THE ROLE OF SCIENTIFIC INSTITUTES in American Education

UNTIL recent years, the traditional pattern of American graduate schools has been frozen along divisional and departmental lines. Natural cleavages have developed from this pattern which are far more serious than good-natured interprofessional rivalry. The old saw that the chemical Tweedle-Dees make very inaccurate measurements on very pure substances while their physical twins are merely mirror images, although amusing, nevertheless contains some very arresting truth. The fact of the matter is that the departmental scheme is not in itself adequate to cope with the myriad problems of modern organized research. In these days of increasing cost and complexity, the continued leadership of our universities in fundamental research requires a reconsideration of policy by our graduate schools.

Increasing costs involved in the development of high energy accelerators, for instance, limit the number of such devices available and bespeak a maximum efficiency in the utilization of their facilities by all interested scientists, whether they be physicists, chemists, or biologists. Increasing complexity in many fields requires more interprofessional collaboration if science is not to degenerate to a collection of confusing minutiae reminiscent of the blind men and the elephant. For both these reasons, means must be found to relax the hampering boundaries of rigid departmentalization.

Fortunately, a promising solution is being developed at a number of our universities. A new type of organization is springing up which we shall describe in what follows as an *institute*. To be sure, this generic term includes groups who have been somewhat less formal in choosing names. We shall for our present purposes define an institute as an autonomous university unit which engages in research and advanced instruction in a field sufficiently diverse to require the cooperation of a staff trained in different fundamental disciplines. As examples we may cite the Electronics Research Laboratory and the Laboratory of Nuclear Science Engineering at MIT, the Johnson Foundation for Biophysics at the University of Pennsylvania, the Marine Physical Laboratory at UCLA, the Institute of Atomic Research at Ames, and the Institute of Nuclear Studies and the Institute for the Study of Metals at the University of Chicago.

Some further explanation is perhaps in order concerning our definition of an institute. The most important word in the definition is probably *autonomous*. This word implies that the administration has consciously endowed the group with the same academic and financial standing as the usual department. The support of the group, financial and otherwise, is accordingly subject to the same standards of performance as departmental groups. Individual staff members, regardless of professional discipline, are treated on an equal footing. This state of affairs is to be contrasted with specific groups operating under the jurisdiction of a department. As long as such groups require only staff members of a particular professional discipline, no serious problems arise and the need for the creation of an institute does not exist. However, as soon as staff members of another discipline are needed by the group, the story is different. Thus, if chemists are needed by a physics group within a department, the tendency is to employ them on a somewhat subordinate basis. This policy leads either to inequality of opportunity for equally good scientists or else to inability to attract adequately trained men. Such problems are avoided in the institute arrangement.

The institutes possess advantages other than those deriving from the benefits of economy and the stimulation arising from hybridization of diverse disciplines. An institute can provide services which encourage scientists to tackle problems often avoided in the twilight zones between more classical areas; in this sense, the institute framework has many of the advantages of the industrial laboratory but can be protected from the disadvantages by good academic procedure. It follows that the director of an institute should be an executive officer and, as much as possible, a leader—but certainly not a dictator, any more than is the chairman of a department in a healthy, thriving university. Another possible advantage of the institute is the realistic atmosphere which it is capable of providing for training students in research at both the pre- and post-PhD levels.

The institutes have, of course, certain disadvantages, the most important of which is that well-balanced teaching staffs cannot be guaranteed and thus training of younger students is not likely to be adequate. Institutes should not have authority to grant degrees. Although the polyglot institute atmosphere is stimulating for research, it does not always lead to mastery of a classical discipline. Indeed, it is apt to produce dilettantes with only a superficial knowledge in a number of fields. For this reason institutes can only complement and do not supplant departments as structural units in a university. Nor are institutes with functioning and integrated research programs likely to be the best environment for the exploration of entirely new fields by individuals operating in some lonely scientific frontier. New institutes could well be created in many areas—and it is quite possible that from time to time some should be abolished.

