COMMENTARY
Moving Past a Seminal Generation in the History of Chemistry: A Moment to Reflect

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The recent deaths of John D. Roberts (June 8, 1918-October 29, 2016), Jerome A. Berson (May 10, 1924-January 13, 2017), and George Olah (May 22, 1927-March 8, 2017) took my breath away. They were all of a venerable age—Jack was mighty close to 100, Jerry was 92, George was almost 90—and they had lived long, successful, well-appreciated, and honored lives. But they were also my friends and my heroes, and I miss them.

Jerry was still enjoying life when he died. Shortly before his death, he wrote to me:

> Considering my age, I am not in bad shape. I go to the gym 3 times a week and it does me good. My piano studies have developed into a fierce contest between me and Chopin. He is winning, but it's fun.

For Jerry—for anyone—that's an excellent way to go.

The deaths of these giants call to mind the many giants from what is often called the Golden Age of Chemistry. There are too many to name here, but we especially salute those whose lives were cut far too short: Saul Winstein at just 57, R. B. Woodward at 62, and especially Rosalind Franklin at 37.

Thankfully, numerous others, like Berson, Roberts and Olah, lived long and full lives. Paul Bartlett and Georg Wittig, 90; Carl Djerassi, Gene Garfield, Vladimir Prelog and Günther Wilke, 91; H. C. Brown, 92; William Doering, Carl "Speed" Marvel, Tetsuo Nozoe, and Linus Pauling, 93; Frank Westheimer, 95; Sir John Cornforth and Herman Mark, 96; Helmut Zahn, 100; and Wilson Baker, 102, to name a few.

Many more of their generation, happily, are still living, and several are still publishing. E. J. Corey, now 88, published four state-of-the-art papers in the *Journal of the American Chemical Society* and two in *Organic Letters* in 2016. Albert Eschenmoser, now 91, published seven papers on corrin syntheses leading to the total synthesis of vitamin B_{12} in 2015. These papers spanned almost 600 pages in one issue of *Helvetica Chimica Acta.*

Also still with us in their late 80s and 90s are synthetic chemists (Alan Battersby, Teruaki Mukaiyama, Gilbert Stork, E. C. Taylor, Zen'ichi Yoshida), natural products chemists (Duilio Arigoni, Madeleine Joullié, Jerry Meinwald, Koji Nakanishi,), and physical organic chemists (Norman "Lou" Allinger, Ned Arnett, Marjorie Caserio, Rolf Huisgen, Andy Streitwieser, Ken Wiberg).

Because I am an organic chemist by education and research experience, my examples are primarily from organic chemistry. But clearly chemists from the other subdisciplines who still live should be cited—crystallographer Jack Dunitz, 93; inorganic chemist John Goodenough, 95; and physical chemist Sir John Rowlinson, 91, among others. And "Queen of Carbon Science" Mildred Dresselhaus who just died at 86.

Let us pause to reflect on the wonderful achievements of these and many other icons of chemistry and on the times in which they, and we, have lived.

I ask: Is there something fundamentally special about THIS generation of chemists that distinguishes them from the greatest chemists of earlier generations? I believe so. There certainly is a natural tendency for each of us to look upon the leading figures of our own era, when we "came of age" in chemistry, and conclude that this was truly THE Golden Age of Chemistry. But our giants—and there surely were a large number of them—appeared larger than life. They lived and worked through a major explosion in chemical knowledge and a concomitant expansion in the entire academic and commercial chemical enterprises. The reach of chemistry in our lives also has expanded along with scientific prestige. Indeed, their research had much to do with unprecedented advances in chemistry.

Consider how far we—they—have come in the last 50 years. These pioneers began their careers in near technological darkness and yet uncovered many wonders of our science. Most of them began their research lives before routine NMR, gas chromatography, or mass spectrometry. Certainly they had no HPLC or FT-NMR. Their early days were those of mimeograph machines, typewriters, and plastic molecular models—unless one could afford to own or could borrow Dreiding models. There was no ChemDraw; there were only India ink and Fieser chemist's triangles, stencils and rub-off letters and chemical symbols. Thin-layer chromatography was just becoming routine.

It may be easy to take our heroes for granted, an example of Robert K. Merton's concept of Obliteration by Incorporation. Our heroes are so well known to us that we tend to consider their existence, their names and their legacies as common knowledge. Sadly, many of our youngest contemporaries know little of their own profession's history, let alone the accomplishments of their chemical ancestors. Many chemists have little idea about how we got to where we are today. It's like being partially colorblind or deaf to half of the audio spectrum. I posit, and I am surely not the first, that a scientist's professional experience will be enriched mentally and tangibly with an appreciation of the history of their field. A knowledge of one's own professional underpinnings can have leveraged effects. I ask: What can we, as chemist-historians, do for our discipline, for the communities in which we live and work, and for our colleagues?

We and the chemical enterprise stand on the shoulders of these giants. We should be proud of our history. Our pride stems from roots in a history that is vast, wonderful, and deep—extending beyond Mendeleev, Lavoisier, and Boyle; beyond medieval alchemy; all the way back to man's ancient history.

Those of us who are chemist-historians can take proactive steps to revitalize the pride chemists have in their profession, to bring history of chemistry back into the educational agenda, and to encourage interdisciplinary interactions involving the history of chemistry.

We can bridge the gap by incorporating history into our professional activities. When we teach, prepare grant proposals, or write research results, it would be germane to provide a concise but relevant discussion of the historical roots of our subject. We can insert a paragraph or two on the relevant history of chemistry into our lectures and our writings. We can also make it known to our colleagues that we can provide a history of chemistry "insert" into one of their classes. The Chemical Heritage Foundation, with help from the Division of History of Chemistry of the ACS and historians of chemistry, can provide pedagogical resources that are easy for educators and researchers to access and use. We can invite colleagues to participate in the Division of History of Chemistry's programming (or other history of chemistry groups), even to write an article for the *Bulletin for the History of Chemistry* or for the *Journal of Chemical Education.* We can visit the Chemical Heritage Foundation in Philadelphia and participate in some of its activities.

We can also do something very personal. For those of us fortunate to have teachers and mentors who are still alive, the time to connect with them is now, while they are still around. A call, a postcard, a letter, or a visit would bring them great pleasure. You may be surprised by the joy and enrichment—intellectual and emotional—such a gesture also would bring to you. Because after all, learning begins with human connection, which is the underpinning of our profession.

About the Author

Jeffrey I. Seeman was Chair of HIST in 2005-2006. He served on the Board of Directors of the Chemical Heritage Foundation from 2008-2014 and was Chair of CHF's Heritage Council during the same six years. He is currently on the advisory board of the journal *Accountability in Research*.