Editorial

Scholarship in the Chemical Sciences and Engineering

The Board of Directors of the American Chemical Society recently endorsed the broad definition of scholarship in the Statement on Scholarship in the Chemical Sciences and Engineering on this page. The statement reflects similar ones that have recently been endorsed and promulgated by other scientific and engineering disciplines. I have touched on issues that prompted it in several earlier editorials (*1*). The ACS has taken an important step that will benefit each of us individually, our discipline, our students, and society at large.

Statement on Scholarship

In addition to discovery research, scholarship in the chemical sciences and engineering includes the integration, application, and teaching of chemical sciences and engineering principles and practice. This expanded definition recognizes that valuable scholarship in any of these areas requires originality, creativity, a thorough grounding in the previous accomplishments of other scholars, and effective communication of new contributions in peer-reviewed publications.

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Readers of this ACS statement should be aware of the context within which it was generated. A number of reports published in the last decade made major contributions. One is *Scholarship Reconsidered: Priorities of the Professoriate* (*2*), in which Ernest Boyer identified three "new" scholarships, complementary to and coequal with what he called the "scholarship of discovery" and the ACS statement calls "discovery research". These are

- Scholarship of integration: putting isolated facts into perspective, making connections across disciplines, placing specialized areas into larger context, revealing the meaning within data.
- Scholarship of application: bringing knowledge to bear on consequential problems and providing service to society outside academe.
- Scholarship of teaching: transmitting knowledge and, in addition, transforming and extending it.

These short statements, and more detailed descriptions in *Scholarship Reconsidered*, significantly amplify the meaning of "integration, application, and teaching" in the ACS statement.

More background is provided by *Shaping the Future* (*3*), in which the National Science Foundation identified "The lack of adequate rewards for improvements in education" as the greatest single barrier to reform of undergraduate science, mathematics, engineering, and technology (SME&T) education. For some, discipline-wide consensus that it is crucially important to provide all students with access to excellent undergraduate education in SME&T disciplines might be sufficient reward. Others would doubtless include more tangible indicators such as salary increases, tenure, honors, prestige, and monetary support for new educational initiatives on their lists. *Shaping the Future* concludes that inadequate rewards are largely responsible for current failings of undergraduate SME&T education: too many courses that students regard as dull and unwelcoming; too many teachers entering classrooms without real understanding of the essence of science and mathematics; and too many students leaving campuses without the skills and motivation needed to continue to learn and to solve real problems cooperatively.

The ACS statement also draws upon the Report of the Task Force on Chemical Education Research that appeared in this *Journal* in October 1994 (*4*). That report clearly delineates the characteristics of research in chemical education and provides guidance for colleagues, department heads, and others charged with evaluating the quality of scholarship in teaching chemistry. Chemical education research should be based on theory, it involves careful observation and collection of data, it can produce general results, and those results can be peer reviewed and published—a fact that has often been demonstrated in the pages of this *Journal*. Published conclusions and descriptions of innovations that have been proven successful are very useful to *JCE* readers who design and implement environments within which students can learn chemistry.

The ACS's official endorsement of the broader range of scholarly activities embodied in the Statement on Scholarship in the Chemical Sciences and Engineering is a significant milestone along the road toward improved chemical education. It is now up to us, as educators and chemists, to apply originality and creativity to the body of knowledge collected by previous scholars in our field, thereby conceiving, implementing, and evaluating innovations whose success we can communicate to the discipline at large.

Literature Cited

1. Moore, J. W. *J. Chem. Educ.* **1997**, *74*, 741. Moore, J. W. *J. Chem. Educ.* **1997**, *74*, 1381. Moore, J. W. *J. Chem. Educ.* **1998**, *75*, 935.
2. Boyer, Ernest L. *Scholarship Reconsidered: Priorities of the Professoriate*; Carnegie Foundation for the Advancement of Teaching: Princeton, NJ, 1990.
3. Advisory Committee to the National Science Foundation Directorate for Education and Human Resources. *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology*; NSF 96-139, 1996; Executive Summary, NSF 96-141, 1996. *http://www.ehr.nsf.gov/ehr/due/documents/review/96139/start.htm* (accessed Sep 2000).
4. Task Force on Chemical Education Research. *J. Chem. Educ.* **1994**, *71*, 850.