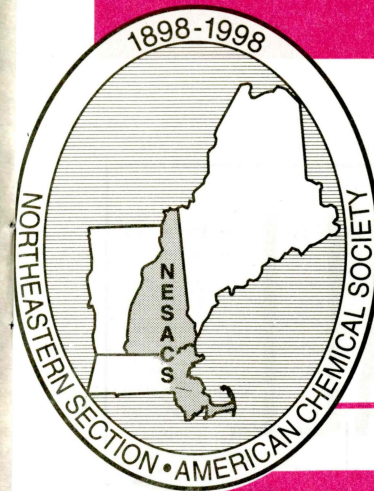




THE
NUCLEUS
Centennial Issue

February 1998



THE NUCLEUS

Centennial Year

February 1998

Vol. LXXVI, No. 6

History of NESACS

Pre-1898 History

Founding of the Section

1898-1974

Recent History

Summer Scholar Report

*Synthesis of Glycidol by
kinetic resolution*

Alfred Amos Noyes
First President of the
Northeastern Section





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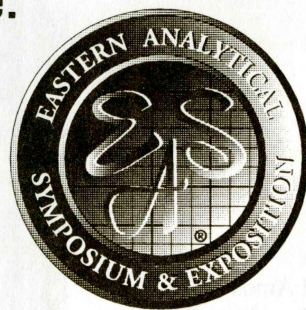
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Contents

Monthly Meeting _____ 5

Attila Pavlath speaks on "The Future of the ACS"

NESACS History

Pre-Northeastern Section Professional Activities of Chemists _____ 4

Founding of the Northeastern Section _____ 8

The First Seventy-five Years _____ 10

The Last Quarter Century _____ 15

Pictures of Nobel Laureates of the Section _____ 16-17

The Northeastern Section and the Nuclear Test Ban _____ 22

History of the Medicinal Chemistry Group _____ 23

Listing of Awardees, Chairmen _____ 24

Pictures from the Northeast Regional Undergraduate Day _____ 25

A National Chemistry Week Event on November 8, 1997 hosted at Boston University.

Summer Scholar Report _____ 26

Practical Synthesis of Enantiomerically Enriched Glycidol by Michael E. Furrow, Scott E. Schaus and Eric N. Jacobsen (Harvard Univ.)

Cover: Alfred Amos Noyes, first President of the Northeastern Section. From an oil-portrait by S. Seymour Thomas (1932), currently displayed in the Arthur Amos Noyes Conference Room, Rm. 592, Dreyfus Chemistry Building, M.I.T. (Photo: M.I.T. Museum)

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THE NUCLEUS

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NESACS History

Pre-Northeastern Section Professional Activities of Chemists

by David L. Adams, Ph.D., Babson College, Babson Park, MA

At the time of the establishment of the American Chemical Society's Northeastern Section on February 4, 1898, Boston area chemists had already been involved in a variety of organizations, actively reporting and sharing their research results in meetings and publications. Interest among the Boston chemists varied, and it is useful in understanding their activities to subdivide these chemists into five camps: Harvard College, the Massachusetts Institute of Technology (MIT), other local colleges, high school, and industry. Each of these groups organized, met, and published. They sometimes shared the same meetings and journals, but just as often worked in separate and distinct venues.

Harvard College chemists formed several societies and clubs for their undergraduate and graduate students for the purpose of discussing current chemical developments and sharing research results. The Boylston Club was founded on October 7, 1885 by a group of students including Theodore William Richards. It was almost certainly named after the Harvard chemistry laboratory of the time, Boylston Hall, in which it held regular meetings. The club allowed undergraduates as members and required certain undergraduate courses as membership prerequisites. Club members met frequently with faculty advisors to hear speakers and discuss recent advances in chemistry. At the 35th anniversary dinner, held January 11, 1921, the club hosted a dinner program. Among the faculty listed as attending were James B. Conant, Elmer P. Kohler, and Theodore W. Richards. Louis Fieser was listed as an active member on the program.

The Harvard Chemical Club was restricted to graduate students and professors - no undergraduates were allowed at the meetings. Originally called the Cambridge Chemical Club, it was founded in 1879 by O. Wolcott Gibbs for the purpose of discussing original chemical papers on any chemical subject of interest. T.W. Richards became a member on January 13, 1887 and presented his first research paper on March 24, 1887. Gilbert Norton Lewis was elected to membership on December 13, 1897. The Harvard Chemical Club disbanded around 1900 or 1901 after an incident that apparently outraged Prof. Charles L. Jackson, then Club mentor, to the point that he did not call another meeting. Harvard records indicate that another club, the secretive Carbon Club, was formed at around the time of the demise of the Harvard Chemical Club. The Carbon Club was for graduate students only and inducted honorary members. Honorary members included James F. Norris, Arthur Michael, Willis Whitney, and Theodore W. Richards. Harvard archives documents also indicate that Professor Elmer Peter Kohler acted in an advisory capacity to the club.

The American Academy of Arts and Sciences, founded in 1780 and headquartered in Boston, provided a particularly convenient outlet for Harvard chemical research. Although the Harvard chemistry faculty published in many journals during the 1880's, the majority of their papers were published in the *Proceedings of the American Academy of Arts and Sciences* (PAAAS). For instance, from 1885 to 1898, the Harvard chemistry faculty published 47 papers: 18 in PAAAS, 14 in the *American Chemical Journal* (ACJ) edited by Professor Ira Remsen, 4 in the *American Journal of Science*,

continued on page 6

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NESACS

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Health & Safety: Mary Ann Solsted

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Program: *Don Rickter

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Monthly Meeting

The 795th Meeting of the Northeastern Section of the American Chemical Society

Thursday, February 12, 1998; Simmons College, 300 The Fenway, Boston

5:30 Social Hour; a table of Career Services Literature and Aids will be available. Special Functions Room

6:30 Dinner. Fens Dining Room

8:00 Evening Meeting, Dr. Michael J. Hearn, Chair, presiding
Dr. Attila E. Pavlath, U.S. Dept. of Agriculture, Albany, Cal.
The Future of the A.C.S.

