ISOPRENOID, NUCLEOTIDE, PIGMENT

SUBMITTED BY-

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SYNOPSIS

- INTRODUCTION
- DEFINITION
    1. HETEROCYCLIC COMPOUND
    2. SECONDARY METABOLITES
- NUCLEOTIDES
- ISOPRENOIDS
- PIGMENTS
- SUMMARY
- CONCLUSION
- REFERENCES

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INTRODUCTION

Nucleotides -

The basic building block of nucleic acids, such as DNA and RNA. It is an organic compound made up of nitrogenous base, a sugar, and a phosphate group.
e. g. ATP (Adenosine triphosphate) , UDP (uridine triphosphate).

Isoprenoids -

They are the class of organic compounds composed of two or more units of hydrocarbons, with each unit consisting of five carbon atoms arranged in a specific pattern. They are secondary metabolites also called terpinols.
E. g. Rubber.

Pigments -

It is the material that change the colour of reflected or transmitted light as a result of the wave length selected absorption. E. g. Chlorophyll.

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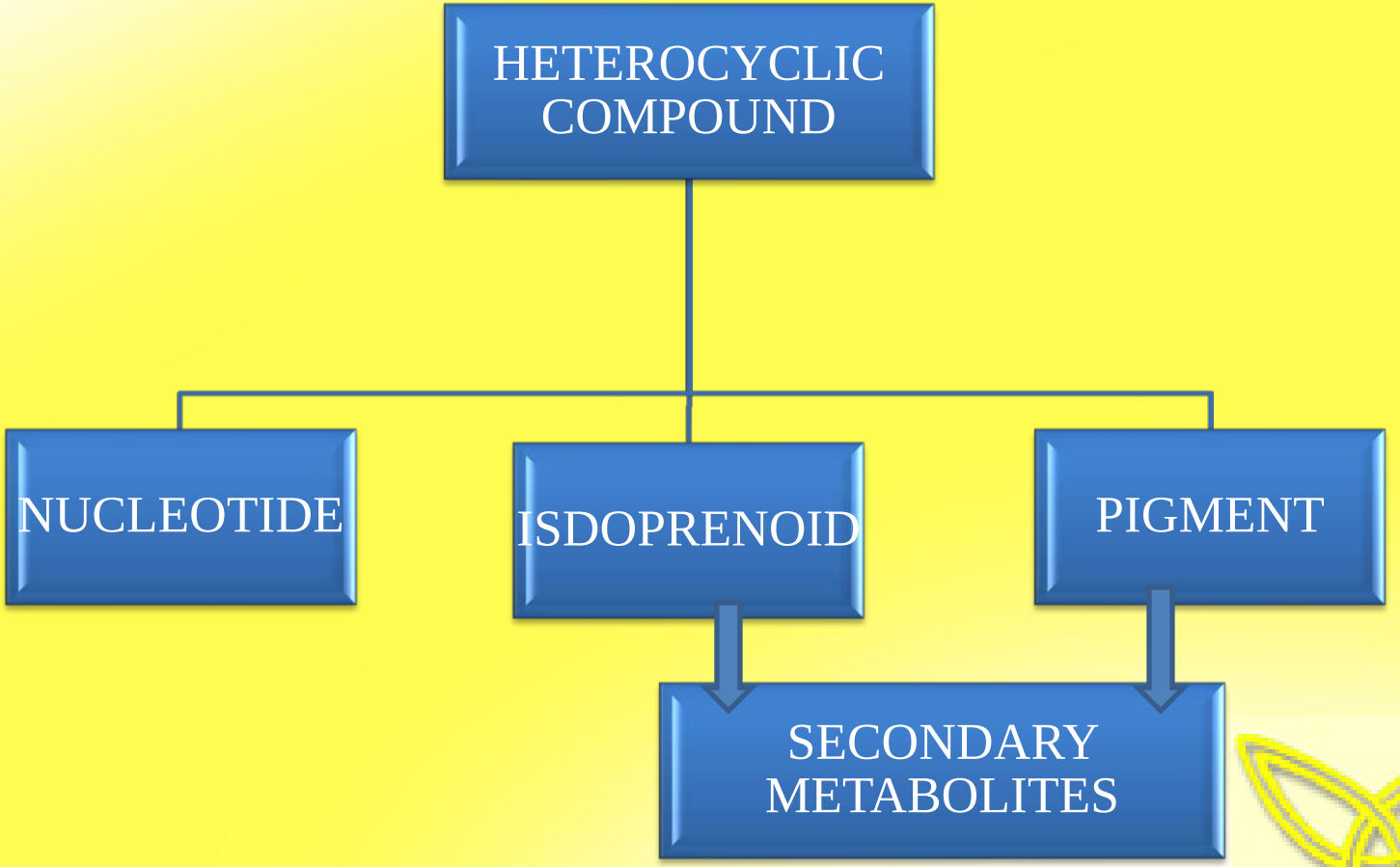
INTRODUCION



