**Course Title: Medical Biochemistry II**

**RAD 2nd, Sec A**

**Student Name: Mahnoor Ali**

**Student ID: 15984**

 **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”.**

**Ans. “ATP synthesis coupled with electron flow”**

* **Electron transfer to O2 was found to be coupled to ATP synthesis of ADP+p in isolated mitochondria**
* **ATP** would not be synthesize when only ADP and Pi are added in isolated mitochondria suspension.
* **O2** consumption ,an indication of electron flow, was detected when a reductant (e.g. succinate) is added accompanied by an increase of ATP synthesis.
* Both O2 consumption and **ATP** synthesis were surprised when inhabits of respiratory chain. (E.g cyanide ,Co or intimacies A) was added.
* **ATP** synthesis depends on the occurrence of electron flow in.
* **O2 consumption (**thus electron flow) was nighter observed if **ADP** was not added to the suspension, Althought a reductant is provided!.
* Electron flow also depends on ADPsynthesis.

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

**Ans:**

* **Acyl CoA dehydrogenase**

Acyl-CoA dehydrogenase(ACADs) are a class of enzymes that function to catalyze the initial step in each cycle of fatty acid B-oxidation in the mitochondria of cell.

* This enzymes action represents the first step in fatty acid metabolism( the process of breaking long chains of fatty acids into Acetyl-CoA molecules).
* **“NUCLEOTIDASE”**
* A nucleotides is a hydrolytic enzyme that catalyze the hydrolysis of a nucleotides into a nuclei side and a phosphate
* **Adenosine deaminase**

**ANS:-** Adenosine deaminase ( also known as adenosine aminohydrolase,or ADA) is an enzyme (EC 3.5.4.4) involve in purine metabolism.

* It is needed for the breakdown o adenosine from food and for the turnover of nucleic acids and tissue.

Its primary function in humans is the development and maintenance of the immune system**.**

* **Gluconolactonase:**

**ANS:-**  In enzymology, a Gluconolactonase is an enzyme that catalyzed the chemical reaction D-glucono-I5-lactone+H2OD-gluconate Thus,

* The two substrate of this enzyme are D-glucono-I,5-lactone and H2O,
* Whereas its product is D-gluconate.
* **Enoyl-CoA hydratase**

**ANS:-** Enoyl-CoA hydrates or crotons is an enzyme that hydrates the double bond between the second and third carbons on 2-trans/cis-enoyl-CoA;ECH is essential to metabolizing fatty acids in beta oxidation to produce both acetyl CoA and energy in the form of ATP.

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

**Ans.**

* **Nucleotide:**
* **Def:** Nucleotides are organic molecules consisting of nucleosides and a phosphate. They serve as monomeric unit of the nucleic acid polymer deoxyribonucleic acid and ribonucleic acid , both of which are essential biomolecules with in All life forms on earth.
* **Nucleoside:**
* Nucleotides is an enzyme which catalyzes the phosphor lytic cleavage of nucleotides.
* Although originally found in snake venom.
* The activity of nucleotides has been described for bacteria and plant cells, and is widely distributed in vertebrate tissue.
* In mammalian cells the enzyme is predominantly located in the conversion of extracellular nucleotides.(E.g 5-AMP) which are generally impermeable, to the corresponding nucleoside(E.g adenosine) which can readily enter most cells.
* Consequently, the enzyme plays a key role in the metabolism of nucleotides.
* **Difference B/w DNA and RNA:**

|  |  |
| --- | --- |
| DNA | RNA |
| DNA is mostly found it nucleus and nucleotides | **RNA** is mostly found in the Cytoplasm |
| Stand for deoxyribonucleic acid | Stand for ribonucleic acid |
| Deoxyribose the sugar where the base are A,T,C, And G, | Ribose is the sugar where the base areA,U,C, and G,  |
| A longer polymer | Shorter than DNA |
| A pair with T and C, Pair with G | A pair with U, And C, pairs with G, |
| Double-standard and it exhibit a double-helix structure | Single-standard sometimes it form secondary and terror structure |
| Refers B-form | Refers A-form |
| More prone to UV damage  | Less prone to UV damage |
| Carries the genetic information, necessary for the development, functioning and reproduction | Mainly involved in protein synthesis some time it regulate the gene ex oppression |

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

**ANS:-**

* The Dickens and Horeckers pathway is also known as HMP(Hexose mono phosphate pathway) Because this pathway/cycle is starting from a compound which is known as Glucose-6-phosphate.
* Glucose is 6-carbon molecules, hexose.
* The group attached o the 6th carbon of glucose G-6-P which we called phosphate group.
* The group of phosphate attached to 6th carbon of G-6-P is one in number, that’s why it is called mono phosphate, and the mono phosphate group is attached to glucose 6th phosphate so it is called hexose mono phosphate.
* **" LIST OF ENZYME"**

**i.** Glucose-6-phosphate dehydrogenase.

**ii.** Gluconolactonase.

**iii.** 6-phosphogluconate dehydrogenase.

* **"NON OXIDATION PHASE"**

**i.** Epimerase.

**ii.** isomerase.

**iii.** Trans ketoses.

**iv.** Trans Aldolase.

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

**ANS:-**The carnitine shuttle is responsible for transferring long-chain fatty acids across the barrier of the inner mitochondrial membrane to gain access to the enzymes of beta-oxidation.