Dinner reservations should be made no later than February 5, noon. Please call or fax Marilou Cashman at (800) 872-2054. Reservations not canceled at least 2 hours in advance must be paid. Members, \$25.00; Non-members, \$28.00; Retirees, \$15.00, Students, \$8.00. THE PUBLIC IS INVITED.

Anyone who needs special services or transportation, please call Marilou Cashman a few days in advance so that suitable arrangements can be made.

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Next Meeting: March 12, 1998. Richards Medal Award to Dr. K. Barry Sharpless (*Scripps Research Institute, La Jolla, Cal.*) at Harvard University.
5:30 Reception and dinner, Faculty Club, 8:15 evening meeting, Science Center, 1 Oxford St.

Biography

Dr. Attila E. Pavlath is a Research Leader at the Western Regional Research Center of the U.S. Department of Agriculture in Albany, California, leading a research group of 20 senior and supporting scientists on the utilization of agricultural products as chemical resources. He finished his undergraduate and graduate studies in Hungary. First, he was awarded a Diploma in Chemical Engineering at the Technical University of Budapest, then a doctor degree in chemistry by the Hungarian Academy of Sciences. He left Hungary in 1956 and was a Research Fellow at McGill University in Montreal, Canada until 1958, when

he joined the Western Research Center of Stauffer Chemical Company in Richmond, California as a Senior Group Leader. Since 1967 he has been with the U.S. Department of Agriculture in Albany, leading various research projects.

Dr. Pavlath's research experience of more than 45 years includes a wide variety of scientific areas. He is an internationally known expert on fluorine, textile, agricultural, glow discharge, and energy chemistry. He is recognized as one of the early pioneers in fluorine chemistry. He has numerous publications and patents to his name in this field. He has written a monograph on fluorine chemistry and is presently working on an updated version. He was one of the first few to apply electric glow discharge in

organic chemistry. He was one of the leaders of research using agricultural products as alternate energy resources. His newest research is the utilization of agricultural products, e.g. carbohydrates, fats, proteins for other than food purposes.

He has over 110 scientific publications, 25 patents, three books, numerous chapters and reports. He has lectured at various scientific meetings world-wide. He is a tour speaker on eight topics for the American Chemical Society.

In 1976 The ACS California Section gave him their Outstanding Contributions to Chemistry Award, recognizing his 25 years of research in fluorine chemistry. In 1987 he was selected Federal Scientist of the Year in California. In 1989 he received the ACS Henry A. Hill Award for Distinguished Services in the area of Professional Relations, in 1991 the California Section's Walter Peterson Award for Outstanding Services, in 1994 the Professional of the Year Award from the Organization of Professional Employees of the Department of Agriculture, and in 1997 the Chemical Pioneer Award from the American Institute of Chemists. He has also received numerous merit awards from the U.S. Department of Agriculture.

Dr. Pavlath has more than a quarter century of involvement in the American Chemical Society in various capacities. He is well-known for his concern for the professional interest of chemists and chemical engineers. After chairing numerous committees of the American Chemical Society, he is presently serving his third three year term on the ACS Board of Directors. He is a member of various professional societies and ten ACS Divisions. ◇

CHICKENS AND EGGS

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NESACS History

continued from page 4

3 in German language journals, and the remainder in assorted other publications. Given the existing opportunities to meet and publish, it is little wonder the Harvard chemists took their time in becoming interested in the fledgling ACS and in forming a local section. It is also interesting to note that the constitution of the Northeastern Section, both at its founding and now, stipulates that in the event of the dissolution of the Section its finances would pass to the American Academy of Arts and Sciences.

At the same time, MIT chemists formed similar but largely separate groups across the Charles River in Boston [at that time MIT was located in the Back Bay area, *ed.*]. The undergraduates had the opportunity to belong to several chemical clubs, most notably the K₂S Club, founded in 1885. Although little information can be found about the activities of this group, the 1897 MIT yearbook *Technique* listed Arthur A. Noyes, Samuel P. Mulliken, James F. Norris, and Henry P. Talbot as alumni or honorary members. In 1925, the K₂S society appears to have been supplanted by the national chemical Fraternity Alpha Chi Sigma, the local chapter of which was founded in 1919. Another local club was the MIT Chemical Society, formed in 1903. Both graduates and undergraduates were invited to its monthly meetings, which include guest speakers and social hours. The society frequently held joint meetings with the Harvard Boylston Club. Honorary members were proposed and elected into membership. Honorary members included Arthur A. Noyes, James F. Norris, William D. Coolidge, and Leonard P. Kinnicutt, among others. Kinnicutt was a charter member of several chemical clubs around New England, including the Harvard Chemical Club, The Ouroboros Club, and the Northeastern Section of the ACS.

In the nineteenth century, MIT faculty was devoted to the MIT Society of Arts. The MIT charter

established this society. Its first meeting was held on April 8, 1862. The goals of the Society were to "awaken and maintain active interest in the sciences and their practical applications, and to aid generally in their advancement in connection with arts, agriculture, manufacture, and commerce." Regular meetings were held twice a month, starting in October and ending in May. Papers presented at the meetings were published in the Society's *Abstracts of Proceedings* until 1891, afterward in MIT's *Technological Quarterly* (TQ). By 1907 opportunities for specialized gatherings and access to journals in the many areas of science made it difficult for the Society to procure manuscripts for its more general *Technology Quarterly*. As a result, the society did not meet again until 1917 when its mission was drastically changed. It was no longer an outlet for cutting-edge research, but rather a venue for popular lectures in science for high school students.

