

## Editorial

## The Many Faces of (General) Chemistry

The theme for this year's National Chemistry Week is "The Many Faces of Chemistry". In support of this theme, Erica Jacobsen and Betty Moore coordinated the series of career profiles on pp 1562–1586. The diversity of careers described there as well as some of the other articles in this issue led to these thoughts about how we introduce students to chemistry.

In a number of other countries, the United Kingdom for one, some university chemistry departments are in crisis for lack of students. That is not the case in the U.S., and one of the main reasons is that university chemistry departments serve far more than just their own students. Many other departments in biological sciences, other sciences, and engineering depend on us to help educate their students. This provides a large number of students in our introductory courses and also a great opportunity to recruit more good students toward careers in chemistry.

We see many faces and have a great opportunity to help them learn chemistry and see our subject's great beauty. But what face do we chemists expose to these students? Too often it is a narrow, skeletal, enigmatic one that does not begin to encompass the diversity of chemists whose careers are described on pp 1562–1586. We can do a lot better.

When asked about how they use chemistry in their careers, our respondents listed biochemistry, brain chemistry, designing monitoring equipment, environmental testing and controls, evaluating security of chemical manufacturing plants, emergency plans regarding hazardous materials, teaching through chemical demonstrations, synthesizing organic chemicals, studying small organic molecules in medicines, working on patents in chemical and engineering disciplines, working with drug development groups, and applying the scientific method—even in nonscientific areas. When asked to describe personal skills essential to their current jobs, our correspondents mentioned communication/interpersonal skills, problem-solving skills, teamwork, enthusiasm, leadership, content knowledge, curiosity, attention to detail, conceptual vision, creativity, persistence, and openness to new ideas. Many of these were mentioned several times; those listed first were mentioned more often than those listed last.

I contend that most of us are doing a relatively poor job of introducing students to the diversity of applications of chemistry exemplified in the careers of our respondents and also of preparing students with the diversity of skills employed by chemists in both traditional and nontraditional careers. I recently had access to results of a survey of a large number of general chemistry instructors regarding what topics were most important to include in their courses. The results were very disappointing. There was little interest in topics involving biochemistry, organic chemistry, medicinal chemistry, industrial chemistry, environmental chemistry, atmospheric chemistry, materials chemistry, surface chemistry, nanoscience, or other areas in which my younger faculty colleagues are actively engaged in research. Some of this may be because those responding to the survey were unfamiliar with these newer areas of chemical research, but much of it appears to be the result of a strong desire to provide students

**Each semester or each year, explore with your general chemistry students one or two new aspects of chemistry and one or two new ways of teaching that you have not explored before.**

with the background needed for them to succeed in subsequent chemistry courses.

That's a worthy goal, but it presumes (incorrectly) that these students will all take subsequent chemistry courses. Without some vision of the great power of chemistry to bring good to society and solve important problems, how will these students be motivated to take more chemistry? Right now most of that motivation comes from other disciplines that require chemistry courses, but that could easily change if the chemistry courses do not suit the needs of those disciplines. General chemistry is like a nearly naked emperor in danger of being found to be irrelevant to the needs of many client disciplines. We need to put on a new suit of content and pedagogy that will better meet the needs of chemistry, other disciplines, and society at large.

How can we do this? Some good advice is provided on p 1584 by Alan Ehrlich, a chemist and patent attorney. "Don't be afraid of change. Never stop learning. Most of all, *follow your dreams*." Each semester or each year, explore with your general chemistry students one or two new aspects of chemistry and one or two new ways of teaching that you have not explored before. Share with the students your enthusiasm for the subject, for teaching and learning, and for the roles they might play in applying what they learn to improving their own lives and the lives of others. Worry more about motivating them to take more chemistry courses and less about preparing them with specific content that they will need in those courses. Let them know that you really care about chemistry and about their success in learning chemistry. Show that you have a dream for where they may eventually find work that will be fulfilling to them and useful to society. Show that you are living that kind of dream in your own career.

The most important aspect of general chemistry is that it is *general*. That is, it can provide an overview of the subject that interests and motivates students and helps them "see the connections that make life interesting" (as Roald Hoffmann puts it on p 1632). If we do that, then most of our other goals involving content and skills will be much more easily achieved. And our students, decades later and in careers not even envisioned today, will remember their general chemistry course as a pathway to their own dreams and goals.