**FUNCTIONS:-**

* The oxidation of fatty acid is an important sources of energy for ATP production in mitochondria through the entry o acetyl-CoA into the crabs cycle.
* Fatty acid are oxidized inside the mitochondrial matrix but the arty acid to be oxidized come from the cytosol by stirification with coenzyme A (CoA) to form acyl-CoA (RCO-CoA, where is fatty acid acyl group).
* Activated medium-chain fatty acid (c8 and cl0)freely diffuse into mitochondria to be oxidized but long chain fatty acid do not diffuse into mitochondria so they must be transported in.
* the transport o long chain fatty acid into mitochondria for oxidation is accomplished bit the carnitine palmitoyltransferase system (CPTI and CPTII). CPTI exchange carnitine for the CoA attached to long chain fatty acid to or a fatty acid-carnitine conjugate(RCO-carnitine)
* The fatty acid-carnitine is transported into the matrix by a transporter protein in the innermitocondrial membrane.
* once the fatty acid-carnitine is inside the matrix , CPTII exchanges CoA for carnitine to produce energy. The free carnitine is transported back out to renew the cytoplasmic pool of carnitine and allow the transfer process o continue.

**"STAGES INVOLVES IN BETA OXIDAION"**

ANS:-The stages involved the beta oxidation o fatty acid.

(a) Activation of fatty acid occurring in the cytoplasm.

(b)Transport of fatty acid into mitochondria.

(C) Beta-oxidation in the mitochondrial matrix.

**"ACTIVATION OF FATTY ACIDS:**

* In the cytoplasm o cell, long-chain fatty acid are activated by ATP and coenzyme A, and fatty acyl-CoA is formed .
* The ATP is converted to AMP and pyrophosphate.
* AMP will attached with fatty acid and will convert to fatty acyladenylate.
* In next step fatty acyl acetylate will react with coenzyme A in the precens of fatty acylCoA synthesis enzyme.
* From fatty acyl acetylate the AMP group will remove and CoA will attached to from fatty acyl to CoA ,an activated from of fatty acid.

**"TRANSPORT OF FATTY ACIDS INTO MITOCONDRIA.**

* Fatty acyl-CoA from cytosol react with carnitine in the outer mitochondrial membrane, forming fatty acyl carnitine . The enzyme ua4s in carnitine acyl transfer’s.
* Fatty acyl contain easily passes from the inner membrane to mitochondrial matrix ,where it reforms to fatty acyl-CoA the enzyme used is carnitine acyl transfers II.
* Inside the mitocondria,the fatty acyl CoA undergoes beta-oxidation.

"**BETA -OXIDATIONIN THE Mitochondrial matrix"**

* Beta oxidation in which all reaction involved the beta carbon of a fatty acyl CoA will occur.

**"STEPS OF BETA-OXIDATION"**

* There are four steps of beta-oxidation. These steps are repeated until all the carbons of fatty acid acyl-CoA are converted to acetyl-CoA. The four steps are :

(a) **Dehydrogenation.**

**(**b)**Hydration.**

(c)**Dehydrogenation.**

(D)**Cleavage.**

1. **"DEHYDROGENATION"**
* FAD accept hydrogen from a fatty acyl-CoA in the first step. A double bond is produced between the alpha and beta carbons, and an Enoyl-CoA is formed in the presence of acyl-CoA dehydrogenase.
* The FADH2 that is produced interacts with the electron transport chain, generating ATP.
1. **"HYDRATION"**
* H2o will adds across the double bonds , a beta hydroxyl acyl-CoA is formed in the presence of Enoyl-CoA hydrates.
1. **"OXIDATION"**
* Beta hydroxyl acyl-CoA is oxidized by NAD+to beta ketone acyl-CoA in the presence of beta hydroxyl acyl-CoA dehydrogenase. The NADH that is produced interacts with the electron transport chain, generating ATP.
1. **"CLEAVAGE"**
* The bond between the alpha an beta carbons of the beta ketone acyl-CoA is cleaved a those enzyme that required coenzyme. Acetyl-Cost is CoA,and the remaining carbons from a fatty acyl-CoA that is two carbons shorter than the original.
* The shorter fatty acyl-CoA repeats these four steps, repetition continue until all the carbon of the original fatty acyl-CoA are converted to acetyl-CoA.