

## HISTORY OF CHEMISTRY IN THE *JOURNAL OF CHEMICAL EDUCATION* (1)

---

Carmen J. Giunta, Le Moyne College, Syracuse, NY, USA, giunta@lemoyne.edu and Martin D. Saltzman, Providence College, Providence, RI, USA

### *Supplemental Material*

#### Abstract

For many decades after its founding in 1924, the *Journal of Chemical Education* was the principal outlet for publication for American chemist-historians. In the later 1980s, one of the motivations for the American Chemical Society's Division of the History of Chemistry to expand its newsletter into a more ambitious publication was the "decreasing emphasis on history of chemistry in more traditional chemical journals, such as the *Journal of Chemical Education*." Shortly thereafter, the Division published an *Index to the History of Chemistry in the Journal of Chemical Education, 1925-1990*, prepared by Martin D. Saltzman with the assistance of Daniel A. Lombardi. This paper discusses highlights of the *Index*, such as which subjects and which authors appear most frequently among its records. The *Index* is newly available on the Division's website.

#### Preface

This paper was originally presented as part of the HIST Award symposium in honor of Mary Virginia Orna. The subject matter was particularly appropriate for the occasion because of Orna's exemplary record in chemical education as well as in history of chemistry. Orna received the James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry in 1996 and the George C. Pimentel Award in Chemical Education in 1999. She was long associated with the Division of Chemical Education (CHED), which published the *Journal of Chemical Education (JCE)* for most of its history (and continues to publish it in conjunction with

ACS Publications). As it happens, both CHED and the Division of the History of Chemistry (HIST) are 100 years old in 2022.

#### History of Chemistry and *JCE*

The importance of *JCE* as an outlet for publications about history of chemistry, particularly for members of HIST, has been noted by several leaders of HIST. In the first issue of the *Bulletin for the History of Chemistry*, published in 1988, the founding editor, William Jensen, gave as one of the reasons for starting the new publication "the decreasing emphasis on history of chemistry in more traditional chemical journals, such as the *Journal of Chemical Education*," a sign, albeit an indirect one, of the importance that *JCE* had had (2).

Other HIST leaders were more explicit. At a symposium in honor of the first 85 years of HIST, Paul Jones (1930-2019), Jensen's successor as editor of the *Bulletin*, noted that Edgar Fahs Smith (a founder of HIST) had sought to raise funds for a journal devoted to history of chemistry, but he was not able to do so. In the absence of such a journal, "the primary outlet for publications in chemical history for Americans, at the time of the founding of the HIST division and for several succeeding decades, was the *Journal of Chemical Education*" (3). James Bohning (1934-2011), HIST's historian, at that same symposium, noted that the founding editor of *JCE*, Neil Gordon (1886-1949), appointed Lyman Newell (1867-1933), then secretary of HIST, as editor for historical papers (4).

Newell served as editor for *JCE*'s history of chemistry "department" until his death in 1933. The following year, Tenney Davis (1890-1949) succeeded him. Starting in 1941, the *JCE* masthead stopped identifying departmental editors but listed associate editors without identifying a specialization. Perusing lists of associate editors into the early 1980s, when *JCE* stopped printing such lists in its front papers, reveals that the journal always had at least one editor strongly associated with HIST. These include Davis until his death in 1949, Ralph Oesper for 25 years from the 1940s through the 1960s, Henry Leicester throughout the 1960s, Aaron Ihde from 1960 into the 1970s, Derek Davenport from the late 1960s through the 1970s, John Wotiz from 1975, Albert Kirsch from 1982, and Mary Virginia Orna also from 1982.

The importance of *JCE* to the community of chemists interested in the history of their discipline—the core membership of HIST—has long been appreciated by that community. It was also appreciated in the community of professional historians of science and technology. A review in *Technology and Culture* (the journal of the Society for the History of Technology) of a book of reprints of historical articles from *JCE* began (5):

No technical or trade journal in America has done more to promote the history of its professional discipline than has the *Journal of Chemical Education*. In nearly every monthly issue since its founding in 1924, this journal has carried one or more historical articles acquainting its many subscribers with the origin or development of some aspect of modern chemistry.

The book in question was *Selected Readings in the History of Chemistry*, edited by Ihde (1909-2000) and William F. Kieffer (1915-2012) and published by *JCE* in 1965 (6). Ihde was a historian of chemistry at the Uni-

versity of Wisconsin's history of science department at the time and Kieffer editor of *JCE*. The reviewer, John J. Beer (1927-2021), was an historian at the University of Delaware who concentrated on industrial chemistry and the chemical industry.

A review in *Isis* by Frank Greenaway (1917-2013) of the Science Museum, London, also spelled out the relevance of *JCE* to both chemists and historians (7):

The *Journal of Chemical Education*, has for a long time provided a valuable supplement to the journals devoted exclusively to the history of science. Many of its historical articles have gone far beyond the duty of widening the vision of the professional chemist and have offered new information and enlightenment to the specialist historian.