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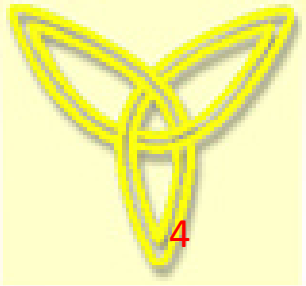
DEFINITION

- HETEROCYCLIC COMPOUND -

  Compound in which the ring structure is a combination of more than one kind of atom. For e.g. Pyridine.

- SECONDARY METABOLITES –

  A natural chemical product plant not normally involved in primary metabolic process such as photosynthesis and cell reproduction. For e. g. Chlorophyll.



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NUCLEOTIDE

❖Nucleic acids are polymers of nucleotides.

❖Nucleotides are carbon ring structures containing nitrogen linked to a 5-carbon sugar (a ribose).

❖ Nucleoside a compound containing a purine or pyrimidine base linked to a sugar(usually ribose or deoxyribose) .

❖In eukaryotic cells nucleic acids are either:

- Deoxyribose nucleic acids (DNA)
- Ribose nucleic acids (RNA)

➢Messenger RNA (M RNA)
➢Transfer RNA (tRNA)
➢Ribosomal RNA (rRNA)

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STRUCTURE

NUCLEOTIDE

- Despite the complexity and diversity of life the structure of DNA is dependent on only 4 different nucleotides.
- Diversity is dependent on the nucleotide sequence.
- Nucleotides are structures composed of:

5-carbon sugar	β-D-ribose (RNA) β-D-deoxyribose (DNA)
Base	Purine Pyrimidine
Phosphate group	

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Fig no. – 1. Nucleotide Structure - Sugars

