Microbiology

Microbiology Compare and contrast photophosphorylation and oxidative phosphorylation. Both photophosphorylation and oxidative phosphorylation result in production of ATP. Photophosphorylation is a process by which ATP is produced using energy of the sunlight. In oxidative phosphorylation, ATP is produced by energy released by the oxidation of nutrients (Boyer, 1977). In photophosphorylation, light energy is used to create a high-energy electron donor and a lower-energy electron acceptor. In oxidative phosphorylation, electrons are transferred from electron donors to electron acceptors such as oxygen, in various redox reactions which are carried out by a series of protein complexes within mitochondria among eukaryotes and in the cells' inner membranes among prokaryotes (Boyer, 1977). There are 2 types of photophosphorylation and they are cyclic and noncyclic. In cyclic photophosphorylation, the electron begins in a pigment complex called photosystem I, passes from the primary acceptor to plastoquinone, then to cytochrome b6f (a similar complex to that found in mitochondria), and then to plastocyanin before returning to chlorophyll. In the noncyclic type, first, a water molecule is subjected to photolysis and broken down into 2H+ + 1/2 O2 + 2e- The two electrons released thus from the water molecule are kept in photosystem II. The 2H+ and 1/2O2 are left out for further use. Thereafter, a photon is absorbed by chlorophyll pigments on surrounding the reaction core center of the photosystem. The light excites the electrons of each pigment and this causes a chain reaction. The reaction transfers energy to the core of photosystem II and causes excitation of the two electrons that are transferred to the primary electron acceptor, pheophytin. In oxidative phosphorylation, the energy released thus by electrons flowing through this electron transport chain is then used to transport protons across the inner

mitochondrial membrane and this process called chemiosmosis (Boyer, 1977). 2. Assume that you are responsible for decontaminating materials in a large hospital. How would you sterilize each of the following? Briefly justify your answers: a. A mattress used by a patient with bubonic plague. Household disinfectant or 10% bleach solution must be applied to the mattress which is then cleaned up, sealed in bags and disposed. Rubber gloves must be worn for disinfection and hands must be washed thereafter. This is because; people usually get plague from being bitten by a rodent flea that is carrying the plague bacterium or by handling an infected animal (CDC, 2005). b. Intravenous glucose-saline solutions. Intravenous glucose-saline solutions are sterilized by mechanical filtration because; they can get damaged by heat, irradiation or chemical sterilization. A filter with pore size 0. 2 µm will effectively remove bacteria. If viruses must also be removed, a much smaller pore size around 20 nm is needed. Solutions filter slowly through membranes with smaller pore diameters. Prions are not removed by filtration. Filters can be made of several different materials such as nitrocellulose or polyethersulfone (Block, 2001) c. Used disposable syringes. Undiluted bleach (sodium hypochlorite 5. 25%) appears to be an effective disinfection solution for used needles. Proper needle disinfection with undiluted bleach may reduce the risk of HIV transmission among injection drug users from needle sharing (Romnelli, 2000). d. Tissues taken from patients. Decontamination can be done either by 5% sodium hypochorite solution or 96 percent formic acid (Block, 2001).. References Block, S. S. (2001). Disinfection, sterilization and preservation. US: Wolters Kluwer Health Boyer, P. D., Chance, B., Ernster, L., et al. (1977). Oxidative and photophosphorylation. Annual Review of Biochemistry, 46: 955-966 CDC.

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