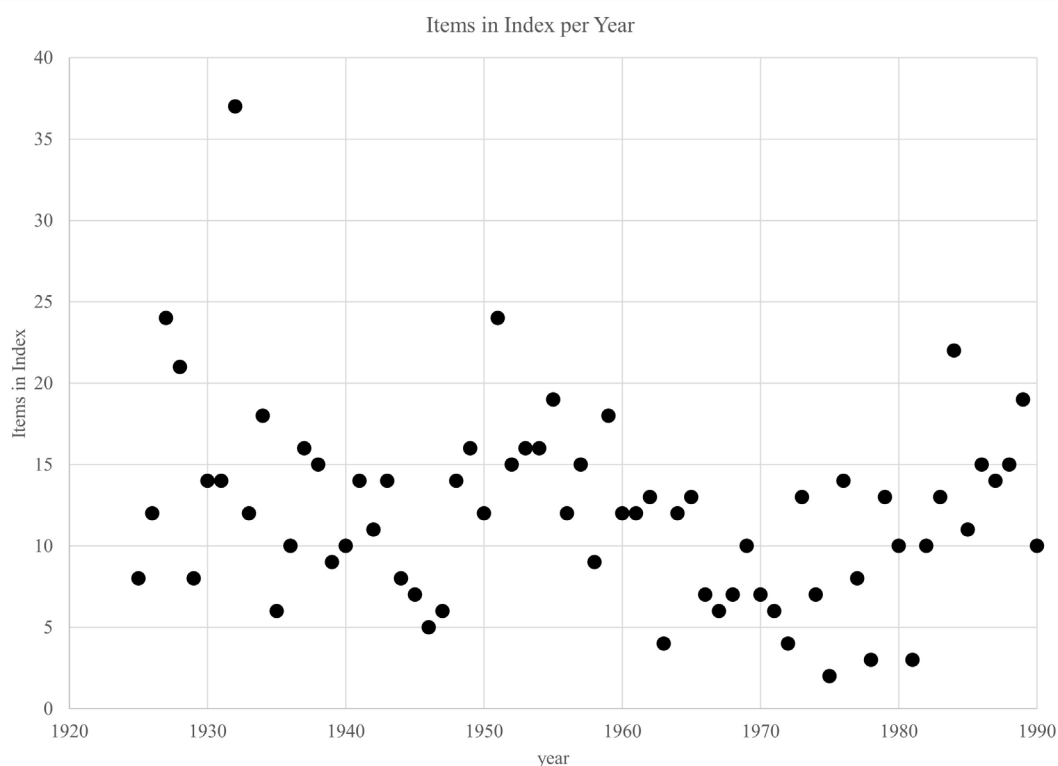


Figure 1. Index records per year, 1925-1990.

Recognizing the trove of historical articles to be found among the pages of *JCE*, HIST published an *Index To The History of Chemistry in the Journal of Chemical Education, 1925-1990* (simply the *Index* henceforth) in 1995 (8). That *Index*, prepared by Martin Saltzman, contains 800 records of historical articles from the journal. Early in 2022, the *Index* was digitized and lightly edited. HIST has published it on its website as a searchable pdf file retaining the organization of the original, and it has also published a spreadsheet containing its records, which

is both searchable and sortable. The *Index* is the main source for the rest of the article.

### The *Index* by the Numbers

As noted above, the *Index* contains 800 records. All of them refer to articles, although some are quite short. No book reviews were indexed. Dividing 800 *Index* items into the 66-year publication span covered by the *Index* yields 12.1 items per year, one per issue. Figure 1 displays a plot of *Index* items for each year. A lot of scatter is evident in the plot and very little correlation. There is one outlier year, 1932, whose 37 records exceeds any other year by 12 or more records. It is worth noting that about half of the entries in 1932 were the first 18 articles in Mary Elvira Weeks's (1892-1975) 21-article series on the *Discovery of the Elements*.

Table 1 shows the authors most frequently listed in the *Index*. It includes Weeks, of course. It is topped by Ralph Oesper (1886-1977). George Kauffman (1930-2020) would have been on top if the *Index* included a few more years or if it included book reviews. Many of these prolific authors will be discussed below.

**Table 1.** Authors of six or more articles listed in the *Index*.

author	entries	author	entries
Oesper, R. E.	38	van Klooster, H. S.	12
Kauffman, G. B.	34	Ihde, A. J.	11
Weeks, M. E.	31	Reilly, D.	8
Browne, C. A.	23	Armstrong, E. V.	7
Davis, T. L.	18	Stock, J. T.	7
Newell, L. C.	15	Saltzman, M. D.	6
Leicester, H. M.	14	Tarbell, D. S.	6
Smith, E. F.	13		

