The EWEB project is now being criticized and derided by some people in the Eugene area. Chiefly, this seems to be because the project is linked with the utility's plans to build a 1000-megawatt nuclear plant somewhere in the upper Willamette Valley. The Oregon Environmental Council, a body on which a number of conservation groups are represented, believes that EWEB and other Oregon utilities, encouraged by state and federal authorities, are moving into the field of nuclear power generation precipitously. The council is concerned about possible hazards, such as it fears will arise from persistent low-level emission of radioactive substances or from a catastrophic reactor accident.

Opposition to the proposed plant also has developed among some farmers who are afraid they will lose land to the plant and its 2500-acre cooling lake. The lake is an essential part of the project, for, with the plant scheduled to go on the line in 1976, EWEB cannot gamble on using still hazily formulated and unproved concepts for a closed-loop system to cool plant effluents and serve agriculture simultaneously. Warm water from the lake would be made available for irrigation, but the water used by the farmers would be in addition to the amount the power plant would require for its closed-cycle cooling system.

Opponents of the nuclear plant tend to regard EWEB's warm-water irrigation project as a public relations gimmick. The project, they note, was well publicized during EWEB's highly successful campaign last fall to win the approval of Eugene voters for a $225-million bond issue. Yet the idea for the warm-water irrigation project clearly did not originate within EWEB as a public relations ploy. Miller, of the Vitro Corporation, believes in warm-water irrigation with evangelistic fervor, and he came to the utility with the idea. Promoting it, too, was William Puustinen, a commercial salmon fisherman and a long-time crusader against water pollution. Puustinen is a farmer as well as a fisherman and is one of the seven orchardists taking part in the EWEB project.

The project is encountering some criticism on its own merits as well as on the grounds that EWEB is using it as a public relations device. Some of its critics are University of Oregon professors who believe that the project promises much more than it is likely to deliver—and, further, that it could lead ultimately to health hazards. For example, Howard T. Bonnett, a botanist and associate professor of biology, indicates that the project's claims for providing frost protection are inflated. "This spring was an excellent spring for flower and fruit development," he says. "All orchardists in the Eugene vicinity had excellent crops, whether they were parties to the warm-water experiment or not." Bonnett also questions whether the enormous quantities of warm water—up to 500,000 gallons a minute or more—that a 1000-megawatt plant would be continuously discharging could be used by farmers in the area surrounding it. In the Willamette Valley, he observes, "irrigation is only needed a few months during the year. Frost control [is needed] only a few days a year."

Bonnett's major concern, however, is that an irrigation system using effluents from a nuclear plant would lead to the contamination of plants and livestock. "Numerous radioactive isotopes, such as tritium, are released in the cooling water during normal function of nuclear plants," he says. "The possible dangers of directly providing for the accumulation and concentration of radioisotopes during plant and animal growth, followed by human consumption of such crops, should be carefully studied. This issue is exceedingly complex and may be of overriding importance."

Furthermore, Bonnett, as well as some scientists in the School of Agriculture at Oregon State University, feel that a utility has no business conducting what is essentially an agricultural experiment. While EWEB speaks of its project as a "demonstration," not much is known scientifically about how crops respond to warm water under actual field conditions, nor can one predict yet how warm water will affect insects and plant disease organisms. In the critics' view, research problems of the complexity of those presented by the EWEB project could best be dealt with by a university, which could bring a greater wealth of scientific resources to bear than any utility could, and which might be less likely to have axes to grind.

In sum, by searching for a beneficial use for the heat that is a troublesome by-product of electric power generation, EWEB has taken a forward-looking step; but, if the fears expressed by Bonnett and others have merit, the utility has ventured upon a course beset with more problems and uncertainties than it has imagined.

—LUTHER J. CARTER

Harvard Graduate School: The Elite Response to Enrollment Pressures

Rapid enrollment increases and severe morale problems have led Harvard University to plan substantial reductions in the size of its graduate school of arts and sciences. The faculty, on 6 May, approved a proposal to reduce the overall size of Harvard's graduate school in the next 5 years by at least 20 percent—from its present enrollment of more than 3000 to 2400 students. This plan will begin to go into effect for applicants to the graduate school in the 1970–71 academic year.

The action has potentially wide significance, for Harvard has long been recognized as a pacesetter in American academic circles. Most universities—particularly the publicly supported institutions which must respond to the demands of the taxpayers—will probably continue to expand to accommodate increasing numbers of qualified applicants. But for the elite private institutions, Harvard has suggested that there is another response to the growing hordes of applicants. Instead of opening the gates wider, Harvard has chosen to nudge them closer together.

In a report explaining the reasoning behind this decision, a special Harvard faculty committee said:

> It is sometimes argued that bigness *is* a necessity: that Harvard has a moral and social obligation to the nation to train as many graduate students as possible. To this we reply that there are already many and soon will be more graduate schools far larger in numbers than Harvard could possibly become. We are conscious of Harvard's national obligation, but we believe we must continue to put our em-

phasis upon the high quality of our students rather than upon our numbers. We believe these numbers are already so far inflated that they have begun to affect adversely the quality of our graduate programs.

