18/MHS06/013

Aerobic respiration is an enzymatically controlled release of energy in a stepwise catabolic process of complete oxidation of organic food into carbon dioxide and water with oxygen acting as a terminal oxidant. The common mechanism of aerobic respiration is also called common pathway because its first step, glycolysis, is common to both aerobic and anaerobic modes of respiration. The common aerobic respiration consists of three steps: glycolysis, Krebs cycle and terminal oxidation

1. Glycolysis- The process of breakdown of glucose or similar hexose sugar to molecules of pyruvic acid through a series of enzyme mediated reaction releasing some energy (ATP) and reducing power (as NaDH2). Glycolysis occurs in the cytoplasm. It is also called EMP pathway because it was discovered by three German scientists; Embden, Meyerhof and Parnas. It takes place in 9 steps; Phosphorylation, Isomerization, Phosphorylation, Splitting, Dehydrogenation and Phosphorylation, Formation of ATP, Isomerization, Dehydration and Formation of ATP.

Net reaction of glycolysis-

Glucose + 2NAD+ +2ADP+ 2H3PO4 + 2H3PO4 -> 2Pyruvate + 2NADH + 2H + 2ATP

1. Krebs Cycle- The Krebs cycle, also named citric acid cycle or tricarboxylic acid cycle (TCA) after the initial product. This cycle was discovered by Hans Krebs. It occurs inside the mitochondria. The Krebs cycle is stepwise oxidative and cyclic degradation of activated acetate derived from pyruvate. Pyruvate enters the mitochondria and is decarboxylated oxidatively to produce CO2 and NADH. The product combines with sulphur containing coenzyme A (activated acetate). Acetyl co A functions as substrate entrant for Krebs cycle. The components of the Krebs cycle include: Condensation, Dehydration, Hydration, Dehydrogenation, Decarboxylation, Dehydrogenation and Decarboxylation, Formation of ATP/GTP, Dehydrogenation, Hydration and Dehydrogenation.

Glucose + 4ADP + 4H3PO4 + 10NAD+ + 2FAD -> 6CO2 + 4ATP + 10NADH + 10H+ +2FADH2

1. Terminal Oxidation- This is the name of oxidation found in aerobic respiration that occurs towards the end of catabolic process and involves the passage of both electrons and protons of reduced coenzymes to oxygen. It consists of two processes- Electron Transport and Oxidative Phosphorylation.
2. Electron Transport Chain- A series of coenzymes and cytochromes that take part in the passage of electrons from a chemical to its ultimate acceptor
3. Oxidative Phosphorylation- The synthesis of energy rich ATP molecules with the help of energy liberated during oxidation of reduced coenzymes (NADH2, FADH2) produced in respiration. The enzyme required for this synthesis is ATP synthetase.