

DOES HISTORY OF CHEMISTRY HAVE A FUTURE?

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Abstract

Brief remarks are offered on the current status and future prospects of the following topics, mainly in the United States: historical resources for the history of chemistry; textbooks and history of chemistry courses; history of chemistry and general chemistry; organizations and journals for history of chemistry; chemical historians and historians of science. Because history is not a predictive science, this is more an opinion piece than a documented piece of history.

When I first volunteered a contribution with the above title, I did so because I thought it was a perfect fit for the theme of this special issue of the *Bulletin*. Only later did I realize the full repercussions of what I had done. While Mark Twain's famous quip that "history does not repeat itself, but it often rhymes" has a certain vague, albeit amusing, truth to it, the grim reality, as repeatedly emphasized by Karl Popper, is that history is not a predictive science (1).

An historian, by definition, deals with the past and not with the future. He traffics in factual evidence, even though his personal biases may color both his choice of that evidence and his interpretation of its significance. This means that, in choosing the above subject for my contribution, I have removed myself from the realm of proper history and instead placed myself among those psychics whose annual predictions of the future clutter the pages of the *National Enquirer* and other such dread-

ful publications found in the checkout aisle of your local grocery store. In keeping with this, what follows should be viewed more as an opinion piece or editorial than as a properly documented contribution to history.

Over the years several of my previous publications have obliquely touched on aspects of the above topic and this is especially the case with a paper I presented as part of a symposium organized by Sy Mauskopf in 1993 (2-4). What I intend in the following is to update my comments found in these earlier papers. I will first briefly review the current status of the following topics: historical resources for the history of chemistry; textbooks and history of chemistry courses; history of chemistry and general chemistry; organizations and journals for history of chemistry; chemical historians and historians of science, followed in each case by my opinion of their future prospects. For obvious reasons I will deal largely with the situation in the United States, since I have more direct personal knowledge of this.

Historical Resources

Current Status

By historical resources I mean significant collections of period books, chemical journals, prints, photos and physical artifacts of interest to the chemical historian. I will say nothing about such primary sources as personal papers, diaries, company or institutional records, etc.,

since it is not possible to make generalizations concerning either the locations or accessibility of such materials (5).

Books and Chemical Journals: Collections of books and chemical journals of interest to chemical historians are available at the Oesper Collections in Cincinnati, Ohio, the Science History Institute (formerly the Chemical Heritage Foundation) in Philadelphia, Pennsylvania, and the Edgar Fahs Smith Collection at the University of Pennsylvania (6). In all three cases their holdings span the 20th century back through at least the 17th, if not earlier. Typical examples of other, smaller, but significant collections include the Morgan Collection in the History of Chemistry at Ohio University in Athens, Ohio (7), the History of Science Collections at the Linda Hall Library in Kansas City, Missouri, and the Williams Miles Textbook Collection in the History of Chemistry at Harding University in Searcy, Arkansas. For those specializing in alchemy, there is the Ethan Allen Hitchcock Alchemy Collection at the St Louis Mercantile Library in St Louis, Missouri. Unlike the case of the Oesper Collections, several of the above collections are not housed apart but are rather submerged within larger, more generalized, library holdings.

Prints and Photos: Once again large collections of both prints and photos relating to the history of chemistry are to be found in the Oesper Collections, the Science History Institute, and the Edgar Fahs Smith Collection. The Frank B. Dains Print and Portrait Collection, which was used extensively to illustrate Mary Elvira Weeks' classic study, *Discovery of the Elements*, is to be found in the library collections at the University of Kansas in Lawrence, Kansas. On the other hand, the Ferris Jewett Moore Collection of Chemical Portraits at MIT, which was the basis of the 1949 book by Smith (8), has apparently disappeared (9). There are also several sites on the internet which attempt to sell scans of historical prints and photos relating to the history of science, despite the fact that the images in question have long been in the public domain.

