

Project Year

2001

Project Team

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Project Title

Simulating Equilibrium and Kinetic Binding Phenomena

Audience

Students enrolled in courses in biochemistry, pharmacology, immunology, and biomedical and biochemical engineering, as well as researchers in those disciplines.

Pedagogical Issue

Effector stimuli are governed by a biological response. At the heart of this biological response is a ligand-receptor interaction. Understanding ligand-receptor interactions is fundamental to the study of all life sciences, but students have difficulty visualizing the concepts that govern these interactions.

Solution

This project team proposes to develop an interactive, web-accessible simulation to enhance students' understanding of ligand-receptor interactions. Their understanding will be enhanced by watching animations that demonstrate how various parameters such as dose, temperature, and cooperative effects between receptors can affect the quality of the interaction. This will help students to understand the energetic and molecular principles, which are fundamental to understanding the nature of the biological signal and the biological outcome. The program will include an equilibrium binding tutorial that will explore the fundamentals of binding phenomena, using the example of oxygen binding to myoglobin (non-cooperative binding) and hemoglobin (cooperative binding). The second part of the module, which will also include a tutorial, will explore the principles of enzyme and binding kinetics. Users will be able to simulate Michaelis-Menten kinetics for a general enzyme and explore the effects of competitive, non-competitive and mixed inhibition on the enzyme system. This module will be designed to be a powerful general purpose simulation for ligand-receptor interactions, enabling users to ask questions and see results quickly and easily. The web-based simulation, once completed, will also serve as a research tool. Researchers will be able to model binding equilibria and explore the effects of variables on the observed binding profiles.

Technologies Used

Web Design, Programming – Java