Cellular Pathways That Harvest Energy – Respiration

1. Obtaining Energy and Electrons from Glucose

    A. Cells trap free energy while metabolizing glucose
    B. Redox reactions transfer electrons and energy
    C. NAD is a key electron carrier in redox reactions

2. An Overview: Releasing Energy from Glucose

    A. In the presence of O_2, glycolysis begins the breakdown of glucose
    B. In the absence of O_2, some cells carry on fermentation

3. Glycolysis: From Glucose to Pyruvate

    A. The energy-investing reactions of glycolysis require ATP
    B. The energy-harvesting reactions of glycolysis yield ATP and NADH + H^+
    C. Reviewing glycolysis and fermentation

4. Pyruvate Oxidation

5. The Citric Acid Cycle

    A. The citric acid cycle produces two CO_2 molecules and reduced carriers

6. The Respiratory Chain: Electrons, Proton Pumping, and ATP

A. The respiratory chain transports electrons and releases energy
B. Active proton transport is followed by diffusion coupled to ATP synthesis
C. An experiment demonstrates the chemiosmotic mechanism
D. Proton diffusion can be uncoupled from ATP production

7. Fermentation: ATP from Glucose, Without O_2

A. Some fermenting cells produce lactic acid
B. Other fermenting cells produce alcohol

8. Contrasting Energy Yields

9. Connections with Other Pathways

A. Catabolic pathways feed into respiratory metabolism
B. Anabolic pathways use intermediates from energy pathways

10. Regulating the Energy Pathways

A. Allostery regulates respiratory metabolism
B. Evolution has led to metabolic efficiency