Fear of All Snakes, Spiders, . . . and Chemicals

by David A. Evans

I admit to being terrified of snakes, even when I recognize a nonpoisonous species. My daughter will not enter a room if she suspects the presence of a spider—even though she knows that there are no harmful spiders in the UK where we live. We are both scientists, but to be provided with any amount of profound and convincing evidence that these species are benign does not remove our fear. It is not a matter of trust, it is simply an irrational response. But knowledge does help—we do not kill these species and we recognize their beneficial role in their environment.

Similarly, a section of the population has a fear of, or a dislike for, “chemicals.” Whereas such a phobia is often based upon lack of knowledge or familiarity, the same irrationality governs the responses. Again, informative statements based upon faultless logic almost always fail to convince. For others, the root of chemophobia is in a dislike of meddling with nature—and this group is often unaware that natural products consist 100 percent of chemicals. Thus, my niece seeks to consume only “pure butter, free of chemicals of all sorts”—we also note that she has a problem with the concept of purity, but purity is very often taken to mean the absence of manufactured chemical additives!

I know that many colleagues share these experiences, but what can we do to gain a better appreciation of our work? Perhaps the most obvious, yet frequently ignored, aspect is absolutely never to rebut an irrational or emotive argument by bombardment with scientific data and explanations. “Don’t you realize that these chemicals are safer than toothpaste” just doesn’t convince the sceptics—and it besmirches the qualities of toothpaste! Similarly, we should try to resist stating that many natural products are much more poisonous than synthetic chemicals. For many of the public, this is akin to trying to compare apples with pears—they are not parts of the same argument.

We should also acknowledge that people are not always unjustified in their fear of chemicals and history teaches that some dangerous chemicals have slipped through the net. In the past, we have sometimes been less than straightforward with the public, with appalling consequences for our credibility. We should understand that to many people, including highly educated citizens, the term “chemical” is now exclusively synonymous with manufactured materials, presumed to be toxic or carcinogenic. These find their way either on purpose or accidentally into the products they buy, the food they eat, or into the air, water and soil—and questions should be asked and answers given.

In practice, I know of no all-encompassing answer to this problem, but one of the best ways to make progress in my experience is to describe the benefits of a chemical product or process, together with straightforward comments about costs and risks. Most people are best persuaded by a benefit that they themselves experience. Thus, healthcare products provide an easy win, but to state that pesticides help farmers’ profitability is hardly a selling point!

Segmenting the Audience

Our positive messages need to be tailored to our audiences—the public is very heterogeneous. A win for one group might be an anathema for another. Let’s consider some of the active groupings:

The Media
The prime objective of all media, with the possible exception of some public service broadcasting, is to sell advertising space—in which audience ratings and circulation figures dominate. In the UK, some of the newspapers have devoted themselves to tirades against chemical usage. They are aware that sensation sells and never fail to print alarmist reports of the slightest chemical incident with exaggeration and distortion adding to the mix. Conversely, erudite reports of progress in science attract only a few and thus command very few column inches. Nevertheless, a fascinating story about a new development will get printed in the quality newspapers. A win here demands persistence in which development of relationships between science reporters and, for example, the press officers of learned societies, is required. Good relationships also facilitate the rebuttal of the nonscientific scaremongering that is often peddled to the public. Some learned societies have taken the initiative by assembling a rapid-response panel to deal with urgent press inquiries.

But scientists have an important part to play, too.
When addressing the media, we are prone to raise unrealistic expectations and to exaggerate. We sometimes are guilty of providing support for our pet project by unjustly denigrating an alternative—and the result is the debasing of all science. Whereas critique and debate are a part of the scientific method, public rancor amongst members of our profession is very damaging.

**Government**

The prime aim of a ruling political party is to stay in power, for example by re-election in a democracy. It is naïve to hope that politicians will rally to a cause that is unpopular with the public electorate, although there are notable exceptions to this. The paradox is that the actions of governments affect generations, but elections occur every few years. Small wonder therefore that political decisions are often short-term expedients. So what can long-termist scientists do about this? In my experience, the fostering of regular liaisons between the political office of a learned society and the appropriate government body can be mutually beneficial. The provision of authoritative and consistent information, independent of vested interests, is highly appreciated by politicians. This brings into focus the potential for IUPAC to act as an NGO. As an organization that is dedicated to accuracy, standards, and the principles of scientific method, IUPAC is well placed to provide leadership in this arena. Its freedom from bias, coupled with the formidable breadth, expertise, and authority of its membership, means that IUPAC is splendidly placed to act as an independent NGO, in contradistinction to many of the single-issue pressure groups that currently masquerade under this banner. It must also be mentioned that trade associations, however well intentioned, will not be regarded as neutral by governments, again underscoring a role for IUPAC.

