

# Citation for Chemical Breakthrough Award Program Update (Including 2018 Award Year)

Jeffrey I. Seeman  
Award Committee Secretary

March 22, 2019  
Revised September 26, 2019

## Summary

- Thirteen years of awards (2006 –2018) have been completed including six awards for the 2018 award year
- As of January 1, 2019, 67 CCB Awards have been presented to date at 81 sites (due to multiple collaborations and locations) in 12 countries (not including the 2019 award year). The countries are: Canada, England, France, Germany, Italy, Latvia, The Netherlands, Poland, Russia, Scotland, Switzerland, and the United States.
- Status for the 2019 award year: The awards committee has completed its task and six awardees have been selected. These awardees will be notified shortly, drafts of the six plaques are being prepared and will be sent to the manufacturer for production once they have been approved by the recipients..
- CCB Awards are plaques given to institution from which the research was published
- We provide assistance with and generally participate in award ceremonies
- Five award ceremonies were held in the last 12 months.
  - Leipzig University (Arrhenius, reaction rate as a function of temperature, 1889) by Guillermo Restrepo
  - Cambridge University (Aston, 1919, invention of the mass spectrometer), Peter Morris.
  - Humboldt-Universität zu Berlin, 1907 (Fischer, structure of proteins), Alexander Kraft.
  - Merck Corporation (Hirschmann, et al., 1969, synthesis of an enzyme), Miriam Gulotta.
  - University of Stuttgart (Hückel, 1931, development of Hückel MO theory), Hans-Joachim Werner.
- Photographs and associated text dealing with the 13-years of award ceremonies are found on the CCB Award's web pages  
[http://www.scs.illinois.edu/~mainzv/HIST/awards/citations\\_chem-breakthroughs.php](http://www.scs.illinois.edu/~mainzv/HIST/awards/citations_chem-breakthroughs.php)
- The CCB Award program now has many and an increasing number of links on Wikipedia (see below)
- The CCB Award program also has a link and a large description of the program on the ACS National Historic Chemical Landmarks Program (see below).

## **Objectives, Strategies and Criteria of the Citations for the Chemical Breakthrough Award Program**

The Citations for Chemical Breakthrough Award program is intended to honor and celebrate the achievements in chemistry and the molecular sciences in a publicly visible fashion. Through the involvement of the recipient institutions in the design of the plaques and in the organization and hosting of award celebrations, the program will “expand people’s minds through the enlightening power of the history of chemistry. It will bring history of chemistry to scientists and bring scientists to the history of chemistry.”

The Citations for Chemical Breakthrough award recognizes breakthrough publications, books and patents worldwide in the field of chemistry. The term “breakthrough” refers to advances in chemistry that have been revolutionary in concept, broad in scope, and long term in impact. The award consists of a very high quality plaque, to be placed at a site selected by the recipient near the office or laboratory where the breakthrough was achieved. Each award will be made to the department or institution where the breakthrough occurred, not to the individual scientist(s).

### **Elaboration of criteria**

- “Revolutionary” implies some sort of change in practice or theory after the appearance of the patent or publication.
- “Broad in scope” implies an advance that permeates a sub-discipline of chemistry, or that has applications in more than one sub-discipline, or that has a significant benefit to society.
- “Long-term” implies a minimum of twenty five years since the date of publication.

**A tabulation of number of awards per year follows on the next page.**

## Number of Citation for Chemical Breakthrough Award by Year

	Award Year	Number Awarded	Duplicates due to multiple collaborative sites	Duplicates due to researcher associated with other locations
1	2006	10		
2	2007	5	1	2
3	2008	6		1
4	2009	5		1
5	2010	5		
6	2011	5		
7	2012	4		3
8	2013	4		
9	2014	4		
10	2015	5		
11	2016	4		
12	2017	4		
13	2018	6		
14	2019	4		1
	Total sites*	71	1	8

\* For instances in which the award publication resulted from a collaboration at two or more institutions, the “Total” represents each of these as a single award. For instances in which a duplicate plaque was provided to the researcher’s current institution, the “Total” does not include this duplication.

The members of the 2018 Award Committee are listed below (next page) and also on the HIST website (with the Award Committee members from the earlier award years).

