

THE IMPORTANCE OF PLURALITY AND MUTUAL RESPECT IN THE PRACTICE OF THE HISTORY OF CHEMISTRY

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Abstract

This paper emphasizes the need for professional historians of chemistry, chemist-historians and chemists to respect each other's contributions in the development of the history of chemistry. We posit that only a wide diversity of contributions including both entirely extrinsic and entirely intrinsic scholarship, and everything in between, will result in a complete history of chemistry. We also call for more scholarship in the history of modern chemistry and for the inclusion of history of chemistry in all chemistry courses. Several other recommendations are also provided.

“Science without its history is like a man without memory” (1) — Colin Russell (1984).

Preface

In 1993 Frederic L. Holmes (Figure 1) wrote in the opening sentences of his essay (2) in the book (3) *Chemical Sciences in the Modern World*,

The great externalist-internalist debate of the 1970s now appears outdated, not because the questions raised during its prime have been resolved but because most of us grew tired of contesting the issue. It has been relatively easy to retire from confrontation, because rival claims could be settled merely by partitioning the history of science into two sets of subproblems. Those who were attracted to studying external situations [professional historians]

have found ample scope to do so, while those who preferred what were lumped together as internalist problems [chemist-historians and chemists] were also free to go their own way. A minority of eclectic historians have made efforts, generally applauded, to penetrate more than superficially across the perceived boundaries, but their exemplary studies have not been seen as resolving the issue.

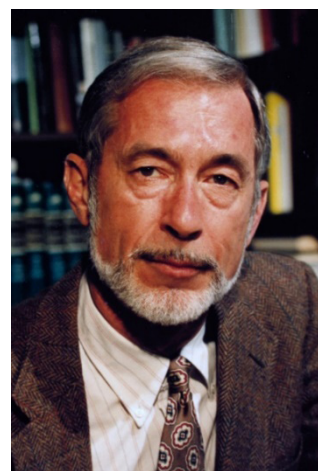


Figure 1. Frederic Holmes. Photograph courtesy John Harley Warner and the Section of the History of Medicine, Yale School of Medicine.

Holmes was prophetic. Historians do their thing (4, 5). And chemist-historians do their thing (6, 7). And a few “eclectic” scholars find some degree of synergistic bridging to their endeavors (8, 9). The barriers separating these two legitimate academies, silos in modern terms,

have been reinforced by decades of organizational and behavioral norms. True, books and publications are published for all to read and use. But even a limited citation analysis (10) demonstrates that the intellectual territories poorly overlap, notwithstanding the skepticism of some (11) and support by others (12) regarding these concepts.

We, the authors, a professional historian and a chemist-historian, believe in the value of diversity and the importance of respect and even admiration amongst

the practitioners of the history of chemistry (HoC). Where do these values take us in 2022 and beyond?

Introduction

This special issue of the *Bulletin for the History of Chemistry* celebrates the 100th Birthday of the Division of History of Chemistry (HIST) of the American Chemical Society (ACS). The theme for this special

Table 1. Chemists' and Chemist-Historians' versus Historians' Backgrounds and Research Activities

Topic	Chemists writing "pure" chemistry	Chemists writing history of chemistry	Historians of science
Undergraduate education	Chemistry		History and/or liberal arts and much less frequently science with some exceptions
Graduate education	Generally Ph.D. in chemistry		Ph.D. in history or history of science
Job position	Academic, government, industry, other		Department of History or Department of History of Science or retired from one of these positions
Time period of research in history of chemistry	Mostly post-1900		Mostly pre-1900
Number of publications and/or patents in a chemistry (sub) discipline	0 to over 100	Many, often over 50	Few or none
Collaborations within one's own discipline (intradisciplinary collaborations)	Many	Infrequent	Few to none
Participation in interdisciplinary collaborations	0 to many	Few	Few to none
Professional society memberships	ACS, RSC, and other national chemical societies	E.g., Division of History of Chemistry of the ACS; History Group of the RSC	SHAC, HSS, BSHS
Participation in professional society meetings	Yes	Yes, especially history of chemistry sections	History meetings
Reads their presentations	No		Yes
Browses chemistry journals at least several times/year	Yes		No
Browses history journals at least several times/year	No	Maybe to yes	Yes
University tenure criteria	Number of and quality of journal publications, funding		Number of and quality of books
Nature of academic practices	Science faculty have research groups with graduate students and postdoctoral students working closely with major professor		Faculty may mentor graduate students but not co-publish with them.
Associations with other departments	Not too often	Sometimes	Rarely

issue of the *Bulletin* is *Novel Insights in the History of Chemistry: Looking Back Yet Mostly Looking Forward*. To be responsive to this special issue's theme, we have, after much thought and several false starts, chosen the questions below as the central themes for our paper.

What is the history of chemistry? Who have contributed and will contribute to the HoC? What is the relationship between the various stakeholders in the HoC? Is the HoC maximally benefiting from the diversity of those active in the field? What is the future of the HoC?

