Speaking of Science

Chemistry and Science: The Next Hundred Years

On 1 August 1774, Joseph Priestley discovered a new constituent of the earth's atmosphere which he called dephlogisticated air and which we know as oxygen. The discovery led ultimately to the downfall of the phlogiston theory of the alchemists and to the rise of modern chemistry. Priestley later immigrated to the United States to escape persecution for his religious and political beliefs, beliefs that were influential in the development of the Unitarian Church and of Thomas Jefferson's theories of political democracy. But it is for his discovery of many common gases and his experiments with them that Priestley is chiefly remembered.

Priestley's contributions to science were commemorated on 1 August 1874, at the Centennial of Chemistry gathering of nearly 100 chemists in Northumberland, Pennsylvania, which had been Priestley's home for the last years of his life. The meeting was the first national congress of chemists in the United States, and from it came the impetus that led to the formation of the American Chemical Society (ACS). Participants at the 1874 meeting noted how far chemistry had advanced beyond Priestley's time, although some expressed opposition to the formation of a new society because "there were not enough chemists and probably never would be, in the United States to support such a society."

That view has proved false, and participants in the second Centennial of Chemistry celebration a few weeks ago* were likewise treated to an accounting of how greatly chemistry has expanded in the past 100 years. The total membership of the ACS, for example, is now about 108,000, and there are, if anything, too many chemists for the jobs available. The sophistication and reach of chemical research is also at least as advanced over 100 years ago as the chemistry of that period was over Priestley's. Whether such a rapid rate of progress can be maintained for yet another 100 years was the subject of the keynote address delivered by Franklin Long of Cornell University at the 1 August centennial ceremonies in Northumberland.

Long hedged his look into the future by noting that most predictions about how science will develop turn out to be wrong. Not ruling out the possibility of thermonuclear war between, for example, the United States and the Soviet Union, he stipulated that it was the prospects for worldwide chemistry he was addressing. He contrasted Priestley's optimistic view about the role of natural philosophy (science) in uplifting men's lives, souls, and living circumstances—a happy vista, as Long put it—with his own more sober outlook. Using chemistry as a paradigm for science as a whole, Long considered the prospects for chemistry in its third 100 years as a field of research, as a profession, and as a human endeavor.

In his outlook for chemical research, Long seemed to split the difference between the optimists who believe in an unending frontier and the pessimists who believe that science's golden age is almost over. There is a point of view which considers chemistry a mature science with secure, well-established paradigms, unlikely to produce major new surprises. More broadly, this line of argument is based on the assumption that knowledge is finite and that almost all the sciences will play out eventually as sources of new ideas. Long acknowledged these opinions, but seems at root to disagree. He predicted that chemistry will be alive and well 100 years from now, even if new breakthroughs come more slowly than in the past. But he warned that the chemistry of the future then might look somewhat different from today's. There will be more interaction between chemists and other kinds of scientists, he believes, and applied chemistry will become even more important than it is today.

As for chemistry the profession, Long sees it as an international community of scientists, who, while they may fail to live up to Priestley's description of them as "superior and exalted beings," are nonetheless characterized by a shared set of values that include honest work, open publication, and openness to criticism. The number of chemists and of their publications, however, cannot continue to grow as in the past, Long believes, but must instead make some approach to a steady state. Among the troublesome consequences of this that Long foresees are fewer young scientists and a possibility of greater resistance to new ideas. The status of scientists may decline somewhat—their role as high priests exchanged for another—in a society in which growth and change are themselves deemphasized. With a more crowded world in 2074, cooperation may be more important than competition. All of these changes, Long believes, will affect future chemists both as scientists and as citizens. What will be needed, he thinks, is a greater commitment to science in the service of man.

Long pointed out that, although the relevance of scientific theories and their practical consequences to the human condition are now generally accepted, such acceptance is a relatively recent state of affairs. Still newer is the direct look to science for solving social problems, for technical fixes, which Long believes will be the interesting challenge of the future; Long also believes that in 2074, science for society may be in its golden age. The focus of chemistry in the coming century, then, may be to realize in full Priestley's dictum that "the use of science is the power it gives us over nature." Whether this will prove as interesting and as satisfying to chemists as the opportunity to find something really new is obviously another question, but Long was ultimately optimistic. "One hundred years from now there will be chemists, there will be chemistry, and it will end up being, as it now is, an essentially satisfying and interesting field of endeavor."

—ALLEN L. HAMMOND

* The second Centennial of Chemistry celebration, 30 July to 3 August 1974, sponsored by the American Chemical Society and the Pennsylvania State University Department of Chemistry.