Preface

This volume contains twenty-six articles on mathematics pedagogy for life science students, representing twenty-two institutions from large research universities to community colleges. While many of the articles discuss projects designed to fit a particular niche at a particular institution, each emphasizes lessons learned that could be applied elsewhere. The articles are sorted into three themes, Models, Processes, and Directions, as described in the General Introduction that follows the table of contents, and in the editorial introductions to the three parts. Curricular development in mathematics for biology is occurring at a variety of levels, including advanced undergraduate courses, interdisciplinary courses, alternatives to the standard calculus sequence, and complete curricula. Articles in the Models and Processes sections focus on curriculum projects on one of these levels. The division of the articles into two groups was motivated by the observation, made by many of the authors, that successful innovation in mathematics pedagogy for biology requires more than a good pedagogical idea. Several excellent projects have failed to become established because they could not attract sufficient enrollment or have fallen into disuse because they could not be institutionalized. We wanted to present them as outstanding models while addressing the reasons for their failure.

For the most part, articles in the Models section focus on the details of a curricular model, while articles in the Processes section focus on the issues involved in implementation. Some articles were written as a pair, one in each section, while others address both themes and were placed in whichever section seemed most appropriate; the connections are noted in the general introduction and the editorial introductions. Articles in the Directions section propose changes in emphasis and topic selection. We hoped to have articles on assessment of curricular projects as well, but we were unable to find any assessment results that we thought were sufficiently robust and exemplary to warrant inclusion as separate articles. A few of the articles contain assessment results, but there is clearly a need for assessment of curriculum projects that is only beginning to be met.

Each article begins with a brief summary of the institution and the students involved in the project; where possible, each indicates additional information accessible on the web. Other web resources can be found through the BIO SIGMAA and Bioquest web sites.

Many of the curriculum projects discussed in this volume started as responses to the publication in 2003 of the BIO2010 report of the National Academies. The report recommended improvements in the quantitative education of research biologists. It received some criticism from a small number of biologists who believed (incorrectly, in my opinion) that it was aimed primarily at medical research, but it was largely endorsed by biologists and thoroughly embraced by mathematics educators. “All” that remained was to implement its recommendations.

The Mathematics Association of America (MAA) published *Math and BIO2010*, edited by Lynn Arthur Steen, in 2005. It consists primarily of essays with suggestions for mathematics curriculum reform, but has very few concrete examples of successful programs. Simultaneously, a growing number of mathematics faculties began addressing problems of curriculum reform for their own institutions, and some textbooks from these projects were published in the first few years after *BIO2010*.

Mathematics curriculum development for biology expanded in 2006 with two developments. The first was that the planners for the Joint Mathematics Meetings (JMM) of 2007 found themselves with three distinct proposals for contributed paper sessions on mathematics education for biology. Two were consolidated, resulting in two distinct sessions. One was organized by Elton Graves of Rose-Hulman Institute of Technology; I organized the other with Jack Bookman, James Fulton, and Yajun Yang. The second development was the founding of the Biology Special Interest Group of the MAA (BIO SIGMAA) by Eric Marland of Appalachian State University. I was among the people invited by Eric to help form the group. I suggested that BIO SIGMAA’s first action should be to sponsor my contributed paper session, which resulted in my selection as the first Program Director of BIO SIGMAA.

The mathematics-for-biology sessions at JMM 2007 were a great success. My session had so many contributors that it had to be broken into three parts. Though some parts were scheduled at undesirable times, the talks were well attended, with audiences ranging in size from twenty participants to more than fifty. The mathematics-for-biology sessions also caught the interest of people involved in publishing. Shortly after JMM 2007, I received offers for publications from *PRIMUS*[1] editor Brian Winkel and MAA Notes editor Steve Maurer. After discussions with the other JMM contributors, we arrived at a plan—I would edit a *PRIMUS* issue on ideas of small scope that could be implemented within the context of an individual course, and Jenna Carpenter and Tim Comar would join me in editing an MAA Notes volume on projects at the course and curriculum levels. The *PRIMUS* issue, published in January 2008, consisted of invited papers based on talks in my JMM session.

Jenna, Tim, and I planned this volume with help from Eric Marland. It was Eric who suggested that we should look for articles that would describe curricular models, discuss the curriculum change process, and suggest directions for the future. This led to the structuring of the volume in parts devoted to models, processes, and directions.

Some of the contributions for this volume were solicited from leaders in mathematics education for biology, but we also wanted to cast a wide net. We used the BIO SIGMAA listserv to send out a call for papers. This brought us a large number of proposals for articles, resulting in the twenty-six papers in this volume. The papers offer the reader a wealth of accumulated experience.

It appears likely that mathematics curriculum development for biology students will affect an increasing number of educational institutions. However, it is difficult to move from a good idea to an accepted course or curriculum. Models that meet the needs of one institution may not work for others. New courses or curricula need to be tested and refined at their own institution. For this reason, each article begins with a summary of the facts about the program and the institution. To the reader who is struggling with mathematics curriculum development for biology students, these articles offer an opportunity to make use of the experiences of those who have already faced the same challenges.

My co-editors and I want to acknowledge the valuable assistance of Steve Maurer and the team of reviewers that read through the articles. They had a lot of work to do with the first draft, owing to the lack of experience of the volume editors, but their critiques resulted in extensive changes for the better. While this volume has taken a long time to reach print— because of the large number of people and revisions involved—the extra time has allowed many articles to discuss how the projects changed over time. We hope that the information presented in this volume will inspire a new generation of successful curriculum models.

Glenn Ledder
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[1] *Problems, Resources, and Issues in Mathematics Undergraduate Studies*