EDUCATION

Training new crystallographers

JEFFREY (nearest camera) with students in crystallography laboratory

The crystallography laboratory at the University of Pittsburgh is now offering a PhD program in crystallography. The laboratory, which has received interdepartmental and university-wide status at Pittsburgh, is the second crystallographic center to be set up in the US during the past year. The other center is the Roswell Park Division of Health Research in Buffalo, N.Y., under the direction of David Harker (see PT, Jan. 1965, p. 84). Both centers reflect a culmination of ideas over the past 250 years on the nature of crystallography and the proper training of crystallographers.

Crystallography had its beginnings in the 18th century in mathematical studies of crystal symmetry and physical investigations of solids. Results of these studies were later used in classifying minerals; indeed, the first crystallographers were mainly mineralogists. Crystallography merged with physics in 1912 with von Laue's discovery of x-ray diffraction, and x-ray techniques were soon exploited by physicists, chemists and metallurgists. In the past ten years, because of the impetus of modern electronic equipment and digital computers, crystallography has found further application in biological and materials-engineering sciences.

Different interests among pioneers in the field led to different affiliations in various countries. In Germany, for example, the science of crystals has continued to be closely associated with mineralogy. Until recently German mineralogical institutes carried out research and teaching in crystallography. In England crystallographers are associated with the British Institute of Physics through their x-ray-analysis group. And in the United States the American Crystallographic Association is a member society of the American Institute of Physics.

Where crystallography has formed the basis of academic courses, it has generally been taught in physics or geology departments (examples are Fankuchen's courses at Brooklyn Polytechnic Institute, those of Buerger and Warren at MIT, and crystallographic teaching at Cavendish Physics Laboratory and the Mineralogy Laboratory at Cambridge). At the same time graduate schools of crystal-structure research have developed within chemistry departments (those of Pauling at Cal Tech, Robertson at Glasgow, and Hodgkin and Powell at Oxford). More recently, important biological applications of crystallography have led to a shift in emphasis toward bioscience departments connected with medical schools and hospitals. Less spectacular advances are also being made by crystallographers in solid-state physics, the chemistry of solids, and physical metallurgy.

With such diverse crystallographic activity, how do we train a crystallographer? The optimum environment would require encouragement of interdisciplinary interests as well as competence at the frontier level of crystallographic research. Previously such an environment was possible mainly within the traditional departmental structure of university education. But the increasing amount of study needed to pursue the mainstreams of physics and chemistry makes the training of crystallographers more and more difficult. The problem is further aggravated by the complexity of computer-programmed interpretative methods. When a crystallography graduate student can sometimes do his research merely by pressing a button, it becomes especially important that he understand fundamentally what he is doing.

The doctoral program at Pittsburgh is an attempt to provide a single comprehensive environment for training in crystallography. Heading the program is G. A. Jeffrey, past president of the American Crystallographic Association and currently chairman of the National Committee for Crystallography.

The program is open to students in any field with crystal-structure relevance, and PhD qualifying exams will be given in the student's undergraduate major. Specific objectives of the program, according to Jeffrey, are development and use of x-ray-diffraction methods and modern computing techniques for crystal-structure study in theoretical chemistry, solid-state physics, earth sciences, material sciences and biochemistry.

The laboratory will accommodate about ten faculty and postdoctoral fellows and 20 graduate students. Its main experimental arm consists of 12 x-ray tubes, with associated single-crystal photographic and counter-recording equipment, and an automatic diffractometer. Its interpretative arm includes an IBM 1620 computer with a 20 000-bit memory capacity, and IBM 7070 and 7090/1401 computers, all at the Pitt computing center.

"We would hope," says Jeffrey, "that the universities can continue to

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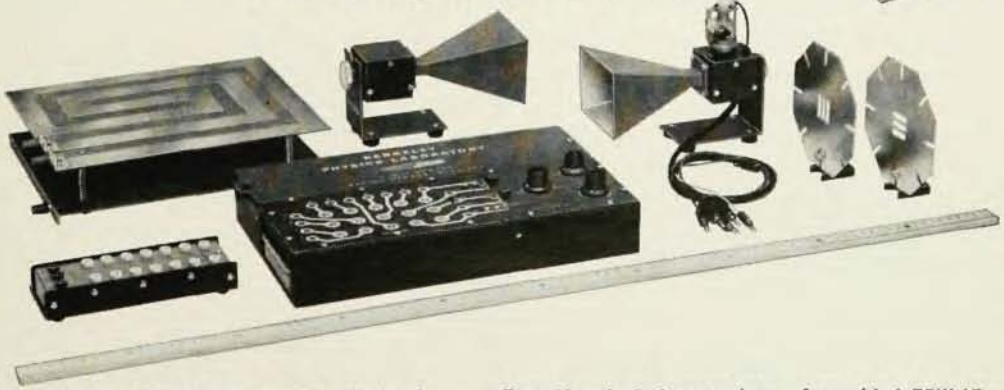

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educate crystallographers who are complete masters of their powerful techniques and also cognizant of frontier knowledge in the relevant sciences. In this way they may be able to make their own distinctive contributions in both academic and industrial environments."

