

Guest Editorial

Learning Science by Doing Science

**W. Franklin Gilmore, President
Sigma Xi, The Scientific Research Society
P.O. Box 13975, 99 Alexander Drive
Research Triangle Park, North Carolina 27709 USA**

In addressing a Legislative Committee on Appropriations about the importance of undergraduate research, my colleague, Rick Douglass, said: "I teach science by doing science." In making this statement, Dr. Douglass explained that in teaching biology to undergraduates he takes his students into the field and lets them become involved in his research projects. By doing science, students learn that answers to questions are not absolutes in that yes or no answers usually do not exist. They learn that data are not always reproducible at the desired statistically valid level. The critical importance of properly controlled experiments becomes clear when one does science.

Undergraduate research differs in important ways from undergraduate laboratory experiments or papers written on assigned topics. While these are excellent teaching strategies, they usually do not introduce the element of creativity that is the hallmark of research in most, if not all, disciplines. Creativity is the element of research that moves the discipline forward and it is essential that this become a part of the thought process and learning process early in the academic phase of a person's career. I know that early exposure to creative thinking is essential in the sciences and engineering and I don't see how this could not be true in other disciplines.

If creative thinking in research is what moves disciplines forward, ethics in research is what keeps the integrity of the process sound. Early exposure to the ethics of research is also very critical in that we tend to follow the principles we are exposed to early in our careers.

Inculcation of sensible work habits is another essential element of research that

needs to be introduced early in the career. Inculcation of sensible work habits does not include encouraging students to become workaholics. What is important here is to demonstrate that it is possible to accomplish great things while having a meaningful personal life. Students should be shown how to be smart in their work habits.

Undergraduate research takes many forms across the many different institutions represented in America. This is healthy and exactly what should be encouraged. However, the programs that are sound include a number of key elements that can only be taught by doing research. In my comments here, I have mentioned three of these elements: creativity, ethics and sensible work habits. Each of us should make a list of the elements that we consider important in introducing students to research and make sure we sensitize students to these characteristics of successful people.



Dr. Frank Gilmore is President of Sigma Xi, the Scientific Research Society, an international society of 75,000 researchers in the sciences, mathematics and engineering. Dr. Gilmore also serves as Chancellor and campus CEO of Montana Tech of the University of Montana. Prior to

that, he was the executive vice president and vice president for academic affairs at the West Virginia University Institute of Technology. For 26 years, he was professor, chair and research professor in the department of medicinal chemistry at the University of Mississippi. A native of Mississippi, Gilmore earned a B.S. in chemistry at Virginia Military Institute and a

Ph.D. in organic chemistry at the Massachusetts Institute of Technology. After service in the Army, he spent a postdoctoral year at the Institute of Molecular Biophysics at Florida State University.

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In addition to honoring scientific achievement, Sigma Xi also endeavors to encourage support of original work in science and technology and promote an appreciation within society at large for the role research has played in human progress. During its centennial celebration in 1986, Sigma Xi adopted an additional mission: to foster worldwide interactions among science, technology and society.

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