Adjustments in University Plans and Programs to Meet Long-Range Needs

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A CRUCIAL PROBLEM WHICH FACES THE NATION today has been identified and documented with abundant and carefully sifted data by the preceding speakers. In addition, suggestions have been made as to how we might best plan to meet the situation. I have been asked to discuss what seem to me to be necessary adjustments in university plans and programs.

I believe we can agree at the outset that all personnel plans and charts of demand for specially trained individuals in various categories must be viewed only as our present best estimates of the situation and not as inflexible and precise blueprints of the future. From what has already been said, we see that differences of opinion exist concerning the immediate needs for scientific personnel in certain specialized areas, and that our task is complicated further by the fact that the immediate problem differs considerably from the long-term one. Commissioner Clague has indicated that while the current need for scientists and engineers is great, present-day enrollment in colleges and universities is such that in a few years graduates in some of the technical fields, notably engineering, may have difficulty in finding employment specifically related to their training. M. M. Boring, of the General Electric Company, in the October issue of the *Journal of Engineering Education,* also concludes that there is likely to be an oversupply of engineers about 1950, with certain engineering specialties having a much greater oversupply than others. Volume IV of the Steelman Report states the problem in a somewhat different way. It sets forth that while there will be too few scientists in the next two or three years to permit the large-scale expansion of research and development programs currently envisaged in our national policy, the immediate attempt to train additional scientists might do more harm than good, since in the long run "there is a danger of a shortage of *high-quality* scientists because of current overcrowded conditions in colleges and universities."

The above remarks are not alarming to me. In my experience there is nothing new in the fact that a man or woman trained along a particular line later finds employment opportunities restricted in that line and undertakes a job, often with great success, in another and related field. As we look over the past 20 years of history in our country, we recall the terrors of technological unemployment which faced us in the early '30s and then, only 8 years later, the scarcity of technically trained men to carry on our war effort. Of course, it would seem highly desirable from the standpoint of the utilization of manpower to have the number of jobs exactly match the number of people trained for them, but when I say that this might be highly desirable, I mean only from the theoretical standpoint of social planning. Actually, I consider it fortunate that changing conditions make precise planning in this area impossible, for I see grave limitations in an education so restricted in outlook as to provide an adequate basis only for one type of occupation.

It seems to me axiomatic that education, to be worthy of the name, must do much more than fit a person for a particular vocational slot in the social system. Our objective should be to determine and then develop, to the fullest possible extent, the capacities and aptitudes of individual students. Unless the individual has greater resources than those demanded by any specific job he may undertake, he lacks that adaptability to changing circumstances which is not merely the hallmark of the educated man but the margin of flexibility which permits our democratic society to progress.

It is a dangerous fact that even in the universities we sometimes, these days, forget the importance of the individual student. Overrun with numbers far greater than we had opportunity to plan for, we are apt to have our thinking conditioned by the necessity of facing physical problems of housing, of classroom space, of schedules, and always of budgets. If we are to meet the challenge of our scientific personnel needs, we in the universities must concern ourselves vigorously with the effective education of the individual. This will require more careful evaluation of his or her potential capacity. In short, we should give full attention to the identification of talent at the earliest possible stage of the individual's college career. Indeed, if such identification can be made and made

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effectively in the secondary schools, it should be done there. I presume that it is too early to determine the results of the Science Talent Search supported by the Westinghouse Electric Corporation, but I am sure that this program is a really fundamental experiment in the early identification of scientific ability.

After identification has been made of the individual who shows promise of capacity as a scientist, what shall we do with him? Shall we require of him that he go through the conventional pattern of higher education, or shall we make a conscious effort to see that his potential talent is cultivated? I do not for a moment suggest that he be set apart from his fellows as a sort of intellectual curiosity, for if there is one thing that I am sure the scientist of the future needs, it is keen awareness of the social implications of his work. I do believe, however, that often a student of superior capacity is bored by the inadequate challenge to him of conventional academic requirements. Of course, many universities have recognized this, and various procedures for honors courses and for special laboratory work have been established. It seems to me, however, that much more could be done in this direction, and especially along the line to be suggested.

The counseling of college students is an activity that has expanded remarkably and successfully during the last two decades. It is my observation, however, that this counseling is usually concerned with problems of personal adjustment of the student to his environment. I now wish to suggest a program of professional counseling for the student who has been selected as one of promise in scientific work. There is nothing really new in this idea. The earliest educational procedure of which we have any record is study under a master. We find in a good deal of scientific literature that some great scientific figure of today was a pupil of, say, Rutherford or, in our own country, a pupil, for example, of Carlson. The effect of these masters on the whole trend of scientific thought and activity is incalculable. By reason of our preoccupation with numbers and dollars in American higher education today, we are apt to forget that the most potent force in the education of scientists is the opportunity to associate with a scientist who has achieved full professional stature.

To establish a practicable program of professional counseling will require the most careful sort of administrative planning, for the supply of those capable of undertaking such a role is distinctly limited; moreover, since such persons are leaders, they are sought out by government and by industry for great responsibilities as consultants. I submit, however, that the most valuable contribution that such leaders can make is that of multiplying their personalities by their guidance of groups of scientists in training.