NUCLEOTIDE

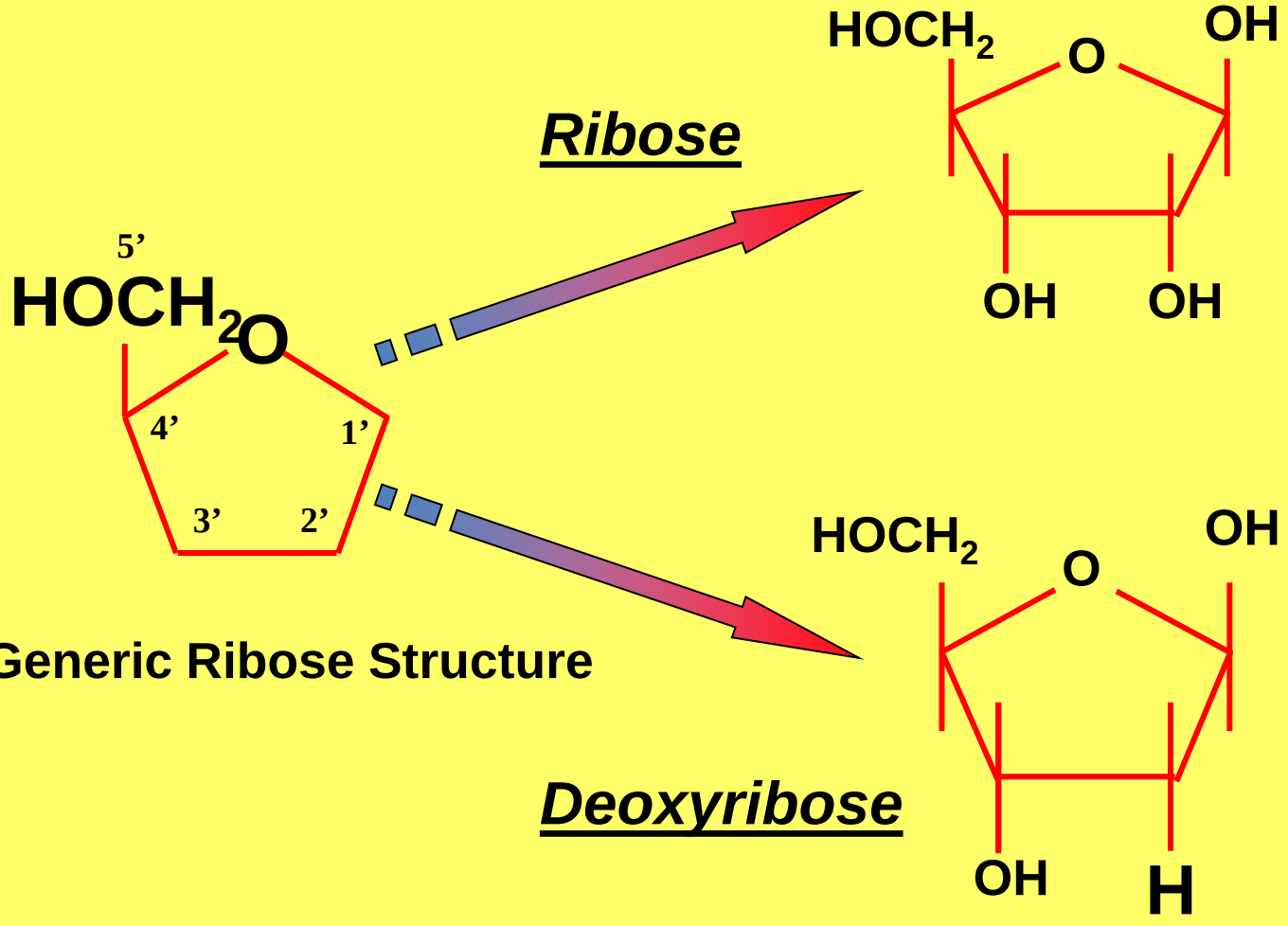

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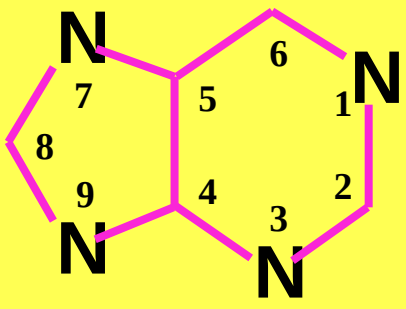
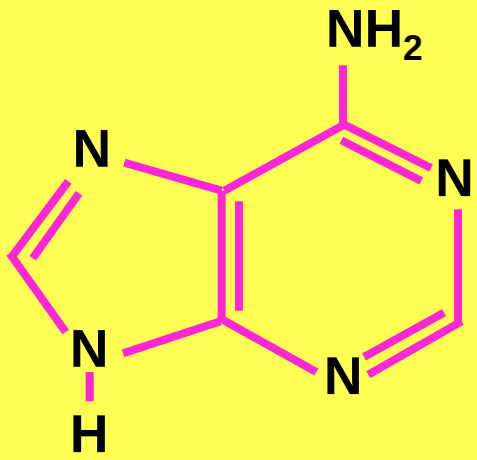
Fig no. – 2. Nucleotide Structure - Bases - Purines

