Outcomes of the Undergraduate Research Summit

Thomas Wenzel, Department of Chemistry, Bates College, Lewiston, Maine 04240

Undergraduate Research Summit

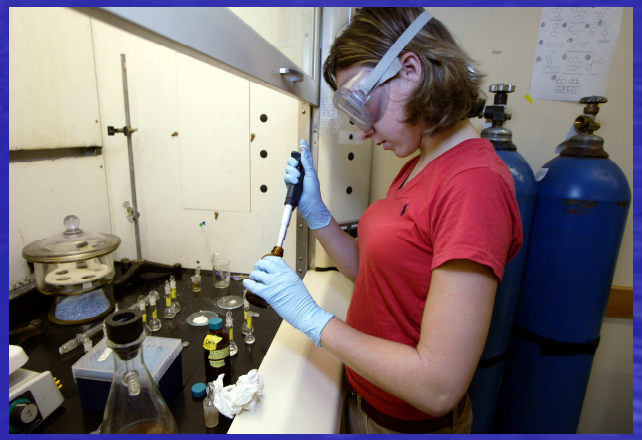
- Concern that PUIs are not responding rapidly enough to the changing landscape of higher education and research
- Steering Committee formed
- Proposal to the Chemistry Division of NSF-Summer 2002
- Spring 2003 – Two symposia at the ACS meeting – Steering Committee met

- Agreement to write a series of ten white papers (full text of these are available on the Summit website)
- Summer 2003 – Summit meeting held at Bates College
- Brought together range of stakeholders to examine issues involved in undertaking research at PUIs
- Report that provides recommendations on how to enhance the quality, productivity, and visibility of chemistry research at PUIs

Topics in the Final Report

- Goals of UR
- Assessment of UR
- Diversifying the Chemical Sciences
- A Research-Supportive Curriculum
- Partnerships and Collaborations

- The Role of Individual Faculty Members in Initiating and Sustaining UR
- Initiating and Sustaining a Departmental Culture of UR
- Creating an Institutional Culture of UR
- Promoting UR



Definition of Undergraduate Research

Undergraduate research is an inquiry or investigation conducted by an undergraduate that makes an original intellectual or creative contribution to the discipline

-Original work

-Peer-reviewed publications

Why do research at a PUI?

- Creation of new knowledge
- Enhanced student learning and intellectual development
- Student socialization into the discipline
- Faculty development and visibility
- Institutional recognition and prestige
  - -Recruitment and retention

Activities that Occur when Conducting Research

- Search and read the literature
- Master equipment and laboratory skills
- Participate in oral and written communication
- Depth of understanding that goes beyond peers

- Design experiments
- Solve problems
- Interpret data
- Think and act like a scientist
- Socialization into the discipline

Research-Supportive Curriculum

- Develops the skills that are needed for successful participation in an independent research project
- Facilitates student participation in research by allowing time and offering credit for undertaking research

Desired Learning Outcomes

- *Knowledge outcomes* – "..particular areas of disciplinary or professional content that students can recall, relate, and appropriately deploy."
- *Skills outcomes* – "the learned capacity to do something – for example, think critically, communicate effectively, productively collaborate, or perform particular technical procedures – as either an end in itself or as a prerequisite for further development

- Affective Outcomes – "..usually involve changes in beliefs or in the development of particular values, for example, empathy, ethical behavior, self respect, or respect for others."
- Learned abilities – "..typically involve the integration of knowledge, skills, and attitudes in complex ways that require multiple elements of learning. Examples embrace leadership, teamwork, effective problem-solving, and reflective practice"

From Ewell, P.T., *Accreditation and Student Learning Outcomes: A Proposed Point of Departure*, Council for Higher Education Accreditation (CHEA) Occasional Paper, Washington, DC, September 2001

- A research-supportive curriculum will necessitate giving up some other requirements in the major

- Adding a research requirement to a packed schedule of instructional courses and laboratories will diminish the gains that can occur through research

A research-supportive curriculum integrates research and research-like experiences throughout, and culminates in a capstone research experience

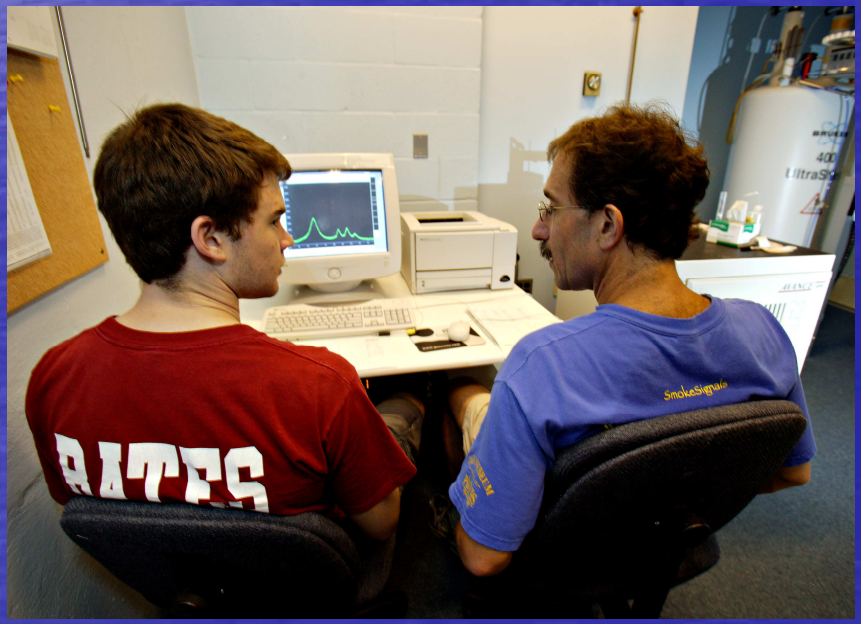
A research-supportive curriculum has the potential to impact favorably the diversification of science

Creating the Time for Students to Conduct Research

- Eliminate and integrate instructional labs
- Free up senior year of any instructional labs
- Reduce vertical/restrictive aspects of the curriculum
- Have fewer requirements and more electives

- Have students in instructional labs with courses undertake actual components of a faculty member's original research

- Have students rotate through faculty members' research projects during the sophomore or junior year



Creating the Time for Faculty Members to Conduct Research

- Incorporate actual research projects into courses
- Create teaching schedules with a day(s) off or with uninterrupted blocks of time
- Assign unbalanced teaching loads in different semesters – one light, one heavier

Research-Supportive Chemistry Curriculum at Bates

- Reduced the number of courses that had associated labs

- Created upper-level integrated labs
  - -emphasis on research-like activities
  - -advanced synthesis or measurement lab
  - -corresponding elective courses

- Senior year free of instructional labs
- Thermodynamics or Physical Biochemistry
- Required senior thesis

My Own Courses

- General Chemistry
  - -designed around a theme
  - -cooperative learning
  - -semester-long project
- Upper-level separations course
  - -cooperative learning
  - -semester-long project

Acknowledgment

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