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Obsolete Instrumentation at Universities

At one time university scientists were comfortable in the belief that their institutions were the leading places where fundamental research might be conducted. But now doubts have been expressed. There is concern, particularly among the physical scientists, that the universities have fallen far behind industry in the quality of instrumentation available to them. There is also a fear that students who are using obsolete equipment are not being properly trained.

The performance of the new equipment is much better than that of the older items. Some of the devices make possible entirely new measurements. Others have improved sensitivity. Some permit more precise determinations, while others increase greatly the number of observations that can be made in a given time. In discussing what has happened in his field, a distinguished crystallographer told me that with today's equipment and computational resources his life's work could be performed in less than a year.

Improvements in the various measuring devices have occurred at different times but there have been some common features. One type of advance has come from the use of lasers. This has led, for example, to a great improvement in Raman and infrared spectroscopy. Another type of common feature is the use of dedicated minicomputers for control and data processing with instruments such as gas-liquid chromatographs combined with mass spectrometers. Electronics combined with Fourier transform techniques has in many cases improved the precision of results by an order of magnitude. Improvements across the field of instrumentation during the past two decades have been roughly at the rate of a factor of 10 every 5 years. In general, equipment purchased 10 years ago is obsolete.

In the years up to the late 1960's federal support for equipment was generous. But for more than a decade funds for instrumentation at the National Science Foundation have been inadequate. For example, in 1977 the equipment monies for chemistry totaled $6.5 million. At the same time there were about 14,000 tenured faculty at chemistry departments and about 14,000 graduate students. Only a fraction of the faculty attempts to do research, and other sources of funds are sometimes available, but the order of magnitude nationwide of the average annual equipment support appears to be no more than $1,000 per capita. In contrast, at good industrial research laboratories the annual support per capita is in the range of $15,000 to $30,000. The cost of many of the new powerful instruments is in the vicinity of $150,000 and more. Prospects are that the equipment gap between the universities and industry will continue to increase.

The National Science Foundation has been aware of this problem. But it has had only modest success in convincing Congress of the need for expanded funds for instruments. In what amounts to a desperation move the Foundation has announced a program to establish regional instrumentation facilities. During the current fiscal year a total of about $3 million will be allocated for this program. The exact number of facilities is not yet known, but perhaps five will be created. In later years additional centers would be established. Each center will be devoted to a particular type of instrumentation, such as nuclear magnetic resonance. In principle the instruments will serve the needs of many people and they will surely be scheduled for 24 hours a day, 7 days a week. The effort to make measurements on advanced equipment broadly available is laudable.

But the sums of money earmarked are tiny in comparison with total needs. In addition, creation of the centers will spawn new problems such as management, scheduling, time lost in travel, and frustrating delays for eager experimenters who must await their turn. And an enormous amount of effort will go into the writing of proposals by would-be hosts to the centers.

The desirable solution is an increase by an order of magnitude of the equipment funds budgeted for NSF and NIH by Congress. Without a substantial increase in such support the universities' capability to carry out their educational role will continue to atrophy.—PHILIP H. ABELSON