

Incorporating Biological Problems into Mathematics Courses

A Report on a Non-existent White Paper*

Lester Caudill
Kathy Hoke

University of Richmond
Department of Mathematics and Computer Science

lcaudill@richmond.edu



* For now

What is a “White Paper”?

- A report or guide that often addresses problems and how to solve them.
- WPs are used to educate readers and help people make decisions.
- The thing in the binder is NOT the white paper!

Combining Biology and Math

- Three possible approaches:
 - Incorporate biological applications into existing math courses
 - Incorporate mathematical techniques into existing biology courses
 - Create new “hybrid” mathematical biology/biomathematics courses

Working Group:

- “Incorporating Bio into Math Courses”
- Formed at Quantitative Biology meeting at ETSU, July 2007

Why Work Bio into Math Courses?

- Help students recognize, appreciate, and utilize the interconnections between biology and mathematics
- Prepare biology students for modern quantitative biology
- Prepare mathematics students to support and contribute to modern biological research
- Reflect on what Pat and Malcolm said

Different Levels of Integration (of bio into math courses)

1. Keep math course as it is, but insert biological applications (i.e. “flavoring” an existing course)
2. Adapt the math topics in an existing course to include bio-friendly topics
3. Build a new math course, including only bio-relevant math topics (e.g. math methods for biology)

Four Challenges to Incorporating Bio into Math Courses

- Challenge #1: Not everyone recognizes the importance of doing this.
 - This is true on both sides of the fence.

Four Challenges to Incorporating Bio into Math Courses

- Challenge #2: Competing interests
 - Biologists want to work on the biology courses
 - Mathematicians want to work on the math courses
 - Evidence: Working group memberships

Four Challenges to Incorporating Bio into Math Courses

- Challenge #3: Identifying and utilizing good biological applications of mathematics is difficult to do
 - To identify “new” applications, need people well-educated in both biology and math
 - Even bio-mathematicians usually only know the biology directly related to their research field

Four Challenges to Incorporating Bio into Math Courses

- Challenge #3: Identifying and utilizing good biological applications of mathematics is difficult to do
 - Need real data sets to work with
 - Not many texts available as resources

Four Challenges to Incorporating Bio into Math Courses

- Challenge #4: Implementation issues
 - Possible conflict between adapting course content for biological purposes and maintaining content needed for succeeding math courses
 - Resource issues (faculty dev time, course revision time, team teaching credit)

Addressing the “Four Challenges”

- Challenge #1: Not everyone recognizes the importance of doing this.
 - Not everyone will buy into the idea – THIS IS OKAY! (PR can help)
 - Just need at least one biologist and at least one mathematician

Addressing the “Four Challenges”

- Challenge #2: Competing interests
 - Many of the same math-bio connections will serve both sides, so WORK TOGETHER!
 - Each connection should be good for use in both bio and math courses

Addressing the “Four Challenges”

- Challenge #3: Identifying and utilizing good biological applications of mathematics is difficult to do
 - Work together and share! (e.g. existing courses – see wiki)
 - Need a repository of math applications in biology (More about this later)

Addressing the “Four Challenges”

- Challenge #4: Implementation issues
 - Decide on goals and consequences at the start, then proceed accordingly

Repository of Applications

- Bio-math people contribute applications from their fields of specialization
 - E.g.:
 - Lester contributes applications from bacteria-antibiotic dynamics
 - Edith contributes applications from biostatistics
 - Laurie contributes applications from bioinformatics
 - Each contribution includes biological background
 - Searchable, organized by math topic and by bio topic, with indications of level of sophistication of each

Repository of Applications

- This would be a significant undertaking
 - Requires a curator (not named Lester!)
- Q: Is this something that HHMI, NSF, or NIH would sponsor?

Concluding Remarks

- Begin stimulating audience discussion now...