AMERICAN CHEMICAL SOCIETY
LEGISLATIVE AND GOVERNMENT AFFAIRS
1155 Sixteenth Street, NW Washington, DC 20036 Phone: 202-872-4386 www.chemistry.org/government

Scholarship

As stated in a National Research Council report, "…research is a process for obtaining information, and scholarship is a process for converting information into knowledge."[1] Scholarship requires originality, creativity, a thorough grounding in the previous accomplishments of other scholars, and effective communication of new contributions, making them available for analysis, critical review, refinement and elaboration by other scholars. Scholarship in the chemical sciences and engineering may include discovery of chemical principles, integration of chemical knowledge within both formal academic and informal public arenas, application of chemical knowledge to new problems and situations, and the study of teaching and learning of chemistry and related sciences.

Advancing the Chemical Sciences in the New Millennium

Science and technology are undergoing rapid and dramatic changes. The National Research Council in its 2003 report *Beyond the Molecular Frontier: Challenges for Chemistry and Chemical Engineering* states that these fields have broadened their scope into biology, nanotechnology, materials science, computation, and advanced methods of process systems engineering and control. The chemical sciences also are becoming integrated with other fields ranging from biology to solid-state physics to electrical engineering. In *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (2006), the National Academies recognize the increasingly multidisciplinary, technologically complex, and collaborative nature of innovation.

Fostering a Higher Level of Innovation

The kind of sweeping change required in response to these reports will not occur until the reward system in higher education recognizes that scholarship includes more than research in its narrowest sense. The Boyer report[2] *Scholarship Reconsidered* led the call for change. Boyer proposed that the traditional faculty roles of research, teaching and service be expanded. He suggested four overlapping and interconnected scholarly categories: discovery, integration, application, and teaching (eventually expanded to teaching and learning).

A subsequent report *Scholarship Assessed*[3] extended the usefulness of the new definitions by laying out the standards that could be used to assess scholarship. Scholarship must have clear goals, show adequate preparation, use appropriate methods, show significant results, exhibit effective presentation, and have a reflective critique.

Rigorous scholarship in discovery, integration, application, and the study of teaching and learning is needed to foster the innovations that will ensure our economic health in a global economy. By endorsing a broader definition of scholarship, ACS will join other professional organizations in many disciplines, including the arts, humanities, social sciences, mathematics,

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engineering, and the sciences, in acknowledging the importance of converting information into knowledge that builds upon and informs the work of others.

Enhancing the Quality of Chemistry Education

Preparing a scientifically literate public and a well-trained workforce that will advance scientific and technical innovations in the new millennium was the focus of the ACS 2003 invitational conference "Exploring the Molecular Vision." The report states that "Chemistry education can only reflect the current practice of chemistry if it also includes: 1) the convergence of chemistry with other disciplines, particularly with biology and physics, 2) the impacts of improved mathematical and computational tools and of interactions through cyberspace, and 3) the relevance of the discipline through engagement with broader society and the promotion of high ethical standards and environmental performance."[4]

Implementing these changes requires that educators not only update and reinvigorate the content of courses, but also determine and exploit pedagogical innovations and best practices. The scholarship of teaching and learning[5, 6, 7, 8] is still perhaps the least understood and recognized of all the forms of scholarship, but has the potential to transform chemical education. It must be encouraged and its role in preparing scientists for the new millennium must be recognized.

The chemistry community must accept and act upon a broader definition of scholarship, rewarding faculty for the wide range of activities needed to bring about a modern and effective research and education infrastructure.[9,10] With original, creative and rigorous scholarly activity that encompasses the entire spectrum of intellectual activities, the chemical sciences and engineering will continue to be at the forefront of innovation.

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[1] *Assessing the Value of Research in the Chemical Sciences*, National Academies Press, 1998, p. 86

[2] *Scholarship Reconsidered: Priorities of the Professoriate*, Ernest L. Boyer, Carnegie Foundation for the Advancement of Teaching, 1990

[3] *Scholarship Assessed: Evaluation of the Professoriate*, Charles E. Glassick, Mary Taylor Huber, and Gene I. Maeroff, 1997, Jossey-Bass

[4] *Exploring the Molecular Vision* - Conference Report, p. 3, 2003, ACS: (http://www.chemistry.org/portal/resources/ACS/ACSContent/education/soced/final%20EMV%20report.doc

[5] "The Scholarship of Teaching," Pat Hutchings and Lee S. Schulman, *Change*, 1999, **31**(5), 10-15.

[6] *Faculty Priorities Reconsidered*, KerryAnn O'Meara and R. Eugene Rice, 2005, Jossey-Bass

[7] "Report of the Task Force on Chemical Education Research," *JCE*, 1994, **71**(10), 850–852

[8] "Milliken Lecture 1998: Building a Science of Teaching Physics," E. Redish, *Am J. Phys*., 1999, **67** (7)

[9] *Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology*, National Science Foundation (NSF 96-139), 1996

[10] Testimony of Nobel Laureate Carl Wieman before Congress, March 15, 2006, www.house.gov/science/hearings/research06/march%2015/wieman.pdf (accessed June 11, 2006)