The fundamental disciplines themselves will continue to flourish and departments should evolve naturally through a process of appropriately integrating new knowledge into their curricula. The evolution of insti-

tutes is not so clear. If an institute is limited to studies of a very specific sort, progress may remove its raison d'être; if an institute is large and broadly based, it can by shifts in emphasis develop with time. However, there is grave danger in the larger institutes that the individual interest of staff members will stray to alien areas and that the effort of the institute will ultimately become so diffuse as to lose significance. Consequently, to remain healthy, institutes must continually review their aims and reassess their staffs, lest they degenerate into incongruous academic appendages. Reorganization from time to time, particularly among the senior staff, may be desirable in some cases.

If we conclude then that both departments and institutes should exist, how can each be economically staffed? The device normally employed is the joint appointment; i.e., academic staff members join in institutes in order to benefit from the research opportunities which they offer, but at the same time retain their affiliation in the departments for the purposes of formal education. This device, to be sure, leads to certain difficulties in practical operation. For instance, the over-all requirements of an institute sometimes are at variance with the over-all requirements of a department. High academic standards and a spirit of cooperation reduce friction on this score to a minimum. Again, participation in an institute—particularly a large one—often demands a somewhat lighter teaching schedule. The lightening of teaching schedules in this case should be uniform so that all the individuals in a department have an equal opportunity to perform both research and teaching. By and large, good research men like to teach and are as anxious to participate in departmental activities as in institute activities.

A number of our large universities have already adopted the institute approach. Just after World War II a fair number of new institutes was created. It is perhaps too early to say just what the long-term effect of these institutes on American education will be. It is already apparent, however, that their influence on the scientific scene is appreciable and growing. It is also apparent that new and diverse institutes should be created. Each university cannot (and should not) expect to have an institute in every possible field of inter-departmental collaboration. Rather, they should seek to support relatively few but really good institutes in those areas most appropriate for the particular university in question. Quality in science has always been more effective than quantity. Many parts of the over-all job should be left for other universities.

In this connection we would like to emphasize the great possibilities inherent in the institute approach for our smaller colleges and universities. An institute does not have to be big—it can, in principle, involve only three or four people, calling itself perhaps by the more appropriate name of committee. Certainly groups on this scale are not beyond the realm of possibility for any healthy college and could play an increasingly important role on the scientific scene.

The best approach to the formation of an institute is the spontaneous desire of a group of people to pool their intellectual resources. University and college administrators should do all they can to encourage such groups. However, where departmental shackles and jealousies interfere with such spontaneous actions, or where barriers do not exist but the spontaneity is lacking, university administrators would do well to ponder the underlying reasons.

We have confined our remarks above to institutes concerned with physical sciences. These remarks may apply also to other areas of scholarship, where the need for institutes is perhaps even greater.

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NOTES AND COMMENTS

Activated Reservist

From various articles which I have read, I have been led to believe that this country faces a shortage of trained personnel in the scientific professions. I believed this to include college graduates along with the doctorates and post doctorates, the general scientist along with the highly specialized. Apparently this is not true for many of us who at present hold only the BS or the BA degrees.

As a veteran of World War II and a member of the Inactive Naval Reserve, I find the fact that I have pursued a course of study leading to a degree in physics, that I have been actively employed in the field for almost two years, and that there are no trained technologists available to replace me at this time of no concern to the Navy. I have recently been recalled to active duty by the Navy where I am expected to serve in my previous capacity as an Aerographer's Mate 3/c.

Even though it has been acquainted with the facts through a request for deferment submitted by my employer, the National Bureau of Standards, the Navy still insists on my returning to active duty. Thus am I not only prevented from making use of my scientific training, but I am also robbed of the opportunity of further education in my chosen profession.

Is this great demand for trained scientific personnel someone's pipe dream, or is it real? Are only the PhD's to be considered while the great potential of the rest are lost to the country through the incongruousness of the Armed Services? Certainly my situation is not unique. There must be a great many others whose training is thus being wasted. . . .

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