Harvard's decision was made in accordance with recommendations of a faculty committee—chaired by Robert Lee Wolff, professor of history*—which spent 17 months analyzing the implications of recent rapid increases in the number of students admitted to the graduate school. (The school's enrollment grew from 2321 in 1960–61 to 3106 in 1967–68.) The committee was appointed at the request of Franklin Ford, dean of the Faculty of Arts and Sciences, after faculty members and some graduate students expressed concern over the quality of the graduate program. The committee made some two dozen recommendations concerning the size of the graduate school, admissions policies within departments, financial aid, the quality of graduate student life, policies toward teaching fellows, faculty advisory problems, and other issues. The essence of some of the key proposals was as follows:

1) That the size of the graduate school of arts and sciences be substantially reduced and that this be accomplished by drastically cutting admissions on a departmental level.

2) That professors with an unusually heavy burden of theses-direction should have their loads redistributed so that supervising responsibilities would fall more equitably on all faculty members.

3) That all departments review their present grading practices and curricular requirements to minimize routine requirements, cut down letter-grading, and achieve a greater degree of flexibility in arranging for individually tailored doctoral programs.

4) That the university should provide a substantial long-term guarantee of financial support to all Ph.D. candidates.

In its report, the faculty committee strongly recommended that each department cut its admission levels, beginning in the academic year 1970–71, so that at the end of 5 years the desired overall reduction will have been achieved. The reductions are to be implemented on a department-by-department basis, with some departments encouraged to make more stringent cuts than others, since increases in enrollment have taken place unevenly. The dean of the graduate school, J. P. Elder, will meet annually with each department chairman to negotiate on the number of reductions the department will make in a given year. Elder told *Science* that Harvard handles its graduate admissions almost entirely at the department level and indicated that the departments would be allowed considerable flexibility in their reductions as long as each department chairman cooperates satisfactorily to help the graduate school achieve its overall goal. Whether department heads will cooperate in the program or will resist the cuts and thus undermine the prospects of reducing the size of the graduate school remains to be seen.

Poor Student Morale

In explaining its reasons for recommending the cuts, the faculty committee said that a basic consideration was the problem of poor morale among Harvard's graduate students. "Somewhat to our surprise, we began to realize early in our deliberations that the gravest current problem in the Graduate School is the one summarized by the well-worn but convenient word 'morale,'" the committee said. "A distressingly large number of graduate students find their experience at Harvard disappointing." The committee attributed this poor morale in part to excessive numbers of students, and in part to widespread discontent with the educational system, a general feeling of neglect, a "deep distrust of authority," and a lack of rapport in the academic community. The committee said the "malaise" seemed worst in large departments where the demands imposed by increasing numbers of students upon the resources of the faculty were greatest. In urging that those who wear the shoe should be "consulted about its fit," the committee recommended that the individual departments at Harvard be more responsive to graduate students' needs in order to soften the themes of "belittlement, isolation, and neglect" that "ran contrapuntally through the chorus of complaints."

The committee pointed out that the attrition rate in the graduate school is high—only 50 to 60 percent of all Harvard graduate students who embark on Ph.D. programs actually complete them. The committee also discovered that Harvard faculty members find their graduate students "less gifted and engaging" than their undergraduates. In explaining the poor performance of graduate students, the committee said that, for some of them, admission to graduate school is itself the goal and having achieved it, "they blissfully abandon whatever habits of study may have qualified them for admission." The committee also explained that most students had been in a series of competitions since birth and that "it is perhaps little wonder if some of them have become cynical or have run out of steam."

Another reason for poor student morale, in addition to the problem of size, is Harvard's failure to provide its graduate students with the kind of financial certainty they can be assured at other major institutions. Under current procedures, many holders of Harvard scholarships, particularly in the social sciences and the humanities, are assured financial support for only 1 year and must enter competition each year for scholarship renewal. The committee recommended that Harvard eventually guarantee 5-year support to students who enter on university scholarships and who achieve satisfactory levels of academic performance.

Burden on Faculty

Another source of dissatisfaction, both among graduate students and among professors, is the increased burden that large enrollment places on the faculty. The committee indicated that the number of graduate students has risen almost twice as fast as the number of faculty members during the past 17 years. Not anticipating any large-scale increases in the number of tenured faculty members, the committee predicted, moreover, that when the Vietnam war ends, the pressures on graduate enrollment will be magnified considerably.

The committee also called attention to growing discrepancies in teaching loads and thesis-direction responsibilities among faculty members. Quoting from a survey made recently by another faculty committee, the Wolff committee noted that some Harvard faculty members direct as many as 16 theses while others direct none at all. Figures showed that 56.8 percent of the tenured faculty who responded to the survey questionnaire were directing four theses each or fewer, while 11.5 percent were directing more than 10, and 4.9 percent were directing 16 or more. The committee said, "we are sure that not even the twelve super-

* Other members of the committee include Herschel C. Baker, professor of English; William N. Lipscomb, professor of chemistry; Robert G. McCloskey, professor of American history and government; and Robert W. White, professor of clinical psychology.

men among our colleagues can each effectively direct sixteen theses or more." The committee said that in many cases the individual student "is being shabbily treated" and the individual professor "is courting thrombosis."

