

REPORT

A Citation for Chemical Breakthrough Award to an Italian High School, the Scientific Liceo Amedeo Avogadro of Vercelli, for Avogadro's 1811 Paper

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On October 20, 2012, the Scientific Liceo Amedeo Avogadro (Amedeo Avogadro High School of Science) of Vercelli, an Italian high school located in Vercelli (about midway between Torino and Milano), received a Citation for Chemical Breakthrough (CCB) award from the ACS Division of the History of Chemistry (HIST). This award honors publications, patents and books that were breakthroughs in chemistry and the molecular sciences. The term "breakthrough" refers to advances that have been revolutionary in concept, broad in scope, and long-term in impact (1). As HIST's only member who resides in Italy, it was my honor and privilege to represent HIST and present the award plaque to the Scientific Liceo Amedeo Avogadro.

HIST annually confers CCB awards to institutions from which these breakthrough publications were submitted and published. The first CCB awards were presented in 2006, and the 2012 awardees were recently named. The award consists of an attractive plaque, generally depicting the cover of the book or a portion of the first page of the award paper. More information about the CCB award including photographs of all the award plaques and various award ceremonies can be found on the HIST website (2).

Among the 2011 awardees is Amedeo Avogadro's 1811 paper: "Essai d'une manière de déterminer les masses relatives des molécules des corps, et les proportions selon lesquelles elles entrent dans ces combinaisons" (3). In this paper, Avogadro formulated the famous law bearing his name: Equal volumes of gases at the same temperature and pressure contain the same number of molecules. This paper represents a breakthrough publication because it elucidated a distinction between atoms and molecules. This publication laid one of the most important foundations of chemistry.

HIST decided to give the award and plaque (Figure 1) to an Italian high school, the Scientific Liceo Amedeo Avogadro of Vercelli. In fact, Avogadro conceived the famous law while he was teaching "Positive Philosophy" (Physics and Mathematics) in this institution. (Actually Avogadro had been teaching in a building not a long way away from the place where the high school has been since 1956.) So, for the very first time the CCB award has been presented to a high school.

The Avogadro CCB award ceremony was preceded by a short but highly informative and very well attended

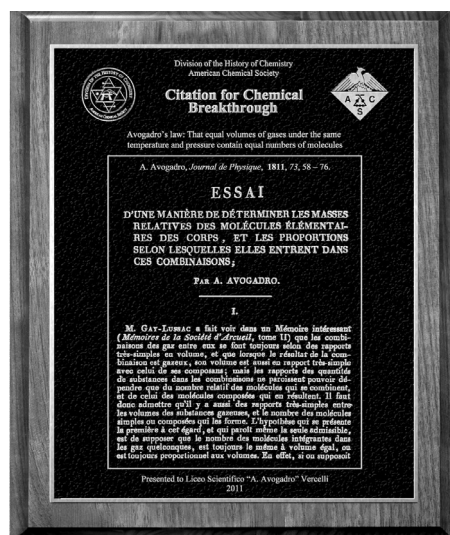



Figure 1. The CCB award plaque for Avogadro's 1811 paper

symposium. The meeting honoring the great scientist took place in the High School Hall on October 20, 2012, followed by the plaque exposition ceremony. The program (Figure 2) shows the ceremony schedule, the list of speakers and the titles of their contributions.



20th, October 2012,
Aula Magna, Liceo Scientifico "A. Avogadro", Vercelli

Presentation ceremony for plaque received from the History Dpt. of the American Chemical Society to acknowledge the breakthrough of Amedeo Avogadro.

Coordinator: Mrs. Maura Forte, Vice-Headmaster of the Liceo Scientifico

h. 9.00 Welcome addresses by the Civil Authorities

h. 9.15 Opening speech.
Professor Paolo Garbarino, Chancellor of the University of "Piemonte Orientale"

h. 9.30 Exhibition: "Avogadro in his age, in his town" (on the web)
Mr. Francesco Brugnotta, Teacher at the Liceo

h.9.45 From Amedeo Avogadro a teaching for the youths
Mr. Adalberto Codetta Raiteri, Headmaster of the Liceo

h. 10.00 The Chemistry's Citation for Chemical Breakthrough awards
Mrs. Teresa Celestino, The Division of the History of Chemistry of American Chemical Society

Transfer to the hall of the Liceo - Plaque exposition - Drinks reception (room 8)

Figure 2. Program of the presentation ceremony for Avogadro's 1811 paper

The opening speech by the Professor Paolo Garbarino, Chancellor of Amedeo Avogadro University of Piemonte Orientale, focused the importance of the great figures of history of science. Undoubtedly Avogadro is a national glory, like Galileo, Volta or Spallanzani. In 2006 the Academy of Sciences of Turin and the University of Piemonte Orientale organized a conference for the 150th anniversary of his death. The speakers highlighted and analyzed various unpublished and little-known papers of this eminent scientist (4).

The speech of the Headmaster, Adalberto Codetta Raiteri, described the scientific and human adventure of Avogadro, focusing on the historical and political context during his life. Avogadro's career developed in a crucial phase of Italian history, over the age of Enlightenment, the Napoleonic era, the Restoration and the Risorgimento (5). The passion of the young Amedeo for physics and chemistry led him away from a long family tradition in the field of law, giving up an easier and prestigious career.