The publications of Arthur A. Noyes of MIT illustrate the wide range of available publishing opportunities. From 1893 to 1897 Noyes published 34 research papers: 19 in German language journals, 5 in TQ, 4 each in ACJ and the *Journal of the American Chemical Society*, and 2 in *Physical Review*. From 1898 to, 1902 his 29 papers were distributed as follows: 15 in German language journals, 11 in the JACS, 2 in *Physical Review*, and 1 in TQ. By 1911-1917, 12 of his 13 papers were to be found in the JACS, and 1 in *Popular Science*. The declining influence of German chemistry and the increasing influence of the ACS and its local sections are evident here, as in the difference in publication outlets of Harvard and MIT chemists.

Around the beginning of the twentieth, and likely in the late nineteenth centuries, chemists in the New England academic community outside the Boston area apparently banded together to exchange views on chemical education and research. A successor club to one of these earlier organizations is the Ouroboros Club, begun in 1910. This fraternal club,

which still exists today, was instrumental in assisting chemists in higher education outside Boston in keeping up to date with their urban counterparts.

Another organization that counted many chemists among its members was the American Association for the Advancement of Science. In 1874 this group, had established a separate chemistry section, later to become known as Section C, to provide more professional opportunities for chemists. By 1898, many Boston area chemists, including A.A. Noyes, H.P. Talbot, and C.L. Jackson had joined this section, although others, most notably T.W. Richards, had not. Boston area chemists did attend meetings of Section C at which they read papers, most of which were described in abstract form in the *Proceedings of the AAAS* and later published in other journals.

Many high school chemistry teachers in and around Boston apparently had no structured organization until the 1890's. Their association was prompted by a change in the admission requirements of Harvard College. The college instituted a required laboratory examination in experimental physics for all freshmen, effective in 1887. Harvard published and made available to high school physics teachers a list of experiments recommended to prepare students for this examination. In 1895, Harvard professors Edwin H. Hall and Wallace C. Sabine assisted in organization of the Eastern Association of Physics Teachers in order to facilitate communication among high school physics teachers on the details and peculiarities of the physics laboratory admissions examination. This was the first association established to allow teachers to engage in mutual discussion for the betterment of instruction within a specific discipline. The value of this organization was immediately apparent. Since many teachers of physics also taught chemistry, for a few years the program for the Association's meetings also included chemistry topics. In 1898, as preparations

continued on page 7

NESACS History

continued from page 6

were being made for a meeting of the Association, Mr. John Hutchins and Mr. Frank Rollins conceived the idea of a similar association for chemistry teachers. On February 19, 1898, therefore, the New England Association of Chemistry Teachers (NEACT) held its first meeting at Malden High School. Within fifteen days both the Northeastern Section of the ACS and NEACT were organized. Although it cannot be said with certainty, it appears that these were two independent and unrelated events. The time seemed ripe for chemists to organize in New England.

Chemists working in the industrial laboratories around New England had their own specialized opportunities for meeting and sharing information. Groups such as the Manufacturing Chemists Association, founded in 1872, and the American Section of the Society for Chemical Industry, founded in 1894, held meetings and published journals devoted to chemical applications. Other, more specialized groups grew up around certain key industries of the time. These included the American Paper and Pulp Association, founded in 1878, and the American Organization of Agricultural Chemists (AOAC) founded in 1884.

The American Chemical Society, founded in 1876, soon united the five camps of chemists described in the opening paragraph into a single society. Their publication records illustrate the loyalty the Boston area chemists eventually felt for the ACS. For example, from 1895 to 1898, not a single Harvard chemistry faculty article was published in the ACS Journal, *Journal of the American Chemical Society*. By the academic year 1914-1915, however, 42 out of 51 (82%) contributions from the same department were published in the JACS.

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5. Harvard Chemistry Groups: Harvard University Archives, Pusey Library, Cambridge, MA
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8. NEACT history: by Carleton, R.K. *J. Chem. Educ.* 1941, February, 82-84.
9. *A Handbook of Principal Scientific Institutions in Boston and Vicinity*, prepared for the 50th Anniversary Meeting of the AAAS, Boston, 1898. ◇

Education News

Prof. Patrick A. Mabrook of Northeastern University informs us that Patricia Bedard, a 1998 Biochemistry major, who worked in her research lab during the summer of 1997, has been awarded one of seven travel grants by the ACS Analytical Division.

This grant will allow Patricia Bedard to travel to the Dallas, TX ACS National Meeting to present her research. This work has been published in the November 1 issue of *Biochem. Biophys. Res. Communicat.*

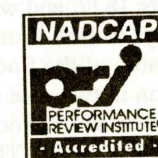
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Founding of the Northeastern Section, ACS

by Myron S. Simon, Section Archivist

Part I, The Early Years of the American Chemical Society.

We tend to think of European chemical societies as being ancient forerunners of American ones, but this is a view which does not stand up to the facts. For example, the Chemical Society of Philadelphia was founded in 1792. True, it lasted only about seventeen years, but was revived in 1811 as the Columbian Chemical Society of Philadelphia. The Chemical Society (London) was founded thirteen years later, in 1841. The Société Chimique de France founded in 1857, and the Deutsche Chemische Gesellschaft in 1867 were not established too many years earlier than our American Chemical Society.

