



THE MERIT OF UNDERGRADUATE RESEARCH: A Confluence of Student, Faculty, and Institutional Rewards

Kerry K. Karukstis



Professor of Chemistry, Harvey Mudd College
President, Council on Undergraduate Research



National Academies - Partnerships for Emerging Research Institutions Workshop



Council on Undergraduate Research

- A **national organization** of individual (≈ 3000) and institutional members (> 510) representing all disciplines and over 900 institutions of all types
- **Seven disciplinary divisions:** Biology, Chemistry, Geosciences, Mathematics & Computer Science, Physics & Astronomy, Psychology, Social Sciences
- **Two multidisciplinary divisions:** At-Large and Undergraduate Research Program Directors
- **National office** in Washington, D.C. with **Executive Officer** Dr. Nancy Hensel and 24 councilors per division

The mission of the Council on Undergraduate Research is to support and promote high-quality undergraduate student-faculty collaborative research and scholarship.

CUR's Focus : Faculty Development

Promoting and supporting undergraduate student-faculty
collaborative research and scholarship

MEETINGS

National Conference

CUR Dialogues

Institutes

Posters on the Hill

Regional Workshops on
Institutional Undergraduate
Research

SERVICES

Consulting Service

Mentor Network

CUR Fellows Awards

CUR List-serve

Undergraduate
Researchers' Graduate
School Registry

PUBLICATIONS

CUR Quarterly

"How To" Series

Specialized Volumes

HARVEY MUDD

C O L L E G E

- Private liberal arts college of science and engineering
- One of 5 UG colleges in Claremont Colleges consortium
- 730 students, 80 faculty
- All majors require a senior research research thesis or team-based clinic project
- Active research program throughout the year: Summer 2007 - 170 students and 40 faculty on campus
- About \$3 million/year in external awards to support UR



A Generally-Accepted 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.

Statement developed at a CUR Dialogues workshop in 1997:
Wenzel, T. J., "What is Undergraduate Research?," *Council on Undergraduate Research Quarterly*, 1997, 17, 163.

Undergraduate Research as an Effective Pedagogical Tool

- Greater gains in learning - science/math/logic, problem solving, literature/language/context mastery, and personal initiative and communication skills
- Increased connection to and retention within the major
- Stronger enrollment in graduate education
- Increased employment in major-related fields
- Greater participation in other intellectual opportunities on campus
- Overcoming traditional boundaries for women, students of color, and first-generation students

“Learning through Research” - CUR Tagline

Student Benefits of Undergraduate Research Participation

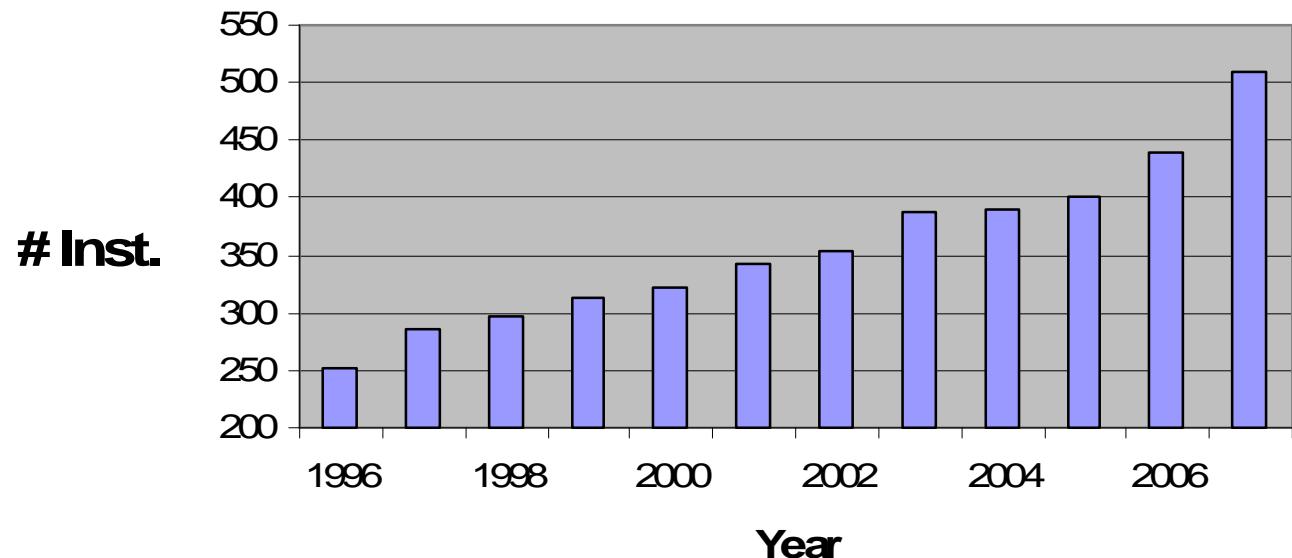
- **Disciplinary learning beyond traditional courses**
 - Learning laboratory techniques in depth
 - Extensive hands-on use of research-grade equipment
 - Seeing the relevance of classes - Application of classroom knowledge and laboratory skills in a research setting
 - Practicing experimental design
 - Significant use of the scientific literature
 - Seeing first-hand how contributions to the scientific knowledge base permit other scientists to build upon one's efforts

