**DynBio: An Educational Application to Facilitate the Instruction of Mathematical Modeling in Biology**

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**Introduction**

Mathematical biology is to a large extent the modeling of interaction networks and their formulation as differential equations. Teaching mathematical biology on an undergraduate level presents a two-fold problem:

1. Students are uncomfortable with the formalism of differential equations.
2. Educators face the problem of being limited in the concepts that they can teach students with little formal background.

To date, various modeling software exist [1] to model interaction networks, predominantly targeted at scientists [2-5]. None of the existing software puts emphasis on the student and educator relation. Thus, we have developed an application called DynBio that is geared to facilitate easy modeling of networks. Direct visual feedback of the network, plot over time and phase diagram of the network and its equations are presented to the student. Additionally, DynBio contains a flexible data structure which allows detection of modeling errors for the student and the easy extension to various network types for educators.

**Case Study (SIR model)**

Biol 2400: Mathematical Models in Biology
- geared towards sophomores with little programming experience

CASE STUDY (from Biol 2400, Spring 2009)

"Imagine there is an outbreak of a disease similar to the avian flu in Northeast Malaysia. There are a number of villages affected by the disease, although it seems that epidemic outbreaks only occur in the largest villages. Your job is to understand why.

- There are between 500 and 5000 people in each village.
- The suspected outbreak involves, initially, a single infected individual.
- The typical villager interacts with ~1% of their village in a typical day.
- It takes approximately 2 weeks to recover once ill (according to prior cases).
- The probability of infection given a contact is very low, .5%.

Does the epidemic depend on village size?"

\[ \frac{1}{r} = 14 \quad r = 0.0714 \]

\[ S(0) > \frac{r}{b} = \frac{0.0714}{0.00005} \approx 1428 \]

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**References**