The date of the founding of the American Chemical Society is 1876. The organization was founded in New York City, with fifty-three New York residents and eighty out-of-staters as charter members. It was chartered as a non-profit organization by the State of New York in November 1877, and was restricted in many ways to New York. For example, all business of the Society had to be carried on in the state of New York, and Directors of the Society had to be New York citizens. The Society started well (230 members by the end of 1876, growing to 323 by 1884) but began slowly to decline (238 in 1890) as members lost interest and resigned.

The first meeting outside New York was an attempt to revive interest in the Society and try to make it more national in its activities. The meeting was held in Newport, Rhode Island in August, 1890, under the chairmanship

of Charles E. Munroe. It is interesting to members of the Northeastern Section to note that two of the fourteen men in the committee on preparations were Professors Wolcott Gibbs and Josiah P. Cooke of Harvard University, who had summer homes in Newport. This meeting had the desired effect of restoring confidence in the Society, and the resignations were replaced by almost forty new members before the year was out. The formation of local sections had been encouraged and Rhode Island chemists, after the success of the Newport meeting, hastened to form the first.

In August 1891 a conference was held in Washington, in the presence of chemists as delegates from local chemical societies from many parts of the country, to broaden the Society and make it a truly national organization. The work from that meeting resulted in a new Constitution and By-Laws being drawn up and accepted in 1892, revised in 1897 and 1901, and a law was enacted in New York in 1895, removing the residence restrictions for Directors and locations of Society business meetings.

National Meetings, once begun successfully in Newport, settled down as a standard part of the Society's activities. Until 1900 there were ACS National Meetings in August and December. After 1900 the twice yearly meetings continued, but other months were found more suitable. The tenth meeting, December 27-28, 1894, was held in Boston and Cambridge. There was no groundswell of interest in forming a section in Boston at that time. The local societies and clubs, such as MIT's Society of Arts, Wolcott Gibbs' Cambridge Chemical Club, the American Academy of Arts and Sciences, or Section C of the American Association for the Advancement of Science, apparently served the local chemists well enough in terms of professional meetings and publication opportunities. (See the accompanying article by Dr. Adams)

It was shortly before the return of the National Meeting to Boston in 1898 that the local chemists organized to become the eleventh local section,

after Rhode Island (June 1891), New York (September 1891), Cincinnati (March 1892, replacing the Cincinnati Chemical Society, founded about ten years earlier), Washington, DC (April 1893, replacing the Chemical Society of Washington, founded in 1884), Lehigh Valley (December 1893), New Orleans (August 1894), Chicago (May 1895), Nebraska (May 1896), North Carolina (December 1896), Columbus (October 1897).

References: *JACS* 48 (8-A), August 20, 1926, Golden Jubilee Number, *A Half Century of Chemistry in America, 1976-1926*.

A detailed description of the first hundred years of the A.C.S appeared in *C&EN*, April 6, 1976, pp. 22-31.

Part II, The Northeastern Section, 1898

"Friday evening, February fourth, about one hundred and fifty chemists met at the Parker House to establish a local section of the American Chemical Society." So begins the volume titled *Minutes of Regular Meetings, February 4, 1898 to 1908* in the archives of the Northeastern Section of the American Chemical Society.

What business was transacted at the "organizing meeting?" Dr. Henry P. Talbot was elected temporary chairman and made introductory remarks calling attention to the value of an organization which brought together the chemists of the area. The group voted to make the president, vice-president, treasurer, secretary the permanent officers of the Section and established an executive committee.

Arthur Amos Noyes (M.I.T.) was elected president. (Dr. Adams notes that it is highly probable that Noyes was the driving force behind the formation of the Section. He had been elected to the governing council of the CS in 1897, agreed to move his publication, *Review of American Chemical Research* into the *Journal of the American Chemical Society* and became vice-president of the ACS in 1898.) Leonard P. Kinnicutt (Worcester Polytechnic Institute) was elected vice-president, Willis R. Whitney,

continued on page 9

Founding of the Section

continued from page 8

secretary, and B.F. Davenport, treasurer. The section's treasury started off with \$90, the balance after paying the expenses for the entertainment of the visiting American Chemical Society at the National Meeting in Boston in 1894.

The Executive Committee was to consist of the permanent officers and five other members. Noyes appointed a nominating committee, consisting of Kinnicutt, John Alden, H. Carmichael and John Shaw, as well, as himself and this committee nominated the following: Alden, Arthur Dehon Little, Shaw, Talbot, Carmichael, A. P. Howard, F.W. Morse, A.M. Comey, a Dr. Hopkins, Russell, Marble, and H.P. Eddy. Elected were Alden, Little, Shaw, Talbot, and Carmichael.

A By-law Committee was appointed by Noyes, made up of Talbot, Allerton Cushman, and J.W. Loveland. The attendees voted that the territory of the proposed section comprise the states of Massachusetts, New Hampshire, Vermont, and Maine. [Now you know why our centenary logo includes these states on the map]. The Executive Committee was asked to provide a name for the Section at the next meeting.

Technical papers had been prepared for this first meeting, but "Owing to the lateness of the hour, it was decided to postpone the reading of the papers announced for the meeting and the meeting was then adjourned." The practice of running meetings beyond the scheduled time seems, from the foregoing, to have been built into the Section's genes.

On February 25th the Executive Committee met for the first time and proposed two names for the Section, *Massachusetts Section*, and *North Eastern Section*. A third name, *The Boston Section*, seems to have been discarded prior to that meeting. A month later, at the regular meeting of March 25, the members voted the name to be the *Northeastern Section*.

The principal business of the new

section was to be communication of the latest chemistry to the chemists who lived in this corner of the country and increased socialization among the local chemists. The proximity of MIT, Harvard, and other colleges, the state government and the large number of local businesses which hired chemists, provided a wealth of speakers whose topics ranged from highly theoretical subjects to very practical everyday areas of chemical interest.