NUCLEOTIDE



Purine

Adenine



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Guanine

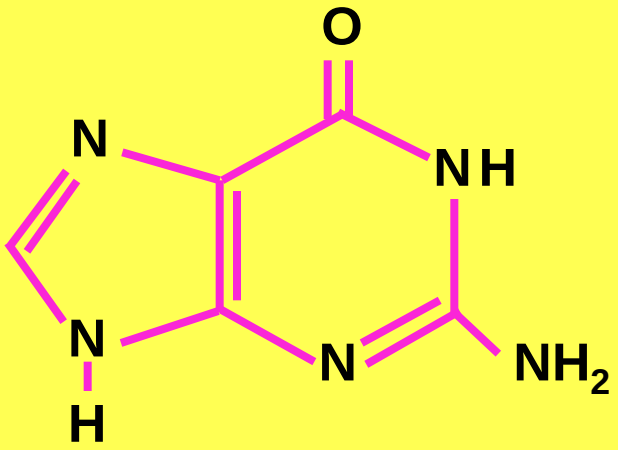

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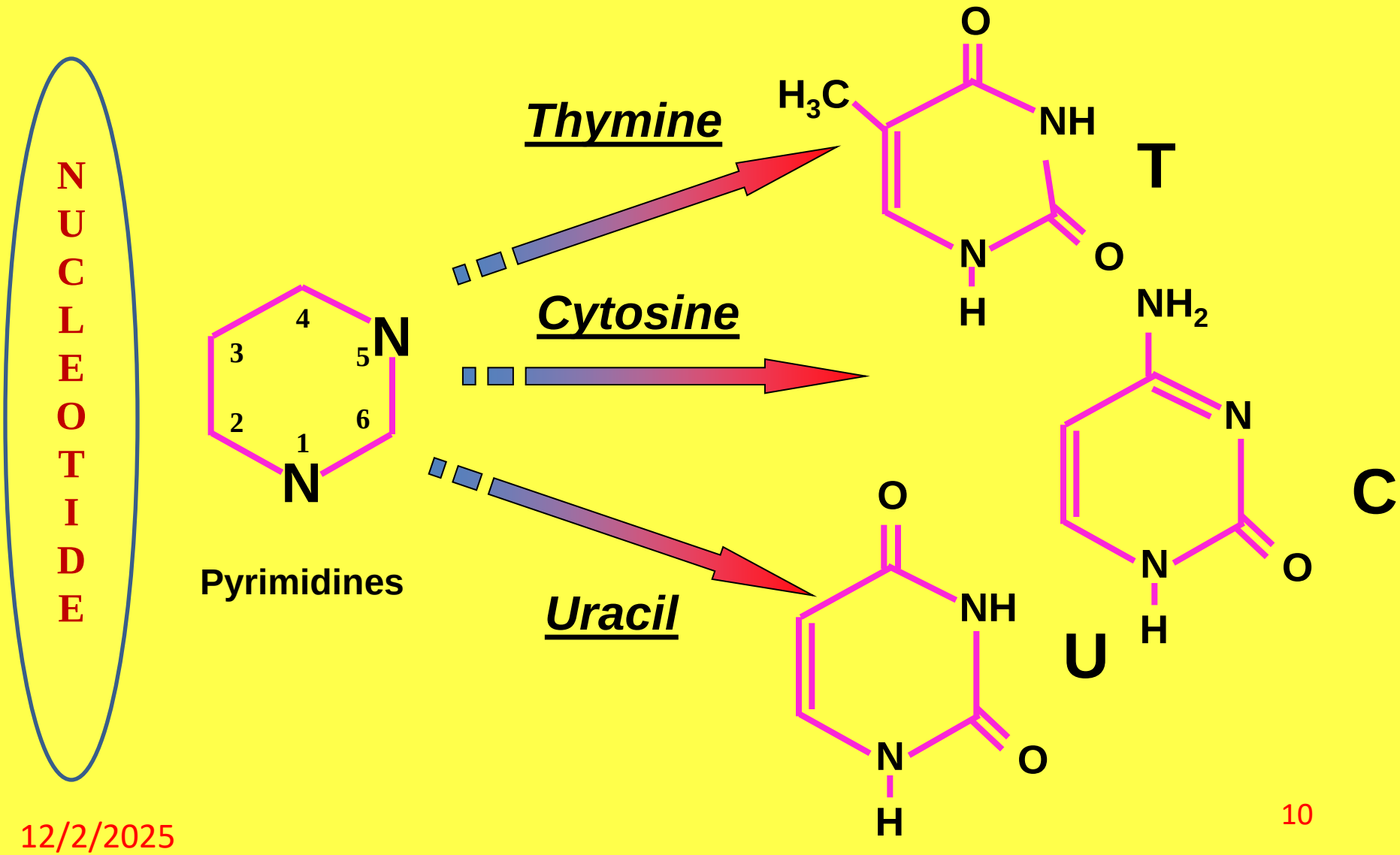
Fig no. – 3. Nucleotide Structure - Bases - Pyrimidines



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Nucleotide Structure - Bases -

NUCLEOTIDE

Adenine found in both RNA and DNA, is a white crystalline purine base.

Guanine also found in both RNA and DNA, is a colourless, insoluble crystalline substance.

Uracil and Thymine are structurally similar.

Cytosine found in both RNA and DNA, is a white crystalline substance .

Thymine is found only in DNA.

