Integrating quantitative reasoning in biology education: Making the science more authentic and the learning more robust

Louis J. Gross

National Institute for Mathematical and Biological Synthesis

Departments of Ecology and Evolutionary Biology and Mathematics, University of Tennessee, Knoxville

Sam Donovan

Department of Biological Sciences
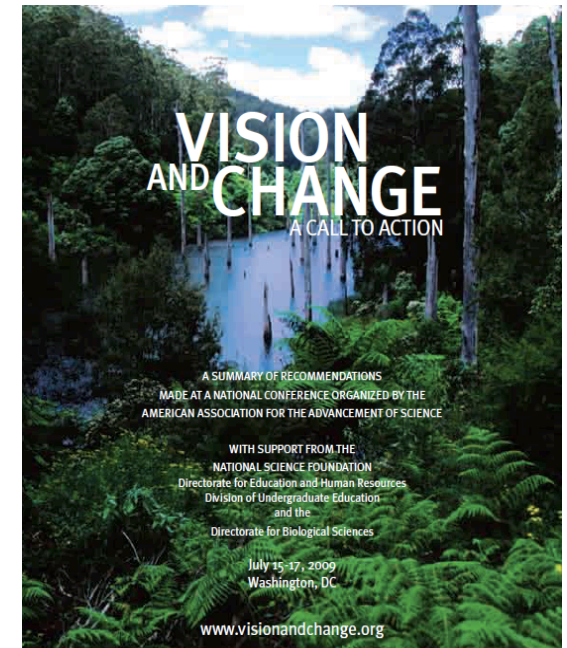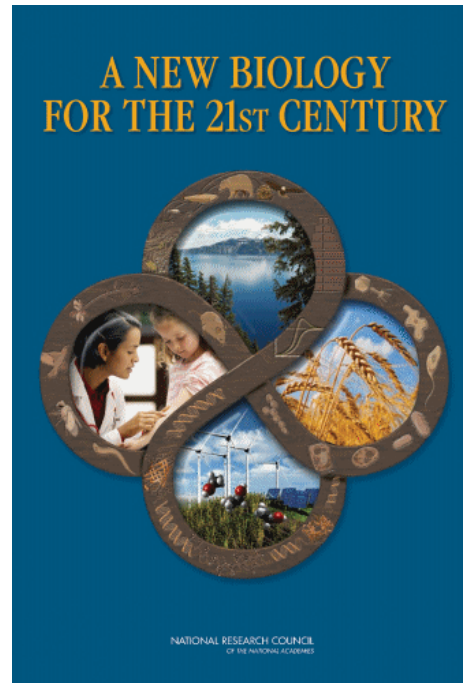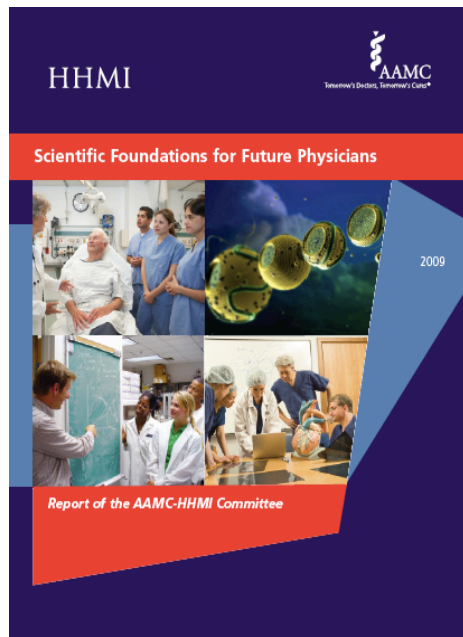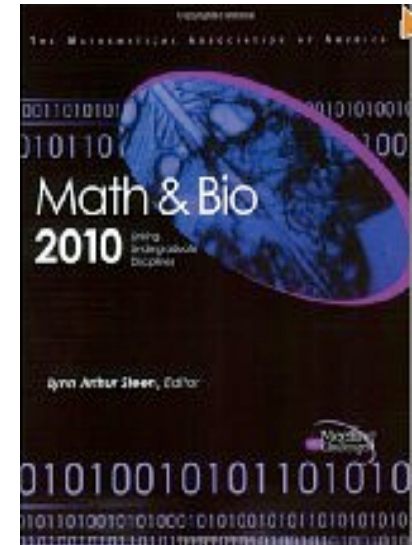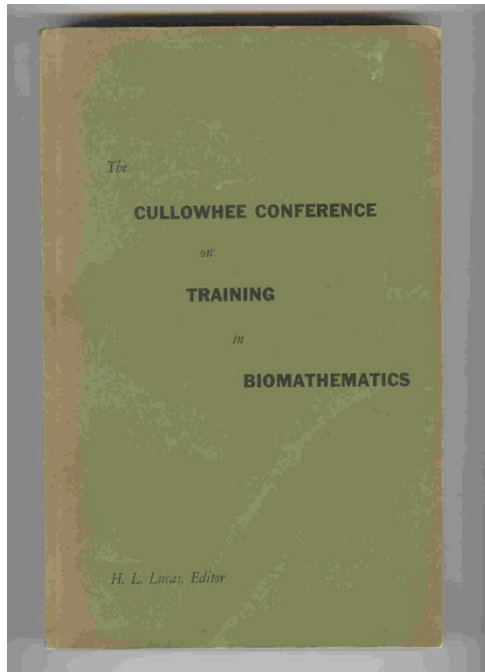**University of Pittsburgh**