Unfortunately, the encounter between Avogadro and the Italian scientific community was quite problematic: his first papers were rejected by the Academy of Sciences of Turin. Moreover, the political situation prevented him for years from gaining an academic position, so he taught from 1809 to 1819 at the High School of Vercelli, in the middle of the Napoleonic era. Despite the positive impression of the Napoleonic government in science policy, the Restoration penalized especially physics and chemistry, disciplines that played a leading role in the industrial revolution, and thus, disciplines mainly

responsible for the political and social disorder according to conservatives.

Avogadro was accused of liberal ideas and lost his professorship at the University of Turin in 1821, just one year after obtaining that position. He regained his position at the same University only in 1833 (6). Thus, Avogadro's life, according to the Headmaster, is an example for young people: despite his genius Avogadro met several obstacles in his career, but he never stopped his research work. Even his scientific law was definitively accepted only many years after its formulation. So the Headmaster invited the students to follow their own passions and dreams, taking the scientist's vicissitudes into account.

During my speech, I explained the purpose of the CCB award and the mechanism by which it is conferred every year. Finally, I discussed the importance of the historical approach in chemistry teaching, and I illustrated these principles by describing some characteristics of the Avogadro's paper. My speech was followed by the plaque exposition.

Thanks to archival research, now we know a lot about Avogadro's scientific activities, but there is still much to discover. Unfortunately, as I pointed out in my presentation, in Italy the history of specific scientific disciplines (for example, physics, biology, geology) is not adequately valued and supported, despite the great intellectual resources available. On the contrary, teaching of general history of science is more common at university level. Cultivating the history of a specific branch of science such as the history of chemistry is also important for its impact on high school teaching practices. Initiatives such this celebration promoted by HIST in a school environment contribute to rekindling students' and teachers' interest in the great Italian historical-scientific heritage. The award plaque, hung in a prominent location near the front door of the school Avogadro's bust (Figure 3), will be a constant reminder of these principles: a small step towards the formation of a next generation of chemists aware of the great cultural value of science.

Students in their last year of school were present in a large number at the conference and seemed to be very interested in the ceremony. The event was been widely reported by several media; journalists belonging to local and national newspapers wrote articles focusing on the reasons of the award given to the school by HIST. The ceremony had great emotional impact on teachers,

students, speakers and representatives of the civil and military authorities. A short video of the ceremony is available on the internet (7) as well as some photos (8).



Figure 3. Avogadro's bust near the award plaque surrounded by the students.

The Liceo of Vercelli too honored the memory of the great scientist. On October 2011 the high school celebrated the 200th anniversary of the formulation of Avogadro's law, reminding the town of Vercelli of this glorious page of the history of science. On that occasion the high school made a documentary exhibition entitled "Amedeo Avogadro in his Age, in his Town" involving devoted teachers and students. The town's main civic institutions contributed in carrying out the project, and other schools of the town were involved too. The exhibition, presented during the award ceremony, is now on a website created by teachers and students (9). The exhibition was presented by the teacher, Mr. Francesco Brugnetta, while some students, coordinated by their science teacher, reminded the audience some highlights of the nineteenth-century history of chemistry.

In summary, HIST's CCB award program has, quite appropriately, reached out and touched scientists and students and the general population thousands of miles from ACS headquarters in Washington, DC. So much great chemistry was done in countries distant from the United States, even a hundred years prior to the formation of the ACS. The Scientific Liceo Amedeo Avogadro is proud to receive this honor, and I am proud to have been part of the award ceremony.

Acknowledgments

I would like to thank Prof. Jeffrey I. Seeman, who offered me the opportunity to represent HIST, for his careful review of this article, and Prof. Carmen Giunta for its publication. I'm grateful to the Headmaster Adalberto Codetta Raiteri for the welcome I received in his school.

Notes and References

1. See J. I. Seeman, "HIST's Citation for Chemical Breakthrough Awards: The First Paper or the 'Breakthrough' Paper?" *Bull. Hist. Chem.*, **2013**, 38, 4-6.
2. http://www.scs.illinois.edu/~mainzv/HIST/awards/citations_chem-breakthroughs.php
3. *Journal de physique, de chimie et d'histoire naturelle et des arts*, **1811**, 73, 58-76. The title translates to "Essay on a Way to Determine the Relative Masses of the Elementary Molecules of Bodies and the Proportions in Which Such Combinations Are Established."
4. Proceedings published in M. Ciardi, Ed., *Il fisico sublime. Amedeo Avogadro e la cultura scientifica del primo Ottocento*, Il Mulino, Bologna, 2007.
5. The relevant Restoration is of the Savoyard monarchy, which ruled Piedmont, Savoy, and Sardinia for many years before Napoleon and from their restoration until the unification of Italy. The term Risorgimento refers to the political and social movements in various Italian states toward national unification—a movement that was underway but not yet accomplished by the time of Avogadro's death.—Ed.
6. Biographical details are taken from M. Ciardi, *Amedeo Avogadro. Una politica per la scienza*, Carocci, Roma, 2006.
7. A five-minute version is available at <http://www.youtube.com/watch?v=CtvK93u806E> and a 15-minute version at http://www.youtube.com/watch?v=FqwFOIYXq_Q.
8. T. Celestino, "Citation for Chemical Breakthrough Awards," http://www.teresacelestino.net/teresacelestino.net/Album/Pagine/Vercelli_2012.html#grid
9. http://www.liceoscientifico.vc.it/Amedeo_Avogadro/Avogadro.htm

About the Author

Teresa Celestino is a PhD candidate in chemical education at the School of Advanced Studies of the University of Camerino and a member of HIST.