- The program has received excellent responses in the USA and Europe. To date, no awards have been presented to Asia, the Middle East or South America.
- Nominations are open to all and are advertised on HIST’s website and in an announcement in *C&EN*.
- The plaque-design process is much more difficult than anticipated. It is often hard to obtain the required high quality scans of original publications from the 19<sup>th</sup> Century. There have been design issues with the recipient organizations.
- We have received extraordinary cooperation from the plaque manufacturer, Stellar Kent (<http://www.stellarkent.com/index.php>). In fact, in 2014, HIST Certificate of Appreciation Awards were given to Carol Hall, Linda Mason, and the Stellar Kent Corporation for their work on the CCB award program.

- As of past years, the Linda Hall Library of Science, Engineering and Technology (Kansas City, MO) has donated several high quality images of journal articles, if available, at no charge for the award program

### **Award Committee Members**

**2019**

Anthony G. M. Barrett, F.R.S. (Imperial College of Science, Technology and Medicine)

Michael Bowers (University of California, Santa Barbara)

Carmen Giunta (Le Moyne College)

Harry Gray (Caltech)

Dudley Herschbach (Harvard)

Peter Morris (Science Museum London)

Amos Smith (Penn)

Jeffrey I. Seeman, Committee Secretary (Non-voting) (University of Richmond)

### **Finances and Donations**

- The plaques cost ca. \$350 each including shipping to the USA. Shipping to Europe is another \$75 - \$100.
- Initial funding
  - \$10K from ACS DAC Innovative Grant
  - \$10K from ACS Corporate Associates
  - \$6K from ACS DAC Innovative Grant for Local Section travel
  - Funds from individual donors (donations continues to this day)
- HIST currently provides 50% matching to an annual donation (individual donor, \$1200/year; HIST, \$600/year).
- Annual costs ca. \$1700 - \$2200/year.
- Annual income ca. \$1800/year.
- As of March 19, 2019, \$246.56 is available for the plaque program (excluding travel, see bullet statement immediately below). This does not include the 2019 income.
- Based on the latest update available for HIST Treasurer Vera Mainz, there is \$4103.16 available for travel support for local section and related representation (ACS Innovative Grant Program).
- The program will seek additional funding from HIST and from the donors because the plaque manufacturer has raised their prices beginning in 2019. We will seek \$750 from HIST and \$1500 from outside donors.

## **Website**

The HIST website contains high quality images of all the plaques and much supplementary information, including photographs of many awards ceremonies, ceremony agenda, and related materials.

[http://www.scs.illinois.edu/~mainzv/HIST/awards/citations\\_chem-breakthroughs.php](http://www.scs.illinois.edu/~mainzv/HIST/awards/citations_chem-breakthroughs.php)

The CCB award program's website is exceptional and expanding, thanks to the continuing excellent work of Vera Mainz. The website is organized by award year. Originally, there was only a table of all award winners for each year (from 2006 when the first awards were presented). From that page, one could and can see the award plaques for each winner as well as the supplementary material associated with that award. In 2014, several new pages were added that provide the visitor with rapid access to the awardees, organized by name OR location OR date of the awardee's publication.

We are fortunate that most of the recipients have provided photographs and other information about their presentation ceremonies, etc. for use on our website.

## **CCB Award on Wikipedia**

In early August 2016, Ron Brashier introduced us to Mary Mark Ockerbloom, Wikipedian in Residence at the Chemical Heritage Foundation. She has volunteered, as part of her outreach role at CHF, to place information about the CCB awards on Wikipedia. For many of these awards, text and links are found in multiple locations due to multiple authors who already have Wikipedia sites. We plan on completing links and text for all CCB awards by 2020.

## CCB Award on the ACS Historic National Historic Chemical Landmarks Program Website

On the “About the ACS Historic National Historic Chemical Landmarks Program” web page, <https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/about.html> the following text and link appears:

### Citation for Chemical Breakthrough Awards

Since 2006, the Citation for Chemical Breakthrough Award program, administered by the ACS Division of the History of Chemistry, has honored scientific publications, books and patents that have been revolutionary in concept and broad in scope, and that forever changed the face of chemistry.