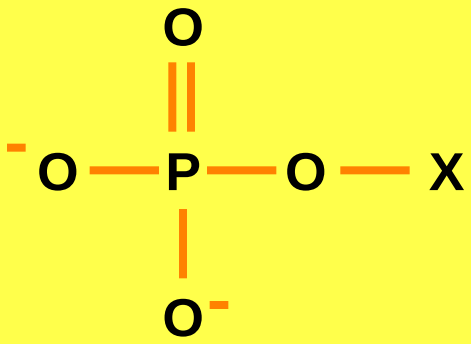
In RNA, thymine is replaced by uracil

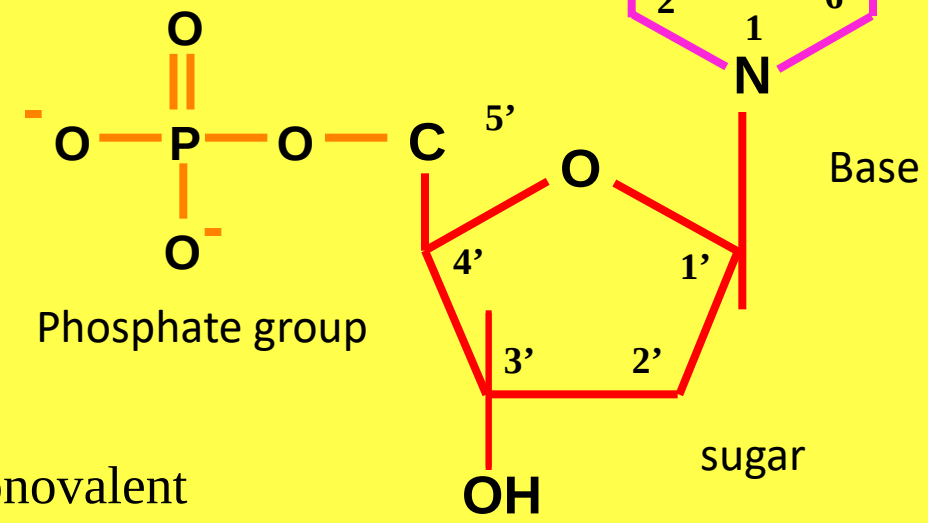
Fig no. – 4. Nucleotide Structure - Phosphate Groups

NUCLEOTIDE

Phosphate groups are essential for nucleotide polymerization.

Basic structure:





Phosphoric acid is contain 3 monovalent hydroxyl group and a divalent oxygen atom, all linked to the pentavalent phasphorus atom.

Monophosphate

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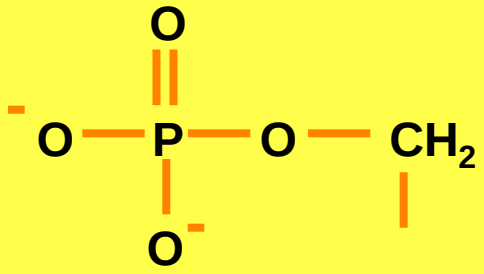
Fig no. – 5 Nucleotide Structure - Phosphate Groups

Number of phosphate groups determines nomenclature

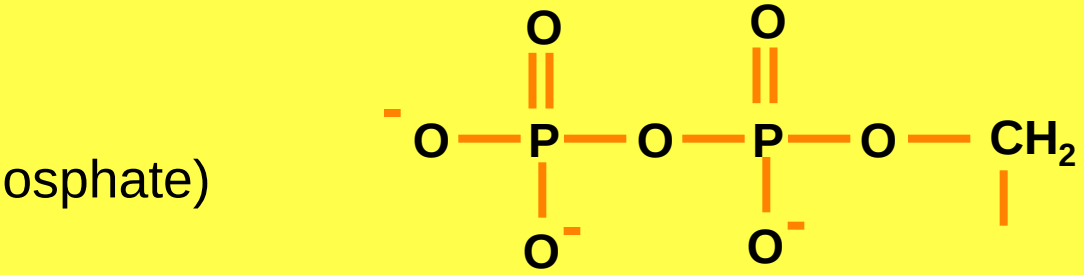
NUCLEOTIDE

Monophosphate
e.g. AMP (Adenosine monophosphate)



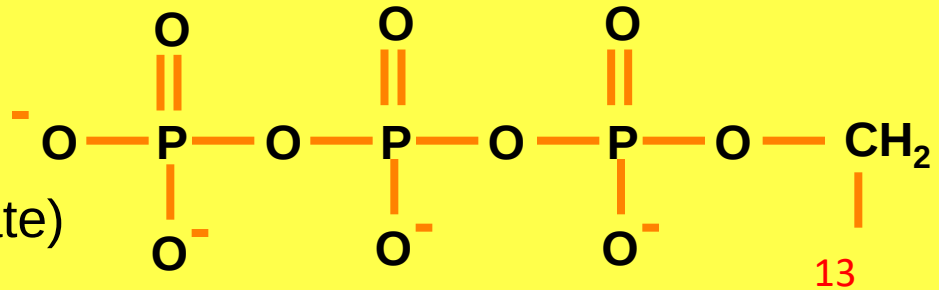
Free = inorganic phosphate (Pi)

Diphosphate
e.g. ADP (Adenosine diphosphate)



Free = Pyro- phosphate (PPi)

Triphosphate
e.g. ATP (Adenosine triphasphate)



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APPLICATION

BIOLOGICAL APPICATION OF NUCLEOTIDE

- Building blocks for DNA and RNA
- Intracellular source of energy - Adenosine triphosphate (ATP).
- Second messengers - Involved in intracellular signaling (e.g. cyclic adenosine monophosphate [cAMP])
- Intracellular signaling switches (e.g. G-proteins).
- As component of cofactors and coenzymes (such as coenzyme A , NAD+ and FAD).