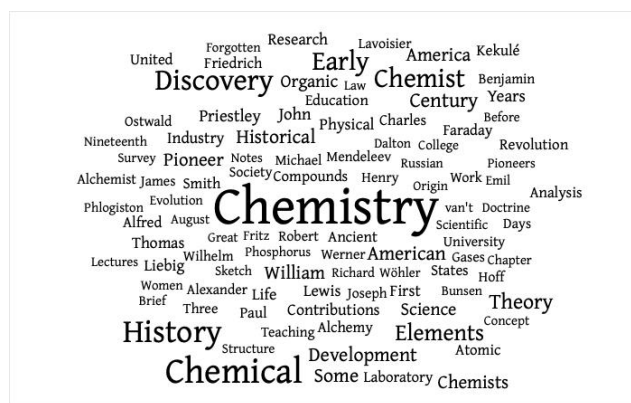
### HIST Founders

In this anniversary year for HIST and CHED (namely 2022), it is worth looking at the publication activity of the founders of HIST in *JCE*. Edgar Fahs Smith (1854-1928) and Charles A. Browne (1870-1947) are usually considered the founders of HIST (4). Smith sought to establish a journal for history of chemistry, but that did not keep him from contributing historical articles to *JCE*. He appears in the *Index* as author 13 times—an impressive tally considering that he died in 1928. He was also the subject of three articles. Smith's first article, appropriately enough for a founder of both HIST and CHED, was titled "Observations on Teaching

the History of Chemistry" (9). Browne was also a prolific contributor of historical articles to *JCE*. He appears in the *Index* 23 times as an author and once as a subject. Among Browne's subjects were Smith, in a 1928 obituary (10), and HIST (11). Browne's paper on HIST was not the first on that subject to appear in *JCE*. Newell, who was the journal's associate editor for historical articles, wrote on the foundation and early years of HIST in an article published in 1932 (12). All of the first five chairs of HIST (Smith, Browne, Frank Dains (1869-1948), Newell, and Davis) published historical articles in *JCE*—four of them more than a dozen articles.

### Favorite Subjects

Figure 2 is a "word cloud" generated from the titles of the 800 papers in the *Index*, showing some of the words that appear most often in the papers' titles. Many of the words are neither surprising nor interesting, such as chemistry, history and variations on those terms. Discovery and elements would appear prominently if only for Mary Elvira Weeks's 21-part series on discovery of the elements.



**Figure 2.** Word cloud generated from the titles of articles in the *Index*. The image was generated using Word It Out (<https://worditout.com/word-cloud/create>).

America or American shows up 45 times and United States 9 more, reflecting at least some attention to chemistry in this country. Alchemy and related words appear in 23 titles. Structure and related forms appear in 10 titles. Revolution appears in 9 titles, referring to the French, the American, the chemical, and the industrial, so it is not really a key concept. Periodic (as in table or system) appears in only five titles. That strikes us as a low number, but perhaps we are still under the influence of the 2019 International Year of the Periodic Table. Benzene appears in as many titles and phlogiston in one more title.

There are a great many proper names in the titles of articles in the *Index*. The ones that appear most often are all men. (The *Index* does contain a section, albeit a small one, on women in chemistry.) The three names that appear in 10 or more titles in the *Index* are Priestley (Joseph), Liebig (Justus), and Lewis (most but not all for G. N. Lewis).

### Dexter/Edelstein/HIST Award Winners in *JCE*

Beginning in 1956, HIST has recognized outstanding achievement in the history of chemistry with its highest award. It was originally called the Dexter Award after the Dexter Chemical Company, which was founded, like the award, by Sidney M. Edelstein (1912-1994). After Edelstein's death, the award was renamed the Edelstein Award (13). More recently, it was renamed the HIST Award, and in 2023, has been renamed the Joseph B. Lambert HIST Award. The list of winners of the award (which can be found at the HIST website (14)) constitutes a who's who in history of chemistry from around the world, including both chemist historians and professional historians. Many of the award winners published historical articles in *JCE*, particularly those who were American chemists.

The first winner of the Dexter award, Ralph Oesper, is in the *Index* more than anyone else, 38 times. He published a great number of biographical sketches in the journal, from 1927 (on August Kekulé) to 1955 (Bunsen's transfer from Cassel to Marburg). The second Dexter winner, Williams Haynes (1886-1970), published several articles in *JCE*, but none is in the *Index*. Haynes's articles were mainly on contemporary aspects of chemical industry rather than historical ones. The first woman to receive the Dexter award, Eva Armstrong (1877-1962), is listed as an author in the *Index* seven times in the late 1930s through most of the 1940s.

John Read (1884-1963), the fourth Dexter winner and the first from outside the US, appears in the *Index* once as an author, with what appears to be his Dexter award address in 1960, and once as the subject of an article by Ralph Oesper. The next British winner of the Dexter was J. R. Partington (1886-1965), and again his one entry in the *Index* appears to be his Dexter award address on the discovery of oxygen.

Henry Leicester (1906-1991) is another Dexter Award winner (1962) who wrote more than 10 articles in the *Index*. Leicester's historical work may be best known

today from his sourcebooks (15) and as a co-author of the final edition of *Discovery of the Elements* (16), but most of his historical articles in *JCE* are on 19<sup>th</sup>-century Russian chemists.

Martin Levey (1913-1970) and Earle Caley (1900-1984) won the Dexter in 1965 and 1966 respectively. Both wrote quite a bit on chemistry and chemical technology of the ancients and chemistry in archaeology, including in *JCE*.

The 1967 Dexter winner is listed as the author of 31 articles in the *Index*, 21 of which were published in a two-year span and later collected into her highly successful and well-regarded book, *Discovery of the Elements* (17). Of course we refer to Weeks. Two excellent articles published in 2021 focus on Weeks, one by Kathleen and James Neeley in this journal (18) and one by Vera Mainz in the symposium volume *150 Years of the Periodic Table* (19).

