

CHAPTER OVERVIEW

21: Binding and Association

Molecular associations are at the heart of biological processes. Specific functional interactions are present at every level of cellular activity. Some of the most important:

1) Proteins Interacting with Small Molecules and Ions

- Enzyme/substrate interactions and catalysis
- Ligand/receptor binding
- Chemical energy transduction (for instance ATP)
- Signaling (for instance neurotransmitters, cAMP)
- Drug or inhibitor binding
- Antibody binding antigen
- Small molecule and ion transport
 - $\text{Mb} + \text{O}_2 \rightarrow \text{MbO}_2$
 - Ion channels and transporters

2) Protein-Protein Interactions

- Signaling and regulation networks
- Receptors binding to ligands activate receptors
 - GPCRs bind agonist/hormone for transmembrane signal transduction
- Assembly and function of multi-protein complexes
 - Replication machinery in replisome consists of multiple proteins including DNA polymerase, DNA ligase, topoisomerase, helicase
 - Kinetochore orchestrate interactions of chromatin and the motor proteins that separate sister chromatids during cell division

3) Protein-Nucleic Acid Interactions

- All steps in the central dogma
- Transcription factor binding
- DNA repair machinery
- Ribozymes

In all of these examples, the common thread is a macromolecule, which typically executes a conformational change during the interaction process. Conformational flexibility and entropy changes during binding play an important role in describing these processes.

[21.1: Thermodynamics and Biomolecular Reactions](#)

[21.2: Statistical Thermodynamics of Biomolecular Reactions](#)

[21.3: DNA Hybridization](#)

[21.4: Biomolecular Kinetics](#)

[21.5: Diffusion-Limited Reactions](#)

[21.6: Protein Recognition and Binding](#)

[21.7: Forces Guiding Binding](#)

[21.8: Specificity in Recognition and Binding](#)

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