Outcomes of the Undergraduate Research Summit

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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
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”
• 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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