Education in acoustics

The Acoustical Society of America is actively at work on a program to improve acoustics education at all levels of the curriculum. Through its committee on education in acoustics, the society is seeking to determine the present status and needs of acoustics education. The committee is also compiling a book of acoustics experiments and preparing a career booklet.

At a conference on acoustics education held two years ago, ASA found that the acoustics profession was experiencing many of the problems encountered by workers in optics. The need for trained acousticians far exceeded the available supply. Manpower requirements were met mainly by the expensive and wasteful on-the-job training of scientists and engineers from other fields. The very concept of acoustics was being misunderstood not only by the public, but by scientists as well (ASA considers acoustics to be the science of mechanical radiation in all its aspects, including origin, transmission and reception). Acoustics courses, almost always elective, were taken by relatively few students. Physics textbooks contained little on such modern, exciting branches of acoustics as ultrasonics. A further weakness was lack of an intermediate text in general radiation physics that covered wave propagation from an analytical viewpoint, with emphasis on both mechanical and electromagnetic radiation.

To attack these problems, the Acoustical Society set up a committee on education in acoustics headed by Alan Powell of the David Taylor Model Basin. One committee group, consisting of Frank Andrews, Douglas Muster, and Robert Lambert, is compiling a collection of experiments suitable for graduate students and senior undergraduates. When completed the collection will be available to all acoustics teachers to help them set up programs in experimental acoustics.

Another working group, comprising Alan Powell, Mark Harrison, and David Saltus, is studying the present status of education in acoustics. Initial emphasis has been on the PhD level, but eventually the study will embrace the master's level, short courses, and nondegree courses. A third working group, headed by John C. Johnson, is determining needs in acoustics education, again concentrating initially on the doctoral level. Finally, a group under R. Bruce Lindsay is completing work on a career booklet directed primarily to high-school students.

Hawaii expands astronomy program

The University of Hawaii in Honolulu has introduced graduate courses in astronomy and plans to offer a PhD in the field before long. A $500 000 NASA contract will enable the school to build an observatory for an 84-inch telescope, which will be used mainly for infrared planetary observations. Hawaii already operates a solar observatory and sky-glow station on Maui. Concurrent with the new astronomy program Hawaii's Physics Department, under John R. Holmes, has changed its title to the Department of Physics and Astronomy.

Computer research associates

The Massachusetts Institute of Technology computation center is awarding a limited number of post-doctoral research-associate appointments during the 1966-67 academic year. The awards, supported by International Business Machines Corp., will be based on each candidate's proposed research program and his indicated ability to carry it out. Although the MIT associateships are academic appointments, they require no teaching duties other than optional supervision of thesis students. Applicants should submit an outline of proposed research, a list of graduate courses taken with grades and degrees, two letters of recommendation and an indication of the desired appointment period and stipend. The material should be sent before 1 March to Director, MIT Computation Center, Room 26-142, MIT, Cambridge, Mass. 02139.

NSF college teachers awards

The National Science Foundation has announced grants in support of 30 conferences for college teachers of science, mathematics and engineering. Since the conference directors will choose participants, applicants should address their inquiries to the directors and not to the foundation. The directors include the following:

Ferdinand Baer, Department of Atmospheric Science, Colorado State University, Fort Collins, Colo.

John T. Marshall, Department of Physics and Astronomy, Louisiana State University, Baton Rouge, La.

Allen L. King, Department of Physics, Dartmouth College, Hanover, N.H.

James A. Eyer, Institute of Optics, University of Rochester, Rochester, N. Y.

William L. Parker, Department of Physics, Reed College, Portland, Ore.

Charles W. Burmeister, Department of Physics, Trinity University, San Antonio, Tex.

Claude C. Barnett, Department of Physics, Walla Walla College, College Place, Wash.

Daniel Frederick, Department of Engineering Mechanics, Virginia Polytechnic Institute, Blacksburg, Va.

Science journalism at BU

Next September Boston University's School of Public Communication will enroll its first students in a three-semester MS program in science communication. Under the direction of Associate Professor James D. B. O'Toole, the program will include two semesters of 15 credits each, followed by a summer internship, and a final semester devoted to thesis writing. The program is directed at science, engineering and mathematics graduate students who are seeking careers in science writing, rather than further specialization in their fields.

Correction: A University of Maryland college-teacher summer program was incorrectly reported in Jan. PT. Item should read: "NSF support includes weekly stipends of $75 for predoctoral and $100 for postdoctoral participants."