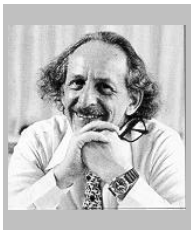

Top-Flight Research At Small Colleges Merits More Recognition, More Support

Reprinted from *THE SCIENTIST*® 7(11):12, 31 May, 1993.

Last month, I had the pleasure of speaking at a Bethesda, Md., meeting of scientists, college administrators, funding agency officials, and others on a subject that has long been of paramount interest to me: the value of undergraduate research at small liberal arts colleges.

The meeting was part of a two-day program cosponsored by the National Institutes of Health, the National Science Foundation, and the Council on Undergraduate Research (CUR). The council's 2,000-plus membership, for the most part, is composed of science faculty and administrators at undergraduate schools throughout the United States. It had organized the event with the aim of stimulating dialogue among its own members and representatives of NIH and NSF on the subject of funding opportunities and grant administration policies as they pertain to the smaller colleges and universities.

Earlier this year in *The Scientist* (Feb. 22, 1993, page 10), CUR's immediate past president, Laura Mays Hoopes, offered cogent, qualitative arguments in support of her recommendation that undergraduates be drawn into "high-risk but low-budget experiments that can launch whole new fields of investigation." I agree that hands-on research is immensely important as a means of encouraging young people to enter and remain in the science pipeline. Moreover, in my own studies I have found that undergraduate institution research, judging by the frequency with which it is cited in subsequent papers, is quite often of very high impact. Thus, it is important not only as a means to an end, but also as an end in itself. In my talk at the meeting, I reviewed some of my findings with the audience, and was therefore able to provide a quantitative complement to Hoopes's views.

Several years ago, at the Institute for Scientific Information, we did a citation analysis of the Oberlin Group—50 small colleges that produce a significant percentage of future Ph.D.'s. (A report on this analysis was published in the Aug. 17, 1987, edition of *Current Contents* under the title "Research and dedicated mentors nourish science careers at undergraduate institutions.") In my talk at the recent gathering, I expanded the analysis to include many more schools—since CUR represents some 600 colleges. I demonstrated that many of these

colleges have also been producing research of higher impact, both short- and long-term, than that produced in many graduate institutions. In other words, the liberal arts schools have proved successful not only in producing science graduates, but also in contributing substantially to the advancement of scientific knowledge.

For example, I showed that the average impact for papers produced at the 74 CUR institutions that were consistently productive between 1981 and 1992 was well above the "world average"—that is, the average impact for all papers indexed by ISI. In fact, two schools—Haverford College and Wellesley College—doubled the world average. Clearly, these undergraduate institutions make a significant contribution to research. These data support the notion that NSF, NIH, and other funding sources would do well to increase support for undergraduate research—and that such support isn't merely a disguised welfare program for talented students.

Laura Mays Hoopes believes that CUR members' "appreciation of research as an integral component of science education explains why we produce more than our share of future scientists." Of course, as a training ground for a substantial proportion of our future scientists, undergraduate colleges make a critical contribution to our research base. However, the contribution they make to published research has not been appreciated. As indicated by my analysis, that contribution is significant—especially remarkable in light of the size, facilities, and funding of these colleges compared with the more comprehensive research universities.

Were NSF and NIH to support much larger numbers of undergraduate projects at all undergraduate institutions, we might really be able to see how much, as Hoopes believes, you learn to become a scientist not by "studying" science—but by "doing" science.