By June 1899, at the end of the first full year of its life, the Northeastern Section had held eight regular monthly meetings with an average attendance of sixty. There had been thirteen papers or addresses read and additional informal talks. Fifty-four members had resigned from the Section "principally through change of address" but the Section ended the year numbering 197 active members and 31 associate members. The total membership of the American Chemical Society in 1899 was 1569, so the Northeastern Section began life as one of "large sections."

The remoteness of the Boston area, where the Northeastern Section was formed and continued to have its headquarters, was a disadvantage to chemists in many of the outlying parts of this four-state section. The gradual geographic reduction of the section began with the formation in April, 1911, of the Connecticut Valley Section, centered in Hartford, which cleaved off the western half of Massachusetts. Next to go was the state of Maine, which in April 1912 became a section centered at the university in Orono. The Green Mountain Section followed in April 1916, again located at the state university in Burlington, Vermont. Finally, the Central Massachusetts Section was founded in Worcester in 1947.

Part III, Scientific Programs One Hundred Years Ago

Two main objects of the local sections of the American Chemical Society are to encourage and facilitate the communication of chemical science, and to provide useful and pleasant social

interactions for their members. The faithful recording of the meetings of the Northeastern Section by bygone secretaries has allowed us to peek into time-worn volumes and see which topics interested earlier members of our Section. As we can see by reading the titles, the papers presented were an eclectic mixture of the latest results in chemical theory, and pre-eminently practical reports on more mundane topics, such as sewage or metallurgy.

The President of the Section, A.A. Noyes, presented the very first paper, at the March meeting: "*The Dissociation Theory of the Condition of Salts in Solution and Some of its Important Applications*." The other paper that night was by John Alden, "*The Production of the Direct Azo Colors on the Fibre*." Alden performed dyeing experiments, passed around samples of dyed materials, and presented to the members folders containing dyed samples and interesting data concerning the preparation of the colors. The Section's scientific program was off to a good start.

At the April meeting the members heard H.W. Clark, a chemist of the Massachusetts State Board of Health, Department of Water Supply and Sewage, on "*Sewage and Sewage Purification*." The companion paper was by S.P. Mulliken of M.I.T., "*Qualitative Detection of the Elements in Organic Compounds*."

The May meeting in Worcester included plant tours to the Sewage Purification Plant, the Washburn and Moen Rolling Mills, and the laboratories of Worcester Polytechnic Institute. The evening talk was on "*Metallurgy of Steel*" by Dr. J.O. Emmanuel Trotz of Washburn and Moen. In addition, abstracts of papers to be published in the Journal were presented: "*On the Reliability of the Dissociation Values Determined by Electrical Conductivity Measurements*" by A.A. Noyes, "*On the Segregation of Carbon in a Sample of Boiler Plate*" by H.P. Talbot and Henry Fay.

The Section had adopted the school year, so the May meeting was the last meeting of the short first sea-

continued on page 10

The First Seventy-Five Years

by Edward R. Atkinson,
Amherst, Mass

The writing of the history of any organization covering 100 years of its existence might seem like a major task. However, we in the Northeastern Section are fortunate because on the occasion of our Diamond Anniversary in 1973 the late Robert D. Eddy and I were invited by the editor of *THE NUCLEUS* to publish a series of articles (over two years) describing the history up to that time. The following is a condensation of these articles. Copies of the original articles may be obtained from the Section Archivist, M.S. Simon (20 Somerset Rd., West Newton, MA 02165-2722), from me (163 Gray St., Amherst, MA 01002-2105), or from the Editor of *THE NUCLEUS*.

Founding of the Section

continued from page 9

son. The National Meeting of the Society took place during the summer. The new season started with the October meeting and a paper by A.D. Little, "Recent Developments in Electrochemistry."

November attendees heard Prof. Theodore W. Richards of Harvard University speak on "Adsorption and Desorption." A pair of papers followed: A. M. Coney "Historical Notes on the Presence of Gold in Sea Water" and H. Carmichael, "Reactions of Gold in Sea Water."

The calendar year of 1898 closed with W.H. Walker's paper, "Recent Advances in Analytical Chemistry," Erastus Hopkin's paper, "Analytical Research on Sard Oil," and A.A. Noyes' illustrated paper, "Some Applications of the Dissociation Theory."

Reference: *Minutes of the Regular Meetings, 1898*, in the archives of the Northeastern Section. ◇

1. The Founding of the Northeastern Section (Robert D. Eddy) *THE NUCLEUS* 51, No. 4, 6 (1973). In the introduction to the series, Eddy, then Secretary of the Section, gave good examples of the flavor of the Section minutes dating back to 1898. A description of the founding of the Section is also given in an article by M.S. Simon, p.8 in this issue.

2. The Early Years of the Northeastern Section (1898-1930). (Robert D. Eddy) *THE NUCLEUS* 51, No.6, 10 (1973). During the early years, meetings of the Section were held at various sites that at one time or other included all of New England. They often included lecture experiments and visits to chemical manufacturing plants. They were held on any days of the week, except Sunday. In 1939 a decision was made to hold all meetings on the second Thursday of the month, except for the months of July and August, a practice still being followed.

During the period of this report most of the concerns that beset chemists and chemical engineers today, in 1998, were discussed: - the status of chemists and chemistry; professional ethics; licensing of chemists; the environment; the application and misapplication of scientific knowledge. World War I brought its own concerns: war gases, fertilizers, the dye industry, etc. Other items of interest were as follows:

- undergraduate seniors and graduate students were solicited for membership
- the Executive Committee decided that the use of intoxicating beverages be left to each member's choice. During the period of the report an open bar was a feature of each evening meeting.
- resolutions for the adoption of the metric system were noted in the minutes on several occasions.

