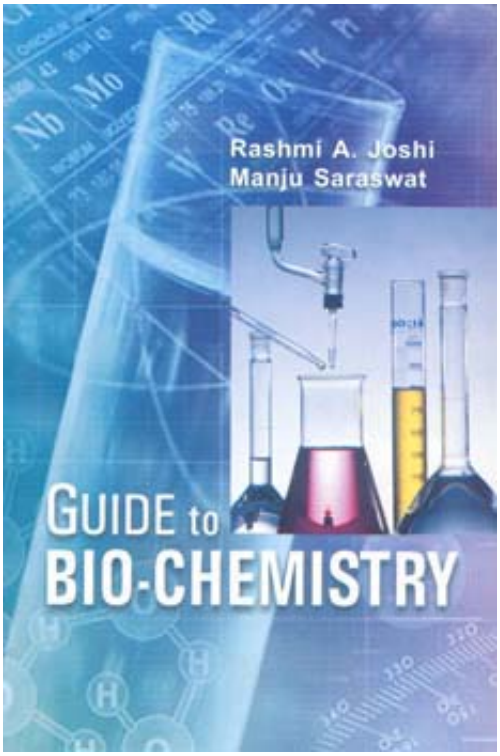
Rashmi A. Joshi
Guide to bio-chemistry

Leseprobe

Guide to bio-chemistry
von Rashmi A. Joshi
Herausgeber: B. Jain



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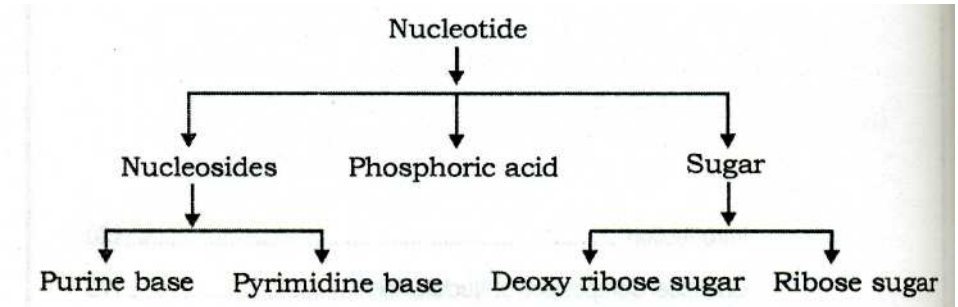
INTRODUCTION

Nucleic acids were first isolated in 1869 by Friedrich Miescher and is named because he found them in the nuclei of leukocytes (pus cells) from discarded surgical bandages. In 1944, Oswald Avery, Colin Mcloed and Maclyn Mac Carty reported that the transforming principle is deoxyribonucleic acid (DNA). The nucleic acid, DNA is the major component of chromosomes. Small amounts of DNA are also found associated with chloroplasts and mitochondria. Certain animal viruses and many bacteriophages are DNA-protein particles. Ribose nucleic acid (RNA), the other nucleic acid, is found mostly in the cytoplasm and in plant viruses. Very little DNA and RNA occur in free forms.

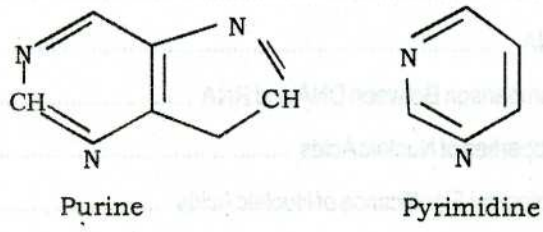
CHEMICAL COMPOSITION OF NUCLEIC ACIDS

Elements taking part in the constitution of nucleic acids are C, H, O, N and P. In almost all nucleic acids, there is approximately 15 to 16% nitrogen and 9 to 12% phosphorus. Nucleic acids are made up of monomeric units of nucleotides which are analogous to amino acids of proteins. However the number of nucleotides taking part in the synthesis of nucleic acid is fewer. Each nucleic acid has a base, phosphoric acid "and a sugar moiety.



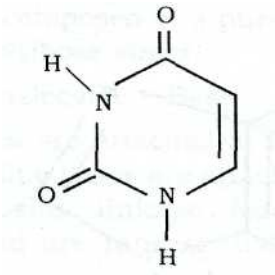
Bases

These are of two kinds, purines and pyrimdines.



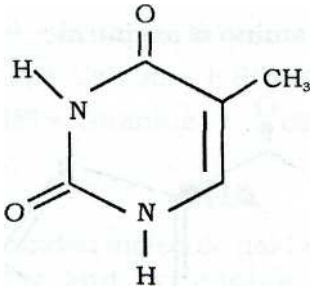
(A) Pyrimidine Bases - They have a single Ring Structure. There are three main pyrimidine bases. These are :-

(i) *Uracil*:- It is 2, 4 dioxypyrimidine.



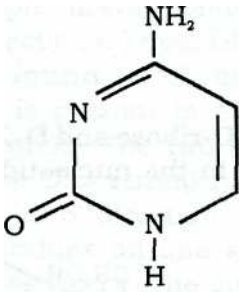
Uracil (U)

(ii) *Thymine :-* It is 2, 4 dioxy 5 methyl pyrimidine.



Thymine (T) (iii) *Cytosine* :- It is

2 dioxy 4 amino pyrimidine.