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DEFINITION

ISOPRENOIDS –

They are the class of organic compounds composed of two or more units of hydrocarbons, with each unit consisting of five carbon atoms arranged in a specific pattern.

They are secondary metabolites also called terpinols. Which are naturally occurring in animals and plants.

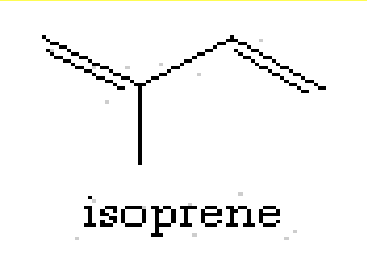

Fig no. -7.

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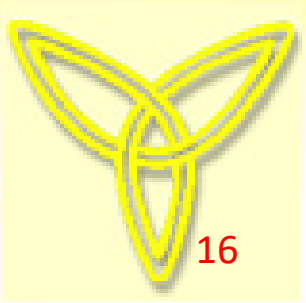
CLASSIFICATION

ISOPRENOIDS -

- HEMITERPENOIDS - 1 unit 5 carbons.
- MONOTERPENOIDS – 2 unit 10 carbons.
- SESQUITOTERPENOIDS – 3 unit 15 carbons.
- DITERPENOIDS – 4 unit 20 carbons.
- SESTERPENOIDS – 5 unit 25 carbons.
- TRITERPENOIDS – 6 unit 30 carbons.
- TETRATERPENOIDS – 7 unit 35 carbons.
- POLYTERPENOIDS - 8 unit 40 carbons.



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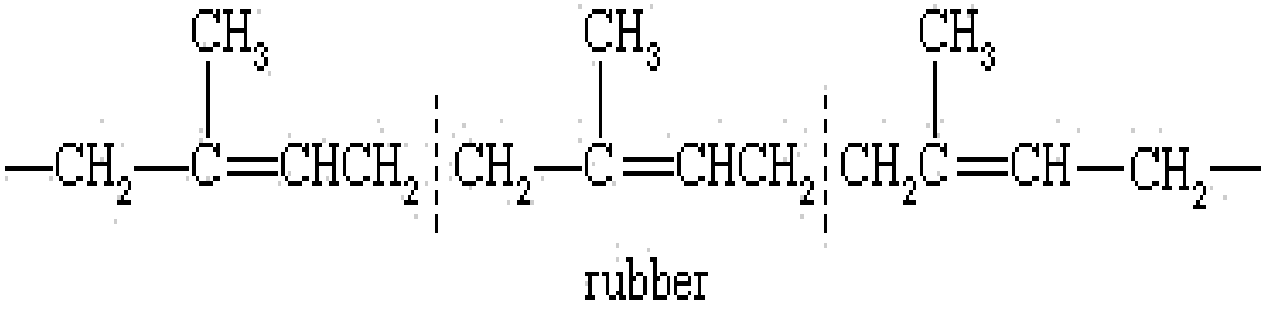
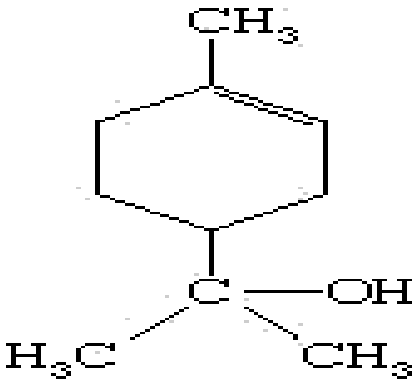
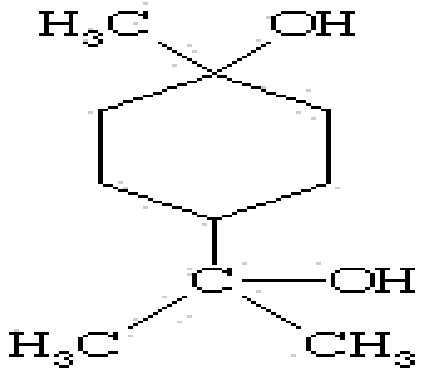
STRUCTURE