Artifacts: Every major American city has either a science museum or a natural history museum or both. However, neither of these institutions deals with the history of science, let alone with the history of chemistry. To be blunt about it, both, to an increasing extent, are currently focused on entertaining children—the former via interactive displays for them to play with, and the latter via extensive displays centered around that favorite of all small boys—the dinosaur, both as fossil skeletons and increasingly as life-size animated mechanical models. Nor are we talking about the traditional 19th-century chemi-

cal museums that were often associated with university chemistry departments and which consisted of displays of important chemical products. The best known of these in the United States were those created by the brothers, William and Charles Chandler—the first at Lehigh University and the second at Columbia University (10-12).

There are, of course, many proper, albeit smaller, historical collections scattered throughout the United States that deal with either the history of medicine or the history of pharmacy—the latter usually in the form of a reconstructed 19th-century drug store. Though not their major focus, both kinds of collections often contain small amounts of 19th-century chemical apparatus (13). However, far more extensive collections of historical chemical apparatus may be seen in the reproduction of Thomas Edison's Menlo Park Laboratory at Greenfield Village in Dearborn, Michigan, and at his original laboratories in both West Orange, New Jersey and Fort Myers, Florida.

Harvard, Yale, MIT, Dartmouth (14), and Transylvania University in Lexington, Kentucky (15, 16) all have collections of historic scientific instruments, though most of their holdings deal with apparatus used to teach physics and astronomy. Years ago I was given a tour of the storerooms for the collections at Harvard and saw many items related to the history of chemistry, though none of them were on display in the museum itself. I suspect this is also true of the other historical instrument collections.

The reasons for this apparent avoidance of historical chemical apparatus are interesting. Unlike the beautiful brass and ivory 18th- and 19th-century self-contained instruments used to teach physics and astronomy, for which it is often possible to trace the instrument maker responsible for their creation, traditional bench-top chemical apparatus was, and still is, largely modular and anonymous. Take the simple case of distillation. Just displaying the separate pieces of glassware and hardware used to construct a typical distillation train would be both uninformative and boring. The pieces have meaning only when assembled to illustrate how they were actually used in the laboratory by practicing chemists. This requires period heat sources, stands, clamps, condensers, distillation flasks and/or retorts, adapters, receivers, and possibly fractionating columns, depending on how elaborate the setup. It is improbable that all of these parts would come from a single source, let alone be labeled with the company that originally made or sold them, and so there is no instrument maker to trace. In addition, minor but key parts are often missing, such as a cork, rubber tubing, or a bent glass tube. If a purist demands that these be period pieces as well, rather than modern substitutes,

the proposed display will never see the light of day. In addition, pre-pyrex (i.e., 19th-century and earlier) glassware did not exactly have a long life expectancy and so it is often necessary to use modern reproductions instead.

Much larger general museums, such as the Smithsonian in Washington, DC, and the Deutsches Museum in Munich, also own large collections of historical chemical apparatus, only a fraction of which is on display. At one time the Deutsches museum featured displays of impressive reproductions of so-called alchemical laboratories and 16th-century distillation apparatus (17, 18), as well as a reproduction of Liebig's famous laboratory at Giessen. Likewise, the Smithsonian featured displays of Joseph Priestley's laboratory apparatus, and Ira Remsen's circa 1876 laboratory at Johns Hopkins in Baltimore.

Though there are many museums in Europe that specialize in historical chemical apparatus, such as the Daubeny Collection at Oxford (19) or the Liebig Museum in Giessen (20), the only two in the United States that I am aware of are, once again, the Oesper Collections in Cincinnati (21) and the Science History Institute in Philadelphia. To aid in the study of these artifacts, both of these locations also own large collections of apparatus catalogs spanning the 19th and early 20th centuries.