There is an extensive literature on these issues. Over many decades, there have even been one major and several minor skirmishes in what might be called "the science wars" (1, 5, 7, 13-18). Even what constitutes the field of chemistry has grown and morphed (10). To maintain its own relevance, the American Chemical Society has enlarged its fleet of technical journals centered about one of its more recent titles, *ACS Central Science*. Following its merger with the Life Sciences Foundation in 2015, the Chemical Heritage Foundation changed its name in 2018 to the Science History Institute and, thereby, broadened its vision and mission.

In the meantime, the HoC marches on, following its own organic pathway. By "organic growth" we refer to an evolutionarily natural process based on the activities and behaviors of members of the HoC community individually and spontaneously adapting to the situations at hand. In this paper, we intend to examine the pattern of growth and the health of the HoC endeavor as a function of its member-participants.

Discussion

The history of chemistry is the study of the development of chemistry. Over the last sixty years, HoC as done by chemist-historians and HoC as done by professional historians (also referred to as "historians" hereafter), have become separate academic fields. From a sociology of science perspective, chemist-historians and historians of chemistry inhabit different disciplinary silos characterized by their own unique behavioral norms. A listing of the most relevant normative behaviors of chemists, chemist-historians, and historians is shown in Table 1.

Importantly, the authors of this paper themselves reside rather firmly in these different silos, Morris being a historian and Seeman a chemist-historian. That this paper represents the best thoughts of each author and

of the combined authorship team is noteworthy. One reviewer of this article wrote, "The authors clearly favor the chemist-historian/chemist type of history of chemistry over that of the professional historians." Certainly, the present authors have our own idiosyncratic professional stories. Yet we state unequivocally our equal support and admiration for all scholars who study and write the HoC. We strongly reject the conclusion of this reviewer.

There are some scholars who have maintained one foot in each camp, but they are few. Historian Alan Rocke (see Figure 2) is one; he has published papers in several chemistry venues (19-22) and is a Fellow of the American Chemical Society. On the other side of the coin is Steve Weininger, a recently retired academic chemist, who has published multiple times in history journals: three times in *Ambix* (23-25) and once in *Annals in Science* (26).



Figure 2. (Left) Alan Rocke. (Right) Stephen Weininger. Photographs courtesy Cristine Rom and S. Weininger.

All academic fields have their normative behaviors. Examination of Table 1 is particularly instructive, especially noting which behaviors are the same (just a few) and which different when comparing the chemist-historian silo with the historian silo. Many of these behaviors derive from one's academic training, in this instance, from one's undergraduate and graduate school experiences as well as the academic norms of one's professional institutions. For example, chemists obtain university tenure by publishing in high quality chemistry journals and obtaining major research funding. Historians usually obtain university tenure by having at least one book by respected academic publishers.

Clearly, the chemist-historians' norms *versus* the professional historians' norms are quite different. Chemists and chemist-historians unreflectively and unreflex-

ively tend to follow the conventions of chemistry whereas historians follow their silo's conventions. The normative behaviors for both professions must be followed, else publishers, journal editors, and reviewers will reject their submissions and their careers will suffer.

Largely because of these conventions and the consequent skill sets of the individuals, HoC written by chemists is different from that written by historians

(Table 2). Chemists have been writing the history of chemistry from the 18th century (1) though they have only been called chemist-historians in the last 60 years or so. The basis of chemist-historians' normative behaviors when writing HoC stems directly from their education as chemists. To see this, compare the normative behaviors of chemists with those of chemist-historians in Table 1, columns 2 *versus* 3.

Table 2. Chemist-Historians' Publications versus Historians' Publications

Topic	Chemist-historians	Historians of Science
Journals published in	<i>Bulletin for the History of Chemistry</i> and a few mainstream chemistry journals, e.g., <i>Angewandte Chemie</i> , <i>Nature Chemistry</i>	<i>Ambix</i> , <i>Isis</i> , <i>Annals of Science</i> , <i>Studies in History and Philosophy of Science</i>
Readership for publications	chemists	historians
Primary format for publications	journals	books
Co-authorships	infrequent	rare
Time-period covered	vast majority post-1900	generally pre-1900, mostly even pre-1850
Focus of paper	chemical developments (internalist) "typically focus on ideas and their sequential developments" (27)	social context of change (externalist) "typically seek to understand the relationship between scientific practices, scientific institutions and the wider society in which they exist" (27)
Treatment of historical events	"emphasis on heroic achievements of 'great men' and the linear development of theory" (27)	"less deterministic, more open-ended account of scientific development" (27)
Reliance on primary actors	Yes	Usually
Use of primary literature	Major	Minor
Use of secondary literature	Minor	Major
Style of publication	concise, scientific style	discursive
Use of problematization	no	frequent
Use of scientific data	Yes, especially post-1820s	Rarely ever
Inclusion of conclusion section	mostly, often extensive	rare and tend to be short
Use of chemical structures and reactions	Yes	Generally no
Similarity to chemistry publications	Yes	No
Similarity to non-scientific history publications	No	Yes
Use of substantive footnotes	limited, generally discouraged	common
Publishers' policy toward chemical formulae, chemical structures and reaction schemes	It is the publishers' standard practice to include structures in chemistry journals favored by chemist-historians	History journals generally do not encourage the publication of chemical structures

