A panel discussion, "Science Literacy in the 21st Century: Encouraging the Next Generation of Scientists," took place at a joint meeting of the American Society for Biochemistry and Molecular Biology (ASBMB) and The American Association of Immunologists (AAI) in New Orleans, Louisiana, June 6, 1990. The panel was cosponsored by the ASBMB Committee on Equal Opportunities for Women, the ASBMB Committee on Equal Opportunities for Minority Groups, and the AAI Committee on the Status of Women. The panel discussed ways in which scientists teaching and researching at the college level could be linked to elementary and high school programs to assist both science teachers and students.

The panel was moderated by Bruce Alberts of the University of California-San Francisco. Participants were Marsha Lakes Matyas of the Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science; Dr. Alberts; and Deidre D. Labat of Xavier University of Louisiana.

Dr. Matyas began by discussing "Grades K-12: Programs that Work." She explained that although educational research provides information about what promotes student interest and achievement in science and mathematics, most programs of this type have not been widely disseminated in school systems. They still remain discrete programs, most of which take place outside of regular school activities.

Many programs concentrate on teachers and counselors. They often attempt to increase teachers' knowledge of specific science content or their access to the resources of the scientific community. They attempt to increase understanding of teaching strategies that promote achievement or motivation in students, and to help educators and administrators encourage the participation of female, minority, and physically disabled students in learning science.

Programs for students try to expand skills and to improve children's understanding of what a scientist is, as many children "have a very narrow image of scientists," seeing them as "White males who wear lab coats, look 'nerdy,' and are evil." Other programs inform parents about what scientists do; what courses their children should take if they wish to pursue science or engineering careers; and how they can encourage children's interest in science and mathematics. Some attention has been given to educating federal and state legislators about what constitutes good science and math education; during the past 5 years, the AAAS Office of Opportunities in Science has conducted four seminars for U.S. congressional members and seminars for legislators in five states.

An unexpected ally in the efforts to improve K-12 science education has been community-based organizations (CBOs). Groups like the Girl Scouts, Girls Clubs, and many Black churches sponsor programs and special events such as field trips to interest children in science. Since 1985 the AAAS Linkages Project has worked with such groups and has established 38 computer learning centers in local CBOs throughout the country. The Linkages Project is setting up training programs for Girl Scout troop leaders, designed to help them feel "more comfortable, confident and skilled in leading girls in hands-on science and math activities." The program can also be used by other groups for science education efforts.

Dr. Matyas maintained that "the key to success for most K-12 science education efforts is the involvement of individual scientists and engineers." Scientists do not necessarily have to develop full-blown programs to contribute to this effort; they can speak to a group of children about their work, donate old but still usable equipment, or donate materials. Those with more time to invest might help a local group raise funds for a science event, obtain university support for such events, or do short workshops for adults who work with children, educating them about ways to encourage science learning.

**Scientists Must Become Involved**

"As scientists," Dr. Matyas concluded, "we have to become involved in stimulating . . . children's interest and achievement in science and mathematics." The National Science Foundation has estimated that by 2010 the U.S. will need 700,000 more scientists and engineers than it will be able to provide; by the time they finish junior high school, most children will lose interest in scientific careers. "If we don't set some time aside to be involved, . . . there will be few scientists to follow in our footsteps . . . to be our undergraduate and graduate students . . . and to continue our life's work. The time for individual involvement is now."

Bruce Alberts then discussed the Science and Health Education Partnership, which links UCSF with the San Francisco Unified School District (SFUSD). The Partnership is currently in its fourth year, and its founding was based on two assumptions: that precollege science education depends almost entirely on the "dedication, energy, and abilities" of teachers, and that they can be helped and encouraged by a science-rich institution, which has much to offer them. Such institutions can provide material and supplies. The difference between the science supplies provided by a school district and even a modest supply budget for research is "pathetic"; in some districts the average expenditure is $1 per year per student. However, according to Dr. Alberts, even more important is " . . . the status we offer to the teachers by giving them a sense of being part of the science community."