Ihde was another Dexter winner listed in the *Index* more than 10 times. Two entries spanning 27 years were co-authored pieces on chemistry at the University of Wisconsin. Ihde's co-author on the first paper was his mentor in food chemistry at Wisconsin, Henry Schuette, who also nurtured Ihde's interest in history of chemistry (20). His co-author on the later paper was a former student of his and future Dexter award winner, Alan Rocke (21). Ihde's articles in the *Index* in between were remarkably varied, though, which should not surprise anyone who read his *Development of Modern Chemistry* (22). Ihde also co-edited a volume of historical articles from *JCE* (6).

The 1978 Dexter winner, George Kauffman, is second to Oesper in the number of entries in the *Index*—only because the *Index* stops at 1990. Kauffman's entries in the *Index* begin in 1959 with an article on Sophus Mads Jørgensen (23). (Somehow the *Index* missed his first historical article in *JCE*, in 1955 on Frédéric Swarts (24).) His last *Index* entry is from 1990, an article on the war-strained friendship of Emil Fischer and William Ramsay (25)—and he continued to publish in *JCE* after 1990, the closing date of the *Index*. Kauffman's last historical article in *JCE*, as far as we can tell, was a 1999 paper on the Czech chemist and composer Emil Votoček (26), and he published many book reviews and the occasional letter after that. For more on Kauffman's career and especially his personality, see Jeffrey Seeman's recent article in this journal (27).

Of the 15 most prolific authors in the *Index*, eight won the Dexter award, and another four died before there

was a Dexter award. Stanley Tarbell (1913-1999) and John Stock (1911-2005), winners of the Dexter in 1989 and 1992 respectively, were the last two Dexter winners to appear more than five times in the *Index*. There are many reasons for this. For one, the *Index* stops in 1990. For another, the journal began moving away from publishing historical material around this time, as already noted. And by the late 1980s and early 1990s, winners of the Dexter and later Edelstein and HIST awards were already being drawn frequently from a group of scholars who never did publish frequently in *JCE*. The group served by the journal was primarily American chemists interested in history, whereas the Dexter and its successor awards are international in scope, and they frequently go to historians as well as chemists.

It is worth noting, though, the winners of the awards in the later 1990s and beyond who appear in the *Index*. They include three historians who were kind enough to contribute to the special centennial issue of the *Bulletin for the History of Chemistry*: William Brock, Alan Rocke, and John Parascandola (28). Rocke received the 2000 Dexter award and we have already mentioned his *JCE* paper with his mentor Ihde (21). Brock received the 1995 award; he published an article in *JCE* in 1963 on William Prout's Bridgewater treatise (29). And Parascandola, winner of the first Edelstein award (in 2002), published an article on adiabatic calorimetry (30).

In addition to these three historians, several chemists who won the awards also appear as authors in the *Index*. They include Keith Laidler (1916-2003), William Jensen, Otto Theodor Benfey, and Mary Virginia Orna. Jensen is no stranger to the journal, and he wrote its "Ask the Historian" column for many years. About 40 short articles ran under that heading from 2003 through 2009, and he published several other short articles afterwards (through 2013) based on questions for that column. His last historical article was in 2014 on the Kimball free-cloud model of chemical bonding (31). Benfey's first historical article in the journal was in 1952 on Prout's hypothesis (32) (missed in the *Index*, unfortunately). If we are not mistaken, Orna's last historical article in the journal was in 2009 and it was about her favorite element, francium (33).

Some chemists who received the HIST award more recently have also published in the journal on historical topics, either after the date of the *Index* or otherwise not in it. They include Joseph Lambert on archeological chemistry in 1983 (34), Jeffrey Seeman on chemical autobiography in teaching chemistry (35), and David Lewis on chemistry at Kazan (36).

## History in *JCE* Since 1990

Searching for history of chemistry in *JCE* since 1990 initially made us think that the demise of the subject in this journal was greatly exaggerated. A SciFinder search turned up 287 items in just over 31 years (1991-2022). Compared to the time covered by the 800-item *Index*, namely the 66 years from 1925 through 1990, there is a decline, but apparently only a modest one (12.1 for the *Index* years vs. 9.3 since).

In fact, though, the decline is much greater than this figure makes it appear. In reality, many fewer than half of the items turned up in the SciFinder search would have made it into the *Index* if the *Index* had been extended. One of the unfortunate takeaway messages from this exercise is that it is difficult to use SciFinder to search for general history of chemistry content (as opposed to particular subjects). This search turned up items that had some form of the word history in the abstract, for example, an article about teaching chemistry at historically black colleges and universities or articles that simply used a time series of data.

Of the entries that had something to do with history of chemistry as we understand it, many were book reviews. The *Index* did not include book reviews, but it is worth noting that *JCE* continued to review books on history of chemistry well into the 21<sup>st</sup> century. For example, *The Lost Elements: The Shadow Side of the Periodic Table*, was reviewed in 2016 (37). Increasingly over this period, though, articles that had history of chemistry content needed to have an explicitly pedagogical aspect to them to appear in *JCE*. Some were about historical aspects of chemical education, some about teaching history of chemistry, but most were on an application of historical material to the teaching of chemistry or teaching about the nature of science.