In considering solutions to this problem, the committee made a recommendation that could prove alarming to some academicians. The committee recommended that in those cases where, over a period of years, it proves impossible materially to decrease the number of thesis writers in a given field within a department, the department should redistribute its faculty positions and give priority to the overcrowded fields when making new permanent appointments, even at the cost of sacrificing traditional patterns of coverage.

Reactions among the faculty to the Wolff report were mixed. *Science* interviewed a dozen senior faculty members and found that most were in general agreement with the committee's conclusions, but to varying degrees. Some professors found the report self-serving; a reduction in the number of students would mean less work for the faculty in grading papers and supervising projects. Others felt that, with fewer students, less research would be done and important areas of study, especially in the basic sciences, might suffer. Some professors felt that the university is, indeed, neglecting its children by harboring too many of them. Others felt that the quality of education at Harvard is not directly related to the number of students enrolled.

Natural Scientists Dissatisfied

The greatest dissatisfaction was expressed by professors in the natural sciences. Most of the scientists interviewed felt that the natural sciences departments should be allowed to maintain their present size. They noted that scientific research depends more heavily on graduate students than most other academic research does. And they asserted that the natural sciences are "rich" in comparison to the social sciences and humanities, and should be allowed more students because faculty in these disciplines usually have substantial research grants that enable them to finance the thesis writing of their doctoral candidates. Most of the natural scientists interviewed felt that the natural sciences were in less trouble, in terms of growing numbers of students, than the social sciences.

Konrad Bloch, chairman of the chemistry department, said that the Wolff report is a "necessary measure," but he stressed his hope that the chemistry department would maintain its present size, emphasizing a need in the natural sciences for more graduate students to assist with undergraduate teaching. Bloch said that the attrition rate in chemistry is "exceedingly small" and noted that the dropout rate, on the whole, is far smaller in the natural than in the social sciences.

Christopher Jencks, director of Harvard's Center for Educational Policy Research and co-author, with Harvard sociologist David Reisman, of a recent book on higher education, *The Academic Revolution*, told *Science* there is no particular evidence to indicate that reducing the size of the graduate school will reduce the number of problems. He said that in many cases the faculty members who complained of being overworked would continue to be overworked under any system because these professors invariably choose to be more fully involved. Commenting on the widespread student dissatisfaction among graduate students, Jencks said that the faculty could become more responsive to students' needs by choosing new faculty members who would serve as "good models" for students. Jencks believes the solution to student dissatisfaction is less a matter of good teaching than of good advisory qualities. He stressed the need for students to be motivated by intellectuals and emphasized that these motivators need not be "standard academicians" but could well be experts brought in from outside the ivory towers. Jencks commented that he finds Harvard's attrition rate neither surprising nor "necessarily undesirable." One of the greatest problems that graduate students face, he said, is that of being unsure what they want to do and of becoming frustrated at having to focus on a narrow profession.

It is somewhat doubtful that recent steps taken by Harvard's faculty to reduce the size of Harvard's graduate school will set a general trend for other institutions, but some of Harvard's ills —such as overcrowding and increased dissatisfaction with the quality of graduate education—are shared by many universities with large graduate programs. Of the Harvard faculty members interviewed, most expect that the nation's graduate schools will tend, on the whole, to grow to meet the rising demands to educate more students on the graduate level, but they expect that the rate of growth will tend to be much less pronounced at prestigious private institutions like Harvard than at state universities and many second-level institutions.

In adopting the Wolff committee recommendations, Harvard's faculty members decided to place the emphasis at Harvard upon high quality rather than upon large numbers of graduate students. They dissented from the widespread view that bigness in the university is almost inevitable. Instead, they stressed a belief that the moral and social obligations of universities like Harvard lie, not in training as many good graduate students as possible but in training a few excellent ones well.—MARTI MUELLER

APPOINTMENTS

C. Kupfer

F. T. Wall

Carl Kupfer, professor and chairman of the ophthalmology department, University of Washington Medical School, Seattle, to first director of the new National Eye Institute. . . . **Frederick T. Wall**, vice chancellor for graduate studies and research, University of California, San Diego, to first executive director of the American Chemical Society. . . . **Richard C. Dorf**, chairman, electrical engineering department, University of Santa Clara, to dean, College of Engineering and Technology, Ohio University. . . . **Mortimer H. Appley**, head, psychology department, University of Massachusetts, to dean, Graduate School at the university. . . . **Lewis D. Conta**, program director for special engineering programs, National Science Foundation, to dean, College of Engineering, University of Rhode Island. . . . **Fred M. Davenport**, professor, epidemiology and internal medicine, University of Michigan Medical School, to chairman, epidemiology department, School of Public Health at the university.