Though historians have existed for hundreds of years, historians of science as a profession first began in the 1930s. However, the history of chemistry was dominated by chemist-historians until the early 1960s. Thus, the two kinds of HoC have diverged from the first appearance of the scholarship of historians over those last sixty years. A watershed moment in the identification and specification of the norms of professional historians occurred about the time James Riddick (J. R.) Partington (Figure 3) wrote his massive four-volume series of the HoC. Historians rejected the kind of “history” that Partington and his fellow chemist-historians wrote. For example, noted historian and founding president of the Chemical Heritage Foundation Arnold Thackray (Figure 3) wrote of Partington’s fourth volume and Aaron Ihde’s *The Development of Modern Chemistry* (17)

How much greater therefore one’s disappointment that these works, though scholarly and authoritative, fail to appreciate or reflect the new climate of historical scholarship. Instead they remain firmly embedded in the old, and by now weary, tradition of chemical history by chemists for chemists. ... A history of chemistry which does justice to the present insights of philosophers and general historians remains to be written.

What chemists write today is often in the same style as their predecessors wrote in the 1950s with a few exceptions. They emphasize the science, not the context. And that seems to meet the needs of their audience, mostly other chemists (and other chemist-historians).

Historians writing the HoC followed in Thackray’s footsteps in challenging the traditional HoC model. Some of those challenges were empathetic, for example Stephen G. Brush’s argument that (5)

Scientists should write history of science if they are willing to acquire the skills and background knowledge of the historian of science ... In this enterprise, those scientists who are willing to learn historical methods and study original sources have a continuing and essential role to play.

Thus, two silos started to form, one being chemists writing traditional HoC and the other being professional historians writing a new social HoC. It should not be thought that one silo contained chemists and the other historians with no chemical background. Many of the early professional historians of chemistry had undergraduate chemistry degrees, for example, William H.



Figure 3. (Left) J. R. Partington. Photograph courtesy William B. Jensen and the Oesper Collections in the History of Chemistry, University of Cincinnati. (Right) Arnold Thackray, Smith Library, University of Pennsylvania, early 1970s. Photograph courtesy A. Thackray.

Brock, Maurice Crosland, Owen Hannaway, Colin A. Russell, Bill Smeaton, and Thackray. Their relationships with chemistry varied. Some strongly rejected the chemist’s view of the HoC (e.g., Thackray (17)), others were proud of their chemical background but did not seek to retain links with chemistry (e.g., Brock (28) but see a recent collaboration with a chemist-historian (29)), and yet others positively strove to maintain the link between history and chemistry. A good example of the third group is Russell (30) (Figure 4), about whom his friend, Alec Campbell, wrote (31)

The fact that the [RSC Historical] Group now has an established place in the programme of the Annual Congress, alongside the large Divisions of the R.S.C., is due to Colin’s detailed knowledge of the interplay of forces within the history of science in this country, and his personal commitment to the notion of the history of chemistry as an integral part of living chemistry.



Figure 4. Colin Russell, ca. 1985.

The issue now arose, should chemists when writing HoC adopt the conventions and concerns of professional historians as stated by Thackray (17) and Brush (4, 5) among others? “*Ambix* is a history journal,” Rocke stated to one of the present authors (JIS) during his tenure as Associate Editor of *Ambix*. Most historians have demonstrated by their actions that they prefer to publish in history journals, not journals read by chemists and chemist-historians.

In the 1980s and 1990s there were sustained efforts by historians to encourage chemist-historians to write the kind of history approved by historians. This was partly because some former chemists, especially Russell, did not want their fellow chemists to be viewed negatively, especially in the eyes of professional historians of science or the editors of history of science journals. There were various attempts at that time to get chemists to “buck up” and write the “proper” history of chemistry, notably in a book review (32), paper (33), and essay (34) by one of the present authors (PJTM). The Center for the History of Chemistry also tried to get chemists to adopt the professional historians’ norms after the Center was founded in 1982. The hand of its founding director Thackray was surely behind this influence, for example, in holding a conference *Chemical Sciences in the Modern World* for historians and chemists at the Eagle Lodge Conference Centre outside Philadelphia in May 1990. A comprehensive book (3) edited by Seymour Mauskopf is one lasting consequence of that meeting, notable in part for documenting the concerns of historians of chemistry some 30 years ago.

In contrast, there was strong support for the inclusion of chemistry in HoC studies and in chemistry textbooks (35). One of the most strongly worded statements about how chemists should write HoC was penned by the historian with the strongest chemical background (a former lecturer in chemistry with several chemistry research papers to his credit (36)) and the one most anxious to retain the link of professional history with professional chemistry, namely Russell. He wrote (1)

At a conference some years ago to celebrate the bicentenary of an important British scientist, papers were planned about his literary work, his reforming ideals, his public lectures, his institutional affiliations—even his sporting life! Only as an afterthought was anything proposed concerning his science, though that was the single reason for his importance. Instances like this can be multiplied. They arise when a rightful concern with the context of science has been extended to an almost monomaniac obsession, to the virtual exclusion of its content.

