1990 Summer Precollege Education Programs

by *Marjorie G. Bardeen*

Summer is the busy season for Fermilab precollege education programs. This summer, the Laboratory hosted 95 high school students and 227 elementary and secondary teachers in 9 education programs sponsored by the Education Office, the Equal Opportunity Office and Friends of Fermilab. In addition to the participation of 61 Fermilab employees, over 125 scientists and teachers gave presentations to the participants.

"We believe that the Department of Energy, with its unparalleled collection of scientific laboratories, facilities and experts, has the potential to set a highly visible and creative example of educational collaboration for the federal government and the private sector. We will initiate and support a series of vigorous and immediate steps to help strengthen mathematics and science education in the nation."
— James D. Watkins, Admiral, U.S. Navy (Retired), Secretary of Energy

Fermilab is able to offer so many programs because we utilize expertise from various groups—teachers, science education specialists, scientists—with minimal interference with their regular jobs. We collaborate with a cadre of outstanding dedicated teachers who are involved from the beginning of the program development process. Master teachers are given recognized leadership roles in designing and conducting the summer programs. The major credit for the success of the programs rests with these professionals.

Student programs

Fermilab programs provide high school students an exposure to the environment of a research laboratory, an incentive to continue their studies in mathematics and science and an opportunity to develop work skills. Too many

young people—particularly female and minority students who represent a largely untapped resource—lack the preparation they need to advance to higher education and to careers in scientific and technical fields. Fermilab encourages students to pursue mathematics and science careers through the following summer programs:

DOE High School Honors Research Program in Particle Physics is a research program for gifted high school students. Students are supervised by high school physics teachers and spend two weeks working and studying at Fermilab. The program includes lectures by Fermilab staff physicists, lab tours and tutorial sessions, as well as on-the-job assignments with current Fermilab experiments.

"The DOE Honors Program was one of the best experiences of my life. I learned so much and had fun doing it."

The 1990 program was held June 17 - July 1. Students came from the fifty states, the District of Columbia, Puerto Rico, Canada, the Federal Republic of Germany, Great Britain, Italy, Japan and Mexico. Fourteen of the 59 participants had just completed their junior year in high school; the others were recent high school graduates. In addition to attending *Saturday Morning Physics* lectures, students worked in ten research groups with the following experiments: E687, E791, E740, E771, E761, E690, E706, E704, E672 and E665. Each research group wrote a report and gave an oral presentation describing the nature of the experiment to which they were assigned and the "proton economy" at the site. Field trips included a Chicago tour of the Museum of Science and Industry, the Sears Tower and pizza at Giordanos, and a study of the physics of amusement parks at Great America.

Fermilab-EAL Summer Science Experience, a collaboration between Fermilab and Educational Assistance Ltd. (EAL), provides a science program for selected high school students involved in the EAL College Opportunity Program. The students spend one week at the Laboratory attending classes, visiting laboratory facilities and meeting with personnel to discuss career opportunities. The program is supervised by a high school physics teacher.

In 1990, 12 students, none of whom had studied physics, visited Fermilab from July 22-28. Six came from the Lawndale neighborhood of Chicago, three from Green County in southwestern Pennsylvania and three from Midland, Michigan. In class, the students learned about the world of sub-atomic particles through the Beauty and Charm curriculum. They spent an afternoon in the prairie, visited the Neutron Therapy Facility and SciTech Museum and conducted and analyzed playground physics experiments. Students enjoyed working their minds at Fermilab and said their teacher was "probably the best classroom teacher they had had."

Summer Youth Employment and Training Program is a nine week program. High school interns from DuPage, Kane and Kendall counties are allowed to work a maximum of 35 hours per week. In 1990, two students worked at Fermilab.

Target: Science and Engineering hosts 25 high school students, the majority from Chicago schools, for six weeks. In the mornings, the participants work side-by-side with a scientific, engineering or technical mentor at Fermilab. In the afternoons, the students attend classes and receive assistance in the preparation of an individual or group research project.

The 1990 program was held from June 25 to August 3. The 24 participants came from 17 high schools. Seventeen students were from Chicago. Work assignments ranged from clerical and typing to entry level computer operations training and assisting scintillation counter assembly. Research projects, developed under the supervision of three high school teachers, included lasers and holography, a polarization box and 3-D polarization, a computer math and logic circuit and photosynthesis.

"I learned all about physics and its work environment. I also saw what is expected of me if I were to enter the field of physics. I gained patience and became more efficient."

