Guest Editorial
Why Study History of Chemistry?

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When asking for reasons why chemistry teachers should study history of chemistry, one is likely to encounter the claims that a knowledge of the great chemists of the past will allow them to humanize their subject through the use of biographical anecdotes, or will allow them to illustrate the nature of the scientific method through a recounting of a significant event or past revolution in chemical thought, such as Lavoisier's overthrow of the phlogiston theory of combustion. However, the use of biography is often subverted by the ever-present demands and temptations of both nationalism and political correctness into the creation of a highly distorted view of who did or did not actually make truly significant contributions to the development of modern chemistry, and, alas, the history of chemistry – as modern historians of science have repeatedly reminded us – contains far more examples of chemists who ignored, rather than applied, the niceties of the so-called scientific method.

While not totally dismissing these claims, I would argue that there is a far more compelling reason for teachers to study the history of chemistry – a reason which has more to do with the enhancement of their personal understanding of chemistry than with anything explicitly historical that they might or might not present to their students in the classroom. As teachers of general chemistry we are ideally required to have an understanding of a broad range of chemical topics. Yet, all too often, one discovers a failure to integrate this diversity of subject matter into a coherent and logical presentation of the whole and, in its place, finds instead what is, in reality, merely a collection of random, seemingly unrelated, topics. Even more tragically, one often discovers that the teachers (and this applies equally to secondary and university teachers) know virtually nothing about the origins and limitations of many of the topics they teach beyond what is in the textbook itself.

There is, I would argue, no more effective way of obtaining the necessary breath and depth of understanding required for the effective teaching of general chemistry, nor of understanding the interrelationships and true status of current chemical thought, than through the study of the historical evolution of chemistry itself. Nor am I alone in this opinion. Most of the significant general histories of chemistry of the past have been written, not by professional historians of science, but by practicing chemists and, if one consults the introductions to these histories, one often finds that the underlying motive for writing them was not an intense interest in history for its own sake, but rather a desire on the part of the authors to more fully understand the chemistry of their own day.

Matthew Moncrieff Pattison Muir (1848-1931).

Nothing could be more explicit than the motives outlined by the British chemist, Matthew Moncrieff Pattison Muir (figure 1), for the writing of his 1906 book, *A History of Chemical Theories and Laws* (1):

The more I try to understand chemistry, the more I am convinced that the methods, achievements, and aims of the science can be realized only by him who has followed the gradual development of chemical ideas. A just judgement can be passed on the relative importance of the methods which are obtained, and the problems which are being attacked by the chemists of today, only when a careful study has been made of the methods employed, and the points of attack selected by chemists of the past.

Figure 2. Albert Ladenburg (1842-1911).

And a similar motive was given by the German chemist, Albert Ladenburg (figure 2) in the introduction to his well-known *Lectures on the History of the Development of Chemistry Since the Time of Lavoisier* (2):

A retrospect of the past, especially in the exact sciences, alone affords a proper comprehension of what is accepted today. It is only when we are acquainted with the theories which preceded those accepted at present, that the latter can be fully understood; because there is almost always an intimate connection between them ...

Indeed, Ladenburg goes beyond Pattison Muir in further asserting that the study of the history of chemistry is also important for providing the student with a properly realistic view of the necessarily ephemeral nature of all chemical theory (2):

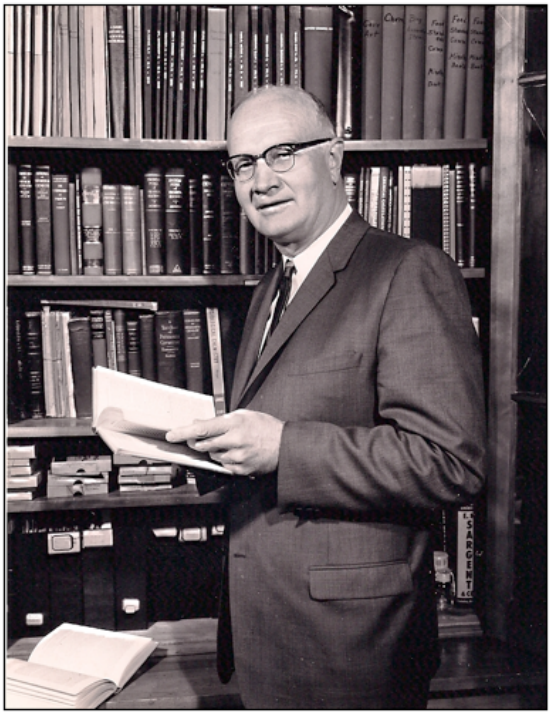
But quite apart from this real advantage of history, which thus, in my opinion, leads to a clearer understanding of our present position, yet another advantage may be adduced which is perhaps of still greater value to the student: namely the accurate estimation of the value of theories. An examination of the past shows the mutability of opinions; it enables us to recognize how hypotheses, apparently the most securely established, must in the course of time be abandoned. It leads us to the conviction that we live in a state of continuous transition; that our ideas of today are merely the precursors of others; and that even they cannot, for any length of time, satisfy the requirements of science.

