Winfried Just
Department of Mathematics, Ohio University
Athens, OH 45701, USA
e-mail: mathjust@gmail.com

Discrete *vs.* indiscrete models of network dynamics

A key step in modeling biological network dynamics is the decision whether to use a stochastic process, a system of differential equations, or a discrete dynamical system. This step in the modeling process poses both special challenges and special opportunities for undergraduate teaching. The challenge is that performing this step requires familiarity with a number of different areas of mathematics, which cannot be taken for granted in undergraduate teaching. Moreover, undergraduates tend to view mathematics as neatly compartmentalized into subdisciplines, each with their own set of standard word problems. The opportunity is for leading students beyond this view and giving them a taste of *bona fide* mathematical modeling where the tools need to be chosen depending on the system and available computational resources. Moreover, one can introduce quite sophisticated mathematical concepts from a variety of areas of mathematics along the way.

This presentation will illustrate the potential of this approach based on ODE and discrete models with finite state spaces for certain networks. We will investigate conditions under which the coarse-graining via discrete models is a valid modeling approach and give examples of open problems that can be explored as undergraduate research projects.