Project Year
2003

Project Team
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Project Title
Interactive Model of Biosynthetic Metabolic Pathways

Audience
Students enrolled in the *Topics in Cell Engineering* course, as well as scientists in the glycobiology community (more than 2000 active researchers worldwide) who would benefit from the development of this resource in an accessible, web-based format

Pedagogical Issue
Metabolic pathways are dynamic, vibrant systems, but are typically portrayed in a static format that sometimes makes it difficult for beginning students to grasp key concepts. To illustrate this issue, consider that even a simple biosynthetic metabolic system includes (1) multiple inputs into the actual metabolic pathway, (2) internal and external regulatory mechanisms that govern the metabolic flux through the primary pathway and intersecting secondary pathways, and (3) an assortment of possible biosynthetic products whose exact composition is determined by factors (1) and (2). Examples of questions that might arise that cannot be explored in adequate detail in the classroom include the following: What are the effects on metabolic flux through the pathways when novel metabolic precursors are introduced into the system? What is the impact on product distribution when one of the component enzymes suffers a mutation found in human disease, or is altered through emerging protein engineering approaches? In a typical classroom lecture, the basic components of a metabolic system are presented, but all the resulting questions cannot possibly be addressed.

Solution
The goal of this project is to create an interactive, user-friendly model of a metabolic pathway system, designed to facilitate independent quantitative investigation by the students, and to provide a broader intellectual framework for this subject. Animations and interactive models of sialic acid biosynthesis and antibiotic production will be developed to complement the static portrayal of a metabolic pathway that is presented in lecture. Students will be able to change individual components of the model and observe the effects on overall system behavior. The model will also supplement the largely qualitative animations presented in lecture, incorporating quantitative parameters that can be examined easily in as much detail as is required to attain a thorough conceptual understanding of the material.

Technologies Used
C/C++, JAVA, Macromedia Flash