Interdisciplinary Mathematics

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The Problem

The Mathematics undergraduate degree is in crisis.

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- What can you do with a math degree?
- Most math majors do not end up doing math for their careers;
- Employers who hire math majors do so knowing they must be retrained;
- Most likely, math graduates will be a) part of a team; b) working on problems that are not well formulated; c) working with people with greatly different training, background, vocabulary, and expectations.
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Remark: The professional schools (law, medicine, business, engineering) have figured out how to maintain their academic discipline and yet train students the vast majority of whom do not end up in academics.
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- Broaden the scope of uses of Mathematics.
- If not Mathematics, then where?
Biology in the 21st Century will be for Mathematics what Physics was in the 19th and 20th Centuries.

The increase in computer power and in the size and number of databases has resulted in a tremendous need for mathematically trained individuals to attack problems in the biological/life sciences.
One Attempt at Change

Mathematical Biology at the University of Utah

Program Overview:
The Department of Mathematics at the University of Utah has a research group consisting of 3 faculty, 6 postdoctoral fellows, and 23 graduate students, whose work is at the forefront of mathematical biology research and education.

Research in Mathematical Biology is in four broad areas: Biostatistics, Ecology and Evolutionary Biology, Neuroscience and Physiology. The goal of this effort is to use mathematical reasoning and techniques to gain insights into complex biological phenomena.

A more complete description of the program is given in the links listed on the right.
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• What the grants do:
  IGERT: Supports beginning students for two years to begin interdisciplinary training and research.
  RTG: Supports REU’s, advanced students, and postdocs for interdisciplinary research.
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- Summary: We are deliberately trying to change graduate education and the research culture.
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- Students are broadly exposed to many areas of biology.
- Graduates get jobs.
- Modern biology is exciting. Students work on cool stuff (that they can talk about at parties).
Challenges/Difficulties

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- Biologists don’t know what to do with a math graduate student.
A few words about words

A big difficulty in communication between Mathematicians and Biologists is because of different vocabulary.

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- to divide - find the ratio of two numbers (Mathematician)
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• to *divide* - replicate the contents of a cell and split into two (Biologist)
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And so it goes with words like germs and fiber bundles (topologist or microbiologist), cells (numerical analyst or physiologist), complex (analysts or molecular biologists), domains (functional analysts or biochemists), and rings (algebraists or protein structure chemists).
Topics of (sometimes heated) Discussion

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Rodney, you are not alone. – p.12/13
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2. Problem formulation;
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2. Problem formulation;
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4. Mathematical Experimentation;
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1. Problem identification;
2. Problem formulation;
3. Problem solving tools;
4. Mathematical Experimentation;
5. Theorem/Proof (only a small part of what makes a mathematician!)
Conclusion

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