Using historical material in the service of representing underrepresented groups in chemistry has been the subject of several articles throughout this period, from an article on patterns of women receiving doctorates in chemistry in the July 1991 issue (38) to a website intended to introduce stories of diverse chemistry into the classroom in the January 2022 issue (39), including several articles by Marelene and Geoffrey Rayner-Canham in between. Examples of articles on teaching history of chemistry include a 2004 article by John Stock based on survey data (40) and an article that described teaching a course in history of chemistry remotely during the COVID-19 pandemic (41). Examples of historical treatments of chemical education include a history of

the high school science sequence in the United States (42) and an editorial about changes (or not) in chemistry textbooks (43). But, as already mentioned, more of the articles containing historical material used that material in the service of pedagogical aims to teach chemistry or some aspect about how science works. The first paper in this journal by one of us (CJG) was an example of this type of article, drawing lessons about scientific practice from the discovery of argon (44). A more recent example, from 2018, reviews highlights of investigations of water from van Helmont's tree experiment through Arrhenius's ionic dissociation theory, drawing lessons on the conduct of science (45).

Purely historical articles in this era include Jensen's "Ask the Historian" column already mentioned. Judging from the title, the 2015 article "British Chemist Henry E. Roscoe's Unintended Contribution to Korean Chemistry in 1907" (46) would appear to be one of the last articles in *JCE* involving pure history of chemistry; however, on closer examination it is more like the history of an educational topic, using textbooks for its main narrative. The last purely historical stand-alone article may have been a 2011 account of photoluminescence before quantum theory (47).

The favorite biographical subjects from the *Index* appeared much less frequently in recent years of *JCE*. Take Priestley, for example. He is a central figure in quite a recent article, from 2021, about public outreach at a local history museum in the UK: certainly historical, but with a decidedly educational (outreach) application (48). Otherwise, he figures in two book reviews (of biographies of Priestley) and in the "From Past Issues" column, rehearsing highlights from earlier articles about

him (49). G. N. Lewis was in the journal frequently in the later period as a disembodied eponym (Lewis structures, Lewis acids) rather than as a subject, with the exception of one book review. Liebig, the third of the most frequently featured historical chemists in the *Index*, fares a little better in the later period. He appeared as an eponym as well, but a contextualized one, in an "Ask the Historian" column on the Liebig condenser. There were also pieces about the Liebig-Wöhler controversy and isomerism (50) and about the history of laboratory instruction (51). Mendeleev appeared more frequently than these three in more recent years—and not because of the recent International Year of the Periodic Table.

### The Importance of History to *JCE*?

We hope that we have shown *JCE* to have been a valuable source of information about the history of chemistry to chemists and teachers of chemistry for much of its history, as well as an important outlet for publications on the subject for chemists and chemistry teachers. Moreover, we emphasize the utility of the *Index to the History of Chemistry in the Journal of Chemical Education, 1925-1990* as a guide to that historical material. In the process, we have highlighted some of the chemists who contributed historical material most frequently to *JCE*.

