

HIST'S CITATION FOR CHEMICAL BREAKTHROUGH AWARDS: THE FIRST PAPER OR THE "BREAKTHROUGH" PAPER?

Jeffrey I. Seeman, Department of Chemistry, University of Richmond, jseeman@richmond.edu

In 2006, the Citation for Chemical Breakthrough (CCB) awards were first presented by the Division of the History of Chemistry (HIST) of the American Chemical Society (ACS). As of 2012, 41 awards have recognized breakthrough (1) publications, books and patents in all areas of science served by the ACS. According to HIST's website (http://www.scs.illinois.edu/~mainzv/HIST/awards/citations_chem-breakthroughs.php), "The term 'breakthrough' refers to advances in chemistry that have been revolutionary in concept, broad in scope, and long-term in impact." Full details of the CCB awards can be found on this website along with the names of the awardees, photographs and information about the awardees and the award ceremonies, the names of the award committee members, and nomination information.

The award committee's first step in the selection process for the CCB awardees is rather simple: from a list of nominees (6), the committee members give 10 points to their Number 1 selection, 9 points to their Number 2 selection, and so forth. The nominees with the highest point totals are that year's awardees. The number of awardees per year is determined by vote distribution among other factors.

Unexpectedly but in retrospect, quite reasonably, for some of the awards, one of the most difficult challenges in conducting the CCB award program is determining the actual award-winning publication. For example, during the design of the 2009 CCB award for Christian B. Anfinsen's research, one of the award committee

members questioned whether the nominated and selected paper was indeed Anfinsen's scientific breakthrough publication. Anfinsen and his collaborators had published several papers within a short period of time, each of which could have been the breakthrough publication. Which was to be the CCB award-winning publication?

It is generally simple to determine which publication came *first* –by using the date of submission or, lacking that, date of publication. Even here, some journals, especially in the 19th century, did not always include the submission dates. Page number comparisons, or even issue number, may not provide unambiguous data when comparing publications from different journals.

However, knowing the chronology of a series of papers may not always be sufficient to choose the CCB awardee. A much more subtle yet bewildering enigma has arisen on a number of occasions, and not just for pre-1900 publications. In principle, the paper published *first* on a particular subject need not necessarily be *the breakthrough* publication. Which, of several publications, caught the attention of the relevant scientific community? Which caused the stir? Which was read and noticed and consequential? Which changed science forever? First is not always breakthrough!

The CCB award program is fortunate in that it can turn to experts in the field to answer this question. We have relied on individuals who are not specifically historians of chemistry but rather researchers who are

experts in the very specific field being honored. In the Anfinsen award instance, we sought out the expertise of several experts in protein and enzyme chemistry to help us identify which *one* of Anfinsen's papers first convinced his peer group that the "native structure of a protein is determined only by the protein's amino acid sequence," as stated on the CCB award plaque (7).

This type of puzzle has reared its curious head several times over the lifetime of the CCB award program. The basis for determination among a group of contending publications is itself worthy of documentation and perhaps even further peer review. The following two articles (8, 9), written by Joseph Gal of the University of Colorado School of Medicine and Norman C. Craig of Oberlin College, respectively, are the first of a series of papers that will explain the basis for selection of one of several publications by the same researcher(s) for a CCB award.

Gal is an expert on Louis Pasteur's chemical research on dissymmetry (i.e., chirality) (10-12). Based on his analysis described fully in this following article, Gal explains why "Mémoire sur la relation qui peut exister entre la forme cristalline de la composition chimique, et sur la cause de la polarisation rotatoire," published in 1848 in the *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* was selected rather than other Pasteur publications that could reasonably have been chosen for a 2012 CCB award.

Similarly, Craig is an expert on Charles M. Hall and has written several papers on Hall's life and career in chemistry. Indeed, Craig was on the faculty of Oberlin College for many years, Oberlin College being the undergraduate school of Hall. Hall made his aluminum invention in a shed in the backyard of his Oberlin, Ohio, home. Based on his analysis described fully in another article published in this issue of the *Bulletin* (9), Hall explains why U. S. Patent 400,766, "Process of Reducing Aluminum by Electrolysis," was selected to receive a 2008 CCB award instead of any of the other four patents issued to Hall on the same day, April 2, 1889.

We marvel that the CCB awards have provided a motivation for chemical and historical scholarship beyond that being honored—in the form of analyses as described herein. We hope you will enjoy these in depth evaluations delving into the breakthroughs of chemistry. We anticipate that these articles will provide insights into history and into science and perhaps also into the human side of science. We further note that the formal award presentations themselves bring a level of scholarship and

teaching (3, 5, 13) also unanticipated when the concept of this award was first proposed to the Division of History of Chemistry.