Future Prospects

In summary, there are abundant resources available to the chemical historian. Indeed, most of the above collections, as well as the many European and British collections I have not mentioned, can be located via their own internet sites. The book, print and photo collections absorbed by various libraries are most likely safe from future loss, though their direct use will increasingly decline as more and more of this material becomes available online. At most they risk being dispersed among the other books in these libraries instead of being concentrated in a special area, as appears to have been the fate of both the Morgen Collection at Ohio University and the Henry Carrington Bolton Portrait and Book Collection at the Library of Congress (22).

The same is true of the artifact collections found in national museums. Though safe from destruction, they risk being overwhelmed by the vast holdings of these institutions, if not completely relegated to the store rooms, as they respond to the increasing public demand for more and more entertaining displays for children. For this reason, I am uncertain whether the history of chemistry displays mentioned above for the Deutsches

Museum and the Smithsonian are still there. Perhaps the worst example of this fate I am aware of involves the Liebig Museum in Giessen. Recent video posted on the internet shows school children watching a modern whizz-bang chemical demonstration show in Liebig's original lecture hall and video of the adjoining laboratory shows a nonsensical jumble of antique and modern apparatus on the central tables more characteristic of the set for a Frankenstein movie than of a realistic depiction of a circa 1850 working chemical laboratory.

The artifact collections most at risk are those connected with universities. Many times these are the creations of a single faculty member interested in history of science. However, once that faculty member retires, the chemistry or physics departments involved are often unwilling to hire a replacement. When coupled with the usual academic squabbles over funding and space, the final result is dispersal, since librarians are not comfortable dealing with physical artifacts rather than books. Such was apparently the fate of the Moore Portrait Collection at MIT, and illustrates the wisdom of Arnold Thackray when he severed the connection between the original Center for the History of Chemistry and the University of Pennsylvania.

Textbooks and History of Chemistry Courses

Current Status

In my 1993 contribution to the Mauskopf volume, I was able to cite only one survey of colleges and universities that were offering a course in the history of chemistry, and the results were not promising (2). This is in large part because such courses are seldom part of the required curriculum for chemistry majors, but rather rely on an interested faculty member willing to offer such a course as an elective. History of chemistry courses are almost as rare within history of science departments, but for a different reason that I will mention in the later section dealing with the interactions between chemical historians and historians of science.

Unhappily, the American Chemical Society (ACS) has played a significant role in undercutting history of chemistry courses. When I formed my own course at the University of Cincinnati, as required by my endowed professorship in history of chemistry, I asked that physical chemistry be listed as a prerequisite, since much of the history of late 19th- and early 20th-century chemistry dealt with its subject matter. According to the standards

for an ACS certified degree, this meant that the course qualified as an advanced chemistry credit. When the ACS discovered this, they refused to certify the BS chemistry degree at Cincinnati until this requirement was removed. In the end, in order to populate the course, since our majors could no longer use it to fulfill part of their advanced credit requirements, I had to offer the course from 4:30-5:30 pm so I could attract high school chemistry teachers and industrial chemists after working hours. In the end I had more students from chemical engineering, pharmacy, and philosophy than I did from our chemistry department.

Needless to say, a history of chemistry course also requires a good history of chemistry textbook that is compact enough to use for what is normally a one semester course. Currently Dover Books has kept several 20th-century classics in print as relatively inexpensive paperbacks, including those by Leicester (23), Partington (24), and Ihde (25). Yet another example is the more recent history by Bill Brock (26).