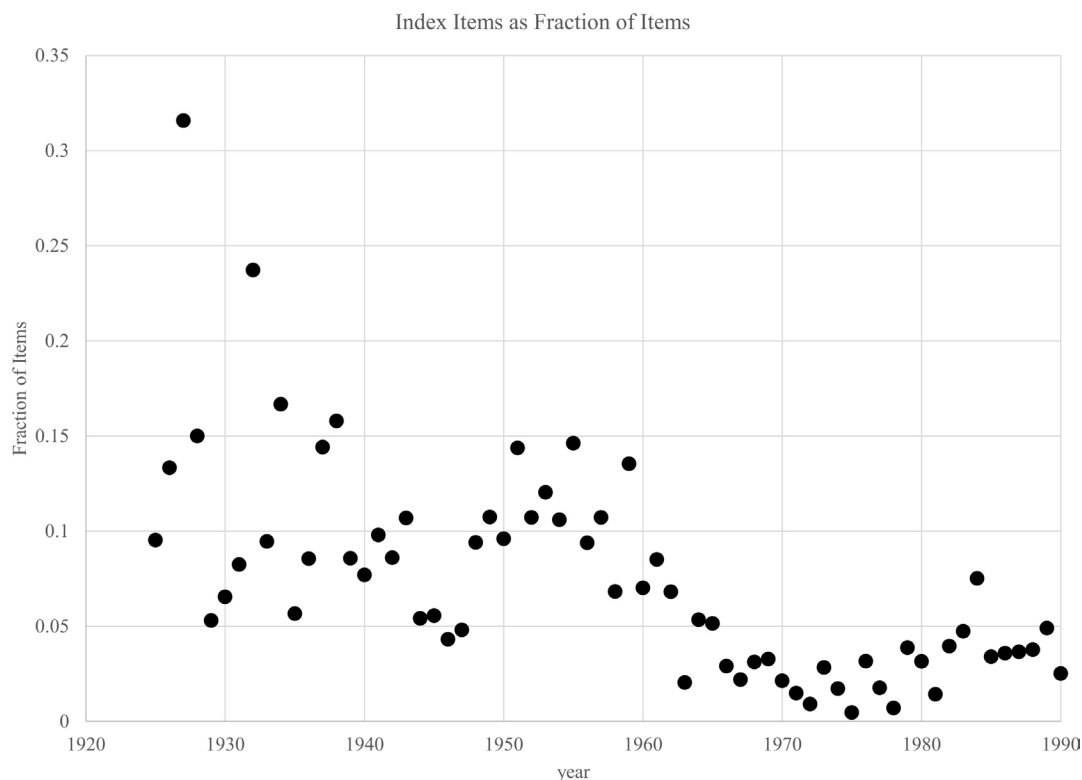


Figure 3. Articles in the Index as a fraction of articles in *JCE*.

We conclude with some observations that the importance of *JCE* to history of chemistry does not imply its converse; that is, history of chemistry was not necessarily important to *JCE*.

It would seem that historical material *was* important to the journal, at least at first. The existence of a history department within the journal, at least while the journal had departments in its first years, suggests that history was one of the journal's core areas. But this may well have been a historical accident due in part to the twin births of the (then) sections of history and education both under the strong influence of Smith.

According to *JCE*'s first editor, Gordon, Smith was asked to edit the new journal. He was trying to start a journal for history of chemistry, and he declined becoming involved with *JCE* at the same time. When it was suggested to Smith that history be included in *JCE*, his response was negative. "He felt that if he were to do that, the history of chemistry would fall into the background and be more or less obliterated," recalled Gordon. But Smith later agreed to write historical articles for *JCE* and suggested the appointment of Newell as editor for historical papers (52).

History was not part of the journal's initial mission statement, though. Gordon's first editorial in *JCE* outlined four primary purposes for the journal: to bring to teachers timely and important papers in chemical education presented before the division and elsewhere; to encourage a community for the circulation of reports and studies on reforms in teaching chemistry; to encourage research among teachers so as to imbue classrooms with an atmosphere of investigation; and to keep teachers and students informed of relevant opportunities in ACS and other scientific organizations (53).

A recent discussion of trends in chemical education practice over the five decades that followed the launch of Sputnik in 1957 does not include history of chemistry among those practices, even as the discussion argues for the importance of a sense of history as a crucial tool for inventing the future (54).

So it is not surprising that the historical content in *JCE* eventually diminished, as Smith expected. Perhaps what requires explanation is why the historical content in *JCE* remained significant for as long as it did. As noted above (Figure 1), the number of historical items in the *Index* shows no marked trend over the period 1925-1990. Figure 3 shows the fraction of *JCE* articles that were in the *Index*. It is apparent that historical articles were a

decreasing fraction of the journal's output over the years of the *Index* (55).

### Acknowledgment

I thank an anonymous referee for suggestions that improved the paper—in particular for asking about the question treated in the brief final section. In addition, James Bohning's and Gary Patterson's short biographies of HIST officers and divisional award winners on the HIST website (<http://acshist.scs.illinois.edu/>) provided valuable background information.

### Supplemental Material

The following can be found in the Supplemental Material for the Bulletin for the History of Chemistry at the journal's website, <http://acshist.scs.illinois.edu/bulletin/index.php>: Reissue of *Index to The History of Chemistry in the Journal of Chemical Education, 1925-1990*, prepared by Martin Saltzman and published by the Division in 1995. It is available as a searchable pdf and as an Excel spreadsheet.

### References and Notes

1. Presented at the 263rd National Meeting of the American Chemical Society, San Diego, CA, March 22, 2022, in the HIST Award Symposium Honoring Mary Virginia Orna.
2. W. B. Jensen, "From the Editor's Desk," *Bull. Hist. Chem.*, **1988**, *1*, 3.
3. P. R. Jones, "Communicating the History of Chemistry," *Bull. Hist. Chem.*, **2007**, *32*(2), 82-86.
4. J. J. Bohning, "Looking Back: Eighty-Five Years of Chemists and Their History," *Bull. Hist. Chem.*, **2007**, *32*(2), 66-81.
5. J. J. Beer, "Review of *Selected Readings in the History of Chemistry*," *Technology and Culture*, **1966**, *7*(4), 535-538.
6. A. J. Ihde and W. F. Kieffer, Eds., *Selected Readings in the History of Chemistry*, Journal of Chemical Education, Easton, PA, 1965.
7. F. Greenaway, "Review of *Selected Readings in the History of Chemistry*," *Isis*, **1966**, *57*(3), 397-398.
8. M. D. Saltzman, *Index To The History of Chemistry in the Journal of Chemical Education, 1925-1990*, Division of the History of Chemistry of the American Chemical Society, 1995. Available as a searchable pdf and as a spreadsheet at [http://acshist.scs.illinois.edu/bulletin\\_open\\_access/special.php](http://acshist.scs.illinois.edu/bulletin_open_access/special.php) (accessed May 20, 2022).

