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Constraints on Surface Science Research

Surface science research offers immense and exciting opportunities. It is fair to say that we have only begun to understand what may be regarded as another state of matter which is just as important as the classical solid-liquid-gas triad. But these promising horizons are constrained in many ways, many of which are common throughout academic research programs.

Scientific advances cannot be made without attracting bright and enthusiastic people into scientific professions and facilitating their work. Loss of a single generation of people actively engaged in scientific inquiry has disastrous consequences. Our highest academic priority should be training students in an atmosphere of free inquiry and stimulating research. Too often we use students to do our research with little regard for their intellectual and professional preparation to function effectively after graduation.

Another factor is the influence of sources of research funds on student education. With the trend toward increasing industrial support of university research has come justifiable concern about the extent to which the "research-for-profit" and "proprietary rights" motives will direct such research support and thereby compromise free inquiry and open dissemination. But we should be equally concerned about the extent to which the involvement of the government in university research has, over the years, influenced the training of students. The lion's share of federal dollars for university research comes in the form of grants or contracts for particular projects, which are judged on the basis of scientific merit or the practical needs of government agencies. In this mode of support, the intellectual and professional training of students plays a secondary role.

Moreover, the number of unrestricted graduate fellowships is now near zero, and thus there is little opportunity for undergraduate students to compete for awards that will give them some measure of acclaim and independence early in their careers. This makes students more dependent on project support and is an indirect, but strong, signal that on the national level we have lost interest in promoting graduate training in the sciences. Such signals reach the high schools, where the natural sciences are seldom highlighted as exciting, worthwhile, and important professions. Reinstating a sizable National Science Foundation (NSF) fellowship competition would be relatively inexpensive and could help to counteract this trend.

Demographics also has important implications. Enrollments in advanced degree programs have already dropped. It is expected that there will be a decline of approximately 25 percent in the number of 18-year-olds over the next 20 years. These factors are sure to bring pressure on our centers of graduate education and research, and we must develop long-term policies to ensure continuity in student training.

In surface science, which is naturally interdisciplinary, these problems are compounded. A major commitment by several departments is necessary to assemble the faculty. Even when chemists, physicists, and engineers are all in place, university departmental structures and procedures often impede implementation. The formation of an institute solves some of these problems, but divides loyalties and tends to focus on project research while pushing graduate and undergraduate training into the background.

Another constraint for surface science is due to its heavy reliance on instrumentation. It is foolhardy for a new investigator to attempt to begin a program with capital resources of less than \$100,000. Funding at the appropriate level is difficult even for senior academic investigators. This point can be illustrated by considering fiscal 1981 data from the NSF. For projects in the surface science—heterogeneous catalysis category the average award size was \$66,000 per year, with an average of \$9,600 budgeted for permanent equipment. Principal investigators, reviewers, university administrators, and granting agencies must all face these economic requirements squarely and positively if significant numbers of surface science programs are to flourish.—JOHN M. WHITE, *Department of Chemistry, University of Texas, Austin 78712*