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Optimization & Systems Biology.

The interdisciplinary field of systems biology was born from the goal of modeling a whole cell, a long standing problem in mathematical biology. The interplay between biology and computer science led to high-throughput experiments that produce massive amounts of information in a reduced time, information that details the relationship between individual cellular components. The objective is to construct a whole-cell model based on the detailed information that can be used to understand and estimate cellular structure and behavior.

The primary modeling vehicle is that of a network, which means discrete mathematicians are well positioned to aid this important research. Moreover, many cellular process are explained in terms of optimization, i.e. maximizing growth. This especially positions those studying optimization and operations research to advance our understanding of cellular biology. We discuss the link between systems biology and optimization, present several research problems, and interpret recent numerical results. The opportunities are vast and include both theoretical and numerical research. (Received January 12, 2007)