rubber



α-terpineol



terpin

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APPLICATION

BIOLOGICAL APPICATION OF ISOPRENOIDES -

- Use in secondary function pollination. It responsible for colour in flowers and fruit's flavor.
- Use to comeback abiotic stress against plant.
- Use to comeback biotic stress in plant against diseases.
- Several isoprenoids are vitally important in metabolic processes in animals.
- Rosin, usually modified by chemical treatment, is widely used to make in expensive soaps and coating materials.
- Use as ingredients of perfumes and incense, flavourings and spices, and varnishes and medicinals.

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DEFINITION

PIGMENTS -

Biological pigments, also known simply as pigments or biochromes are substances produced by living organisms that have a color resulting from selective color absorption. Biological pigments include plant pigments and animal pigments. Many biological structures, such as skin, eyes, fur and hair contain pigments such as melanin in specialized cells called chromatophores.

Fig no. – 10.

The Blue Morpho butterfly, native to Central America, derives its distinctive blue coloring from iridescence rather than from pigmentation.

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PROPERTIS

PIGMENTS -

- It should have high tinting strength.
- Secondary stable solid form.
- They are used for paints.
- Pigment particles remain clustered together in suspension.
- Dyes have a chemical affinity for fiber but pigments do not.

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PIGMENTS

BIOLOGICAL PIGMENTS –

- Heme/porphyrin-based: chlorophyll, bilirubin, hemocyanin, hemoglobin, myoglobin.
- Light-emitting: luciferin.
- Carotenoids:
  1. Hematochromes (algal pigments, mixes of carotenoids and their derivates).
  2. Carotenes: alpha and beta carotene, lycopene, rhodopsin.
  3. Xanthophylls: canthaxanthin, zeaxanthin, lutein.
- Polyene enolates: a class of red pigments unique to parrots
- Other: melanin, urochrome, flavonoids.

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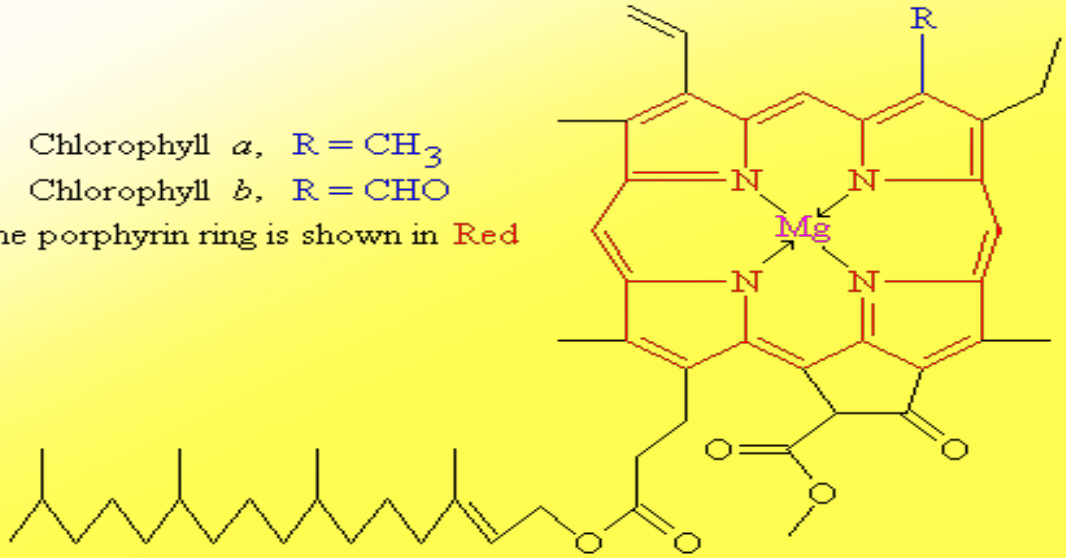
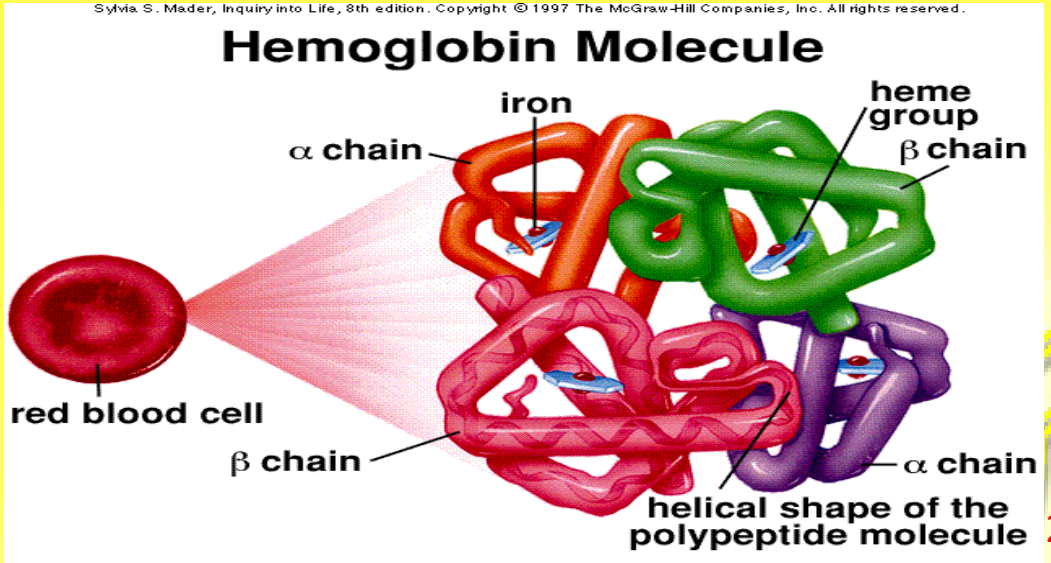
STRUCTURE

