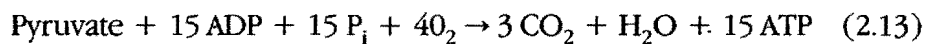


*anaerobic
energy
production*

Figure 2.8. Schematic diagram of location of the cellular metabolic processes. Glycolysis and anaerobic glucose metabolism occur in the cytoplasm, while oxidative phosphorylation, which requires oxygen, occurs in the mitochondrion.

intracellular pH, thus altering subsequent cellular contractile and metabolic activity. In addition, lactate clearance from the cell requires further bodily energy to transport it via the blood and further metabolizing elsewhere—say, in the liver. When oxygen is present, the preferable metabolic pathway for glucose metabolism is to completely oxidize glucose to pyruvate and then, within the mitochondria, to further oxidize pyruvate into CO_2 and H_2O , which are easily cleared from the cell via diffusion into the blood and exhaling of CO_2 via the lungs (Figure 2.9B). Oxidative phosphorylation can thus be further represented as



Thus whereas anaerobic metabolism (glycolysis) of glucose yields 2 ATP per glucose molecule, oxidative metabolism yields 32 ATP per glucose molecule (15 ATP for each pyruvate and 2 ATP for glucose to pyruvate oxidation; Figure 2.9C). Thus when oxygen is available, it is a much more energy efficient mechanism to generate cellular energy.

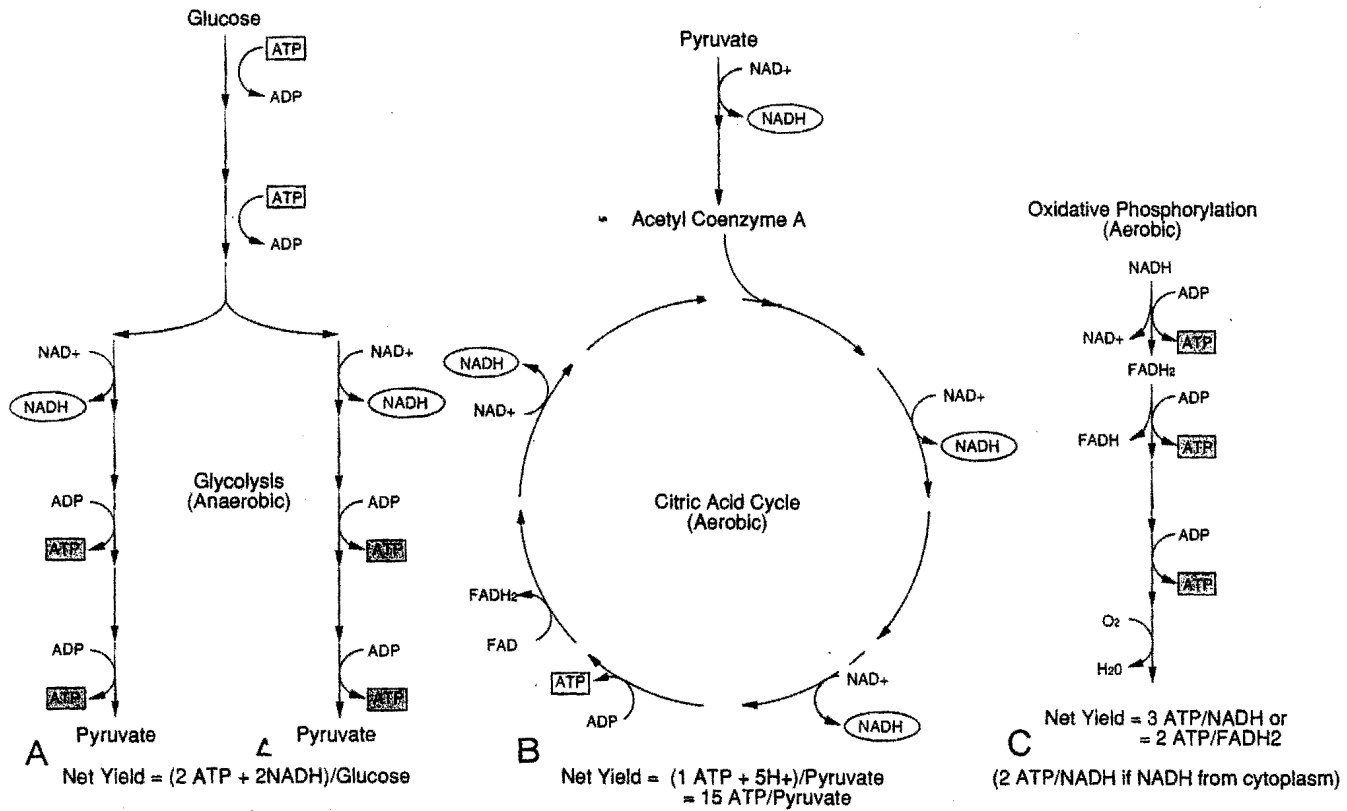


Figure 2.9. Summary of glucose metabolism. **A**, Glycolysis represents the metabolism of glucose to two molecules of pyruvate. This process yields two ATP molecules and two NADH molecules (shown in shaded squares and ellipses) and occurs without oxygen. **B**, The citric acid cycle represents the conversion of pyruvate into acetyl coenzyme A, which then passes through various intermediates (not shown) and yields one molecule of ATP, four molecules of NADH, and one molecule of FADH₂. The NADH and FADH₂ are available for further oxidation by the electron transport system, which yields much ATP. This process requires oxygen. **C**, Oxidative phosphorylation used to generate ATP from either NADH (three molecules ATP per NADH) or FADH₂ (two molecules ATP per FADH₂). If the NADH is derived from the cytoplasm via glycolysis, only two ATP are produced net, since one ATP is required to transport NADH into the mitochondrion.