ing the course of the work, failed to hold formal conferences with Hudson, and received quarterly progress reports from Hudson that "provided very little information on what Hudson had done and what had been accomplished during the reporting periods." Finally, OCD's agreements with Hudson were often not put into writing, so that deviations from the objectives sought by OCD became more likely.

The GAO report recommends tighter administration in all these areas and notes that OCD has already taken steps to correct many of the problems. However, some OCD officials expressed the fear that any effort to define research objectives more specifically might inhibit creativity. And Kahn also argued that a speculative organization like Hudson "must be allowed an unusual degree of freedom to develop its thinking as it goes along." Kahn said Hudson is "only willing to take contracts that provide such scope for what we believe to be necessary to good work of this kind."

Nevertheless, the GAO report contends that objectives can be made more specific without limiting the contractor to specific ways of accomplishing the objectives and "without unduly interfering with the researcher's freedom." Apparently the OCD leadership agrees, for it has issued instructions calling for OCD contract writers to include more "specific" and "definitive" descriptions of work objectives. The GAO expresses the belief that the various measures being taken by OCD "should ensure more useful research studies," but GAO is taking nothing for granted—it plans to "look into the effectiveness of the improved procedures at a later date."

—PHILIP M. BOFFEY

# The Draft: Congress Unlikely To Change Current Policy

Unless the President takes action, which seems unlikely, Congress remains the only hope for modifying the draft regulations that are scheduled to go into effect 30 June. These regulations, issued in early February, end deferments for all students currently graduating from college or completing their first year of graduate school.

Congress, however, does not appear to be inclined to take up the problem of the draft, and, as a consequence, it seems reasonably certain that students are going to make up a sizable portion of military inductees. The Department of Defense (DOD) estimates that more than half of next year's projected draft call of 240,000 men will be comprised of students. What is uncertain and a matter of considerable contention is the numerical effect that this change in draft eligibility will have on graduate enrollments. The Department of Defense's Office of Procurement Policy and General Research estimates that the depletion in male enrollment will not exceed 15 percent. On the other hand, a report released 23 March by the Council of Graduate Schools (CGS) stated that enrollments will be down by 50 to 70 percent from last year. The report, based on a survey conducted by CGS and the Scientific Manpower Commission, a private research organization, predicted that there will be more women than men in first-year graduate classes for the first time since World War II. The survey included 122 graduate schools, representing nearly 40 percent of the total graduate enrollment in the country. The graduate-school officials were asked to give detailed estimates of what their enrollments would be if no draft-eligible men were enrolled next year.

According to one DOD official, the CGS survey is "totally unrealistic." He said it is wrong to assume that every student who loses his deferment will be drafted. "It would be physically impossible to draft all of them," the official said. DOD's estimate of 10- to 15-percent depletion in enrollment is based partly on the assumption that many students who are not drafted this summer will be allowed to start school in the fall and finish the year. However, spokesmen for the National Selective Service Headquarters have said that no provisions have been made, as yet, to permit drafted students to complete the school year before reporting for duty.

In Congress, a bill introduced by Senator Edward Kennedy (D–Mass.) offers little hope that draft policy will be altered this year. Introduced in both the Senate (as S. 3052) and the House (as H.R. 15799), the bill would allow any students who are now vulnerable to the draft to continue their education. The Kennedy bill does not call for the reissuance of graduate-student deferments, but it does seek to avoid a mass induction of students by reversing the order of draft selection. Under the current draft ruling, the oldest available men between the ages of 19 and 26 are drafted first. Since the vast majority of college seniors and graduate students are over 22, they are among the more vulnerable of prospective draftees. The Kennedy bill advocates drafting first the eligible 19- and 20-year-olds, though undergraduates would be permitted to keep their deferments while they are enrolled in college.

However, the Kennedy bill has already encountered formidable resistance, and its supporters are not optimistic about its chances of success. Representative Mendel Rivers (D–S.C.), chairman of the House Armed Services Committee, which has jurisdiction over all proposed draft legislation, told reporters shortly after the Kennedy bill was introduced that his committee did not intend to conduct hearings this session on draft legislation. Rivers, who gave no further explanation, has gone on record several times this year as opposing legislative change of the draft. If changes are to be made, Rivers believes, the law gives President Johnson ample freedom to make them. In a letter to Elvis Stahr, president of Indiana University, dated 1 February, Rivers stated that the President could adopt under the law "a modified young age system"—that is, draft younger men without recourse to legislative action. If Rivers remains unwilling to hold hearings on the Kennedy bill, its supporters could attempt to bypass the committee and bring the bill to a House floor debate. However, the action would require a two-thirds con-

senting vote of House members—the number necessary to suspend House committee rules. Right now, the bill's supporters are confident of support from less than one-third of the House.

