COVENANT UNIVERSITY
NIGERIA

TUTORIAL KIT
OMEGA SEMESTER

PROGRAMME: BIOCHEMISTRY

COURSE: BCH 223

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BCH 223: Bioenergetics

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1.) Explain, briefly, the arbitrary distinction of photosynthesis into Light reactions and Dark reactions.

Answer: The primary light reaction is the absorption of a light quatum by a Mg^{++} containing haeme protein pigment molecule e.g. chlorophyll. The pigment merely accepts the energy and all subsequent reactions are actually dark reactions.

2.) Photosynthesis can be seen as occurring in THREE reactions. Name the reactions.

Answer:

a. Photophosphorylation (Formation of ATP from ipp + ADP)

b. Photolysis of H_2O to (produce the reduction equivalents)

c. CO_2 fixation and conversion (to carbohydrate)

3.) The discovery of photophosphorylation is the most important advance in our knowledge of photosynthesis

4.) Following light quantum absorption the excited energy rich electron is transferred to Ferrodoxin a special redox system and an iron-containing protein with an unusually negative redox potential of -0.432V.

5.) The transport of electrons from plastoquinone redox catalyst to chlorophyll a is coupled to a phosphorylation step.

6.) The chloroplasts have two light systems or photosystems. Photosystems I generates a strong reductant that leads to formation of NADPH whereas Photosystem II produces a strong oxidant leading to O_2 evolution.

7.) Two shuttles are provided for transporting electrons from cytoplasmic NADH into mitochondria, namely:

Answer:

(a.) The α-glycerol phosphate shuttle yields 2 ATPs/ NADH

(b.) The malate-aspartate shuttle yields 3 ATPs/ NADH

8.) The functions of the electron transport chain and oxidative phosphorylation is to take electrons from NADH and $FADH_2$ and transfer them to O_2 making ATP in the process which is known as Cellular respiration.

9.) The electron transport particles contain the following enzymes: (a.) Succinate dehydrogenate (b.) NADH oxidase (c.) cytochrome (d.) several lipoproteins (e.) ubiquinone b, c, c_1 & a.

10.) The exchange of mitochondrial ATP for cytoplasmic ADp is catalysed by the ATP/ADP translocase enzyme.

11.) F_1F_0ATPase couples H^+ gradient to ATP synthesis

12.) The rate of oxidative phosphorylation is controlled by the supply of ADP and P

13.) State the three functions of the mitochondrion

Answer:

(a.) It oxidises substrates

(b.) Consume oxygen

(c.) make ATP

14.) Define the role of uncouplers

Answer:

(a.) Uncoupler prevent the synthesis of ATP but do not inhibit oxygen or substrate oxidation

(b.) They allow protons back into the mitochondria without making any ATP stimulate oxygen consumption.

15.) Define the role of inhibitors

Answer:

(a.) Inhibitors block the flow of electrons at a specific site and inhibit electron flow and ATP synthesis

(b.) Inhibitors inhibit oxygen consumption and ATP synthesis

(c.) Inhibitors actually block one of the steps of oxidative phosphorylation

16.) Give an example each of Uncouplers and Inhibitors of oxidative phosphorylation.

Answer:

Uncoupler- The classic uncoupler is dinitrophenol (DNP)

Inhibitor- The classic inhibitor is cyanide which blocks the last step of electron transfer by combining with and inhibiting cytochrome oxidase.