- members of the Section who were also speakers were asked to pay for their own dinners.
- the Section agreed to pay the travel expenses of one member to national meetings of the ACS Council.
- tickets were sold for a Section meeting at which Lord Rutherford spoke.
- a meeting program debated the relative merits of straight and blended whiskey. The minutes do not contain the usual statement that the meeting had adjourned.
- on December 9, 1921 the speaker was Charles Lathrop Parsons, the National Secretary of the ACS and well known as the power center of the Society. He had been chairman of the Section in 1905 when he was a member of the faculty of what became the University of New Hampshire. He served as National Secretary for the period 1907-1945. He was welcomed to the meeting in song, sung by all in attendance, to the tune of "Solomon Levi":-

My name is Charlie Parsons and I rule the ACS

It's due to my phenomenal tact that you've had such great success.

And now the war is over and I'm free from nitrogen

I'm going to shake you thoroughly and make you grow again.

Directors-at-Large may fluctuate and Presidents may change

But I stay here as permanent as the Appalachian range.

I let my Presidents have their way—at least they think they do—

But the cases in which I don't get mine are unimportant and few.

3. The Later Years of the Northeastern Section (1930-1973).

(Edward R. Atkinson)

THE NUCLEUS 51, No.7, 5 (1973).

This article was one of the longest in the series. It described the more recent growth of the Section. The professional life and activity in Section affairs of the author coincided with the 43 years covered.

In 1930 the Section had 902 members; about 150 of these found it

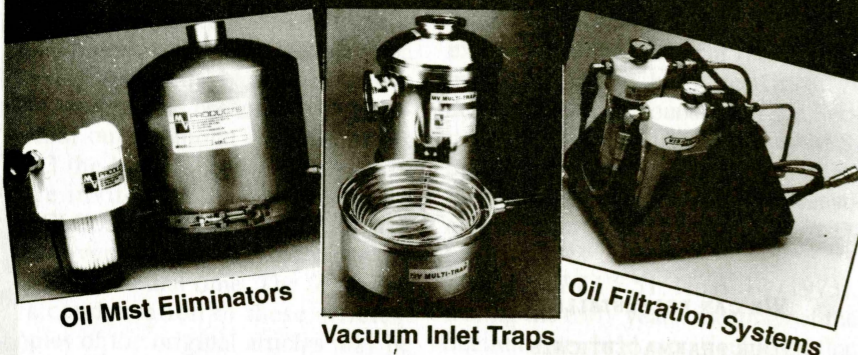
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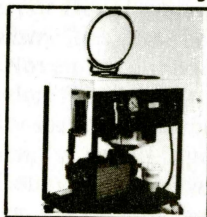
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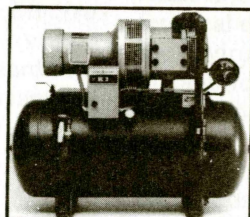


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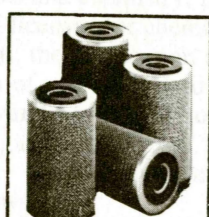
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First Seventy-Five Years

continued from page 10

necessary to resign from the ACS during the early years of the Great Depression. With the coming of World War II and the subsequent increase in the chemical and chemical engineering professions the membership reached 3500 by 1973. In the early 1930's the programs of the Section emphasized chemistry as a profession and as an industry; even Harvard boasted a Professor of Industrial Chemistry (Grinnell Jones, the Section Chairman in 1935). In the years following World War II the chemical industry in the New England area began to disappear and by the early 1950's emphasis in programs had shifted to more academic matters. The monthly meetings of the Section were inadequate to meet the needs of specialized groups. Topological programs preceding the evening meetings were begun in 1943 and the establishment of topical groups was authorized by the Board of directors in 1947. Originally these groups were Analytical, Elastomers and Plastics, and Medicinal Chemistry. Each had its own meeting dates and usually shared one meeting a year with the Section. By 1973 it was apparent that the presence of these groups, along with the increase in seminar activity at the local schools, resulted in a noticeable decrease in interest in the monthly meeting of the Section. When the national ACS established a Tour Speakers programs the Section ignored it. In 1973 only about 25% of the members voted in Section elections.

Until 1939 the Section meetings were held at various locations in the area. In that year a long association with the Massachusetts Institute of Technology (MIT) began. Meetings were held in Huntington Hall (Room 10-250) until 1952 when a committee on local section needs recommended that, once again, meetings be held at schools and industrial laboratories in the area. This practice persists to the present day.

Over the years of this report Section activities included clambakes, beach parties, visits to scenic spots and to concerts in the Boston Symphony's

First Seventy-Five Years

continued from page 12

"Pops" program. Other similar activities today are much needed to enhance interpersonal, relationships, a major object of a professional society.

Life in the Section during the years of World War II was described in a "Historical Note" published in *THE NUCLEUS* 56, No. 1, 11 (October 1977); and *ibid.* 56, No.2, 14 (1977).

The Section served as host to national meetings of the ACS in September 1939, April 1951, April 1959, and April 1972. Meetings in 1939 and earlier were mostly the responsibility of Local ACS Sections. At the 1939 meeting our members organized and managed the first employment clearing house held at national meetings. When attendance at national meetings exceeded the housing capacity of host cities, the ACS began a program of annual Regional Meetings. The Section was host to the first Northeast Regional Meeting, held in Boston in 1968.

During this period the Section maintained a variety of public relations programs. In the 1930's Boston radio stations carried a long series of weekly broadcasts by Section members. Television programs were developed in the early 1950's. At one time the Section supported a professional press consultant and achieved a satisfactory level of Newspaper coverage. The Section has been awarded first prize among large ACS Sections for its annual report.

