Preface

The "call for change" issued by the Board of Governors of the Mathematical Association of America (in *A Call For Change*, 1991) may appear at first glance to be only about the mathematical preparation of teachers, as its subtitle proclaims. But two ingredients combine to give it much broader scope. First, the logic of change is rooted in insight into how all students learn, and is not limited to those few who are preparing to be teachers of mathematics. Second, the call extends to the entire undergraduate curriculum since most students preparing to be secondary school teachers take mathematics courses alongside all other students. Thus *A Call for Change* heralds sweeping reform in all aspects of collegiate mathematics.

Heeding the Call for Change provides the first in a series of challenges concerning where and how to begin the process of change. The themes covered in this volume are quite diverse, ranging from disciplinary discussions (e.g., statistics, geometry) to curricular systems (e.g., the undergraduate major), from administrative concerns (e.g., assessment) to policy debates (e.g., multiculturalism). Yet beneath the surface of these varied papers lie many of the fundamental themes found in *A Call for Change*: that instruction needs to become an active, constructive process in which students learn to communicate about mathematics, to build mathematical models, and to connect mathematical ideas with the world around them.

Chapters in this volume are diverse not only in subject, but also in source. Five chapters (on statistics, quantitative literacy, geometry, environmental mathematics, and assessment) are the products of electronic e-mail Focus Groups. These groups were established by the MAA as a strategy for generating and recording informed debate on topics of current interest. Each group operated for a period of approximately two or three months under the leadership of a moderator, who subsequently prepared a report from the group based on the record of e-mail discussion. Many of the chapters contain appendices that help provide a more complete record of the issues under discussion.

Two other chapters are more journalistic in spirit, each being a report based on telephone interviews and written documents in two areas of lively debate—multiculturalism and educational research in collegiate mathematics. The final two chapters are reprints of important MAA reports that have appeared previously in other more ephemeral sources: the 1990 report *Challenges for College Mathematics* of MAA and the Association of American Colleges (AAC), and the 1991 report of CUPM on the undergraduate major.

The opening chapter, *Teaching Statistics*, brings to the surface the need for change in approach to instruction—less lecture, more exploration—and in emphasis of curriculum—more data, less theory. Moderator George Cobb is Dean of Studies and Professor of Statistics at Mount Holyoke College and chair of the joint Committee on Statistics of the MAA and the American Statistical Association (ASA). A related report from a 1990 workshop organized by Robert V. Hogg is reprinted in an Appendix.

Tomorrow's Geometry, moderated by Joe Malkevitch of York College, reveals the enormous gap between the rich intellectual resource of contemporary geometry and the barren soil of typical college geometry courses that are aimed at preparing students to teach traditional high school geometry. An Appendix to this chapter provides a comprehensive outline of possible new curricula for college geometry courses.

Environmental Mathematics, the third in the discipline triad, introduces an entirely new field of emphasis for undergraduate courses in mathematical modelling, a field of immense interest to students and of great importance to us all. Moderator Ben Fusaro of Salisbury State University is chair of the MAA Committee on Environmental Mathematics. A report from *The Chronicle of Higher Education* on environmental mathematics that was presented at the January 1992 AMS/MAA meeting in Baltimore is reprinted in an Appendix.

Reaching for Quantitative Literacy surveys the many approaches and arguments that surround the vexing question of what mathematics all college graduates should be expected to know. This issue takes on greater importance and difficulty as new standards work their way into school mathematics. As is clear from this Focus Group discussion, it is difficult to frame college expectations in a form that both extends the new school mathematics standards and also is realistically achievable in colleges. Moderator Linda Sons of Northern Illinois University chairs the CUPM Subcommittee on Quantitative Literacy.

In *Multiculturalism in Mathematics: Historical Truth or Political Correctness?*, Allyn Jackson surveys the implications for mathematics (and the attendant controversies) of the efforts to teach mathematics with a more international and less "Western" flavor. Advocates and critics debate the merits of relating the mathematics curriculum to students' cultural or ethnic origins. The issue of multiculturalism, already of great urgency in the humanities, may soon be more widely debated in mathematics departments as well.

Assessment of Undergraduate Mathematics moves even further into the policy arena, examining the goals and objectives of program reviews that are suddenly becoming *de rigueur* in colleges and universities across the nation. The importance of measuring what is of value rather than what is available becomes clear as one reads the comments of these Focus Group participants, including both mathematicians and administrators with considerable wisdom and expertise in program assessment. Moderator Bernard Madison is Dean of the Fulbright College of Arts and Sciences at the University of Arkansas, Fayetteville, and chair of the CUPM Subcommittee on Assessment. An Appendix reprints a seminal article on assessment by Grant Wiggins which every mathematician and department chair should read.

Untying the Mind's Knot, similarly, is about matters of controversy—about whether educational research that seeks to understand how college students learn mathematics leads to fundamental principles that stand the tests of objectivity and replicability normally associated with traditional research. Reporter Barry Cipra reflects in his analysis on the various schools of thought concerning the value of educational research on undergraduate mathematics, and on the likelihood that results of this research can actually improve instructional practice. An Appendix contains the report of an MAA-sponsored conference on this subject held in November 1991, including several recommendations for action by the MAA and other professional societies.

The final two chapters provide contemporary recommendations on the content and context of the mathematics major. The first, *Challenges for College Mathematics: An Agenda for the Next Decade*, is the 1990 report of the MAA-AAC Task Force on Study in Depth that discusses issues of departmental climate, community, and culture that are ingredients of successful undergraduate programs in mathematics. The second, *The Undergraduate Major in the Mathematical Sciences*, is a 1991 report of CUPM that gives detailed advice about curriculum, tracks, and assumptions that should undergird any sound mathematics major.

Each chapter in this volume highlights many options for constructive change; most also offer specific suggestions for improvement in curriculum or instructional practice. They provide not a blueprint but a general framework within which much needed improvement in undergraduate mathematics can take place. Departments that begin to explore the ideas found in the chapters of this volume will indeed be heeding the call for change.

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