In 2019, four awards were made:

- CAS, a Division of the American Chemical Society, for *Chemical Abstracts*, first published in 1907
- Karlsruhe Institute of Technology, Germany, for Fritz Haber and R. Le Rossingol's 1913 paper on nitrogen fixation
- The University of Manchester, England, for M. G. Evans and M. Polanyi's 1935 paper on the transition state
- Princeton University, for Henry Eyring's 1935 paper on the transition state

More information is available on the HIST Citation Awards webpage.

On the CCB Award's website, the following appears:

The [National Historical Chemical Landmarks \(NHCL\) program](#), administered by the American Chemical Society, honors "seminal achievements . . . to chemistry and society in the U.S."

In 2017, two Landmarks were awarded:

- Infrared Spectrometer and the Exploration of Mars
- Chlorofluorocarbons and Ozone Depletion

In 2018, one Landmark was awarded:

- Plutonium-238 Production for Space Exploration

In 2019, three Landmarks were awarded:

- St. Elmo Brady, the First African-American Ph.D. in Chemistry
- Innovation in Steroid Medicines at Upjohn
- The Combination of Gas Chromatography and Mass Spectrometry at Dow Chemical

The first NHCL Landmark was awarded in 1993 for Bakelite: The World's First Synthetic Plastic.

The 2018 awards are listed in the graph below, taken from the CCB Award web site that is housed on the HIST website that is designed and maintained by Vera Mainz.

The 2019 awards will be presented in the next CCB award annual report.

The graphic is taken from the HIST website:

[http://www.scs.illinois.edu/~mainzv/HIST/awards/citations\\_chem-breakthroughs.php](http://www.scs.illinois.edu/~mainzv/HIST/awards/citations_chem-breakthroughs.php)

Scientists/Inventors	Breakthrough Publication (If text is in color, this is a live link to the plaque.)	Location of Award (If text is in color, this is a live link to photographs and other materials related to the presentation.)
S. Arrhenius	"Über die Reaktionsgeschwindigkeit bei der Inversion von Rohrzucker durch Säuren," <i>Zeitschrift für physikalische Chemie</i> <b>1889</b> , 4, 226-248.	Wilhelm-Ostwald-Institute for Physical and Theoretical Chemistry, Leipzig University
F. W. Aston	"A Positive Ray Spectrograph," <i>The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science</i> <b>1919</b> , 38, 704-714.	The Cavendish Laboratory, Cambridge University
E. Fischer	"Proteine und Polypeptide," <i>Zeitschrift für Angewandte Chemie</i> <b>1907</b> , 20, 913-917.	Humboldt Universität zu Berlin
R. Hirschmann, H. Barkemeyer, J. B. Conn, J. E. Deak, R. G. Denkwalter, R. S. Dewey, M. J. Dickinson, V. Garsky, F. W. Holly, T. A. Jacob, S. R. Jenkins, H. Joshua, T. Lanza, Jr., J. D. Milkowski, R. F. Nutt, W. J. Paleveda, Jr., E. F. Schoenewaldt, J. Sondey, R. G. Strachan, S. L. Varga, D. F. Veber, R. A. Vitali, E. Walton	"Studies on the Total Synthesis of an Enzyme," Parts I, II, III, IV, and V. <i>Journal of the American Chemical Society</i> <b>1969</b> , 91, 502, 503; 505, 506, and 507.	Merck Sharp and Dohme Research Laboratories, Division of Merck & Co., Inc.
E. Hückel	"Quantentheoretische Beiträge zum Benzolproblem. I. Die Elektronenkonfiguration des benzols and verwandter verbindungen," <i>Zeitschrift für Physik</i> <b>1931</b> , 70, 204-286.	University of Stuttgart
T. J. Kealy and P. L. Pauson	"A New Type of Organo-Iron Compound," <i>Nature (London)</i> <b>1951</b> , 168, 1039-1040.	Duquesne University, Pittsburgh, PA

The 2018 award plaques are shown at the very end of this report. All plaques are also found on the HIST website under HIST Awards, Citation for Chemical Breakthrough Award. The blue link in the second column leads the web visitor to that award's plaque.