Outline of Workshop

- **Brief background on quantitative biology education**

- **Working session on R with example dataset**

- **Introduction to Data Science through GapMinder**

- **Lunch – breakout discussion groups**

- **Working session on Netlogo as a modeling tool**

- **Working session on Modules in Intro Bio**

- **Wrap-up consulting session**

Learning Objectives

- See how intro bio courses fit in the broader quantitative biology education context across the curriculum

- Obtain some basic skills in the use of a standard data analysis tool (R)

- Obtain a conceptual understanding of agent-based models and how a well-developed tool (Netlogo) can be used in various educational settings

- Consider how other tools (Gapminder, Modules) can enhance active–learning

- You are not alone – sharing expertise and experiences to incorporate quantitative concepts and skills in your teaching

NIMBioS
National Institute for Mathematical
and Biological Synthesis

Reports and more reports:

The CULLOWHEE CONFERENCE *on* TRAINING *in* BIOMATHEMATICS

H. L. Lucas, Editor

BIO 2010

Transforming Undergraduate Education for Future Research Biologists

NATIONAL RESEARCH COUNCIL

Math & Bio 2010

Lynn Arthur Steen, Editor

HHMI   AAMC

Scientific Foundations for Future Physicians

2009

Report of the AAMC-HHMI Committee

A NEW BIOLOGY FOR THE 21ST CENTURY

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

VISION AND CHANGE
A CALL TO ACTION

A SUMMARY OF RECOMMENDATIONS
MADE AT A NATIONAL CONFERENCE ORGANIZED BY THE
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

WITH SUPPORT FROM THE
NATIONAL SCIENCE FOUNDATION
Directorate for Education and Human Resources
Division of Undergraduate Education
and the
Directorate for Biological Sciences

July 15-17, 2009
Washington, DC

www.visionandchange.org

AAAS

Training Fearless Biologists: Quantitative Concepts for all our Students

1. Rate of change
2. Modeling
3. Equilibria and stability
4. Structure
5. Interactions
6. Data and measurement
7. Stochasticity
8. Visualizing
9. Algorithms

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National Institute for Mathematical
and Biological Synthesis

MathForTheLifeSciences.com

Princeton University Press – Aug. 2014

Lessons from Calculus Reform

Rule of Five:

Symbolically

Graphically

Numerically

Verbally

Data-driven (from observations)

What have we learned from all these efforts?

Many model programs developed;

Lots of new curricular material;

Biologists more attuned to quantitative approaches;

Education research provides guidance on what really works.

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Undergraduate Mathematics for the Life Sciences: Models, Processes, and Directions

Glenn Ledder, Jenna P. Carpenter and Timothy D. Comar (editors)

Mathematical Association of America Notes (2014)
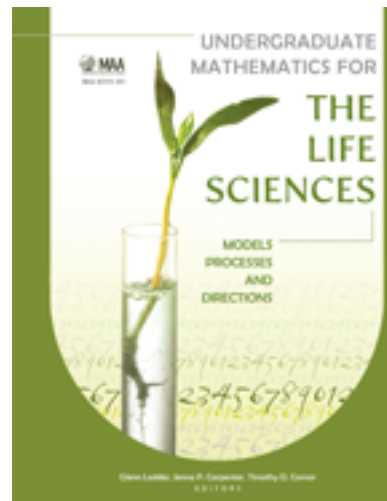
What broad lessons are there for our community?

- Life sciences are inherently integrative
- Undergraduate programs not adequately preparing students.
- Opportunity to reconsider the entire undergraduate life science curriculum.
- A move away from calculus and towards statistics as a life science requirement

QUBES

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FEATURED IN COMMUNITY

Leading Students and Faculty to Quantitative Biology Through Active Learning

FEATURED IN RESOURCES

Teaching Exponential and Logistic Growth in a Variety of Classroom and Laboratory Settings

NEWS AND EVENTS

JAN 17, 2015
American Fisheries Society Internship Opportunity for HS Students

FEB 27, 2015
An In-Depth Introduction to Using R for HPC

JUN 03, 2015
iDigBio API Hackathon - RSVP 2/28, to be held

QUBESHub.org