The educational activities of the Section prospered during this period. Programs of particular interest to secondary school and college students were presented on "Student Nights". An annual competitive examination for secondary school students was supported by industrial organizations and became known as the Avery A. Ash-down competition. A symposium featuring student research at area colleges became an annual event. With funds provided by his widow, Professor Lyman C. Newell of Boston University was honored by grants made to chemistry teachers to attend the annual summer conference of the New England

Association of Chemistry Teachers.

During this period the governance of the Section was remarkably stable. It was described as part of a series in *THE NUCLEUS* named "Know Your Section" (*THE NUCLEUS* 36, 193, April 1959). Problems arose from time to time (see for example *THE NUCLEUS* 24, January 1947). Taking a cue from the national ACS, whose constitution and bylaws were revised extensively in 1947, the Section undertook a similar revision of its governing statutes. The several trust funds of the Section were merged to allow better investment practice. A Section office with a permanent employed secretary was introduced in 1961 and was supported by voluntary annual local dues, first collected in 1959. Prior to that time the elected Secretaries of the Section relied on the favor of their employers to provide the time needed for the job. The Section has a lasting debt to employers who have supported Section activities over the years. An elementary computer system was introduced in 1961.

A complete list of Chairmen of the Section appears on p. 24 ff in this

issue and in the current issue of the Section's Directory. The names of Secretaries and Treasurers during the 1930-1973 period are given in the original article. The first Chairwoman of the Section was Professor Phyllis Brauner of Simmons College who was elected in our 75th year of service in 1974. The history of this period contains a long list of ladies who served the Section in other offices.

In the years following the period of this report many changes in ACS governance occurred both nationally and locally. They were not anticipated in the account being abstracted here. **4. National Leaders from the Northeastern Section** (Edward R. Atkinson). *THE NUCLEUS* 51, No. 9, 5 (June 1973).

Even before the Section existed, Thomas Sterry Hunt, a member of the MIT geology faculty, served as ACS President in 1879 and again in 1888. This section of the history included short biographies of Hunt and ACS presidents Arthur Amos Noyes (1904), Arthur Dehon Little (1912-1913), Theodore William Richards (1914),

continued on page 14

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First Seventy-Five Years

continued from page 13

James Flack Norris (1925-1926), Arthur Becket Lamb (1933), Bradley Dewey (1946), and Arthur Clay Cope (1961). Also included in the Section was a biography of Charles Lathrop Parsons (Secretary and Business Manager 1907-1945). Mention was made of the fact that Gustavus J. Esselen, Henry A. Hill, and John C. Sheehan had served on the national Board of Directors.

5. Chairmen of the Northeastern Section (Edward R. Atkinson), *THE NUCLEUS* 52, No. 1, 9 (1973). A list of previous chairmen and chairwomen can be found in the current Section's Directory and on pp. 24 ff in this issue. It was the practice to nominate for the office members from industry and academic institutions in alternate years. Chairmen served as Chairmen-Elect for one year. It was the custom for many years for the nominating committee to provide a single nominee for the office. Since 1948 two nominees have been named. A provision has always existed for nominations to be made by any group consisting of two percent or more of the Section membership. Biographies of chairmen were published in *THE NUCLEUS* at the time they assumed office. Short biographies were published in this section of the history for Gustavus J. Esselen (1921-1923), Harold A. Iddles (1943-1944), Stuart B. Foster (1945), Henry A. Hill (1963), George A. Kimball (1967), and John T. Blake (1950). Blake served as a Trustee of the Section for so many years that when he retired he was named an Honorary Life Trustee of the Section.

6. The Theodore William Richards Medal (Robert D. Eddy) *THE NUCLEUS* 52, No. 3, 8 (December 1973).

Professor Richards, the first chemistry Nobel Laureate from the United States (1916), died on April 12, 1928. A number of ideas were expressed by his colleagues on how to honor his memory. After much discussion it was decided to use the Northeastern Section as the agent for such an honor. Funds were raised, articles in

the constitution and bylaws of the Section were drawn up and approved, and a 14 carat gold medal was designed by the famous artist Cyrus E. Dallin. The medal bears a likeness of Richards and the inscription: AWARDED FOR CONSPICUOUS ACHIEVEMENT IN CHEMISTRY BY THE NORTHEASTERN SECTION OF THE AMERICAN CHEMICAL SOCIETY, INC. TO _____. A silver replica is also presented to the recipient.

From the first presentation to Richards (posthumously, 1932) until the 1950's, the biennial medal ceremony was graced by the presence of a Pinkerton detective, hired to guard the precious medal. History has some interesting speculations about why one of the medals was once seen in the window of a New York pawn shop.

The medal ceremonies were quite formal. The committee on arrangements was for many years headed by Avery A. Ashdown who insisted on formal dress. One recipient was a noted patron of the fermented grape; a special subcommittee was appointed to make sure that he came to the medal ceremony well-oiled and happy. Eddy's description of the 1947 award to Linus Pauling is a gem. Prior to 1973 there were 26 persons selected for the medal. Eight of these (with the obvious exception of Richards) became Nobel Laureates in chemistry, physiology, or medicine. The winning of the Richards medal has preceded the Nobel Prize for almost half of all U.S. Nobel Laureates in Chemistry.

Recipients of the Richards Medal were chosen by elected committees who were almost autonomous and whose deliberations have always been secret.

Recipients of the Richards Medal are listed in the current issue of the Section's Directory and also on pp. 24 ff in this issue.