9. E. F. Smith, "Observations on Teaching the History of Chemistry," *J. Chem. Educ.*, **1925**, 2, 533-555.
10. C. A. Browne, "Dr. Edgar Fahs Smith," *J. Chem. Educ.*, **1928**, 656-663.
11. C. A. Browne, "The Past and Future of the History of Chemistry Division," *J. Chem. Educ.*, **1937**, 14, 503-515.
12. L. C. Newell, "Historical Sketch of the Division of History of Chemistry, American Chemical Society," *J. Chem. Educ.*, **1932**, 9, 667-669.
13. P. R. Jones, "Fifty Years of the Dexter and Edelstein Awards," *Bull. Hist. Chem.*, **2007**, 32(1), 1.
14. American Chemical Society Division for the History of Chemistry, Divisional Awards, <http://acshist.scs.illinois.edu/awards/index.php> (accessed May 21, 2022).
15. H. M. Leicester and H. S. Klickstein, Eds., *A Source Book in Chemistry, 1400-1900*, Harvard University Press, Cambridge, MA, 1952 and H. M. Leicester, Ed., *A Source Book in Chemistry, 1900-1950*, Harvard University Press, Cambridge, MA, 1968.
16. M. E. Weeks and H. M. Leicester, *Discovery of the Elements*, 7th ed., Journal of Chemical Education, Easton, PA, 1968.
17. M. E. Weeks, *Discovery of the Elements*, Journal of Chemical Education, Easton, PA, 1933, and six more editions through 1968.
18. K. L. Neeley and J. D. Neeley, "A Wave of Women Chemists: Mary Elvira Weeks and Her University of Kansas Colleagues," *Bull. Hist. Chem.*, **2021**, 46(1), 108-133.
19. V. V. Mainz, "Mary Elvira Weeks and Discovery of the Elements," in C. J. Giunta, V. V. Mainz and G. S. Girolami, Eds., *150 Years of the Periodic Table: A Commemorative Symposium*, Springer, 2021.
20. A. J. Ihde and H. A. Schuette, "The Early Days of Chemistry at the University of Wisconsin," *J. Chem. Educ.*, **1952**, 29, 65-72.
21. A. J. Roche and A. J. Ihde, "A Badger Chemist Genealogy: The Faculty at the University of Wisconsin-Madison," *J. Chem. Educ.*, **1979**, 56, 93-95.
22. A. J. Ihde, *The Development of Modern Chemistry*, Dover, New York, 1984 (first published 1964).
23. G. B. Kauffman, "Sophus Mads Jorgensen (1837-1914): A Chapter in Coordination Chemistry History," *J. Chem. Educ.*, **1959**, 36, 521-527.
24. G. B. Kauffman, "Frederic Swarts: Pioneer in Organic Fluorine Chemistry," *J. Chem. Educ.*, **1955**, 32, 301-303.
25. G. B. Kauffman and P. M. Priebe, "The Emil Fischer-William Ramsay Friendship: The Tragedy of Scientists in War," **990**, 67, 93-101.
26. F. Jurik, I. D. Rae and G. B. Kauffman, "Emil Votoček (1872-1950): A Tribute to the Chemist-Composer-Lexicographer," *J. Chem. Educ.*, **1999**, 76, 511-519.
27. J. I. Seeman, "George Bernard Kauffman (1930-2020): A Unique Chemist, Educator, Critic, and Historian. An Obituary-Tribute," *Bull. Hist. Chem.*, **2021**, 46(2), 205-217.
28. W. H. Brock, "The Long and Short of It: The Future Writing of History of Chemistry," *Bull. Hist. Chem.*, **2022**, 47(1), 138-145. A. J. Roche, "Reflections on the Last and the Next Hundred Years," *Bull. Hist. Chem.*, **2022**, 47(1), 171-175. J. Parascandola, "The Development of Medicinal Chemistry as a Discipline: A Topic Ripe for Historical Exploration," *Bull. Hist. Chem.*, **2022**, 47(1), 77-84.
29. W. H. Brock, "Prout's Chemical Bridgewater Treatise," *J. Chem. Educ.*, **1963**, 40, 652-655.
30. S. J. Kopperl and J. Parascandola, "The Development of the Adiabatic Calorimeter," *J. Chem. Educ.*, **1971**, 48, 237-242.
31. W. B. Jensen, "The Kimball Free-Cloud Model: A Failed Innovation in Chemical Education?" *J. Chem. Educ.*, **2014**, 91, 1106-1124.
32. O. T. Benfey, "Prout's Hypothesis," *J. Chem. Educ.*, **1952**, 29, 78-81.
33. M. V. Orna, "My Favorite Element. Francium: Uranium's Daughter, Perey's Discovery," *J. Chem. Educ.*, **2009**, 86, 1364.
34. J. B. Lambert, "Archaeological Chemistry," *J. Chem. Educ.*, **1983**, 60, 345-347.
35. F. A. Carroll and J. I. Seeman, "Placing Science into Its Human Context: Using Scientific Autobiography to Teach Chemistry," *J. Chem. Educ.*, **2001**, 78, 1618-1622.
36. D. E. Lewis, "The University of Kazan-Provincial Cradle of Russian Organic Chemistry: Part I. Nikolai Zinin and the Butlerov School," *J. Chem. Educ.*, **1994**, 71, 39-42. D. E. Lewis, "The University of Kazan-Provincial Cradle of Russian Organic Chemistry: Part II: Aleksandr Zeitsev and his Students," *J. Chem. Educ.*, **1994**, 71, 93-97.
37. J. Kovac, "Review of *The Lost Elements: The Periodic Table's Shadow Side*," *J. Chem. Educ.*, **2016**, 93(6), 990.
38. K. G. Everett and W. S. DeLoach, "Chemistry Doctorates Awarded to Women in the United States: A Historical Perspective," *J. Chem. Educ.*, **1991**, 68(7), 545-547.
39. K. R. Ries and Z. L. Mensinger, "Introducing Diverse Chemists in Chemistry Courses," *J. Chem. Educ.*, **2022**, 99(1), 504-507.
40. J. T. Stock, "The Teaching of the History of Chemistry," *J. Chem. Educ.*, **2004**, 81(6), 793-794.
41. V. Domenici, "A Course of History of Chemistry and Chemical Education Completely Delivered in Distance