Teacher programs

By reaching teachers, the Fermilab programs endeavor to influence indirectly a maximum number of students. Too few teachers receive training of the depth and currency required to deliver mathematics and science instruction in a way that sparks student interest. Our programs enhance the teachers' backgrounds in basic science; demonstrate successful and lively teaching techniques; and expose teachers to current developments in scientific research, basic objectives and problems in modern science, and contemporary relations among science, technology and society. Fermilab brings teachers to the Laboratory through the following summer programs: ·

The DOE Teacher Research Associates Program (TRAC) and the TRAC Graduates Program provide research experiences for junior high and high school teachers. The programs include a national and a regional component. Candidates for the national program are nominated by their state education departments. Candidates for the regional program apply directly. Teachers are assigned to a scientist or engineer involved in a research project and make contact with many professional researchers.

In 1990, 23 high school and 3 junior high school teachers held Fermilab research positions; 12 of them were new to the Laboratory, and 9 had never held a similar appointment. In addition to 21 Illinois teachers, participants came from Alaska, Arizona, Colorado, Indiana and Nebraska. Teaching assignments of the participants included: physics,12; mathematics, 6; computer science, 5; physical science, 3 and chemistry, 2. Summer assignments ranged from writing, testing and debugging computer programs to assisting with synthesis of new dopants in polystyrene for use in fiber detectors.

The Summer Institute for Science and Mathematics Teachers brings 45 high school science teachers in biology, chemistry and physics and 15 high school mathematics teachers to the Laboratory for an intensive four-week program. Lecture sessions in the four disciplines are conducted on Monday, Wednesday and Friday mornings by Fermilab physicists and college faculty. On Tuesday and Thursday mornings, plenary sessions are held with nationally-

known experts lecturing on interdisciplinary science topics. In the afternoon, computer instruction, lab sessions and mathematics sessions with master teachers are held at Naperville Central High School. A follow-up session is held in each discipline during the academic year following the Institute.

The 1990 Institute was held from June 10 to July 6. Participants came from nine midwestern states including Illinois, Iowa, Minnesota, Wisconsin, Michigan, Ohio, Indiana, Kentucky and Missouri. Residential participants stayed at the Iroquois Club apartments in Naperville.

A similar three-week institute, the **Chicago Summer Institute for Science and Mathematics Teachers**, was held at Chicago State University from June 25 to July 13. Sixty teachers represented 39 city high schools. Four follow-up meetings are scheduled during the school year for these participants.

"A dynamic, never-stop inspiration for science teachers. It would have been impossible to have spent these four weeks without getting excited about teaching science. Of all the classes and workshops I've ever taken, I can truly say this one was worth every minute!"

The Summer Science Project brings 45 junior high school science teachers to Fermilab for an intensive three-week institute. The institute curriculum includes seminars on basic science, training sessions on sound science instruction and inservice techniques, laboratory sessions where participants try out hands-on classroom activities and tours. Follow-up activities include quarterly meetings and participation in a network with teachers trained at other DOE laboratories collaborating on the project.

The 1990 program was held from July 29 to August 17. The busy schedule for these participants included a wide range of hands-on activities such as toys in space, holograms, polymer chemistry, robotics and computer applications. The group visited the Fermilab Magnet Factory, Cernan Space Center, Amoco Lasers and Research facilities, Ryndak-River Trails Nature Center, the Fermilab prairie, the University of Illinois Animal Research Labs, Argonne National Laboratory and SciTech Museum. Each participant developed a project to inservice other teachers during the school year.

Teaching Integrated Mathematics and Science (TIMS) is a three-year program for 39 elementary and junior high school teachers from nine school districts and one private school in DuPage and Kane counties. The workshop curriculum includes seminars to update participants' knowledge of basic science, and laboratory sessions to try out TIMS classroom activities. Follow-up meetings are held during the school year. The Fermilab Outreach Coordinator will visit teachers in their classrooms to assess and assist with implementation. Teachers will receive further training during the second summer to prepare them to train other teachers in their districts.

Districts participating in the 1990 program held July 9 -20 include: Batavia District 101, Benjamin District 25, Community District 180, Darien District 61, Elgin District U-46, Elmhurst District 205, Geneva District 304, Lombard District 44, West Aurora District 139 and the Rockford Diocese.

When Fermilab began sponsoring precollege education programs in 1983, it was not at all clear that a research laboratory was an appropriate setting for

major teacher institutes. Teachers have given us the answer, "Yes!" A national laboratory like Fermilab can make a significant contribution to the enhancement of science and mathematics education. Our experience has shown that although our Laboratory is a single purpose institution, teachers from all disciplines can enjoy and benefit from science and mathematics programs held here. Finally, we have shown that teachers respond positively to being treated as professionals and peers by researchers. All were honored to be involved in a program at Fermilab!

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John Peoples,

I really appreciated all you did for us at Fermilab. I really enjoyed myself. Fermilab made us feel welcomed. All the people were kind to us. You let us experiment and explore there. I learned a lot and will never forget this great experience. Thanks for your hospitality.

Sincerely,
Misty VanConant

A letter written by an EAL student.