



Assignment

M.Sc. Zoology
Semester-II

Title of Assignment: Metabolism of nucleotide

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Student Name: Poonam Tomar

Roll Number: 05

→ Don't use of word in writing
→ Spelling - ?

Summary :->

INTRODUCTION

~~DEFICITION~~ ?

BIOSYNTHESIS

(a) de-novo pathway

(b) Salvage pathway

~~FUNCTION~~

~~REFERENCES~~ ✓ AA

INTRODUCTION

- Nearly all organisms synthesize purines and pyrimidines de novo ("anew").
- Many organisms also "salvage" purines & pyrimidines from diet and degradative pathways.
- Ribose generates energy, but purine and pyrimidine rings do not.
- Nucleotides synthesis pathway are good targets for anti-cancer / antibacterical strategies.

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Nucleotides

- RNA (ribonucleic acid) is a polymer of ribonucleotides
- DNA (deoxyribonucleic acid) is a polymer of deoxyribonucleotides.
- Both deoxy- and ribonucleotides contain Adenine, Guanine and Cytosine.

Ribonucleotides contain Uracil
 Deoxyribonucleotides contain Thymine

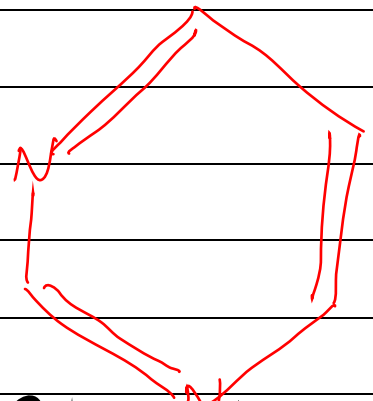
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Nitrogenous Base

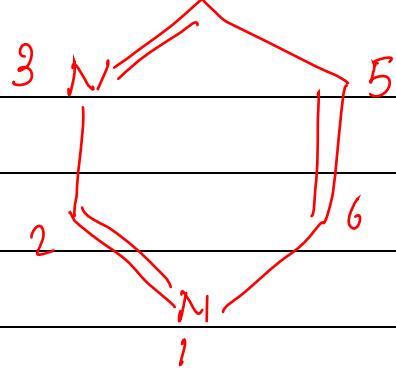
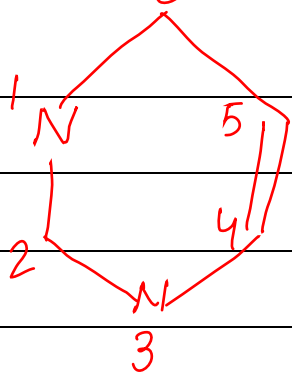
- Planary, aromatic, and heterocyclic
- Derived from purine or pyrimidine
- Numbering of bases is "unprimed"



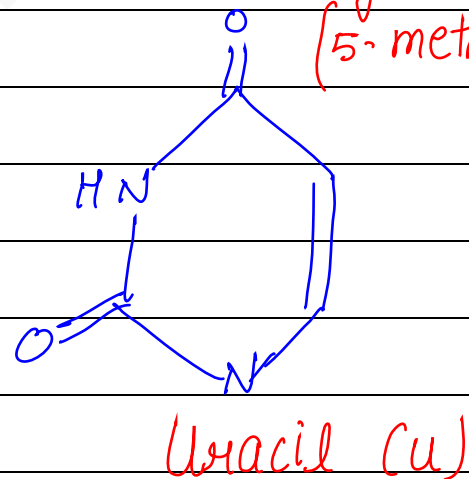
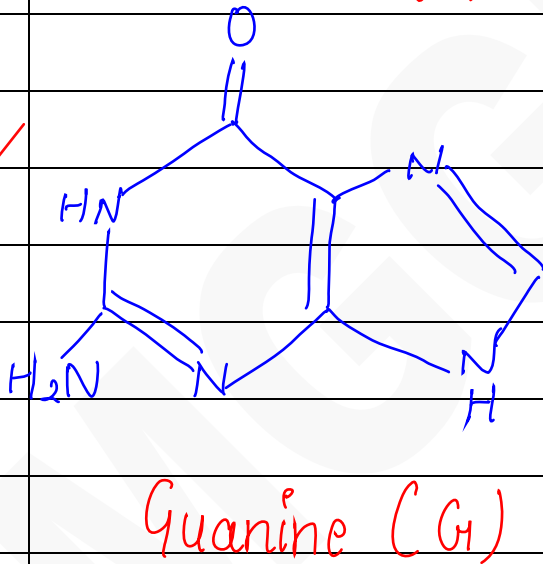
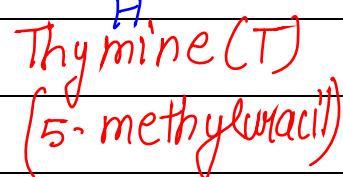
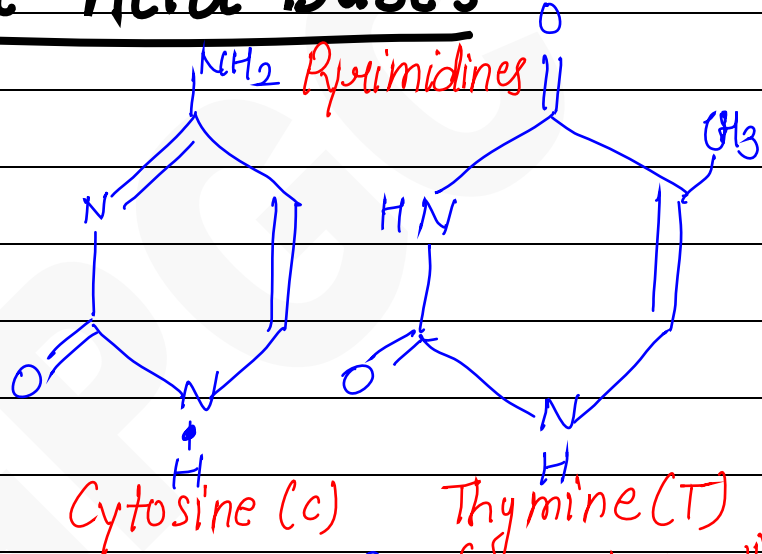
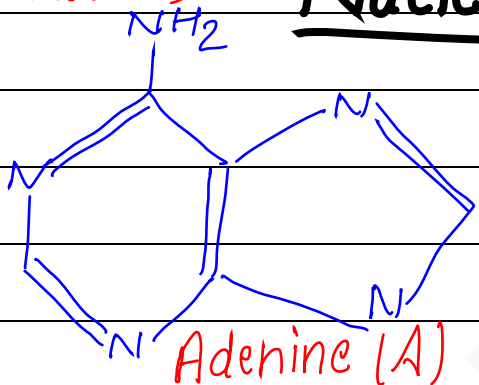
Purine