There were also attempts in the 1990s and 2000s to bring chemist-historians and professional historians together in conferences. These meetings engendered a degree of interest and good-will on both sides, but eventually chemists ceased to come to meetings which were under the control of professional historians and mostly geared to their intellectual outlook. Historians often participated in meetings organized by HIST but chemists rarely attend history conferences. For all of us, financial costs and time availability are serious constraints in attending multiple meetings per year.

The Science Wars of the 1990s largely passed the chemist-historian silo by, although Jay Labinger and Harry Collins co-edited an eirenic book *The One Culture? A Conversation about Science* (37). However, the Science Wars may have increased the wariness of some chemist-historians towards the agenda of the historians and their intentions regarding chemist-historians. This rejection of the historians’ approach was partly pragmatic: the customers for the publications of chemist-historians were other chemists who expected adherence to their own conventions and approach to developments in chemistry.

In terms of journals and publishers, it is an undeniable fact that the journals patronized by professional historians gear their style of publications to an academic professional historian audience which embraces the same style of research and writing. At present, chemist-historians have several publication venues available to them, such as several journals dedicated to the HoC including the *Bulletin for the History of Chemistry*, the British RSC Historical Group *Newsletter*, the German *Mitteilungen der Fachgruppe Geschichte der Chemie* and the Japanese *Kagakushi*. Chemist-historians and chemists have also published HoC in several chemistry journals, such as *Angewandte Chemie*, *Chemistry—A European Journal*, *The Chemical Record*, and on one-off occasions, *The Journal of Organic Chemistry* (38, 39) and other journals of the ACS (40).

Neither silo is about to disappear. We should appeal for mutual understanding and respect between the members of the two silos for their own style and content of their version of HoC. The professional historians should cease to judge the published output of the chemist-historians by their own criteria—criteria it has to be said were at least partly introduced in the 1960s and 1970s to demarcate the new “professional history of chemistry” from the older more traditional HoC. At the same time, chemist-historians should accept that professional historians are making valid criticisms of the norms of chemist-historians, that context does mat-

ter, and that chemist-historians should consider adding more context to their research content. And in the same spirit, professional historians should add more science in their research and in their publications. It is hoped that the application of these ideas may lead to more interdisciplinary collaborations such as the recent publication by Brock and David Lewis (29) or texts such that *Chemical Sciences in the 20th Century: Bridging Boundaries* (41) edited by the historian and former president of the Chemical Heritage Foundation, Carsten Reinhardt.

We do not expect or wish the two silos to merge. That would be unrealistic and would even be detrimental to the field of HoC. In the same way that different fields of science collaborate in interdisciplinary research, we would hope that a growing number of chemist-historians and professional historians will feel able and encouraged to collaborate. Precisely by recognizing and validating the qualities of each silo, we anticipate the participants can seize unique interdisciplinary opportunities and achieve greater academic synergies.

We and certainly others have a growing concern about the study and documentation of the history of recent chemistry (42). There are relatively few chemist-historians or historians writing the history of recent chemistry (chemistry after 1970, a period of no less than 50 years!). Few books and publications on the history of recent chemistry exist other than those written by chemists and chemist-historians written in the style most appreciated by chemists. One of the present authors (PJTM) noted in 2011 that chemist-historians traditionally had taken their histories of chemistry up to the present (33). However, this revival, if it ever existed, has seemingly petered out. On the other hand, Morris was the editor of a volume on the cultural history of chemistry which, at the publisher's request, went up to 2019 (43). And chemist-historian Noboru Hirota has recently published a *History of Modern Chemistry* (44) which goes up to the 21st century. Hirota has more technical detail than the volume edited by Morris, but they are both very general works and are no substitute for a sustained account of the recent history of chemistry.

Writing the recent history of chemistry has several challenges. To understand recent chemistry, one needs at least some advanced level of chemical education. Yet relatively few professional historians of chemistry now have a chemistry background and fewer chemists are writing about that era of HoC. The volume of scientific papers being published is growing exponentially and it is also becoming interdisciplinary. Fifty years ago, it was possible for one chemist to understand practically all of

chemistry and to make generalizations about it. This is no longer the case.

Furthermore, as historian Brush noted 25 years ago (5),

Scientists have much to contribute to the history of science, and there are certain kinds of important questions that can be discussed only by those who have considerable technical background.

Historians find writing the history of today's modern chemistry challenging if not impossible. We speculate that, just as now, some established professional historians in the future will have begun their academic careers as chemistry students, and then shifted into history of science—although they are likely to be few. For these individuals and perhaps for others too, the corpus of modern chemistry is far beyond understanding for non-professional chemists. Who then can write about today's recent chemistry (and "recent chemistry" in the years to come)? Is the field left only to chemists and chemist-historians? If this becomes the case, then professional historians of chemistry will forever be locked into studying pre-1900 chemistry. Or if they venture beyond that era, they will do so by ignoring "certain kinds of important questions that can be discussed only by those who have considerable technical background" (5). One possible solution: interdisciplinary collaboration (7).

