draft will disrupt the lives of substantial numbers of graduate students. In an effort to ease the disruption, many graduate schools have guaranteed readmission to students whose education is interrupted because of the draft.

There is also a good chance—though no guarantee—that students who are drafted during the school year will be allowed to complete the semester before induction. A memorandum from Col. Bernard T. Franck, an assistant to Gen. Hershey, notes that while there is no provision in the draft laws insuring an opportunity to complete the semester, the selective service director has administrative authority to postpone induction, on an individual basis, for good cause. The memorandum adds that "General Hershey would give consideration to the use of this limited postponement authority in individual cases."

It seems clear from the evidence turned up by the *Science* survey that some schools and departments will be hurt by the draft and that this is particularly true of the sciences and engineering. However, the impact may be eased somewhat after two years or so when the initial round of draftees begins returning to civilian life. Meanwhile, some outspoken educators are predicting disaster for the graduate schools in the years immediately ahead, and there is no certain way of telling whether the predictions will be borne out.—PHILIP M. BOFFEY

German Professors: Prototypes, But Paragons No More

Munich. The European university is under attack, and a prime target is the professorial chair, which provides the organizing principle for the traditional system. Germany produced the prototype of the "feudal" professor, and an effort is being made there—notably at the Technische Hochschule in Munich and at the newly founded universities—to depose this last autocrat.

The German professor is the legatee of early-19th century reforms inspired by Wilhelm von Humboldt—diplomat, scholar, and, briefly, Prussian minister of public instruction—who established the forms which were to give German universities preeminence in the 19th century, particularly in the natural sciences.

The tide of German idealism was running at the time of the von Humboldt reforms, and the *Weltanschauung* of that epoch still has an extraordinary influence on the university. The central idea of the unity of teaching and research, *Lehre und Forschung*, entailed a close relationship between professor and student in the universities' main work of acquiring knowledge and passing both knowledge and culture on to following generations. The university was regarded as having a right to self-government free of control by either church or state. "Academic freedom" in Germany chiefly implied the right of the student to study where and when and for as long as he wished.

Functionally, German universities became federations of professors each of whom was responsible for teaching and research in his own discipline and headed an institute with its own staff of assistants, library, and separate administration.

As is well known, the German university was the model on which graduate education in the United States was founded in the latter part of the 19th century. But the American importers grafted German research modes onto an already flourishing Anglo-American undergraduate college system. Central administration was strong in the American university as compared to the German. And the cultural mystique of the German university did not travel well.

In Germany industrialization and the demand for technically trained manpower put heavy strains on the university structure. The tradition of a single chair in a subject proved restricting, particularly in the sciences, as knowledge and new specialties proliferated. Attempts were made to bolster the system with "parallel" chairs and the creation of new higher-education institutions outside the university—technical schools, colleges of education, and specialty schools in mining, forestry, veterinary medicine, and so on. Thus the original university pattern was preserved.

Criticism of the university today centers on overcrowding and the remoteness of the professor from his students. A professor in the science faculty may be responsible for supervising as many as 100 graduate students. He is overburdened by administration, and the division of the university into self-contained little empires means an inefficient use of resources.

There are some other complaints as well. Professors still tend to reign in isolation in their institutes, and interdisciplinary research as well as research in new fields suffers. Junior staff members are overworked and underpaid and, in most cases, have little opportunity to conduct research.

Much of the same criticism is leveled at the technical universities, the *Technische Hochschulen*, which were founded in the late 19th century to respond to the demands of the industrial revolution. There were forerunner institutions established at Clausthal in 1775 and Karlsruhe in 1825, and, between 1868 (when the Technische Hochschule at Munich was founded) and the turn of the century, "TH's" appeared at Aachen, Berlin, Braunschweig, Darmstadt, Hanover, and Stuttgart. They started as technical schools teaching building and industrial techniques, but were soon teaching theoretical subjects as well as applied science, and developing their own research traditions.

The Munich TH is the scene of the best-known effort to reform teaching and research in physics by replacing the institutes with a departmental system on the American model. The effort was initiated by Rudolf L. Mössbauer, who won a Nobel prize in physics for work on resonance absorption of gamma radiation and discovery of the Mössbauer effect. Four years ago Mössbauer agreed to return to Munich on a half-time basis from his professor-

ship at California Institute of Technology, on the condition that physics at Munich be reorganized.

At the Munich TH, physics is part of the faculty of general science, which includes chemistry and mathematics. Other faculties are electrical, mechanical and civil engineering, a new medical faculty, architecture, landscaping, and brewing. Landscaping studies include a stiff quota of agricultural sciences, and the brewing faculty produces engineers who are much sought after in cities famous for their beer, from Munich to Milwaukee.

