

CHAPTER 8

AN INTRODUCTION TO METABOLISM

Learning objectives:

Metabolism, Energy, and Life

1. Explain the role of catabolic and anabolic pathways in cellular metabolism.
2. Distinguish between kinetic and potential energy.
3. Distinguish between an isolated and an open system. Explain why an organism is considered an open system.
4. Explain the first and second laws of thermodynamics in your own words.
5. Explain why highly ordered living organisms do not violate the second law of thermodynamics.
6. Write and define each component of the equation for free-energy change.
7. Distinguish between exergonic and endergonic reactions in terms of free energy change.
8. Explain why metabolic disequilibrium is one of the defining features of life.
9. List the three main kinds of cellular work. Explain in general terms how cells obtain the energy to do cellular work.
10. Describe the structure of ATP and identify the major class of macromolecules to which ATP belongs.
11. Explain how ATP performs cellular work.

Protein Enzymes Regulate Metabolic Pathways

12. Describe the function of enzymes in biological systems.
13. Explain why an investment of activation energy is necessary to initiate a spontaneous reaction.
14. Explain how enzyme structure determines enzyme specificity.
15. Explain the induced-fit model of enzyme function.
16. Describe the mechanisms by which enzymes lower activation energy.
17. Explain how substrate concentration affects the rate of an enzyme-catalyzed reaction.
18. Explain how temperature, pH, cofactors, and enzyme inhibitors can affect enzyme activity.

The Control of Metabolism

19. Describe how allosteric regulators may inhibit or stimulate the activity of an enzyme.
20. Explain how the binding of oxygen to hemoglobin illustrates cooperativity.
21. Explain how feedback inhibition prevents a cell from wasting chemical resources.
22. Describe how localization of enzymes within a cell may help order metabolism.