Future Prospects

The situation with respect to history of chemistry courses is unlikely to change much in the future. They will continue to be elective and to rely on chemistry faculty with a personal interest in the history of chemistry to teach them. At worst, populating such courses with chemistry majors will become more and more of a challenge as the progress of modern chemistry and the resulting increase in ACS degree requirements fill up more and more of the curriculum. With the possible exception of the textbook by Ihde, most of the books mentioned above do a poor job of covering the history of chemistry after 1930, so there is always room for future textbooks that also deal with the last two thirds of the 20th century and possibly with the first two decades of the 21st century (3). This will be quite a challenge, if I am to judge by what has happened in the chemistry department at Cincinnati, and I suspect elsewhere. The traditional *quadrivium* of analytical, organic, inorganic, and physical chemistry is beginning to dissolve. Traditional wet analytical chemistry has essentially disappeared and been replaced by instrumental analysis (27); organic chemistry has mutated into biophysical chemistry and drug design; physical chemistry into computational chemistry; and inorganic chemistry into material science. These changes have been driven as much by shifting patterns in research funding as by the science itself. There is also the problem that many histories of chemistry show a definite national bias relative to the chemists who are featured.

These trends do not necessarily mean that future history of chemistry textbooks will necessarily be larger. It is just as probable that they will splinter into smaller specialist histories. This has long been the case with separate histories for both biochemistry (28) and industrial chemistry (29), and I am also currently aware of separate histories for such subjects as polymer chemistry (30) and clinical chemistry (31).

History of Chemistry and General Chemistry

Current Status

A related topic is the question of how much history of chemistry should be included in the typical introductory chemistry textbook, not to mention the further question of whether it is possible to write such textbooks from an exclusively historical point of view. There is a vast literature on this subject in the education journals. Actual attempts to implement such an approach go back at least as far as the 1950s and the *Harvard Case Histories in Experimental Science*, edited by the American chemist, James Bryant Conant (32), and I think there were even earlier attempts at the University of Chicago. Most of these experiments focused on the use of history of science in college-level general science courses for nonscience majors, though they always contained a chemistry component.

As far as actual chemistry textbooks go, the impact of these approaches has been virtually nil. The only true example of an exclusively historical approach to general chemistry I am aware of is the 1915 textbook by Thomas Lowry, which I have described in detail elsewhere (4). Since at least 1910 the usual claim that your typical chemistry textbook has taken history into account means that there are photographs of famous chemists interleaved throughout the text, each with a two-sentence biographical summary. However, the motives for this are not historical but rather because—according to the publishers—they “humanize” the text. Like textbooks for the history of chemistry, these photo selections often show a distinct national bias.

Future Prospects

I strongly doubt whether the current situation will change in the future. An introductory textbook based on history of chemistry would never be tolerated by your average chemistry department. Indeed, once again the ACS is a determining factor in all of this. Years ago

Mary Virginia Orna served on an ACS committee tasked with developing an introductory chemistry course for nonscience majors. She suggested using an historical approach that I had outlined in a series of articles published in the *Journal of Chemical Education* (33). As she later told me, the committee refused to even consider the possibility of such an approach.

Organizations and Journals for History of Chemistry

Current Status

The ACS Division for the History of Chemistry (HIST) was founded in 1921 and as such is the oldest known professional organization for the study of history of chemistry, with the possible exception of the now defunct Alembic Club (34). From 1948-1967 HIST published an annual, single-volume, hard-cover journal called *Chymia*, and since 1988 has published the *Bulletin for the History of Chemistry*. The second oldest organization for the study of history of chemistry is the British Society for the Study of Alchemy and Early Chemistry, now Society for the History of Alchemy and Chemistry, which dates from 1935, and which began publication of its journal, *Ambix*, the next year (35). Though there are currently several additional organizations and journals for the study of history of chemistry, such as those in Germany and Japan, both *Ambix*, the *Bulletin* and their attendant organizations remain the most important for English speaking chemists and historians.

Future Prospects

As long as there are chemists interested in the history of their science, these organizations will continue to survive. Whether the changes brought on by the COVID pandemic will lead to the increasing use of remote rather than actual physical meetings of these organizations is extremely doubtful since everyone knows that the primary function of these meetings is social networking rather than as a necessary means for presenting original research that in most cases will also appear in print. Likewise with the journals published by these organizations, though these suffer a greater risk of eventually disappearing as hard copy and instead becoming internet publications only. As an old curmudgeon, I hope this will not happen, since I still delight in holding an actual physical copy of a book or journal in my hands rather than viewing it on a computer screen.