We approach this ideal of education more closely in the graduate school, but here we are plagued with other limitations. The growth of knowledge in the natural sciences has been stupendous since the turn of the century, and I should judge qualitatively that the increase is certainly exponential. Yet, we are carrying on graduate study in accordance with much the same pattern that was in effect in the closing years of the 19th Century. It appears to me that universities must give immediate attention to a critical evaluation of stipulated course requirements for advanced degrees. They must put genuine emphasis on the statements that appear so generally in the announcements of graduate schools that the advanced degree is conferred not for attendance in courses but for evidence of productive scholarship. I believe that graduate study might be initiated earlier for those who demonstrate capacity for it. It also seems abundantly clear that graduate schools must make a reappraisal of formal residence requirements in order to make maximum use of the superior facilities for graduate study provided today by large-scale cooperative research installations such as the Brookhaven National Laboratory.

I venture further to suggest that all those who employ scientists should make provision for giving them a periodic opportunity for refresher postgraduate work. As is well known, certain agencies of the government and some industrial concerns already have initiated such programs. As a corollary to this proposition, graduate schools should set up such arrangements of staff and facilities as will give the greatest possible opportunity to the scientists engaged in postgraduate study.

Again, as Mr. Hausrath pointed out (see *Science*, April 9, p. 360), we need to provide opportunity for graduate students to become accustomed to working as teams. In undertaking the teaching of this procedure, scrupulous care must be exercised to insure that the individual's independence of thought is in no way curtailed. The experience of research scientists during the war shows that, while great objectives can be achieved by team research, there is a real danger that the researcher will become merely a technician. A difficult problem is presented by the resolution of the conflicting philosophical bases of free scientific inquiry by the individual and the necessity of fitting together the work of a number of individuals. To my mind, however, this is a problem that can and must be solved. In some ways it has all of the aspects of the conflict of interests that occurs in a democracy: The importance of the individual must never be forgotten, but his effort through his own

self-discipline must be coordinated with the effort of other individuals.

It is commonplace to say that graduate education is the most expensive type of education there is; moreover, graduate study is encumbered with a number of outmoded practices that make it difficult to determine the actual cost. In order to assist a graduate student in making ends meet, the university often awards him an assistantship with free tuition in the graduate school. If he is preparing for a career as a faculty member, the assistantship may give him a valuable opportunity for practical work in teaching. Unfortunately, however—and again, because of the pressure of numbers—the graduate assistant does not receive much guidance in carrying out his duties and so may come to look upon his assistantship work as a menial chore. This does not do him any good and it does even less good to the undergraduate students who are under his ministrations. It seems to me that in view of the national need for well-educated scientists, recognition should be given to the need of funds to support such a program properly. If graduate students plan on a teaching career, their practical work as assistants should form a part of their educational program and not be a distasteful job that has to be done in order to earn a little money.

I note that in the report of the President's Commission on Higher Education a recommendation is made that the Government give financial support to professional graduate study through a system of scholarships, fellowships, and direct grants to the colleges. I happen to be of the opinion that, while some governmental aid may undoubtedly prove most necessary and desirable to insure the solution of this problem, there are other and important steps that should be taken at least concurrently. The universities themselves, by making a thorough reappraisal and reorientation of the graduate program, can do much to make it more effective and to provide a fair proportion of the funds necessary. I believe, also, that industry, which certainly benefits from professional scientific study, should assist in meeting the cost. As is well known, a number of prominent industries already do this, and do it without imposing any restrictions whatsoever upon where the individual shall undertake employment. If, in the end, the measures undertaken by universities and industry should prove inadequate to meet the need, governmental support might be given through the media of scholarships and fellowships to those individuals who have fully demonstrated their ability and promise of further achievement.

In my opinion, however, it would not be good for science education or the Nation for the Government to undertake the whole financial support of insuring adequate scientific personnel resources. It has become too much the fashion to look to government for money to solve all problems. I believe that the surest and best solution lies in the strength of the individual student, professor, and university, with only such governmental participation as is needed as a last resort.

NEWS and Notes

Rufus Oldenburger, formerly professor of mathematics at Illinois Institute of Technology, has been appointed chairman of the Mathematics Department at De Paul University, Chicago.

Chester I. Barnard, president of the New Jersey Bell Telephone Company, will become head of the Rockefeller Foundation on July 1, succeeding **Raymond B. Fosdick,** who plans to retire. Mr. Barnard was national president of the USO during the recent war and is a consultant to the American representative on the UN Atomic Energy Committee.

Frederick K. Sparrow, Jr., associate professor of botany, University of Michigan, will take sabbatical leave covering the second semester of the 1948–49 year in order to participate in a study of aquatic plants in relation to mosquito populations in the region of Villaviciencio, Colombia, at the laboratories of the Rockefeller Foundation.

Carl Eckart, formerly director of the University of California's Marine Physical Laboratory in San Diego, on March 1 became director of the Scripps Institution of Oceanography, succeeding **H. U. Sverdrup,** who has held the post for the past 12 years.

E. V. Staker, associate professor of agronomy in the chemurgy project, University of Nebraska, Lincoln, joined the staff of Gen. MacArthur's Far East Command in Tokyo in mid-March. Dr. Staker will have the responsibility of determining fertilizer needs and assisting with importation and distribution of fertilizers and general supervision of the soil and crop program in Japan, southern Korea, and Okinawa. His assignment is for a minimum period of two years.

Bruce A. Rogers, who has been associated with the U. S. Bureau of Mines since 1935, has been appointed senior metallurgist in the Atomic Research Institute at Iowa State College.

Karl Ver Steeg, of the Department of Geology and Geography, College of Wooster, Wooster, Ohio, will mark his 25th year of service to the College this spring. In honor of this occasion a group of his former students, under the chairmanship of Shannon McCune, of Colgate University, are organizing a special program for May 7–9 at Wooster. There will be two formal sessions along the lines of Dr. Ver