We now make a serious leap in terms of what we consider to be scholarship in the HoC. Who could really argue that the substance of discovery—the compounds, the reactions, the chemical and physical properties of matter, the actual achievements of chemists—is not a key component in the HoC? To do so would be not just unrealistic, but absurd. We posit that journals such as *Accounts of Chemical Research* and *Chemical Reviews* represent valid and necessary contributions to the HoC.

Figure 5 qualitatively illustrates our view as to the role of various publication media with regard to the HoC and the audiences they each serve. We first discuss the upper axis. At the left end of the scale (left and right are chosen arbitrarily) are journals that include HoC with a major if not sole emphasis on externalist factors. These are populated by history journals such as *Ambix* and *Isis*. At the right end of the scale are journals whose major if not sole emphasis is on internalist factors. These are populated by chemistry journals such as *Accounts of Chemical Research* and, at the far right, *Chemical Reviews*. In the middle are journals that include articles that bring both internalist and externalist perspectives in their articles. We posit that the journals cited at the far

right in Figure 5 also contain information relevant to the HoC. The inclusion of *Accounts of Chemical Research* and *Chemical Reviews* as sources for the HoC may seem surprising to some historians as well as perhaps to some chemists.

We recognize that not all HoC is published in professional journals. The second axis in Figure 5 is somewhat orthogonal to the first axis in that it represents media for whom the primary readership is a more general population. The now on-line *Distillations* published by the Science History Institute is a blended publication in that its readership is primarily science professionals, yet the articles are written such that a more general population will also be properly served.

We first analyze the upper axis in Figure 5. At a simplistic level, look just at articles that appear in history of chemistry journals. There is hardly a single chemical pictograph of a molecule, a reaction, or a reaction

mechanism in most *Ambix* articles. Let us consider an *Ambix* paper written by a chemist-historian that is more likely to have internalist material when compared to *Ambix* articles written by historians. Chemist-historian Weininger's recent 25-page *Ambix* article entitled "Delayed Reaction: The Tardy Embrace of Physical Organic Chemistry by the German Organic Community" contains pictography of one reaction and two sets of structures (two pairs of resonance hybrids) (25). Even though he is a chemist-historian, Weininger's text is mostly about externalist factors affecting the course of chemistry in Germany in the 20th century and skirts around what the science of physical organic chemistry was in the 20th century. In contrast, papers in *Accounts of Chemical Research* or *Chemical Reviews* contain page after page of chemical structures, reactions and mechanisms. Our claim is that we need both, articles in *Chemical Reviews* as well as articles in *Ambix*, to fully appreciate and characterize the HoC.