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Dr. Alberts believes that “...we scientists are in no small part responsible for the present sad state of affairs...” that exists in precollege science teaching. Scientists and precollege science teachers usually do not communicate; students thus “...get a clear message: have anything to do with precollege teaching—...become such a teacher—and we will cut you off from the real world of science completely.” At the same time, precollege science teachers are left to the mercy of bureaucrats who, knowing little about science, design and implement science courses that consist of memorization exercises. “Nothing less than a revolution is needed,” Dr. Alberts contended, “in which we scientists must all play a part.”

To change the teaching of science, UCSF scientists have been working on creating a dialogue between precollege science teachers and scientists at the university level. Dr. Alberts reported on the program as it currently exists. He pointed out that UCSF “started on the right foot” by appointing a steering committee of interested teachers, which meets monthly. “Most of the good ideas come from them.” The school year begins with a mixer, at which about 150 teachers meet the volunteers from UCSF. As the teachers are exposed to the many resources available to them at UCSF, each teacher works with a faculty member, a graduate student, or a technician on a one-on-one basis. The nature of what the teams do is up to them.

UCSF sponsors an annual science teaching contest with monetary prizes; in 1990 there were 60 finalists. According to Dr. Alberts, such a contest serves many purposes. Many faculty and students from UCSF go into the schools as judges; this inspires them to volunteer for other activities in the following year. The students become experts in a small area of science, and gain an appreciation both for science and for what their teachers have to do every day. When winners are chosen in May of each year, there is a well-attended and well-publicized awards ceremony at UCSF, with all of the finalists sitting tensely with their teachers in the audience, awaiting the names of the winners. Bringing the contest directly to the campus in this way “gets the UCSF administrators turned on” about the entire partnership program.

Minorities and Biomedical Sciences

The final speaker was Deidre D. Labat of Xavier University, who spoke on “The Educational Pathway for Minorities into the Biomedical Sciences: Graduate and Professional Programs.” She began by describing Xavier University itself, which is a small institution for Blacks in New Orleans. Although it primarily serves the Black community, about 10% of the student body is now non-Black. Although Xavier has a College of Arts and Sciences and requires its students to take core courses in literature, foreign languages, social sciences, and the like, students exhibit a tremendous interest in the health sciences. In the fall of 1989 almost 61% of freshmen were majoring in prepharmacy or premedicine.

In terms of its eminence in science education for minority students, Xavier has been number one in the nation for placing blacks into pharmacy schools and number two in placing them into medical and dental schools. According to Dr. Labat, this success has been based on “an active and ongoing involvement of Xavier natural science faculty in precollegiate activities,” and on modifications in entry-level science courses that make them more accessible to minority students.

Overall, Dr. Labat reported, the number of blacks entering the scientific fields was decreasing; so Xavier’s growth in the sciences was not accidental. In 1976 the university began activities to identify precollege black students with scientific ability and to provide them with activities that would prepare them to achieve their goals in the sciences. The university itself offers summer programs known as the “Xavier Summer Science Academy” in which 740 students participated in 1989.

Perhaps the most important element of the summer academy is a program called SOAR (Stress on Analytical Reasoning). After completing this program many students increase their Scholastic Aptitude Test scores by an average of 120 points. Reading levels usually increase more than 2 years on a standard reading examination. Both teachers and students report that students do significantly better in high school science courses and have more motivation to study science.

Dr. Labat said that SOAR was created by a group of science faculty from Xavier; its development led “to a consideration of how SOAR-like activities could be integrated into entry-level mathematics and science courses.” Today a consortium of faculty called SERG (the Science Education Research Group), which consists of four of the five teachers who developed SOAR, continues to improve the entry-level courses taught at Xavier in biology, chemistry, mathematics, and physics.

The improvements to these courses include standardization. Thus all students in all sections of a given course are taught the same material at the same pace, which better prepares them for upper-level courses. The faculty have developed workbooks that integrate learning goals, study aids, and sample questions students can work with. Such books help students identify the points an instructor wishes to emphasize and aid inexperienced science students. The courses also include some work on enlarging students’ general vocabulary (as differentiated from a scientific vocabulary), which will improve their performances on a variety of standardized tests.

Dr. Labat concluded by saying that Xavier students receive extensive support and assistance at the lower level of their college careers, but that by the time they reach the upper level, courses are being taught more in the manner in which they are taught at any graduate or professional school. According to her, “This strategy forms the basis for the approach at Xavier University, which is summarized as a school where there are ‘Standards with Sympathy.’”