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COURSE: BCH 202
MATRIC NUMBER: 18/MHS06/004

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

2.Water soluble vitamins are precursors of coenzymes. With the aid of two named vitamins, describe the role of coenzymes in metabolism.

3. Describe the nomenclature of nucleosides, nucleotides, and nucleic acid.
4. With the aid of an adequate pathway, discuss the involvement of vitamin A in vision.
5. Account for the response of an individual's vision on exposure to bright light and dim light.
6. Describe the biosynthetic pathway involving the exposure of sunlight on skin, and its relation to a named vitamin.
7. Comment on the effects of acids and alkalis on nucleic acids.
8. Write on the contributions of Watson–Crick in the structure of DNA.
9. In a tabular form, differentiate between DNA and RNA.

10. Discuss the functions of nucleotides.

ANSWERS

1.Vitamins are grouped or classified into different categories such as;

• Fat soluble vitamins which include

- Vitamin A or Retinol
- Vitamin D or Cholecalciferol
- Vitamin E or Tocopherol
- Vitamin K

• Water soluble vitamins which include

i. Vitamin B complex which are;

- Thiamine (Vitamin B1)
- Riboflavin (Vitamin B2)
- Niacin (Vitamin B3)
- Pantothenic acid (Vitamin B5)
- Pyridoxine (Vitamin B6)
- Biotin
- Folic acid

- Cobalamin (Vitamin B12)
ii. Vitamin C or ascorbic acid

Vitamins have numerous biochemical functions;
a. Vitamin A acts as a regulator of cell and tissue growth and differentiation
b. Vitamin D provides a hormone-like function, regulating mineral metabolism for bones and other organs.
c. Vitamins C and E function as antioxidants.
d. Vitamin A plays an important role in vision.
e. The B complex vitamins function as enzyme coenzymes or the precursor for them.

2. Vitamins play a different kind of role in metabolism. They are required as functional parts of enzymes involved in energy release and storage. Riboflavin is an essential component of flavoproteins which are coenzymes involved in the many metabolic pathways of carbohydrate, lipid and protein metabolism. Riboflavin is a precursor of the coenzymes Flavin mononucleotide(FMN) and Flavin adenine dinucleotide(FAD) which are required by several oxidation-reduction reactions in metabolism. FMN and FAD serve as coenzymes for oxidoreductase enzymes involved in carbohydrate, protein, lipid and nucleic aid metabolism and electron transport chain which helps in the production of energy. Niacin is a component and precursor of the coenzyme Nicotinamide adenine dinucleotide(NAD+) and Nicotinamide adenine dinucleotide phosphate(NADP+) which areinvolved in the catabolism or anabolism of carbohydrate, lipids and proteins. NAD+ and NADP+ are involved in various oxidation and reduction reactions catalyzed by dehydrogenases in metabolism. NADP+ linked dehydrogenases or reductases are often found in pathways concernedwith reductive synthesis.

3. Nucleic acid molecules such as DNA and RNA are reffered to as nucleic acid nomenclature. The
most common base pairs are;
- Adenine
- Guanine
- Cytosine
- Thymine
- Uracil
Thymine only occurs in DNA and Uracil occurs in RNA.

Nucleotides are molecules consisting of a nucleoside and phosphate group. They are the basic buildingblocks of DNA and RNA. They are composed of three sub unit molecules; a nitrogenous base, a five carbon sugar and a phosphate group consisting of one to three phosphates. The nucleotides of DNA
includes;
- Adenosine monophosphate(AMP)
- Guanosine monophosphate(GMP)
- Cytidine monophosphate(CMP)
- Thymidine monophosphate(TMP)
The nucleotide of RNA are;
Deoxyuridine monophosphate
A nucleoside consists of nitrogenous base and a five carbon sugar ribose. The nucleoside of DNA are;
- Adenosine
- Guanosine
- Cytidine
- Thymidine
And the nucleoside of RNA are;
- Deoxyadenosine
- Deoxyguanosine
- Deoxyuridine
- Deoxycytidine

4. The cyclic events occur in the process of vision known as Rhodopsin cycle. Rhodopsin, the visual
pigment of rod cells in the retina consists of 11-cis-retinal bound to protein opsin. When rhodopsin
absorbs light, the 11-cis-retinal is converted to all-trans retinal. The isomerization is associated with a conformational change in the protein opsin. Conformational changes in opsin generates a nerve impulse that is transmitted by the optic nerve to the brain. This is followed by dissociation of the all-trans retinal from opsin. The all-trans retinal is immediately isomerized by retinal isomerase to 11-cis-retinal. This combines with opsin to regenerate rhodopsin and complete the visual cycle. The conversion of all-trans retinal to 11-cis-retinal is incomplete and therefore remaining all-trans retinal which is not converted to 11-cis-retinal is converted to all-trans retinol by alcohol dehydrogenase and is stored in the liver. When needed, retinol re-enters the

circulationand is taken up by the retina, where it is converted back to 11-cis-retinal which combines withopsin again to form rhodopsin.

5. Bright light: While vision in dim light is mediated by rhodopsin of the rod cells, colour vision is
mediated by three different retinal containing pigments in the cone cells, the three pigments are called porphyropsin, iodopsin and cyanopsin and are sensitive to the three essential colours: red, green and blue respectively. When light strikes the retina, it bleaches one or more of these pigments, depending on the colour quality of the light. The pigments are converted to all-trans retinal and the protein moiety opsin is released as in the case of rhodopsin.
Dim light: when a person enters from bright light to dim light there is difficulty in seeing due to depletion of rhodopsin but after few minutes the vision improves. During these few minutes, rhodopsin is resynthesized and vision is improved.

7. The effect of alkali on DNA are;
• Low concentration of alkali will not be too harmful to the nucleic acid though some damage is obviously incurred.
• Moderate concentrate of alkali causes deprotonation and the hydrogen bonding between the base pairs is disrupted causing the DNA to denature.
• High concentration of base will induce a hydrolysis of the phosphodiester bonds of the DNA and the DNA will be cleaved into smaller fragments.
The effect of acid on DNA are;
• At low PH, the DNA is deprived of the purines.
• At extremely low ph, the phosphodiester bonding of the DNA is disrupted which cleaves the DNA into nucleosides and nucleotides.

8. DNA is a double stranded, helical molecule. It consists of two sugar-phosphate backbones on theoutside, held together by hydrogen bonds between pairs of nitrogenous bases on the inside. JamesWatson and Francis Crick realized that these pairing rules meant that either strand contained all the information necessary to make a new copy of the entire molecule and the aperiodic order of bases might provide a genetic code

9.

S.N.	DNA	RNA
1.	DNA stands for Deoxyribonucleic Acid. The sugar portion of DNA is 2-Deoxyribose.	RNA stands for Ribonucleic Acid. The sugar portion of RNA is Ribose.
2.	The helix geometry of DNA is of B-Form (A or Z also present).	The helix geometry of RNA is of A-Form.
3.	DNA is a double-stranded molecule consisting of a long chain of nucleotides.	RNA usually is a single-strand helix consisting of shorter chains of nucleotides.
4.	The bases present in DNA are adenine, guanine, cytosine and thymine.	The bases present in RNA are adenine, guanine, cytosine and uracil.
5.	DNA is self-replicating.	RNA is synthesized from DNA on an as-needed basis.

10. The functions of nucleotides are;
• Functions as energy carriers.
• Involved in the synthesis of polysaccharides
• Aids as enzyme cofactor
• Acts as metabolic regulators
• Required for the activation of intermediates in many biosynthetic pathway