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Department: Medical Laboratory Science

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1 Classify Vitamins. Hence, write on the biochemical significance of vitamins.

Answer: Vitamins are classified into two categories based on their solubility which are:

- i) Water soluble vitamins (A, D, E, K)
- ii) Fat soluble vitamins (Vitamin C and all B)

Biochemical significance of vitamins

i) Vitamins are essential for growth, maintenance and reproduction however they are not used for energy production

ii) Vitamins A and D act as steroid hormones

iii) Some Vitamin analogs are used as drugs for example folic acid analogs are used as anticancer agents and antibiotics

iv) Fat soluble vitamins are required for normal color vision, blood clotting, bone formation and maintenance of membrane structure

v) Deficiency of fat soluble vitamins produce night blindness, skeletal deformation, haemorrhages and hemolysis

2 Water Soluble Vitamins are precursors of Coenzymes. With the aid of two named vitamins describe the role of coenzymes in metabolism

i) Vitamin B₆ (Pyridoxin)

Coenzyme for transamination, decarboxylation, non-oxidative deamination and trans-sulfuration reaction

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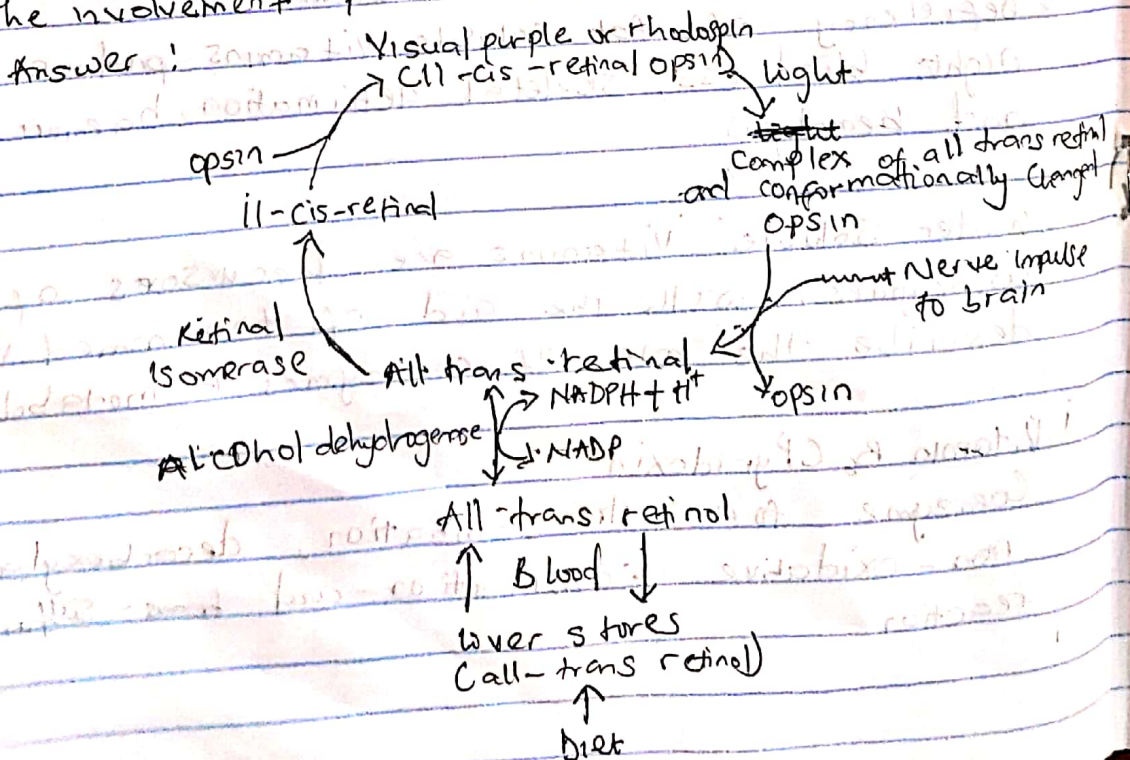
ii Vitamin K:

The coenzyme in metabolism is required for activation of blood clotting factors. Required for γ carboxylation of glutamic acid residue in clotting and osteocalcin proteins.