**The six 2018 award plaques are shown on the next pages.**

**Following the award plaques are photographs of several of the award ceremonies and the placement of the award plaques.**



Division of the History of Chemistry  
American Chemical Society

## Citation for Chemical Breakthrough



*Zeitschrift für physikalische Chemie*, 1889, 4, 226-248.

### Über die Reaktionsgeschwindigkeit bei der Inversion von Rohrzucker durch Säuren.

Von  
Svante Arrhenius.

#### 1. Einfluss der Temperatur auf die Reaktionsgeschwindigkeit.

Die Geschwindigkeiten der bisher in dieser Beziehung untersuchten Reaktionen werden sehr stark durch steigende Temperatur befördert. Diejenigen, welche bei gewöhnlicher Temperatur untersucht sind, sind einer Relation unterworfen von der Form:

$$Q_{t_1} = Q_{t_0} \cdot e^{A \cdot (T_1 - T_0) : T_0 \cdot T_1} \quad (1)$$

wo  $Q_{t_1}$  und  $Q_{t_0}$  die Reaktionsgeschwindigkeiten bei zwei Temperaturen  $t_1$  und  $t_0$ ,  $A$  eine Konstante, und  $T_0$  resp.  $T_1$  die absoluten Temperaturen sind. Ich will zuerst an Beispielen zeigen, wie genau sich diese Formel der Wirklichkeit anpasst, um nachher eine Auslegung der wahrscheinlichen physikalischen Bedeutung der Formel zu geben.

Presented to the Wilhelm-Ostwald-Institute for Physical and Theoretical Chemistry,  
University of Leipzig, 2018





Division of the History of Chemistry  
American Chemical Society

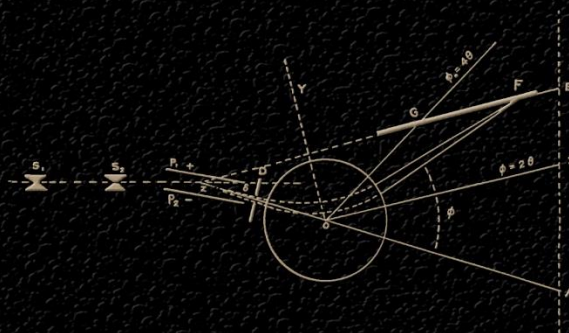
## Citation for Chemical Breakthrough



Invention of Mass Spectrometry

*The London, Edinburgh, and Dublin  
Philosophical Magazine and Journal of Science,  
1919, 38, 707-714.*

LXXXIV. *A Positive Ray Spectrograph.* By F. W. ASTON,  
M.A., D.Sc., Clerk Maxwell Student of the University of  
Cambridge.



Actual photographic results obtained with a preliminary apparatus are submitted showing the great accuracy possible by the method with which it is hoped to compare masses to one tenth per cent.

Cavendish Laboratory.  
August 1919.

Presented to the Cavendish Laboratory, University of Cambridge, 2018.



Division of the History of Chemistry  
American Chemical Society

## Citation for Chemical Breakthrough



*Zeitschrift für Angewandte Chemie*, 1907, 20, 913-917.

### Proteine und Polypeptide.

Von EMIL FISCHER.

Vortrag, gehalten in der Festsitzung des Vereins deutscher  
Chemiker in Danzig am 23. 5. 1907.

(Eingeg. d. 14./5. 1907.)

Hochansehnliche Versammlung! Die freundliche Aufnahme, die der Verein deutscher Chemiker bei seinen jährlichen Hauptversammlungen allenthalben findet, und von der wir gerade eine neue köstliche Probe in dieser gastfreien alten Stadt erfahren, ist ein erfreuliches Zeichen der Popularität, welche sich die Chemie nicht ohne Mühe im Laufe des vorigen Jahrhunderts erworben hat.

Ich habe mich deshalb seit fünf Jahren bemüht, geeignete Methoden für diesen Zweck aufzufinden, und es ist mir in der Tat gelungen, durch Verkuppelung der verschiedenen Aminosäuren Produkte zu gewinnen, die zuerst den Peptonen und bei fortgesetzter Synthese den Proteinen sehr ähnlich sind.

Für diese künstlichen Substanzen, die sich von den natürlichen dadurch vorteilhaft unterscheiden, daß sie als chemisch einheitliche Individuen gekennzeichnet sind, habe ich den Sammelnamen „Polypeptide“ gewählt. Nach der Zahl der Aminosäuren werden sie in Di-, Tri-, Tetrapeptide usw. eingeteilt.