Publication Outlets and Audiences for the History of Chemistry

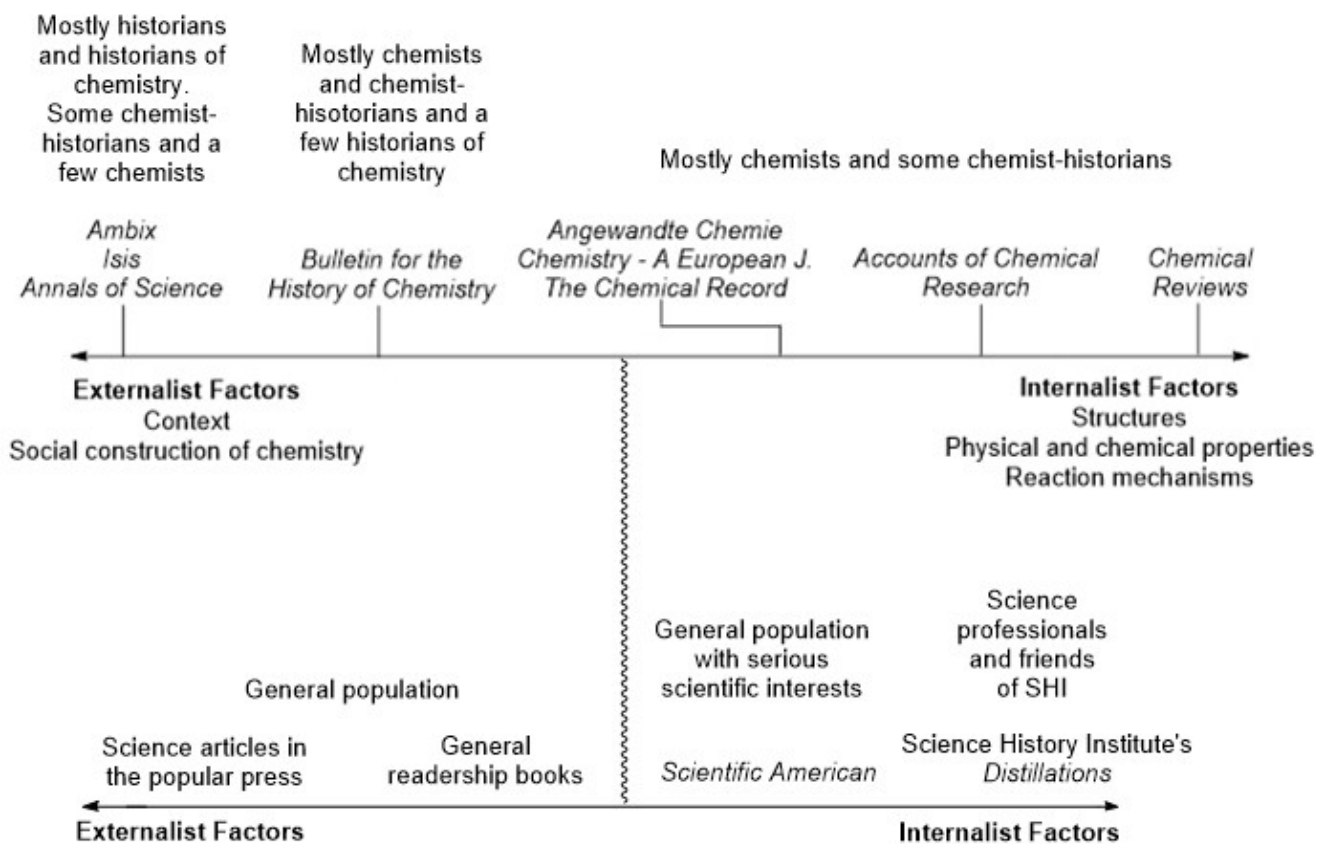


Figure 5. Illustration of the qualitative relationships between chemical content and contextual content of HoC and various publication media. The positions on the two axes are not drawn to scale, and the location of the somewhat orthogonal general population media denoted by the wavy line is arbitrarily placed. The history of chemistry is a discipline that contains both externalist and internalist factors.

We believe that historian Rocke got it exactly right when he wrote in 2018 (45),

If one wants to gain greater clarity on what happened in chemistry, one needs to focus not just on what our historical protagonists *say* and *write*, which is surely important enough, but also on what they *do*, and even on what we might conclude about what and how they *think*. They experiment, pay attention to empirical details, and think about the results of others; they use innumerable instrumental methods to probe the unseen; ... they manipulate formulas on paper, build physical models

Unfortunately, primary documents for research dealing with the late 20th century and thereafter are mostly unavailable and will continue to be so. Letters have been replaced by email (and increasingly so for other even more ephemeral media such as WhatsApp or Snapchat); neither telephone calls nor Zoom meetings are typically recorded and preserved; and laboratory notebooks are being replaced by computer files or purely electronic data. Hence, if current “data” germane to the HoC is not captured and archived while its originators are still alive, it will not be available for future historians of chemistry (46, 47). Ironically, archivists would prefer documents in electronic format, as they are inexpensive to store and relatively easy to search. But that requires chemists to save and donate their electronic files including their emails, an unlikely proposition given that they may contain personal material or material the scientists consider confidential—exactly the material that those studying the HoC would desire!

On the issue of personnel to write this recent history of chemistry, by 2000, there were fewer chemically-trained students *entering* the professional history of chemistry field, and more were and are being drawn from English and history disciplines. There were even fewer full-blown Ph.D. chemists entering this field with a Ph.D. in history or history of science, notwithstanding certain exceptions such as Lawrence Principe at Johns Hopkins and Catherine Jackson at Oxford. The interests of the history professionals were also shifting from the 19th century and the Chemical Revolution to the early modern period (16th to early 18th centuries) and alchemy and chymistry. This meant that the field of 20th-century chemistry was being increasingly abandoned to the chemist-historians. It appears clear today that only chemist-historians will have both the interest and the technical understanding to comprehensively cover this field. That said, this field does offer possibilities

for interdisciplinary research, with the chemist dealing with the technical details and the historian producing the contextual aspects. But does the history community, including and especially their tenure committees, reward interdisciplinary research as does the chemistry community? We believe not.

There appears to be a growth in the number of chemists who are interested in the HoC, not just to read HoC but to produce HoC research, though often on a one-time basis to satisfy a particular motivation. These individuals might be called hobbyists, as one of the present authors thought of himself for several decades (JIS). So how are more chemist-historians recruited, in general, and recruited specifically to work on the recent history of chemistry? Conferences and workshops could be instituted to encourage chemists to study the history of recent chemistry, an idea that might be attractive to those who are on the brink of or past retirement. Even if chemists only wrote about their own life’s work, or that of their Ph.D. advisors, in an intelligent, self-aware manner, this would be an important source of information on the recent history of chemistry. There is a major precedent for this in one of the present author’s (JIS’s) *Profiles, Pathways and Dreams* series of autobiography. Another such source are the biographical memoirs written about the deceased Fellows of the Royal Society (London) and members of the United States National Academy of Sciences (NAS). The authors of the memoirs of chemists are almost always chemists. For example, the organic chemists John D. Roberts and Lord (Alexander) Todd (Figure 6) authored eight biographical memoirs for the NAS and six for the Royal Society, respectively.