References and Notes

1. The CCB award program was first proposed to the HIST Executive Committee at its March 28, 2004, meeting during the 227th ACS National Meeting, Anaheim, CA (2). Two names for the award were proposed, HIST Citation for Chemical Breakthroughs (CCB) and HIST Citation for Chemical Milestones (CCM). The term "Breakthrough" was suggested at that Executive Committee meeting by Mary Virginia Orna and adopted shortly thereafter. The plaques for the first year's awardees read "Citation for Chemical Breakthroughs," and a 2006 article in *Chemical & Engineering News* reporting on the first year's awards cites that name (3). However, during the drafting of a second article on the award program for *Chemical & Engineering News*, Janet S. Dodd, a staff member of *C&EN* and author of the *ACS Style Guide* (4), pointed out that, grammatically, the name ought to be "Citation for Chemical Breakthrough" award (note the omission of the "s" in "Breakthroughs"). That second news article (5) as well as all plaques presented in and subsequent to 2007 and award information have used the revised name. Thus, even the name of the CCB award program has witnessed a degree of ambiguity.
2. V. Mainz, "Minutes of the HIST Executive Committee Meeting - Anaheim, Ca, March 28, 2004," <http://www.scs.illinois.edu/~mainzv/HIST/minutes/Minutes/MinutesSpring2004.pdf>, accessed March 4, 2013.
3. L. Wang, "Pivotal Publications. New Awards Program Honors Institutions That Have Nurtured Breakthrough Discoveries," *Chem. Eng. News*, **2006**, *84* (July 3), 49-50.
4. J. S. Dodd, Ed., *The ACS Style Guide*, American Chemical Society, Washington, DC, 1986.
5. L. Wang, "Landmark Achievements. Award Program Honors Institutions Where Breakthrough Discoveries Occurred," *Chem. Eng. News*, **2007**, *85* (April 30), 35.
6. Nominations may be made by anyone and are intentionally designed to be easy to prepare and evaluate. All that is required is a full citation and a justification no longer than 200 words. In fact, one successful nomination, the Watson-Crick 1953 publication in *Nature*, "A Structure for Deoxyribose Nucleic Acid," arrived with a five word supporting statement: "The title says it all."
7. Anfinsen Plaque. <http://www.scs.illinois.edu/~mainzv/HIST/awards/Citations/Anfinsen%20plaque.pdf>, accessed on March 4, 2013.
8. J. Gal, "Citation for Chemical Breakthrough Awards: Choosing Pasteur's Award-Winning Publication," *Bull. Hist. Chem.*, **2013**, *38*, 7-12.
9. N. C. Craig, "Charles M. Hall's Persistent Quest of Patents for Refining Aluminum Metal by Electrolysis," *Bull. Hist. Chem.*, **2013**, *38*, 13-18.

10. J. Gal, "Louis Pasteur, Language, and Molecular Chirality. I. Background and Dissymmetry," *Chirality*, **2011**, *23*, 1-16.
11. J. Gal, "When Did Louis Pasteur Present His Memoir on the Discovery of Molecular Chirality to the Académie Des Sciences – Analysis of a Discrepancy," *Chirality*, **2008**, *20*, 1072-1084.
12. J. Gal, "Stereochemical Vocabulary for Structures That Are Chiral but Not Asymmetric: History, Analysis, and Proposal for a Rational Terminology," *Chirality*, **2011**, *23*, 647-649.
13. T. Celestino, "A Citation for Chemical Breakthrough Award to an Italian High School, the Scientific Liceo 'Amedeo Avogadro' of Vercelli, for Avogadro's 1811 Paper," *Bull. Hist. Chem.* **2013**, *38*, 1-3.

About the Author

Jeffrey I. Seeman was Chair Elect of HIST from 2003-2004 and Chair from 2005-2006.

2013 HIST Award

The recipient of the 2013 HIST Award of the Division of the History of Chemistry of the American Chemical Society is Professor William R. Newman, Distinguished Professor and Ruth Halls Professor of History and Philosophy of Science, Indiana University, Bloomington, IN. This award is the successor to the Dexter Award (1956-2001) and the Sydney M. Edelstein Award (2002-2009), also administered by the Division of the History of Chemistry.

William Newman was introduced to the history of chemistry by Otto T. Benfey in the 1970s as a student at the University of North Carolina-Greensboro. He did his graduate work at Harvard with the medievalist John Murdoch, also working with the classicist and historian Robert Halleux at the Université de Liège. Newman's doctoral dissertation, finished in 1986, was later published as *The Summa Perfectionis of Pseudo-Geber* (1991), which consisted of an edition, translation, and study of one of the most famous alchemical works of the Middle Ages. Newman demonstrated that this early 14th century Latin alchemical treatise, attributed to Pseudo-Geber, was not a translation of a work of the 8th century Arabic writer, Jabir ibn Hayyan, but an original work by Paul of Taranto. Thus in his doctoral dissertation, Newman laid to rest the Jabir-Geber problem.

Much of Newman's subsequent work has focused on the continuity between alchemy and chemistry in the seventeenth century. Two books, *Gehennical Fire* (1994) and *Alchemy Tried in the Fire* (2002, with L.M. Principe) deal with George Starkey. Newman identified the alchemical writer Eirenaeus Philalethes ("peaceful lover of truth") to be the Harvard-educated chemist George Starkey (1628-1665). Sometimes considered to be America's first scientist, Starkey became Robert Boyle's tutor, Isaac Newton's favorite alchemical author, and a possible influence on the works of John Locke and Gottfried Wilhelm Leibniz. Newman and Principe have advocated the use of the terms "chymistry" and "chymist" to apply to the chemically related work of people such as Newton. Newman's 2004 *Promethean Ambitions* deals with the division between natural and artificial products that has been a problem for chemistry since its origin. His most recent book, *Atoms and Alchemy* (2006), argues that the atomic theories of the nineteenth century were decisively prefigured by a form of chymical atomism that displaced the dominant early modern scholastic matter theory. Newman's novel thesis is that later alchemists were concerned with chemical change in general, not just on the narrowly focused and futile searches for means to transform natural materials into gold. For the last seven years, Newman has devoted most of his time to the Chymistry of Isaac Newton Project (www.chymistry.org), an on-line edition of Newton's alchemical writings hosted by Indiana University. In addition to his appointment in the Indiana University Department of History and Philosophy of Science, he is Director of the Catapult Center for Digital Humanities and Computational Analysis of Texts, also at Indiana University.

The HIST Award consists of an engraved plaque and a check for \$1500 and will be presented to Newman at the fall national meeting of the American Chemical Society in Indianapolis in September 2013. Additional information about the award can be found on the HIST website at http://www.scs.illinois.edu/~mainzv/HIST/awards/hist_award.php.