Presented to the Humboldt Universität zu Berlin, 2018.



Division of the History of Chemistry  
American Chemical Society

## Citation for Chemical Breakthrough



*Journal of the American Chemical Society*, 1969, 91, 502, 503, 505, 506, and 507.  
Ralph Hirschmann and co-workers

### Studies on the Total Synthesis of an Enzyme. I. Objective and Strategy

*Sir:*

The remarkable advances in polypeptide synthesis during the past 15 years have made the synthesis of an enzyme a feasible objective. From a number of considerations the synthesis of RNase S' appeared to be an attractive goal.

### Studies on the Total Synthesis of an Enzyme. II. Synthesis of a Protected Tetratetracontapeptide Corresponding to the 21–64 Sequence of Ribonuclease A

### Studies on the Total Synthesis of an Enzyme. III. Synthesis of a Protected Hexacontapeptide Correspond- ing to the 65–124 Sequence of Ribonuclease A

### Studies on the Total Synthesis of an Enzyme. IV. Some Factors Affecting the Conversion of Protected S-Protein to Ribonuclease S'

### Studies on the Total Synthesis of an Enzyme. V. The Preparation of Enzymatically Active Material

It may be concluded therefore that, under conditions where a 100- $\mu$ g aliquot of natural acetamidomethylated S-protein gave 8–10  $\mu$ g of RNase-S activity, an aliquot of about 60  $\mu$ g of our synthetic protected protein gave 1.2–2  $\mu$ g of RNase-S activity.

Presented to Merck & Co., Inc., 2018.



Division of the History of Chemistry  
American Chemical Society

## Citation for Chemical Breakthrough



*Zeitschrift für Physik*, 1931, 70, 204-286.

### Quantentheoretische Beiträge zum Benzolproblem.

#### I. Die Elektronenkonfiguration des Benzols und verwandter Verbindungen<sup>1)</sup>.

Von **Erich Hückel** in Stuttgart.

Mit 10 Abbildungen. (Eingegangen am 28. April 1931.)

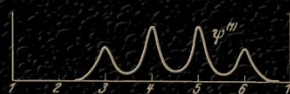


Fig. 10 a. 1, 2-Dihydrobenzol.

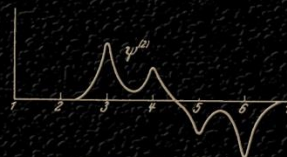


Fig. 10 b. 1, 2-Dihydrobenzol.

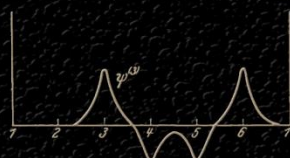


Fig. 10 c. 1, 2-Dihydrobenzol.

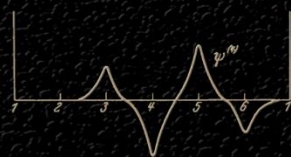


Fig. 10 d. 1, 2-Dihydrobenzol.

Presented to the University of Stuttgart, 2018.



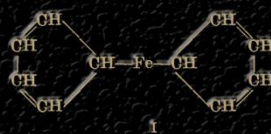
Division of the History of Chemistry  
American Chemical Society

## Citation for Chemical Breakthrough

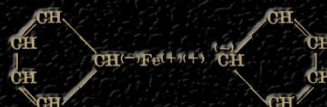


*Nature (London)* 1951, 168, 1039-1040.

### A New Type of Organo-Iron Compound



I



II

The remarkable stability of this substance is, of course, in sharp contrast to the failures of earlier workers to prepare similar compounds and must be attributed to the tendency of the *cyclopentadienyl* group to become 'aromatic' by acquisition of a negative charge, resulting in important contributions from the resonance form (II) and intermediate forms.

