COMMENT

Needed: a realistic environment for science and technology

The number of letters received following the publication of an earlier Comment, "Needed: champions for an informed public" (C&EN, June 26, page 25), far exceeded those previously received by me on any other single topic. Those letters plus a number of discussions concerning that Comment lead me to believe that it would be useful to extend the analysis of some elements of the previous Comment.

This Comment is based upon the thesis that long-term benefits derived by society from science and technology are directly related to how realistic the environment is for science and technology. An unfavorable, but unrealistic, environment could unnecessarily deprive the public of goods and services that are currently technologically feasible and would unnecessarily impede research and innovation leading to goods and services that would serve the public well. The loss to society goes beyond the goods and services themselves to include the impact upon our domestic economy, the availability of employment opportunities, and the U.S. international competitive position in technological matters.

A favorable, but unrealistic, environment could and probably would enhance the support for research, and would accelerate the innovative process and all of the things that flow from the technological process. Undoubtedly, there would be short-term gains in some sectors. But the risk is high that the euphoria would dissipate, the accommodation to reality would be difficult, and the consequences of an overswing to an unfavorable, but equally unrealistic, environment would be traumatic. It may be that we have been and are now experiencing such an overswing.

On balance, society, including the scientific community, will be best served by a realistic environment. To achieve a realistic environment for chemistry and chemical technology is a goal we can pursue constructively and effectively and in the process increase our understanding of the relation of chemistry and the chemical profession to society as a whole. Being a scientist in no way ensures that one understands the relation of science and technology to society. My conclusion is that very few of us do, but that a rapidly increasing number of scientists are making an effort to do so, and that employers are increasingly seeking employees who have an interest in these matters.

There are tremendous advantages in seeking to foster a realistic environment for science and technology. In the first place, it is in the best interest of all of society, including the scientific community, to do so. In the second place, with that as a goal, scientists will be more willing to explore *with all others* the relation of science and technology to society and in the process examine and re-examine current assumptions, evaluate and re-evaluate current practices. Many of these assumptions and practices are social, economic, and political as well as technological. There can be no sacred cows. We can be more objective; we can be active without becoming aggressive or defensive. We can be advocates on selected issues without unduly provoking others to become aggressive or defensive.

What are the primary characteristics of a realistic environment? If we are to foster these characteristics, we should know what they are. They are about equally divided between science and technology in general, and chemistry and chemical technology in particular. A realistic environment is a public *including* scientists that understands that:

- Sciences are amoral.
- The use of science and technology may be judged by society to be moral, amoral, or immoral.
- All technological change (all change for that matter) has a positive as well as a negative impact on some segments of society.
- There are things science and technology can accomplish, and things that science and technology cannot accomplish (i.e. create a risk-free technology).
- Innovation is a slow process based upon technological competence but highly dependent upon social, economic, and political factors.
- The extension of scientific knowledge is a slow process and the productivity of 20 research scientists working for 20 years cannot be matched by 400 research scientists working for 1 year.
- There are areas in which scientific knowledge can be *extended* rather quickly and other areas in which scientific knowledge can only be *acquired* through sustained periods of effort.
- The numbers and quantities of natural chemicals far exceed the numbers and quantities of synthetic chemicals produced by industry.
- Synthetic chemicals are a large factor in achieving the high standard of living enjoyed by technological societies.
- It is the exposure to chemical substances and combinations of chemical substances that leads to acute and chronic toxic responses in specific species of plants and animals.
- Toxic responses to exposures to chemical substances are in no way limited to synthetic chemicals.
- Much of medicine is the selective and controlled use of chemical substances to produce toxic responses.
- Some of the traumatic misadventures associated with exposure to chemical substances have arisen through a lack of scientific knowledge but many have been the consequence of mismanagement.

A number of other characteristics could be listed. The ones listed here may not even be the most important. The list is, however, sufficient to indicate that each of these can be dealt with and that none of these is particularly difficult; moreover, each solution leads to another. To address the problems is absolutely essential if we are to achieve a realistic environment for science and technology.

The above contrasts sharply with endeavors seeking to create a "favorable image" by focusing *exclusively* on the positive contributions of chemical technology to our life style and our standard of living. There is much that can be said and should be said about these accomplishments. But to merit creditability, we also must address the problems publicly. Much of the public knows or at least suspects that problems exist. They deserve to know that the chemical profession is concerned and what we are doing to identify and to alleviate these problems. To emphasize the positive and deny the negative can become merely a public relations activity or be perceived as such by the public, and in the long run may be neither justified nor creditable.

The chemical profession is achieving a new level of maturity and it is time to get on with the business of fulfilling our unique role in society.

Anna J. Harrison
ACS president

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