Chlorophyll *a*, R = CH_3

Chlorophyll *b*, R = CHO

The porphyrin ring is shown in Red





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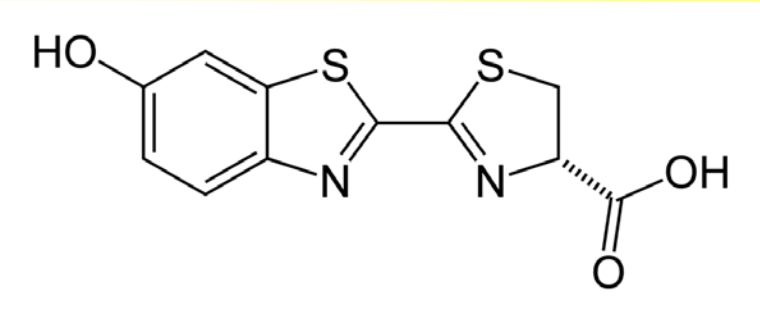
STRUCTURE



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PIGMENTS

USES -

- Pigments may be extracted and used as dyes.
- Pigments (such as astaxanthin and lycopene) are used as dietary supplements.
- Pigments is used in photosynthesis in plant as well as basic physical purposes. Such as protection from sunburn.
- Pigments are used for colouring paint, ink, plastic, fabric, cosmetics, food and other materials.
- Most pigments are used in manufacturing and the visual arts are dry colours usually ground into a fine powder.

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DIFFERENCES

Dyes	Pigments
1. Dyes migrate out of the solution, are absorbed into the fiber, and diffuse from the surface of the fiber toward its center.	1. Pigment molecules carry their own color.
2.There they either: Bond chemically with fiber molecules. “Or” React chemically with fiber molecules to produce permanent, enlarged colored fiber molecules	2. They do not unite with fiber molecules chemically and must be fixed to the fibers with bonding agents.
3. Both situations are permanent.	3. In man made fibers pigments can be mixed into the fiber solution before it is formed.

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SUMMARy

- Nucleotides carbon ring structures containing nitrogen linked to a 5- carbon sugar (a ribose).

- Class of organic compounds made up of two or more structural units derived from isoprene. Isoprene is a five carbon hydrocarbon with a branched-chain structure, two double bonds and the molecular formula C_5H_8.

- Biological pigments, also known simply as pigments or biochromes are substances produced by living organisms that have a color resulting from selective colour absorption.

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CONCLUSION

Nucleotide is a subunit of nucleic acid. They are most widely used as a source of chemical energy to drive many biochemical reactions.

Isoprenoids are secondary metabolites also called terpinols. Which are naturally occurring in animals and plants. Rubber is a polyisoprenoids that they are used in daily life.

Pigments are also known as “biological pigment”. Hemoglobin is a biological pigment which is present in erythrocytes and responsible for RBCs red colour. And chlorophyll is a plant pigment that responsible for photosynthesis.

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