Pyrimidine

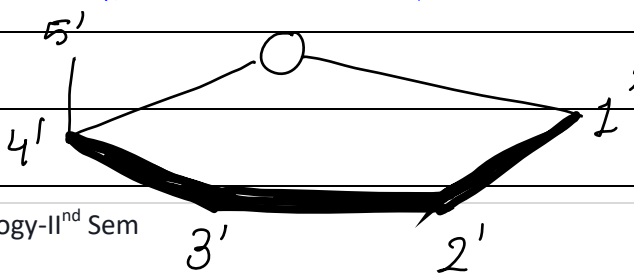


Purines Nucleic Acid Bases



Sugar

- Pentoses (5-C sugars)
- Numbering of Sugar is "primed"



DEFINITION

- Nucleotides are the units of nucleic acids and composed of nitrogenous base, pentose sugar, and phosphate group.
- These are building blocks of nucleic acid (DNA and RNA)
- 2. Involved in energy storage, muscle contraction,
- 3. active transport, maintenance of ion gradients.

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Biosynthesis

There are two types of pathway lead to nucleotides de-novo pathway and the salvage pathways.

De-novo synthesis of nucleotides begins with their metabolic precursors: **Amino acids, ribose-5-phosphate, carbon dioxide and ammonia.**

Salvage pathway recycle the free bases and nucleosides released from nucleic acid break down both types of pathways are important in cellular metabolism.

Two major routes for nucleotides biosynthesis

SALVAGE PATHWAY

Nucleotide → dNTPs

DE NOVO PATHWAY

Activated ribose (PRPP) + amino acids
+ ATP + CO₂⁺.....

Nucleotide → dNTPs

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Purine Salvage Pathways

Nucleic acid turnover (synthesis and degradation) is an ongoing process in most cells.

Salvage pathways collect hypoxanthine and guanine and recombine them with RPPP to form nucleotides in the HGPRT reaction.

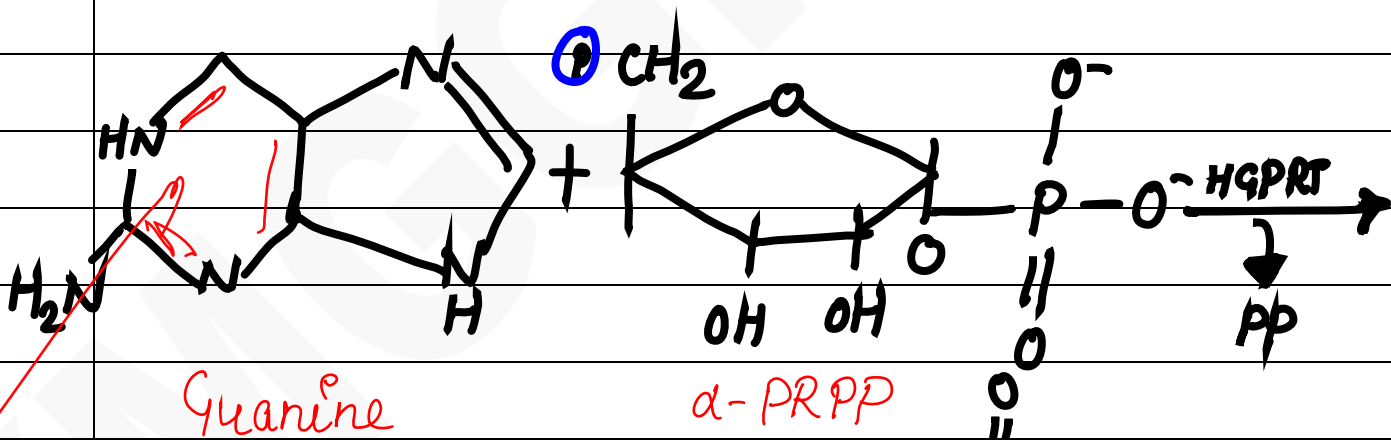
(Hypoxanthine-guanine phosphoribosyltransferase).

