The Birth and Success of MBRS

In the late 1960s, administrators from the historically black colleges and universities (HBCUs) and others began meeting with U.S. government officials and congressional members to convince them that HBCUs were responsible for educating the majority of African-Americans who received baccalaureate degrees and who continued on for advanced degrees at major universities. This resulted in an executive order from President Nixon and congressional action to assist these minority institutions. One of the first programs that resulted was the Minority Schools Biomedical Support Program (later changed to MBRS), which began in 1971 at the National Institutes of Health (NIH, Bethesda, MD).

The program targeted institutions

with predominantly minority enrollments in order to develop their research capabilities and thereby improve the scientific training provided to their students.

In the ensuing years, these schools underwent dramatic changes. They improved their facilities, retrained their faculty, hired new faculty, and revamped their science curricula. Most have more than doubled the number of students majoring in the sciences and expanded their offerings to include biotechnology and research training. Not all of their graduates go directly to the research (doctoral) degree. However, many work in some part of the scientific enterprise—as faculty at undergraduate colleges, high school teachers, research technicians in the private sector and in the health

professions.

The MBRS program has spawned many spinoffs. Once it showed that undergraduate research participation was a success, many other federal agencies and some private foundations, such as the Josiah Macy, Jr. Foundation (New York, NY) and the Howard Hughes Medical Research Institute (Bethesda, MD), began to develop their own programs stressing undergraduate research involvement. The fact that its methods have been widely adopted is a testament to its success. ///

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are too intense for most undergraduates. Large society meetings with many concurrent sessions are also difficult for undergraduates.

My more-advanced students found last February's Miami *BioTechnology* Winter Symposium—Advances in Gene Technology: Protein Engineering and Structural Biology—to be highly rewarding. In our lab, we have been studying the effects of site-specific substrate sequence variation on 5S RNA and tRNA processing efficiency. We use substrate structure probing to assess whether processing effects are due to global misfolding, the disruption of tertiary structure, local helix deformation, or the disruption of nucleotide-specific enzyme-substrate contacts.^{1,2} After Jerry Joyce's (Scripps Research Institute, La Jolla, CA) talk on "Evolutionary Engineering of RNA Enzymes," one of my students rushed over and said, "Why we don't randomize and select for RNA species that can be processed?" On the basis of his enthusiasm, we are now attempting such a project.

The less-advanced students in my group may not have followed all of the technical details, but they too found the meeting enriching. Think back to the last scientific meeting you attended. Did you follow everything that was presented? 50%? What about the first meeting you attended? Now put yourself in the position of a college sophomore at the same meeting. The best one can hope to achieve by student attendance is immersion in the culture of science. In addition, the trip brought a new cohesiveness to the group. My students also attracted a good deal of attention, all positive, at the meeting, being noticeably younger and ethnically more colorful than virtually everyone else there.

On the basis of our experience, we are planning to attend the North Carolina Biology of RNA conference this October. We have submitted two abstracts, including the attempt at 5S RNA randomization/processing size selection that was inspired by Joyce's talk.

Time, Patience, and Enthusiasm

The positive effects of research lab experience on recently graduated technicians are more easily assessed than those on undergraduates because there are fewer technicians and they have already received baccalaureate training and, in some cases, research lab experience. Most U.S. life sciences majors want to go to medical school, and the idea of a research career comes to them somewhat as an afterthought. We are obliged first to plant the seed of interest in research, and then to nourish it.

To encourage aptitude and enthusiasm for research in an academically qualified undergraduate who agrees to work in a research lab takes time and patience. In addition to doing experiments, we must constantly teach in the research lab, much as in our courses. Most importantly, we must set an example. Since students who join a research lab early in their undergraduate training know neither the theory nor the practice of gel electrophoresis, DNA amplification, recombinant DNA technology, or macromolecule purification, we must maintain our own skill levels, while at the same time demonstrating and describing the procedures so that students can acquire these skills and the scientific literacy with which to understand their application to a particular research project. While not all of our projects and experiments are successful, the evaluation of experiments that do not succeed is a critical part of the process of establishing a pervasive culture of science for students. All these activities combined enable us and our students to see where we fit into the larger scientific community. And fit we do.

References

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