Even more so, according to Ladenburg, this understanding is crucial in developing in a student a properly critical, and therefore scientific, attitude toward all current chemical theories (2):

Further, by the study of history, our faith in authority is diminished – a faith which produces pernicious effects by obstructing the way for any original development of the individual.

These considerations are important not only in the teaching of general chemistry to high school students and university undergraduates but also in the education of chemistry majors, as argued more than 50 years ago by Aaron Ihde (figure 3), whose 1964 classic, *The Development of Modern Chemistry*, was perhaps the last great history of chemistry to be written by a chemist (3):

There is no question that we can train a chemical technologist without teaching him any history of chemistry and he may be a very good technologist indeed. I would argue with equal vehemence that we cannot educate a chemist without history of chemistry. I am interested in, and I believe most of us are, in the education rather than the training of chemists. The person who is merely trained to carry out analyses or



Aaron John Ihde (1909-2000).

syntheses can do his job quite satisfactorily without much chemical theory or any history of chemistry. On the other hand, the chemist who is in a position of responsibility for the planning of investigations needs to know something about the past history of chemical investigation and the development of chemical thought. Without such knowledge he is merely a technologist.

Ihde's comments require that we further ask ourselves the difficult question of whether much of what we choose to describe as chemical education is in reality merely chemical training. This is certainly the case with the so-called General-Organic-Biochemistry or GOB course taught to nurses and health science majors in American universities and is increasingly the case with the so-called General Chemistry course as well.

I can testify that my own attempts to master the subject matter of general chemistry and to find some way of more effectively organizing and clarifying its underlying concepts have all been driven by my study of the history of chemistry (4-7). That said, I also feel compelled to issue a warning about the untended side effects of this approach, as I increasingly find myself both bemused and appalled by the large amounts of historical baggage that many of my chemical colleagues unknowingly carry with them. And I find myself increasingly saddened by the spectacle of seeing them stubbornly refusing to even consider the possibility of changing what they teach and how they teach on the grounds that it is a necessary and indisputable God-given truth of modern chemistry, when in actual fact I know it to be little more than an arbitrary historical accident.

Reference and Notes

1. M. M. Pattison Muir, *A History of Chemical Theories and Laws, Wiley*: New York, NY, 1909, p. v.

2. A. Ladenburg, *Lectures on the History of the Development of Chemistry Since the Time of Lavoisier*, Alembic Club: Edinburgh, 1900, pp. 2-3. The first German edition of this book was published in 1869.

3. A. Ihde, "Let's Teach History of Chemistry to Chemists," *J. Chem. Educ.,* **1971**, *48*, 686-687.

4. W. B. Jensen, "Logic, History, and the Chemistry Textbook: I. Does Chemistry Have a Logical Structure?," *J. Chem. Educ.,* **1998**, *75*, 679-687.

5. W. B. Jensen, "Logic, History, and the Chemistry Textbook: II. Can We Unmuddle the Chemistry Textbook?," *J. Chem. Educ.,* **1998**, *75*, 817-828.

6. W. B. Jensen, "Logic, History, and the Chemistry Textbook: III. One Chemical Revolution or Three?," *J. Chem. Educ.,* **1998**, *75*, 661-969.

7. W. B. Jensen, "Logic, History, and the Chemistry Textbook: A Reappraisal," *International Seminar on Chemistry, History, Philosophy and Education,* 24-25 Oct., 2011, Bogotá.