**Aerobic Cellular Respiration in Stop Motion**

**Background:**

All organisms on Earth have evolved to produce useable forms of energy from the free energy that exists in the environment. Aerobic cellular respiration involves removing energy from organic compounds by using oxygen. Aerobic cellular respiration is the process used by all animals, plants, fungi and most other organisms to produce ATP energy. Energy stored in the glucose molecule (C6H12O6) is transferred by a series of chemical reactions to an adenosine triphosphate (ATP) molecule during aerobic cellular respiration.

*Overall Reaction: C6H12O6 + 6O2 🡪 6CO2 + 6H2O + ATP*

Aerobic cellular respiration can be grouped into four main stages: Glycolysis, pyruvate oxidation, Krebs cycle and electron the transport chain including chemiosmosis.

1. Glycolysis is a ten step process during which a 6 carbon glucose molecule is broken down into a 3 carbon pyruvate molecule and 2 ATP energy molecules are produced.
2. Pyruvate oxidation is the second stage of aerobic respiration, where an enzyme, acetyl-CoA , transports pyruvate from the cytosol into the mitochondria.
3. The Krebs cycle is a cyclic process that occurs in the mitochondria of the cell. In the Krebs cycle, NADH, energy carriers, and carbon dioxide are produced through the transformation of pyruvate into different organic molecules.
4. The electron transport chain and chemiosmosis is the fourth stage of aerobic respiration; energy is moved through a series of membrane-bound protein complexes to produce ATP and water as a waste product.

**Aerobic Cellular Respiration Task:**

The class will be divided into three groups. Each group will analyze a different stage of aerobic respiration. Your group will create a working model and a stop motion video of that stage of aerobic cellular respiration in an animal cell. Use your textbook, class notes and other materials to create the model and video. At the end of this task, each group will present their video and explain in detail the chemical reactions that occur during their assigned stage of aerobic respiration.

*Groups:*

1. Glycolysis
2. Pyruvate oxidation and Krebs cycle
3. Electron transport chain.

*Procedure:*

1. Each stage of aerobic respiration is composed of many chemical reactions or steps. Outline each reaction or step that occurs in the stage of aerobic respiration assigned to your group on a sheet of paper. Be certain to have me check the reactions are correct before continuing.
2. Create an outline of a cell including one of its mitochondria on a piece of chart paper. You will be photographing the molecules against this background. Consider which step you are photographing before you draw the cell. Note: The mitochondria may not be to scale.
3. Construct the major molecules involved in each step, using the coloured Styrofoam balls and tooth picks.
4. Create name cards for the major molecules involved in each step.
5. Use the molecules and name cards to Illustrate and explain what occurs during each step as you produce the video.
6. For each step, take several pictures showing the movement of the molecules and enzymes during that reaction; so when the pictures are put together in sequence there are no major gaps in the video.
7. Create the video and submit the video to your teacher. The assignment can be submitted through a web link or on a USB drive.
8. Prepare to show your video and explain the various reactions in your stage of aerobic respiration to your classmates.

*Styrofoam Color Chart:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Molecule** | **Color** | **Molecule** | **Color** |
| Carbon | Black | NADH | Purple |
| Oxygen | Red | NAD | Light Purple |
| Hydrogen | White  | FADH2 | Blue |
| Phosphate | Green | FAD | Light Blue |
| Phosphorus | Light Green | Electrons | Pink |
| ATP | Yellow | GDP | Dark grey |
| ADP | Dark Yellow | GTP | Light grey |
| Coenzyme A | Orange | Enzyme | Brown |

*Important Group Notes:*

Glycolysis group:

* Focus on the six main steps: Steps 1, 3, 4, 5, 6, 7, 10.
* Start by creating the glucose molecule and modify the molecule according to the changes at each step.

Pyruvate oxidation and Krebs cycle group:

* Be sure to include a representation of pyruvate being transported from the cytoplasm into the mitochondria.
* Focus on the main steps: Steps 1, 3, 4, 5,6, 8.
* You may choose to enlarge the size of your mitochondria to enable you to demonstrate the Krebs cycle more effectively.

Electron transport chain:

* Illustrate the membrane bound protein complexes that exist in the inner membrane of the mitochondria.
* You may choose to enlarge the size of your mitochondria to enable you to demonstrate the Electron transport chain more effectively.