Chemical Historians and Historians of Science

Current Status

In recent years it has become common to differentiate between chemical historians (also called chemist historians elsewhere in this issue), on the one hand, and historians of chemistry, on the other, where the former refers to chemists interested in history and the latter to historians interested in chemistry. Chemical historians are by definition self-taught amateurs when it comes to history, whereas many historians of chemistry are self-taught amateurs when it comes to chemistry.

These differences are also apparent in the kinds of books and articles they write. Specialist histories of chemistry written by chemical historians, like those mentioned earlier by Morawetz on polymer chemistry (30) or Rosenfeld on clinical chemistry (31), tend to present each advance in theory or technique in great detail, complete with any necessary equations or chemical formulas, whereas those written by historians of science tend to focus on the sociological aspects of a given discipline, such as the development and politics behind the founding of the requisite professional organizations and journals or the internal squabbles between various key figures (36).

As I have commented in a recent book review, historians of science tend to avoid chemical formulas and mathematical equations as much as possible, apparently for fear their inclusion will damage sales of their books with regard to general readers (37). This is naive to say the least, since I doubt very much that such academic tomes have much of an audience among the general public, their primary readers being either other historians or interested chemists. To attempt to write about the history of a science while simultaneously refusing to use the language of that science is ludicrous in the extreme.

Since at least the 1980s HIST has made an effort to include professional historians as invited speakers whenever it has sponsored special symposia. Likewise, professional historians have long been comfortable publishing articles and reviewing books in *Ambix*. More recently the same is also true to an increasing extent for the *Bulletin*, especially under the current editorship of Carmen Giunta. Unhappily, there is little or no reciprocity. Chemical historians are seldom invited to participate in symposia organized by historians of science, and most are loath to publish in such journals as *Isis* or *The British Journal for the History of Science* for fear of negative reviews.

Future Prospects

I do not see the liaison between chemical historians and historians of science improving any time in the near future, but rather suspect that it will further deteriorate. This prediction is based on current trends in the history of science community.

The first of these is the fact that very few current historians of science are willing to be explicitly identified as being primarily historians of chemistry. When I was a graduate student at the University of Wisconsin there were three faculty within the history of science department that specialized in history of chemistry: Aaron Ihde, Robert Siegfried, and Erwin Hiebert. By 1990 there were none. Current historians prefer to be generalist rather than historians of a particular branch of science (with the possible exception of medicine). Though in recent decades historians have produced any number of significant books on the history of chemistry, these are almost all based on their doctoral theses, and after their publication we hear no more of the authors as they are off in pursuit of some other interest unrelated to chemistry. This is the primary reason that very few explicit courses in the history of chemistry are offered by history of science departments.

The second reason has to do with the difference in how chemists versus historians are trained. A doctoral candidate in history is required to present and defend a truly novel thesis. This usually requires that he dismiss everyone who has previously written on the subject in question as incompetents who have completely misunderstood the history they are writing about and claim that only the candidate's proposed interpretation is the correct one. Lavoisier and the first chemical revolution have been particularly susceptible to this reinterpretation craze, often with highly distorted results.

Connected with this is the increasing tendency, depending on the latest historical craze, of employing informal terminology and strange viewpoints when titling books and papers. Thus the book on the Dartmouth instrument collection in reference 14 does not have a straightforward title, such as *The Dartmouth Collection of Historic Scientific Instruments*, but rather the uninformative, if not misleading, title of *Study, Measure, Experiment: Stories of Scientific Instruments at Dartmouth*, almost suggesting that it is a children's book dealing with the scientific method. If I am to judge from the titles of many of the books sent to *Isis* for review, this is a very mild example of this trend.

Conclusion

In summary, history of chemistry has a future, but that future will not differ much from its past.

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