**The Education Sector**

Here we meet our biggest opportunity for influence—and also a major challenge. Perhaps the best returns are to be gained from involvement in teacher training and by supporting teachers with learning aids and materials. The IUPAC Committee on Chemistry Education (CCE) has spawned or supervised many powerful initiatives in chemical education, many of which have already been described in *Chemistry International*. The National Adhering Organizations (NAOs) that support IUPAC often carry out major initiatives in this sphere and there is no shortage of commitment to continuing this work. This is clearly a major area for contributions from IUPAC in the future.

**Scientists**

It must be recognized that we scientists are ultimately collectively responsible for the esteem in which our profession is held by the public. In addition to the comments above, mention must be made of our past failures in engaging the public adequately. We have often insufficiently explained our purpose and our work. Our public attitude to risk has often been to deny its existence. Our openness when faced with emergencies and accidents has been at fault. In short, science communication has been suboptimal and IUPAC is poised to play a major role here.

**IUPAC’s Key Role**

Whereas IUPAC’s scope for involvement in the public understanding of chemistry is broad, it needs to clearly establish its niche alongside the numerous bodies with interest in this topic. At the 2005 General Assembly in Beijing, Peter Mahaffy, now Chair of CCE, prepared and presented a seminal report entitled *Chemists and “The Public”: IUPAC’s Role in Achieving Mutual Understanding*. This paper sets the direction for IUPAC’s efforts to enhance public understanding based upon an analysis of best practices for science communication (see p. 14). The intention is to help scientists identify and understand their publics, to support science education systems, and to influence international organizations. To quote the report:
Perhaps you read the title above as a test for dyslexia, as the chemistry profession usually inverts the order of those words to highlight the challenges associated with winning increased public understanding of and appreciation for chemistry. And, as outlined in the accompanying article (p. 12), those challenges are profound.

A task group of the Committee on Chemistry Education (CCE) is completing a project aimed at clarifying IUPAC’s niche in meeting the global challenges of increasing public understanding of chemistry. One significant recommendation is that we turn the phrase “public understanding of chemistry” around, and focus considerable attention on helping IUPAC chemists identify and understand their diverse publics, so focused and effective strategies for science communication can be developed.

An overarching goal for the project is to provide a framework that will bring the same level of intellectual rigor to IUPAC’s science communication activities as to IUPAC’s scientific activities. Thus, work began with a careful review of the extensive literature on the public understanding of science and paid careful attention to the nomenclature used to describe these activities. The report recommends that IUPAC clearly define its most appropriate target audiences, clearly articulate goals and motives for IUPAC public understanding of chemistry (PUC) initiatives, and design PUC projects with a plan for rigorous evaluation of outcomes.

The project task group included CCE members Peter Mahaffy (chair), Tony Ashmore, Bob Bucat, Choon Do, and King’s University College undergraduate student Megan Rosborough, who carried out an extensive literature review and assisted in the development of the project report. The report was presented in a well-attended joint workshop at the 2005 General Assembly in Beijing, and will be finalized following the 19th International Conference on Chemists’ Understanding of the Public

Did You Say PUC or PAC?

Chemists derive great benefit from precision in the use of terminology in their scientific work and IUPAC uses a variety of terms for science communication as do other organizations. The practical definitions proposed for the purpose of science communication are:

**Public understanding of chemistry:** Understanding of chemistry matter by non-chemists, including chemistry content, the nature and methods of chemistry (as a social enterprise), and the roles and uses of chemistry in society.

**Public awareness of chemistry:** General knowledge of chemistry content, processes and societal roles, without detailed and precise understanding.

**Public appreciation of chemistry:** A positive attitude to chemistry, including respect and/or admiration for its methods and its contributions (and potential contributions) to society.

This is an extract from Mahaffy’s draft report.

“**IUPAC is just one of many actors in public understanding of science, and will frequently need to work collaboratively with the other scientific unions and other bodies. IUPAC cannot cover the full range of possible activities and address all audiences, not least because it is remote from the general public. IUPAC’s primary targeted public should be IUPAC chemists and educators, and IUPAC’s most important role is to help them understand and work with a variety of other publics.”**

Furthermore, we need to be aware that our notion of public understanding often overlaps with public awareness of, and public appreciation for chemistry. These are rather separate topics encompassing different processes—the report clarifies the distinction.

The public understanding arena is characterized by numerous well-informed and substantive contributions, but there is an evident lack of coordination leading to much duplication of work. Within IUPAC, it is vital to have a focus for our work and I believe that CCE should be that focus. Whereas the Committee on Chemistry and Industry (COCI) has a program in this area, it is agreed that COCI should concentrate on the industrial perspectives with a greater focus upon public appreciation. Many NAOs will pursue their own national programs, and indeed several have pointed out an extensive literature review and assisted in the development of the project report. The report was presented in a well-attended joint workshop at the 2005 General Assembly in Beijing, and will be finalized following the 19th International Conference on