**Course Title: Medical Biochemistry II**

**DT 2nd, Sec A**

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**Max Marks: 50**

**Note: There are FIVE questions, each carry 10 marks with grand total of 50 marks**

**ATTEMPT all questions**

**Avoid copy paste material, as it may deduct your marks**

Q1. Explain the process of “ATP synthesis coupled with electron flow”.

Q2. Write the reactions that are catalyzed by the following enzymes.

* + 1. Acyl CoA dehydrogenase
    2. Adenosine deaminase
    3. Nucleotidase
    4. Gluconolactonase
    5. Enoyl-CoA hydratase

Q3. Define nucleotide, nucleoside and differentiate between DNA and RNA.

Q4. Why Dickens and Horecker’s Pathway is called HMP pathway. Enlist the enzymes used in PPP Pathway.

Q5. What is the function of carnitine shuttle system? Write down the stages and steps involved in Beta oxidation of Lipids.

Q 1. Ans

ATP Synthase:

ATP synthase moves H ions that were pumped out of the matrix by the electron transport chain into the mattress. The energy from the influx of protons into the matrix is used generate ATP by the phosphorylation (addition of phosphate) of ADP. The movement of ions across the selectively permeable mitochondrial membrane and down their electrochemical gradient is called chemiosmosis .

Q2 Ans.

Fatty acid synthesis starts with the carboxylation of acetyl CoA to malonyl CoA. This irreversible reaction is the committed step in fatty acid synthesis. The synthesis of malonyl CoA is catalyzed by acetyl CoA carboxylase, which contains a biotin prosthetic group.

ENOyl-CoA hydrates (ECH) catalyzes the second step in the physiologically important beta-oxidation pathway of fatty acid metabolism. This enzyme facilitates the syn-addition of a water molecules across the double bond of a trans-2-enoyl-CoA thioester, resulting in the formation of a beta hydroxycyl-CoA thioester.

The central Role of Enzymes as Biological Catalysts:

A fundamental task of proteins is to act as enzymes catalyst that increase the rate of virtually all the chemical reactions within cells. Although RNAs are capable of catalyzing some reactions, most biological reactions are catalyzed by proteins. In the absence of enzymatic catalysis, most biochemical reactions are so slow that they would not occur under the mild conditions of temperature and pressure that are compatible with life. Enzymes accelerate the rates of such reactions that would take years in the absence of catalyzed by the appropriate enzyme. Cells contain thousands of different enzymes, and their activities determine which of the many possible reactions actually take place with in the cell.

Adenine deaminase (ADE1) catalyzes the conversion of adenine to hypoxanthine and ammonia as shown in scheme 1 (1,2) ADE is part of purine degradation pathway where hypoxanthine is subsequently oxidized to uric acid by xanthine oxidase via a xanthine intermediate.

Q 3 Ans.

Nucleotide:

A nucleotide contain;

1. Pentose sugar
2. Phosphate group
3. Nitrogenous bases

Nucleoside:

It is a nitrogenous base with sugar.

Example.

Adenine +sugar -🡪 Adenosine

Guanine +sugar🡪 Guanosine

Thymine + sugar 🡪 Thymidine

Cytosine + sugar 🡪 Cytidine

Uracil + sugar 🡪 Uridine

Differentiate between DNA and RNa

|  |  |
| --- | --- |
| DNA | RNA |
| DNA stands for deoxidize nucleic Acid | Ribo nucleic Acid |
| Chiefly found inside nucleus | Found in cytoplasm |
| Double standed | Single steanded |
| The sugar is doxy ribose | The sugar is ribose |
| Four nitrogenous bases are A, G, T,C | Four nitrogenous bases are  A,G,C,U |
|  |  |

Q 4 Ans.

The pentose phosphate pathway (also called the hexose monophosphate pathway) is a metabolic pathway parallel to glycolysis.

This pathway is also called DiCkens and Horecker’s pathway.

It generates NADPH and pentose (5-carbon sugar) a precursor for the synthesis of nucleotides.

Glucose 6 phosphate dehydrogenase is the rate controlling enzyme of this pathway. It is allosterically stimulated by NADP+ and strongly inhibited by NADPH… which stimulates Glucose 6 phosphate dehydrogenase to produce more NADPH This step is also inhibited by acetyl CoA.

Q 5. Ans:

Stages involved in Beta Oxidation.

Three stages involved in beta-oxidation of fatty acid.

1. Activation of fatty acids occurring in the cytoplasm
2. Transport of fatty acid into mitochondria.
3. Beta oxidation in mitochondrial matrix
   1. Activation of fatty acid.

1.In the cytoplasm of the cell, long chain fatty acids are activated by ATP and co enzyme A and fatty acyl- CoA is formed

2.The ATP is converted to AMP and pyrophosphate (PPi)

3.AMP will attached with fatty acid and will convert into fatty acyl Aden late

4.While the pyrophosphate (PPi) is cleaved by pyrophosphate to two inorganic phosphate (2Pi) which will help in the production of ATP if required anywhere.

5. In next step the fatty acyl adenylate will react with coenzyme A in the presence of fatty acyl CoA synthase enzyme.

6. From fatty acyl adenylate the AMP group will removed and CoA will attach to form fatty acyl CoA an activated form of fatty acid

B. Transportation of Fatty acyl-CoA from Cytoplasm to Mitochondria

.Fatty acyl-CoA the cytosol reacts with carnitine in the outer mitochondrial membrane forming fatty acyl carnitine. The enzyme used is carnitine acyl transferase I ( CAT I)

Fatty acyl carnitine easily passes from the inner membrane to mitochondrial matrix where it re form to fatty acyl CoA. The enzyme used is carnitine acyl transferase II.

Inside the mitochondria the fatty acyl-CoA undergoes beta oxidarion.

C.B-Oxidation of Activated Fatty Acids

B-Oxidation (in which all reactions involve the B-carbon of a fatty acyl-CoA are converted to acetyl- CoA. The 4 steps are:

1.Dehydrogrnation

2.Hydration

3.De hydrogenation

4.Cleavage

Dehydrogenation

FAD + accept hydrogens from a fatty acyl- CoA in the first step A double bound is produced between the a and B-carbon and an Enoyl-CoA is formed in the presence of ACYl CoA dehydrogenase. The FADH2 that is produced interacts with the electron transport chain generation ATP.

Hydration

H2O will adds across the double bond and aB-hydroxyl acyl-CoA is formed in the presence of Enoyl-CoA hydratase.

Degydrogenation

B-hydroxyl acyk-CoA is oxidized by NAD + to aB-keto acyl-CoA in the presence of B-hydroxyl acyl-CoA dehydrogenase. The NADH that is produced interacts with the electron transport chain generating ATP.

Cleavage

The bond between the alpha and beta carbons of the B-keto acyl-CoA is cleaved by a Thiolase enzyme that requires co enzyme A. Acetyl-CoA is produced from the two carbons at the Carboxyl end of the original fatty acyl-CoA, and the remaining carbons from a fatty acyl-CoA that is two carbons shorter than the original.

The shortened fatty acyl-CoA repeats these four steps. Repetition continue until all the carbons of the original fatty acyl-CoA are Converted to acetyl-CoA.