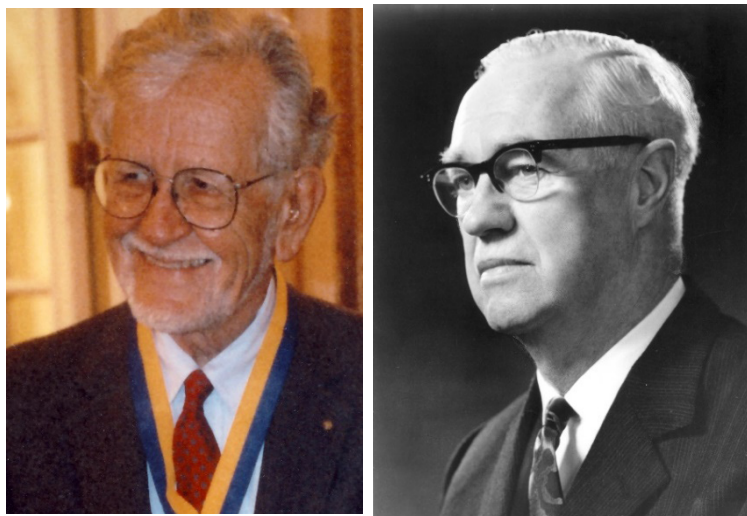


Figure 6. (Left) John D. Roberts and (Right) Lord Todd. Roberts photograph courtesy J. I. Seeman. Todd photograph courtesy the Royal Society (London).

We encourage the editors and publishers of all journals—both history of science journals and chemistry journals—to be more welcoming to cross-disciplinary authored submissions. These would include manuscripts written in an author’s cultural norm which may be quite different from that journal’s norms and its readership’s expectations. At the same time, authors must always be sensitive to a journal’s standards and its own culture. It is surely unrealistic for a journal to publish a paper whose content and style are many deviations outside its own norm.

We now focus on the lower axis of Figure 5. Authors of articles that appear in *Distillations* or in *Scientific American* understand that their readers are not necessarily science professionals. But authors for and editors of such media know that their readership has expectations for scientific content that exceeds the content that appears in newspaper articles and magazines such as *Time* and *People*.

Which brings us to Weininger’s interesting proposal in his article in this special issue of the Bulletin (42). Weininger believes that the HoC published by chemists and historian-chemists “lacks the essential contextual sophistication necessary for its inclusion in history of science publications” (42). But this conclusion may not consider the needs and requirements of the journal, the authors, and the readers of the articles to which he refers. The articles written by the chemists and chemist-historians referred to by Weininger may contain, likely do contain the exact right blend of context and substance for their specific situations, as shown in Figure 5. In the same vein, the articles that appear in the history journal *Ambix* may contain the exact amount of scientific detail as needed by the publisher, editors, authors and readers of that journal.

Weininger’s proposal, to have a workshop co-sponsored by HIST and SHI, “to overcome” (42) the insufficiencies in the articles written by chemists and chemist-historians are particularly likely to succeed if those authors intend to publish in journals like *Ambix* which are history journals. As we discussed in Tables 1 and 2, the cultures of chemists and of historians are so very different that, to meet the goals of crossing disciplinary boundaries, authors can truly benefit from instruction by those in their sister discipline. This conclusion goes equally well for historians who wish to publish in chemistry or chemistry-oriented journals. On the other hand, as we recommend in the next section, perhaps journals and editors ought to be more welcoming to cross-disciplinary submissions. Diversity is a good thing! All

this being said, more HoC context in chemistry articles and more chemistry in history articles may be a good thing all around.

Finally, we make an appeal for the return of the history of chemistry in chemistry courses. While we are perfectly aware of the pressures on the chemistry syllabus, we believe that a discipline that does not know its history cannot learn from its past errors. There is an inevitable tension about whether such courses should be taught by chemist-historians or professional historians. This is essentially a false choice. Historians will demand too much independence in their modes of instruction from their academic institutions. Chemists will claim they have the capability to include HoC in their courses but have neither the time nor the resources and perhaps not even the inclination to do so. The academic chemists would also claim that the necessary course content does not permit the addition of HoC to the syllabus. We can envision that organizations such as the Science History Institute and HoC societies, mindful of the above stated limitations, could develop supplementary material that would make HoC available easily and free to instructors and students. Certainly, the HoC material that might be used in the classroom is very much a matter of an institution’s educational requirements and the instructor’s taste, and a “one size to fit all” approach would not find much use.

Conclusions

We conclude:

- Chemistry, as a discipline, is strengthened by a well-documented and easily available scholarship of its entire history.
- The practice of the history of chemistry is and will be determined “organically,” influenced by societal factors, e.g., financial support for academic departments incorporating the history of science, the presence of history of chemistry journals and also high-quality chemistry journals that publish articles on the history of chemistry, the presence of leading book publishers in the history of chemistry, etc.
- There are two major silos of scholars studying the history of chemistry: professional historians, i.e., individuals whose advanced degrees are in history or history of science though some may have educational backgrounds in chemistry; and chemist-historians, i.e., individuals whose

advanced degrees are in chemistry or the molecular sciences. Individual chemists at times produce one or several publications in the history of chemistry, though they do not consider themselves chemist-historians.