In the Senate, backers of the bill are still awaiting a response by Richard Russell (D–Ga.), chairman of the Senate Armed Services Committee. Though support of the bill seems to be slightly stronger in the Senate, Kennedy aides say they have no real strategy on where to go if the Armed Services Committee refuses to hold hearings.

—FRANK CLIFFORD

# Sweden: New Institute to Focus on Applied Microbiology

*Stockholm.* In mid-April an industrially oriented interloper, the Project for Applied Microbiology, will occupy a new temporary building among the celebrated medical research departments of Stockholm's Karolinska Institutet. There a team under C.-G. Hedén will prepare for the creation of an Institute of Applied Microbiology, hopefully in 2 years. It will examine the opportunities for research in nonmedical bioengineering, for contract work for industry, and for applied microbiology relevant to international needs, especially those of the developing countries. This new venture is supported by the Swedish government's Council for Applied Research. It is a natural outcome of Hedén's interests in novel microbiological techniques, cultivated during two decades. Eight years ago, a bioengineering unit was created for him in the Karolinska's bacteriological department. He will continue to direct that unit, and its recent achievements and interests provide an indication of what may be expected from the new venture.

With the risks of biological warfare in mind, the Swedish Medical Research Council, which deals with military as well as civilian matters, established the bacteriological bioengineering unit. In addition to acting as adviser to the government, Hedén was to study and develop techniques for the large-scale handling of pathogenic microorganisms, particularly in connection with the preparation of vaccines. The work was not secret and remained compatible with the unit's status as a university department; Hedén had a free hand in selecting research projects.

The attraction for the Medical Research Council was the big pilot-scale fermentation plant, completed by the Karolinska in 1958 for its own purposes. As a facility for culture of both pathogenic and nonpathogenic species, it is still unusually large for university biological work. Indeed, with the present trend to continuous culture it begins to look cumbersome. Hedén had played a leading part in the planning and design of the pilot plant; already-existing industrial techniques were inadequate. The plant features extensive automation and remote control, and adaptation to reduced-pressure operation for the handling of pathogens. Much of its versatility is due to the steam-sterilized "stericonnectors" invented by Hedén, which allow vessels to be quickly and safely linked by flexible tubing.

Defense requirements have influenced the pattern of research. The gonococcus provided, at the outset, a test case for concentrated culture of notoriously fastidious pathogens. P. Gerhardt successfully applied a two-phase technique, consisting of a medium solidified with agar and overlaid with a liquid medium. More recently, R. Brooks has preserved gonococcus by freezing and storage in liquid nitrogen. A two-phase liquid culture technique, pioneered by P. A. Albertsson, was adapted to the preparation of tetanus toxin and anthrax antigen by M. Puziss, an American microbiologist working with Hedén. In such a culture, two immiscible aqueous polymers are stirred together; the microorganisms grow in dextran from nutrients transferred from the polyethylene glycol phase, while metabolites cross the interface into the polyethylene glycol. This system can be described as "dialysis without a membrane." The titer of tetanus toxin obtained by this method was a thousandfold greater than that obtained from conventional cultures.

Two interests of the bacteriological bioengineering group have wide implications. Current work on methods for large-scale tissue culture was originally prompted by the probable need for rapid virus-vaccine production in the event of biological warfare. Fundamental research on the physical properties of DNA may prove relevant to identification of unknown nucleic acids. The group's interests have broadened continuously. As expected, the Karolinska pilot plant proved useful for purposes other than experiments related to vaccine production. Its scale made possible the preparation of sparse metabolites and enzymes in quantities useful for fundamental research in Sweden and abroad; its flexibility permitted wide-ranging experimental work on the culture of microorganisms. The Swedish Defense Research Institute (FOA) now has its own group concerned with biological warfare, and the Institute for Applied Microbiology, using the same Karolinska pilot plant, will eventually take over the residual defense activities from the bioengineering group. Hedén remains concerned with the international control of biological warfare and has been prominent in the Pugwash movement's study of the possibilities; he headed the inspection team in the four-nation trial (1966) of safeguards against diversion of microbiological facilities to weapons production.

"The study of artificial environments in which living cells or labile biological substances are produced, preserved, destroyed or modified as desired." That is how Hedén defines his brand of bioengineering. He sees it as a link between basic and applied research; and the work of his group during the past 8 years on the effects of high pressure on microbial cultures illustrates this interplay.

It began with the practical problem of extracting labile toxins at subzero temperature from the bacterium *Bordetella pertussis*. To disrupt the cells, L. Edebo exploited the phase change from ice I to ice III which occurs below