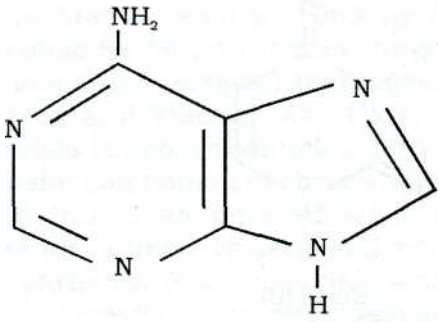


Cytosine (C)

The oxypyridine and oxypurines exist in enol and keto form, enol form is called lactim and keto form is called liactum form. Lactum form is predominant in purines and pyrimidines.

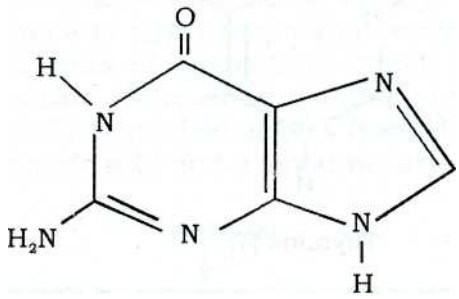
(B) **Purine Bases** - They have a double ringed structure. The purine bases are of two types :-

(a) *Adenine* :- It is 6 amino purine.



Admine (A)

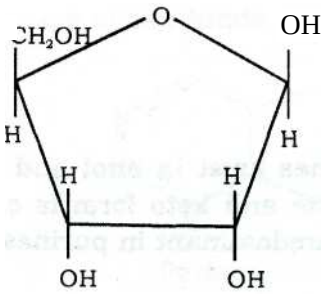
(b) *Guanine* :- It is 2 amino 6 oxypurine.



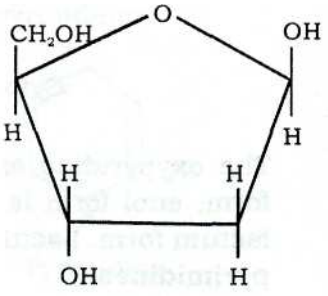
Guanine (G)

Pentose Sugars

The pentose sugars present are D-ribose and D-2 deoxyribose. Both sugars occur as furanose form in the nucleotides.



Ribose



Deoxy-Ribose

NUCLEOSIDES AND NUCLEOTIDES

A nucleoside is composed of a purine or a pyrimidine base and a ribose or a deoxyribose sugar.

Nucleoside = Base - Sugar

The purine bases are attached at N-9 position to a sugar moiety whereas pyrimidine bases are attached at N - 1 position to a sugar moiety by glycosidic linkage. Nucleotides are phosphorylated nucleosides, and are represented by a base sugar phosphate unit.Thus,

Nucleotides = Base + Sugar + Phosphoric acid

Adenosine monophosphate (AMP) = Adenine + Ribose + Phosphate

Thymidylic acid (TMP) = Thymine + 2 deoxyribose + Phosphate

Uridylic acid (UMP) = Uracil + Ribose + Phosphate

Cytidylic acid (CMP) = Cytosine + Ribose + Phosphate

Guanylic acid (GMP) = Guanine + 2 deoxyribose + Phosphate

DNA

DNA is a double stranded molecule held together by hydrogen bonds between the purine and pyrimidine bases. It consists of two polynucleotide strands that wind about a common axis with a right handed twist to form an ~20A° diameter double helix. The two sugar phosphate back bones wind around the outside of the bases like the banisters of a spiral staircase and are exposed to the aqueous solution. The phosphodiester bonds in the two interwoven strands run in opposite directions. Thus, DNA is a polymer of deoxyribonucleotides and is found in chromosomes, mitochondria and chloroplasts. DNA is present in every nucleated cell and carries the genetic information. The two strands are antiparallel (run in opposite directions). One strand runs in the 5' to 3' direction and the other in the 3' to 5' direction. The information resides in the sequence of nucleotides on one strand. The opposite strand is considered as antisense i.e. the complement of the sense strand (Fig 7.1).

The planes of the bases are nearly perpendicular to the helix axis. Each base is hydrogen bonded to a base on the opposite strand to form a planar base pair. It is these hydrogen bonding interactions, a phenomenon known as complementary base pairing, that results in the specific association of the two chains of the double helix.

Adenine base of one strand of DNA is hydrogen bonded to a thymine in the opposite strand, while the guanine is hydrogen bonded to a cytosine.

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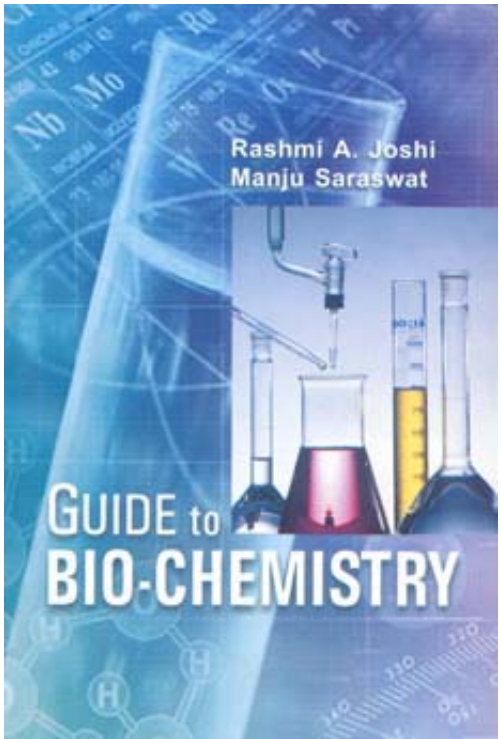

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