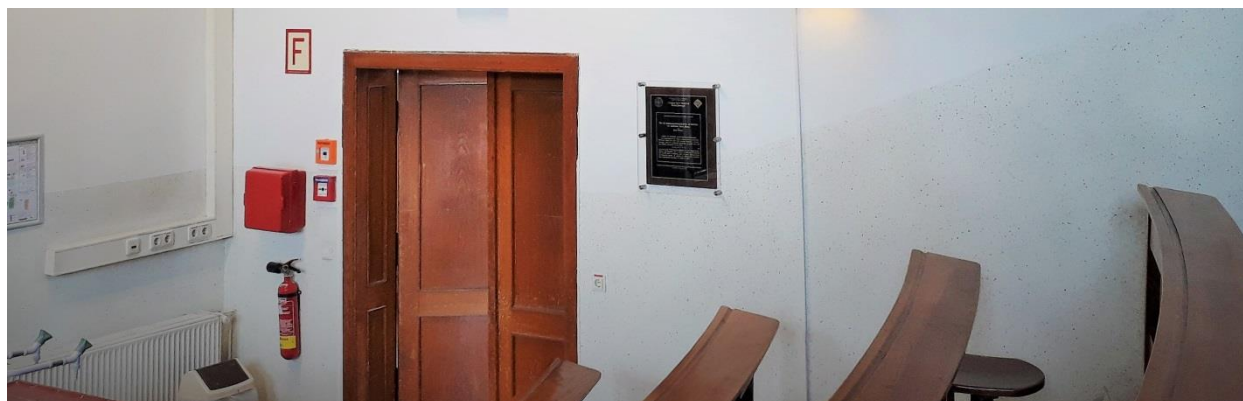
Our studies of this reaction and of other approaches to fulvalene are continuing.

T. J. KEALY  
P. L. PAUSON

Duquesne University,  
Pittsburgh 19, Pa.  
Aug. 7.

Presented to Duquesne University, 2018.

**Arrhenius Award  
Wilhelm-Ostwald Institute for Physical and Theoretical Chemistry  
Leipzig University**



l to r\_dean of the faculty, Prof. N. Sträter, Dr. Guillermo Restrepo (HIST representative), rector of the University, Prof. B. Schücking, Knut Asmis

**Arrhenius Award**  
**Wilhelm-Ostwald Institute for Physical and Theoretical Chemistry**  
**Leipzig University**

(Continued from previous page)

## Einladung

Sehr geehrte Damen und Herren,

im Namen der Fakultät für Chemie und Mineralogie lade ich Sie anlässlich einer Reihe runder Jubiläen der Chemie in Leipzig recht herzlich zu einem Festkolloquium ein.

Das Kolloquium findet am

**2. November 2018**

**von 14:30 bis ca. 16:30 Uhr**

**im Großen Hörsaal der Fakultät für**

**Chemie und Mineralogie**

**Johannisallee 29**

**04103 Leipzig statt.**



Prof. Dr. Norbert Sträter  
Dekan

## Programm

**Prof. Dr. Norbert Sträter**  
Begrüßung durch den Dekan

**Prof. Dr. Beate Schücking**  
Grußwort der Rektorin

**Prof. Dr. Lothar Beyer**  
*Vorstellung der Jubiläen der Chemie in Leipzig*

**Dr. Guillermo Restrepo**  
Max-Planck-Institut für Mathematik in den  
Naturwissenschaften

Verleihung des „ACS Division of the History of  
Chemistry’s Citation for Chemical Breakthrough  
Award“ an das Wilhelm-Ostwald-Institut für  
Physikalische und Theoretische Chemie

**Prof. Dr. Robert Schlögl**  
Direktor und Wissenschaftliches Mitglied am Fritz-  
Haber-Institut der Max-Planck-Gesellschaft und am  
Max-Planck-Institut für Chemische  
Energiekonversion

Festvortrag  
*Energiewende 2.0 - geht nicht ohne Chemie!*



UNIVERSITÄT  
LEIPZIG

Fakultät für Chemie und  
Mineralogie



**F. W. Aston Award  
The Cavendish Laboratory, Cambridge University**



Left to right: Malcolm Longair, Andy Parker, Peter Morris and Richard Friend following the unveiling of the plaque.



The plaque in place in the Cavendish collection of scientific instruments. In the display case to the right of the photograph are Thomson and Aston's positive ray tube (top shelf) and Aston's 3<sup>rd</sup> mass spectrograph (bottom shelf).



**Hückel Award  
University of Stuttgart**