- Historians write primarily for other historians. Chemists and chemist-historians write primarily for other chemists and other chemist-historians.
- As Mary Jo Nye has observed (48), there are many storylines in which the HoC can be told.
- We posit that journals like *Chemical Reviews* and *Accounts of Chemical Research* contribute to the total sum of knowledge in the HoC.
- Today, professional historians of chemistry are typically writing about pre-1900 chemistry and increasingly about pre-1800 chemistry and alchemy.
- Today, chemist-historians are generally writing about the period between 1870 and 1980.
- Chemists and chemist-historians are the most able and the most willing to write the history of recent chemistry.
- Nonetheless, insofar as the history of recent chemistry is being produced primarily by chemists and chemist-historians, the lack of historians studying recent chemistry suggests that the field is in danger of being insufficiently served.
- Research and publications in the history of chemistry will benefit from the widest diversity of scholarship and contributors to the field. We join others (49) and conclude that the contributions from *all* scholars in the HoC bring together *in toto* the scholarship that is called “the history of chemistry.”

We offer the following recommendations:

- The history of chemistry for any era must include the social and organizational aspects of the chemistry (externalist) as well as the chemistry (internalist). To write a complete history of chemistry for any era likely will require the contributions from scholars having diverse knowledge and experiences.
- Regardless of one’s disciplinary silo, all information should be used in the compilation of the history of chemistry, in general, and in the study of any one topic, in particular.

- Individuals in each silo should respect the styles, language, and cultures of others and especially value the academic production of their interdisciplinary colleagues.
- Efforts to force a bridging of these two silos have failed in the past and are probably doomed to fail in the future. Rather, interactions between individual scholars and the societies to which they belong should be encouraged but not with a “missionary vision.” The two silos should take their own routes. They are two unique disciplines with little in common except they share the same historical data (the same scientists, the same scientific results, the same context, and so forth).
- Chemists and chemist-historians should be mindful of including externalist content in their papers, as appropriate for the intended journal and its readership. Historians should equally be mindful of including internalist content to their papers with the same caveats.
- Journal editors and reviewers of chemistry review articles should encourage authors to include more HoC in their papers. Editors should also commission more chemist-historians, and even historians, to write reviews.
- Chemists and chemist-historians (as well as historians) benefit from rigorous peer review of their manuscripts. A diversity of peer reviewers should be engaged by journal editors, a process that will provide for “organic” or “natural” improvement and growth in scholarship.
- Active and recently retired chemists should be encouraged to assist in studying the history of chemistry, especially the recent history of chemistry.
- The inclusion of a blend of internalist and externalist history of chemistry within chemistry courses at both the undergraduate and graduate level is rare and should be enhanced. Institutes focused on the history of science can provide a professional level of context-oriented supporting material for all educational levels.

We also are realists. We recognize that some of our recommendations may be rejected by professional historians and/or chemist-historians. We may be whistling in the wind. But remarkably, and certainly most happily, the present authors have discovered during the course of several years of dialogue and several months of writing this paper that we have each moved our positions much

closer toward the other. Even if that is the only benefit of this manuscript, we are pleased. But we also are optimists. If we can expand our visions and feel gratified, so can others. Organically. For the benefit of all.

Coda

From an anonymous reviewer: "Let a hundred flowers bloom, and let's all read each other's work, I say!"

Dedication

This paper is dedicated to William B. Jensen, founding editor of the *Bulletin* and a notable chemist-historian and recipient of the 2005 Edelstein Award for Lifetime Achievement in the History of Chemistry.

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Peter J. T. Morris received his B.A. in chemistry from Oxford University and his undergraduate dissertation (Part II) was on *The Education of British Chemists in the Eighteenth Century*. He received a D.Phil. from the Faculty of Modern History at Oxford for a dissertation on the development of synthetic rubber at IG Farben. After a postdoctoral fellowship in the history of chemistry research group at the Open University, Milton Keynes (with Russell), he was an Assistant Director (Projects) at the Center for the History of Chemistry at the University of Pennsylvania (with Thackray) for three years. Subsequently, he was at the Open University as the first Royal Society-British Academy Research Fellow in the History of Science. In 1991, he was appointed Senior Curator in Experimental Chemistry at the Science Museum London, and then became Manager of Research in the Collections Unit of the Science Museum before ending his career at the museum as Keeper of Research Projects.

Jeffrey I. Seeman received his B.S. in chemistry from Stevens Institute of Technology, Hoboken, New Jersey, and his Ph.D. in chemistry from the University of California, Berkeley. He was a research chemist for over 30 years in industry and a fulltime consultant in the field of chemistry for another 10 years. In 1983, Seeman published his first paper in the history of chemistry (50). His first career highlight in HoC was the creation and editing of a 20-volume set of autobiographies of eminent organic

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European Society for the History of Science

In 2022, the European Society for the History of Science (ESHS) will host its tenth biannual conference. This year's edition will take place in Brussels, Belgium, and is organised by the National Committee for Logic, History and Philosophy of Science (NCLHPS) of Belgium.

The theme of the ESHS 2022 conference will be Science Policy and the Politics of Science, a topic with a particular resonance over these past years. The outbreak of Covid-19 has called attention to the shifting legitimacy of science-based expertise and the reliance on expert authority in policy-making by state and national governments. Clearly, this serves as an indication for a need to understand the role of scientists and scholars in society within a broader historical frame.

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