At Munich the so-called "second Mössbauer effect" has transformed physics. The department will eventually have 16 full professors, all on an equal footing. Chairmanship of the department rotates and is held for a term of 1 to 3 years. Important features of the centralization are a single departmental library and a business manager who handles most administrative details. As intended, professors now have fewer graduate students—an average of perhaps ten each—and lecturing and seminar duties are more efficiently distributed. A very significant result of the reform is the possibilty of transferring funds within the department, which permits a flexibility in financing research projects and supporting students that was not possible before.

Departmentalization of physics seems to have progressed largely according to plan, although Mössbauer is said to have "gone to the brink" on occasion. The reform has hardly spread like wildfire, however, Some steps along similar lines have been taken in the chemistry and mathematics sections of the same faculty, but the engineering faculties seem less disposed to follow the lead. Outside Munich there have been innovations, perhaps most notably at Freiburg, where an *Abteilung* or departmental system is being essayed, and at the new university of Bochum in the Ruhr, which is organized on a departmental plan. The new universities at Bremen, Konstanz, Dortmund, Regensburg, and Bielefeld are regarded as proving grounds for reform proposals, but it remains to be seen how strongly these experiments will take hold.

Those involved in the reforms at Munich agree that further changes are necessary. Edgar Lüscher, a theoretical physicist who came to the Technische Hochschule in 1964 as part of the "Mössbauer package deal" and is currently serving as dean of the faculty of general sciences, says there is a need to establish some sort of bachelor's degree whose holders could go directly into jobs in industry. But problems of prestige associated with a lesser degree than the traditional diploma or doctorate complicate the picture. There is also a need for "continuing education" in the university, an American phenomenon virtually unknown in Germay. A shortage of technicians trained at the higher-education level afflicts German science and technology, and a program associated with the TH is under discussion in Munich.

Perhaps the greatest obstacle to innovation in the universities lies in the division of authority among federal and Länder governments and the professors themselves (*Science,* 22 March). The national science council (Wissenschaftsrat) has recommended a program of change in the organization and curriculum of the universities, but reactions have been slow, not least because of inertia on the part of old-guard professors.

To the outside observer, the most obvious blocks to reform appear to be the problems of rank, pay, promotion, and research initiative that affect junior and middle-level staff.

At the summit of the traditional system are the "ordinary" professors, *ordentliche Professoren,* who head university institutes, seminars, or clinics. A cut below them are the "extraordinary" professors, a rank originally created to provide for teaching and research in developing fields of knowledge. Both ordinary and extraordinary professors are civil servants with lifetime appointments, but the *Ordinarien* enjoy higher pay and higher status, and from their ranks alone deans and rectors are chosen.

Salaries vary somewhat by Länder, but professorial salaries average about $10,000 per year. In addition, German professors have collected a share of fees paid by their students, which could amount to several thousand dollars a year. This rather medieval perquisite, however, is being phased out in favor of lump-sum payments.

Under the pressures of numbers and a need for specialized teaching, an intermediate range of academic positions, *akademischer Mittelbau,* has been established. This is in addition to honorary professors—usually accomplished scientists from research institutes or industry who teach part time in universities. It is from the lecturers and "nonestablished" professors in this middle range that the *Ordinarien* are chosen. (These latter have achieved the *Habilitation,* the distinction which requires submission of a second thesis and permits the German academic to lecture and hold seminars.) Some of them hold new ranks which entitle them to life tenure.

Assistants, who generally are postdoctoral students, still, in most cases, quite literally assist their professor. Assistants and the lower ranks of the *Mittelbau* have little hope of carrying out their own research projects. A salary equivalent to $400 a month for junior staff is common, and the junior may not be promoted for a number of years since there is as yet no real equivalent, for example, to the American assistant professorship.

In the old days, academics were individuals from the middle class who were expected to have the means to support themselves into middle age, if necessary, while they waited for their professorships. Men of independent means are rarer in Germany now, and low pay and uncertain prospects of promotion are viewed as the cause of both a brain drain and low morale among young scientists. In the middle ranges, the unfavorable comparison with industrial salaries causes complaint.

The civil service structure imposes a special rigidity on academic pay. Sympathetic professors complain that it is impossible to reward unusual ability among the younger men; however, few of the relatively well-paid professors have been conspicuous as crusaders in behalf of their juniors. And the government seems not to put a high priority on a radical reform of the academic hierarchy and pay scale.

A reluctance on the part of the government to intervene in university affairs is understandable. There is the tradition of noninterference in university matters. And the universities came through the National Socialist period as probably the least discredited of German institutions.

Student dissent may well generate enough energy to bring about real changes in the university hierarchical structure if the students turn from external political objectives to reform of the university, in union with a junior staff turned militant. Otherwise reformers may have to hope for the appearance of a latter-day von Humboldt.—JOHN WALSH