In L-N, purine synthesis is increased 200-fold and uric acid is elevated in blood.

This increase may be due to PRPP feed-forward activation of de novo pathway.

HGPRT converts Bases Back to Nucleotide using PRPP

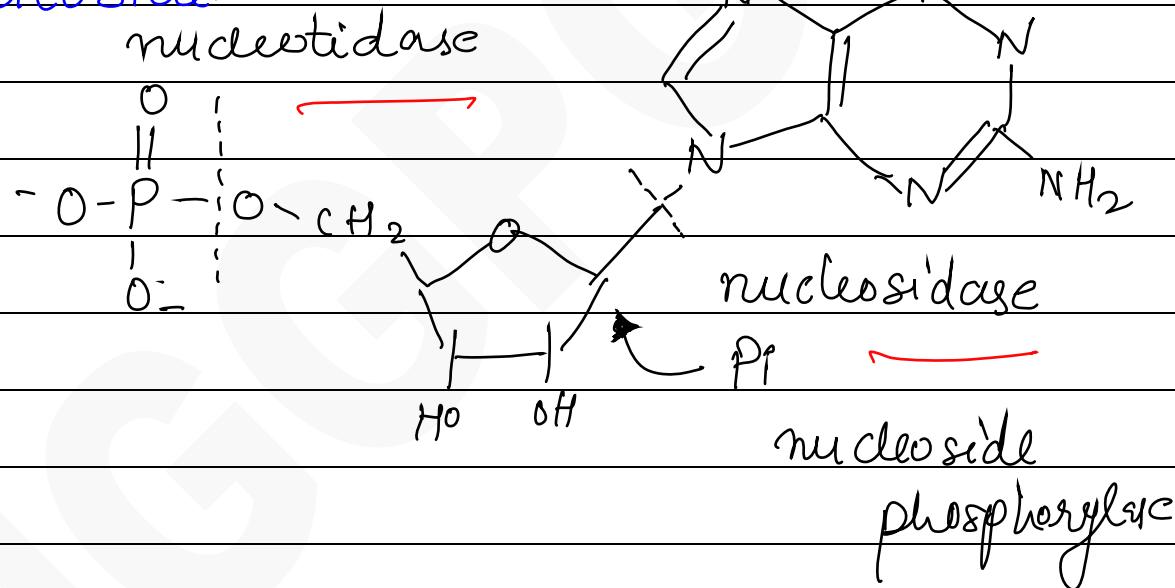
Salvage pathways are very useful because of the high energy cost for de novo synthesis of nitrogen bases. The salvage pathway for adenine recovery (adenine phosphoribosyltransferase) is not shown.



Bonding ?

Some Commonly used Enzymes

- Nucleotidases cleave P_i from a nucleotide.
- Nucleosidases cleave the base from a nucleoside.
- Nucleoside phosphorylase cleaves the base from a nucleoside using P_i .
- Nucleoside kinase adds phosphate to a nucleoside.



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Pyrimidine Synthesis

- In contrast to purines, pyrimidines are not synthesized as nucleotides.
- Rather, the pyrimidine ring is completed before a ribose 5-P is added.
- Carbamoyl-phosphate and aspartate are the precursors of six atoms of the pyrimidine ring.

- Mammals have two enzymes for carbamoyl phosphate synthesis - Carbamoyl phosphate for pyrimidine synthesis is formed by carbamoyl phosphate synthetase II (CCPS-II), a cyt

Biological function of nucleotides

- 1- Building blocks of nucleic acid (DNA and RNA)
2. Involves in energy storage, muscle contract
- ion, active transport, maintenance of ion
gradients.
3. Activated intermediates in biosynthesis
(eg. UDP-glucose, S-adenosylmethionine)
4. Components of coenzymes (NAD⁺,
NADP⁺, FAD, FMN, and CoA)
5. Metabolic regulators:
 - (a) Second messenger (cAMP, cGMP)
 - (b) Phosphate donors in signal transduction
- ion (ATP)
 - (c) Regulation of some enzymes via
adenylation and acylation.

Conclusion

From the above discussion it has been concluded nucleotides are the building block of RNA and DNA. This means that nucleotides act as a mono unit large no. of monomers units polymerize to form a polymer (RNA and DNA)

mono-
mer

RNA and DNA are the genetic material that inherits from one generation to other i.e. (parents to offsprings).