3 Describe the nomenclature of nucleosides, nucleotide, and nucleic acid.

Base	Nucleoside	Nucleotide	Abv	nucleic acid
Purine				
Adenine	Adenosine	Adenylate	Amp	RNA
	Deoxyadenosine	Deoxyadenylate	Damp	DNA
Guanine	Guanosine	Guanylate	Gmp	RNA
	Deoxyguanosine	Deoxyguanylate	Dgmp	DNA
Pyrimidines				
Cytosine	Cytidine	Cytidylate	Cmp	RNA
	Deoxycytidine	Deoxycytidylate	Dcmp	DNA
Thymine	Deoxythymine	Deoxythymidylate	Dtamp	DNA
Uracil	Uridine	Uridylate	Ump	RNA

4 With the aid of an adequate pathway, discuss the involvement of vitamin A in vision.



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5 Account for the response of an individual's vision on exposure to bright light and dim light.

Bright light: When a person enters a bright light the iris serves as the eye's main defense against bright light. This is the coloured part of the eye which is responsible for reducing and enlarging the size of the pupil. When intense light rays reach the eye, the iris responds by constricting the pupil, thus protecting the retina and helping it process the incoming image better.

Dim light: Vision in dim light is mediated by rhodopsin of the rod cells. Colour vision is mediated by three different retinal containing pigment in the cone cells, the three pigment are called porphyropsin, iodopsin and cyanopsin and are sensitive to the

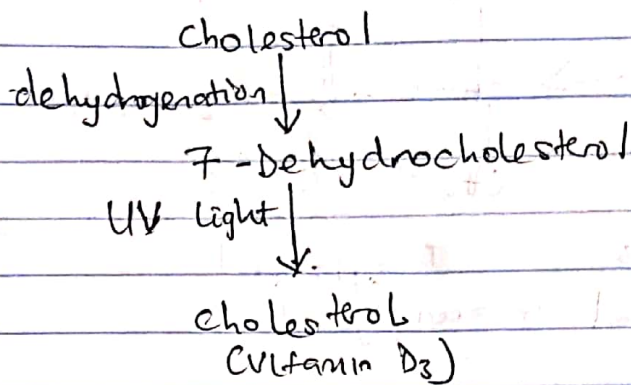
3 essential colors: red, green and blue respectively.

All these pigment consist of all-cis-retinal bound to protein opsin.

6 Describe the biosynthetic pathway involving the exposure of sunlight on skin and its relation to a named vitamin.

Answer: Vitamin D₃ which is the unnamed vitamin above is the naturally produced D₃ or Cholecalciferol is the form obtained from animal sources in the diet or made in the skin by the action of ultraviolet light from sunlight on 7-dehydrocholesterol.

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Biosynthetic pathway involving the exposure of
sunlight to the skin

7 Comment on the effects of acids and alkalis
on nucleic acid

Ans: Acid: Acid hydrolysis cleaves susceptible Purine
N-glycosyl bond in both DNA and RNA, when
RNA is boiled in dilute acid adenine and guanine
are released leaving a purin acid which may be
further hydrolysis to a mixture of pyrimidine nucleotides
The pyrimidine are more ~~resist~~ resistant to acid hydrolysis
Alkali: Alkali hydrolysis of RNA produces a
mixture of 2 and 3 prime nucleotides of cyclic
mono phosphate intermediate:

8 Write on the contributions of Watson-Crick in the
structure of DNA

Answer: The double helix structure was proposed by
James Watson and Frank's Crick in 1953 and it can
be compensated to a twisted ladder, the two strands
are anti parallel; the width is 20 degree A;
each strand of DNA has a hydrophilic deoxyribose
phosphate backbone. Each turn of the helix is
34 degrees A the two poly nucleotide chains are
of identical but complementary to each other due
to base pairing

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9. In a tabular form differentiate between DNA and RNA

DNA

RNA

- | | |
|---|--|
| - They are double stranded molecules | - They are single stranded molecules |
| - Their bases are not modified | - Their bases are modified |
| - The life time of DNA is comparatively high | - RNA are short lived |
| - They are more prone to UV damage | - They are less prone to UV damage |
| - DNA is mostly found in nucleus and nucleoid | - RNA is mostly found in the cytoplasm |

10. Discuss the functions of nucleotides

- + They are precursors of DNA and RNA
- They are metabolic regulators e.g. cAMP and cGMP
- ATP is a universal currency of energy in biological system
- Adenine nucleotides are components of 3 major enzymes NAD⁺, FAD⁺, CoA
- Nucleotides of adenine acts as carrier of methyl group in the form of S-adenosyl methionine.