Student Benefits of Undergraduate Research Participation

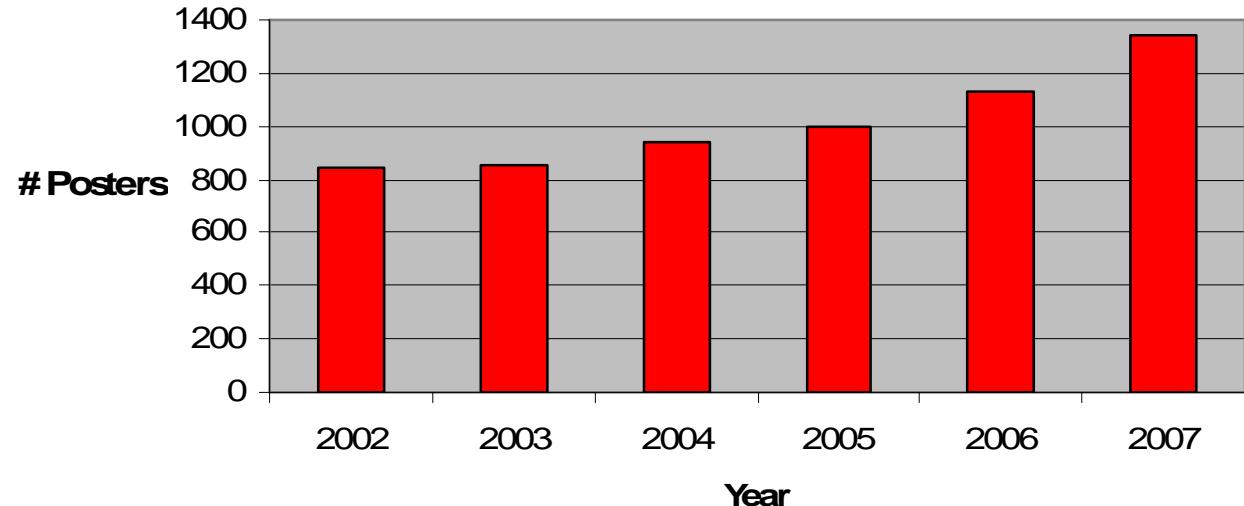
- Professional and personal growth in ways not possible through traditional classroom and laboratory classes
 - Understanding how scientists work
 - Gaining self-confidence
 - Learning how to work independently and collaboratively
 - Learning to tolerate obstacles and be prepared for challenges
 - Learning how to handle uncertainty and to work on problems without clear solutions
 - Aid in deciding future pursuits

Some Measures of Growing Interest in Undergraduate Research

Growth in CUR Institutional Membership



Increase in UGR Posters Presented at National American Chemical Society Meetings



Debating the Merit of Undergraduate Research

WHAT GOOD IS UNDERGRADUATE RESEARCH, ANYWAY?
Chronicle of Higher Education, August 17, 2007

REBALANCING TEACHING AND RESEARCH
T. R. Cech, *Science* 299 165 (2003).

STUDENT RESEARCH: WHAT IS IT GOOD FOR?
Science 293 1614-1615 (2001)

UNDERGRAD RESEARCH MAKES A DIFFERENCE
C. M. Henry, *Chemical and Engineering News* 83 April 25, 2005, pp. 37-38

UNDERGRADUATE RESEARCH AS THE NEXT GREAT FACULTY DIVIDE
M. Malachowski, *Peer Review* 8 (2006)

Origins of the Diverging Views of the Benefits of Undergraduate Research

- A variety of definitions of undergraduate research exist
- Numerous constituencies with different priorities have a stake in undergraduate research (students, faculty, institutions, funding agencies)
- The nature of the research has swung too far toward a “student-driven” activity

It's time to recall that undergraduate research should be a collaborative endeavor of student and faculty mentor.

An Alternative Definition of Undergraduate Research

Undergraduate research is an inquiry or investigation conducted by an undergraduate **in collaboration with a faculty mentor** that makes an original intellectual or creative contribution to the discipline.

This definition revisits the **“teacher-scholar model”** for faculty members and insures that both student and faculty member have a vested interest in the research experience.

“Learning takes place in a community where faculty are committed equally to undergraduate teaching and to their own intellectual vitality, where faculty see students as partners in learning, where students collaborate with one another and gain confidence that they can succeed, and where institutions support such communities of learners.”

***What Works: Building Natural Science Communities
Project Kaleidoscope, 1991.***

Faculty: Our Greatest Investment

“Resources need to be provided on a continual basis throughout the career cycle of faculty members so as to sustain vitality....While it is important to recruit the best individuals possible to join the faculty ranks at any institution, it is perhaps even more important to implement and develop programs targeted towards retraining these faculty and sustaining the professional energies and expertise that caused them to be identified as key individuals to bring into our institutional communities.”

James Gentile
Then Dean of the Natural Sciences at Hope College
Now President, Research Corporation

Faculty Benefits of UR Participation

- Intellectual invigoration, increased enthusiasm, improved teaching
- Personal satisfaction working with undergraduates
- Advances in research program
- Effective means of staying current in one's field



Institutional Benefits of Supporting Undergraduate Research Endeavors

- Enhances intellectual vitality of the institution
- Attracts talented individuals to join a faculty, improving the overall program
- Attracts engaged students
- External funding brings new equipment and facilities
- Leads to more innovative curricula, particularly collaborative and interdisciplinary courses and programs
- Increases opportunities for engagement in national discussions of trends in higher education and new research directions

Undergraduate Research that is:

Faculty-driven
Student-centered, and
Institutionally-supported

Provides the combination of factors

necessary for:

pedagogical effectiveness,
research productivity, and research
program sustainability