- Education Mode during Epidemic COVID-19,” **2020**, 97(9), 2905-2908.
42. K. Sheppard and D. M. Robbins, “Chemistry, The Central Science? The History of the High School Science Sequence,” *J. Chem. Educ.*, **2005**, 82(4), 561-566.
43. N. J. Pienta, “Is Something New Happening with Textbooks?” *J. Chem. Educ.*, **2018**, 95(5), 689-690.
44. C. J. Giunta, “Using History To Teach Scientific Method: The Case of Argon,” *J. Chem. Educ.*, **1998**, 75(10), 1322-1325.
45. J.-L. Aparicio and M. P. Elizalde, “From Water to H<sub>2</sub>O: Using the Human Dimension of Science To Teach the Nature of Science,” *J. Chem. Educ.*, **2018**, 95(10), 1763-1770.
46. J. Park and B.-H. Chung, “British Chemist Henry E. Roscoe’s Unintended Contribution to Korean Chemistry in 1907,” *J. Chem. Educ.*, **2015**, 92(3), 593-594.
47. B. Valeur and M. N. Berberan-Santos, “A Brief History of Fluorescence and Phosphorescence before the Emergence of Quantum Theory,” *J. Chem. Educ.*, **2011**, 88(6), 731-738.
48. H. Cooke, H. L. Dobbs, K. Haxton, F. Parmeggiani and G. Skerratt, “From Nantwich to Oxygen: Public Engagement in Chemistry at a Local History Museum,” *J. Chem. Educ.*, **2021**, 98(4), 1249-1255. J
49. K. R. Williams, “The Discovery of Oxygen and Other Priestley Matters,” *J. Chem. Educ.*, **2003**, 80(10), 1129-1131.
50. S. Esteban, “Liebig–Wöhler Controversy and the Concept of Isomerism,” *J. Chem. Educ.*, **2008**, 85(9) 1201-1203.
51. K. Sheppard and G. Horowitz, “From Justus von Liebig to Charles W. Eliot: The Establishment of Laboratory Work in U.S. High Schools and Colleges,” *J. Chem. Educ.*, **2006**, 83(4), 566-570.
52. N. E. Gordon, “The Section, Division, and Journal of Chemical Education: A Brief Historical Retrospect,” *J. Chem. Educ.*, **1943**, 20(8), 369-372, 405.
53. N. E. Gordon, “Editor’s Outlook,” *J. Chem. Educ.*, **1924**, 1(1), 1-2.
54. M. V. Orna, “Introduction: The Evolution and Practice of Chemical Education,” in M. V. Orna, Ed., *Sputnik to Smartphones: A Half-Century of Chemistry Education*, ACS Symposium Series 1208, American Chemical Society, Washington, DC, 2015.
55. The fraction for each year 1925-1990 was taken by dividing the number of entries in the *Index* by the number of articles in *JCE* according to CAS SciFinder<sup>®</sup>.

### About the Authors

Carmen Giunta is Professor Emeritus of Chemistry at Le Moyne College in Syracuse, New York. He is editor of the Bulletin for the History of Chemistry. Martin Saltzman was chair of HIST in 1995. He is retired from Providence College after 50 years of service on the faculty.

### Society for the History of Alchemy and Chemistry Awards 2023

The Society for the History of Alchemy and Chemistry (SHAC) offers two types of award: support for research into the history of chemistry or history of alchemy by both new and independent scholars and support for subject development of either history of chemistry or history of alchemy. The deadline for applications is 31 May 2023.

Research grants are open to post-graduate students (both masters and doctoral students), those who have obtained a PhD since 1 January 2013 and independent scholars (self-defined). Grants of up to £1000 will be made to cover research expenses, including travel, accommodation, subsistence (at the discretion of the award panel), the reproduction of documents, and library fees. Applications may also include the costs of reproducing images for publication.

Subject Development grants of up to £1000 may be made to support activities such as seminars, workshops, colloquia, lecture series, conference sessions, conferences, exhibitions and outreach activities that support either the history of chemistry or history of alchemy as academic subjects.

Please note that activities covered by the Awards do not have to occur in the UK, and that the Awards are open to members of SHAC resident both in the UK and elsewhere. Further information may be found at <https://www.ambix.org/grants/>