

AUGUST 31, 2001

An Undergraduate Education Challenge

The Howard Hughes Medical Institute (HHMI) has issued a challenge to science professors across the United States: Show the same ingenuity in your undergraduate teaching that you do in your scientific research. HHMI announced today that it plans to award \$1 million each to 20 research scientists on the basis of their plans to transmit the excitement and values of scientific research to undergraduate education. Those selected will become "HHMI Professors" and receive 4-year grants of \$250,000 annually to apply their creativity and enthusiasm to undergraduate teaching. HHMI has invited 84 research universities to nominate tenured faculty members to compete for the grants, which it will award in the fall of 2002. Institute President Thomas R. Cech explained why HHMI has issued the challenge. "Research is advancing at a breathtaking pace, but many college students are still learning science the same old way, by listening to lectures in large classes and memorizing facts from textbooks," he said. "We wish to empower scientists at research universities to become more involved and come up with really innovative ideas that 'break the mold' and take a fresh look at science education." HHMI has kept the guidelines for the new awards flexible, to encourage applicants to be as creative as possible. The nominated scientists might propose, for instance, to teach freshman science courses in a laboratory setting, use the Internet to create new learning materials, establish interdisciplinary research teams that include undergraduates, mentor postdoctoral fellows in how to teach undergraduates effectively-or something else entirely. "HHMI seeks to develop a cadre of scientist-educators who will become leaders in undergraduate teaching as well as research," Cech explained. "The HHMI Professors and their teaching strategies will serve as models for fundamental change both on their own campuses and elsewhere, helping to support and encourage research universities in their efforts to enhance undergraduate education. We don't know what to expect in the proposals, but we do expect them to be exciting." This is the first time that HHMI will award undergraduate science education grants to individuals. Through its undergraduate biological sciences education program, HHMI has awarded \$476 million since 1988 to colleges and universities to enhance life sciences education, notably by expanding undergraduate research opportunities, adding new courses and faculty, and reaching out to the K-12 education community. The Howard Hughes Medical Institute is a medical research organization whose principal mission is the conduct of biomedical research. Approximately 340 Hughes investigators conduct medical research

in HHMI laboratories at 72 of the nation's leading research centers and universities. Through its complementary grants program, HHMI supports science education in the United States and a select group of researchers abroad.

Background: Undergraduate Science Education at Research Universities

The Problem

- Undergraduates who study science at research universities often find themselves in large lecture halls being taught by the most junior faculty. Their interaction tends to be limited with the prominent research scientists who helped the university earn its reputation.

- The 2001 National Survey of Student Engagement reports that only 25 percent of seniors across all majors at doctoral-intensive universities work with professors on research outside of course requirements. (George D. Kuh, professor of higher education, Indiana University at Bloomington and director of the

[National Survey of Student Engagement](#)

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- Many undergraduates take no more than one year of science, often in introductory courses. (National Research Council, "

[Transforming Undergraduate Education in Science, Mathematics, Engineering and Technology](#)

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- The nation's research universities comprise only 3 percent of all institutions of higher learning, yet they confer 32 percent of all baccalaureate degrees and 56 percent of the baccalaureates earned by students who go on to graduate study in science and engineering. (

[The Boyer Commission on Educating Undergraduates in the Research University](#)

, 1998.)

Causes of the Current Situation

Why don't researchers spend more time teaching undergraduates? The Boyer report notes that:

- Tenure and promotion decisions tend to be based almost entirely on research and publication rather than on teaching.
- National scientific meetings rarely offer sessions dealing with effective teaching. When they do, the sessions are often poorly attended.
- University budgets usually adhere to the principle of departmental hegemony. As a result, interdisciplinary collaborations that might include undergraduates often are doomed for lack of departmental sponsorship.

Possible Solutions

The Boyer Commission made several interesting recommendations, including these:

- Reconfigure the freshman year to include a small seminar taught by research faculty who can imbue new students with the excitement of discovery and provide opportunities for intellectual growth.
- Pair undergraduates with mentors as early as possible and maintain those relationships throughout their academic careers.
- Prepare students by their senior year to undertake research of the same character and complexity as that done by first-year graduate students. Even those who do not go on to graduate school will be well served as citizens by learning to solve problems analytically.

Models for Change

- Since 1988, HHMI has awarded more than \$475 million in grants to enhance undergraduate science education. The University of Arizona now considers a faculty member's commitment to undergraduate research in granting tenure. Colgate University has replaced "cookbook" experiments with research that can generate results of publishable quality. Cornell University has created a program that exposes freshmen to research. The University of Miami invites local community-college students to join research teams of its faculty members. (Thomas R. Cech, HHMI president, article in the Chronicle of Higher Education, 2/16/01)
- More than half of all undergraduates at the Massachusetts Institute of Technology take part in an undergraduate research program. (Boyer Commission)
- Undergraduates at the University of Chicago participate in a variety of research projects for which they receive either academic

credit or a salary. (Boyer Commission)

- The Georgia Institute of Technology has committed \$250,000 to help faculty members involve more undergraduates in research projects.(

[Chronicle of Higher Education, 11/17/2000](#)

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- Some universities have developed effective programs to help minority students succeed in the sciences. In a

[recent article](#)

, Freeman A. Hrabowski and Michael F. Summers described their "formula for success" at the University of Maryland Baltimore County.

HHMI's New Program

The Howard Hughes Medical Institute (HHMI) has issued a challenge to 84 research universities to nominate tenured professors with active research programs to compete for \$20 million in grants. Those selected will receive \$1 million each over four years to help "break the mold" in science education and strengthen the ties between researchers and undergraduates. (contact Jennifer Donovan, donovanj@hhmi.org, 301-215-8859)

For program information, contact Mary Bonds, bondsm@hhmi.org (301) 215-8872.