7. The Nucleus and Avery A. Ashdown (Robert D. Eddy and R.P. Gibb, Jr.), *THE NUCLEUS* 52, No. 5, (1974).

THE NUCLEUS, a cornerstone of the Northeastern Section, was first published in 1924 with Gorham W. Harris as editor. It was sponsored jointly by the Connecticut Valley Section (to 1931) and the Rhode Island Section (to 1952). The novelty of the

publication gave rise to a spoof that was sold as "The Nude L'il Cuss" for ten cents at the first Quadrennial Leap Year Party of the Section in February 1924. Harris served until June 1925, then was followed by Walter G. Bullard (October 1925-June 1929), Avery A. Ashdown (October 1929-June 1970), Phyllis A. Brauner (October 1970-June 1971), and David M. Howell (October 1971-1975) [later editors: Michael Berger (1975-1979), Adrienne S. Dey (1979-1989), Arno Heyn (1989-)].

The 41 years of Ashdown's service is the core of our memories. While maintaining a full teaching load at MIT he was able to publish a first-class, slick paper, fully illustrated, and up-to-date magazine for nine months each year. In this he was ably assisted by Eugene A. Averill, a member of the MIT stockroom staff, who died suddenly at age 38 and who was eulogized in the December 1941 issue.

THE NUCLEUS is published under the supervision of the Section's Board of Publications, which receives funds from the Section's Publication Trust Fund and from advertisers. During Ashdown's term as editor he also served as Custodian of the Section's archives, was Chairman of the Section in 1941 and received the James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry in 1963. He set a standard for all subsequent editors. His modesty prevented his publishing his own biographical data when he was chairman of the Section and when he received the Norris Award. Ashdown had a great interest in students as people. A confirmed bachelor, he could laugh when party-goers gave him an autographed photo of a local burlesque queen. He fought endless battles with the post office department to ensure the prompt delivery of *THE NUCLEUS* containing meeting announcements.

He was the mentor of every officer in the Section during the 1930-1970 period. When the Riverbank Court Hotel was acquired by MIT for graduate student housing in 1938, Ashdown was its first house master. Since his retirement in 1962 the house bears his name. Affectionately known as A³, his

First Seventy-Five Years

continued from page 14

name may have been responsible for the abbreviated name of the Americas Cup winner sailed and owned years later by an MIT chemical engineering graduate.

8. The James Flack Norris Awards (Edward R. Atkinson) *THE NUCLEUS* 52, No. 6, 5 (1974).

At the time the Section celebrated its 75th anniversary the Norris Awards were as well known as any other activity and were a major feature of the Section's professional contributions at the local and national level.

Norris was one of the most loved and outstanding chemists of our time. Biographies are numerous. Of special interest to the Section was the special issue of *THE NUCLEUS* 42, No. 10 (August 1965) prepared by Avery A. Ashdown and containing many photographs.

Following Norris' death in 1940 Mrs. Anne C. Norris in 1948 bequeathed a sum of about \$48,000 to be used "to keep green the memory of my husband." In 1973 the principal of the Norris Fund was over \$200,000 and the derived interest supported two Norris Awards, memorial rooms at MIT, Simmons College, and Northeastern University, and, in part, the publication of *THE NUCLEUS*.

Thomas R.P. Gibb, Jr. suggested that the Section establish an award in Norris' memory to honor "Outstanding Achievement in the Teaching of Chemistry." After appropriate amendments of the Section's constitution and bylaws, the first award of \$1000 was made to George Shannon Forbes in 1951. The awardee was chosen by an elected committee of both Section members and members of the ACS outside the Section, as well as the editor of the Journal of Chemical Education, *ex officio*. Originally the award was made in years alternating with the Richard Medal. As available funds grew, the award was made annually with an increased stipend, and, on occasion, two recipients.

In 1963 an extensive study was made of alternative ways in which the Section might further honor Norris,

using the rapidly accumulating monies in the Norris Fund. The Section Chairman, Henry A. Hill, suggested the establishment of the James Flack Norris Award for Excellence in Physical Organic Chemistry, honoring Norris as one of the first chemists to develop that field of chemistry. The first award was made to Christopher Kelk Ingold at a national meeting of the ACS at Atlantic City, N.J. in 1965. This ACS award is made annually, being administered by a committee of the national society, with funds supplied by the Northeastern Section. A list of winners is on pp. 24 ff in this issue and appears in the current issue of the Section's Directory.

9. Famous and Infamous Meetings of the Northeastern Section (Edward R. Atkinson and Robert D. Eddy) *THE NUCLEUS* 53, No. 2, 6 (1974).

The Last Quarter Century,

Part I

by Myron S. Simon, assisted by Phyllis A. Brauner, Arno Heyn and Arthur S. Obermayer with suggestions from Edward R. Atkinson

The early 70's were a time of upheaval throughout the country, upheaval which found its way into the scientific world, as well. Student strikes and marches started a kettle boiling which steamed up the community. A major effect for the American Chemical Society was a movement to turn the Society's attention to the professional status of chemists, both as individuals and as employees in industry. These changes were brought about thanks to the efforts of people such as Henry Hill, William Bailey, Bernard Friedman, and Alan Nixon.

The "Revolution"

In the Northeastern Section the job situation had become very tight: Positions were scarce, layoffs and terminations were common, and there was a feeling that the Society was not taking adequate steps to help unemployed chemists. The word in the trenches was, that the Society was an apologist for management. A group of local chemists proclaimed that the Northeastern Section was out of step with the problems, favoring the *status quo*, and that the same people were in charge year after year without addressing these new problems. The Section's bylaws were challenged as favoring long term incumbents. In 1974 a petition drive ensued; candidates by petition filled fourteen ballot positions and thirteen were elected. A sea change

continued on page 16

using the rapidly accumulating monies in the Norris Fund. The Section Chairman, Henry A. Hill, suggested the establishment of the James Flack Norris Award for Excellence in Physical Organic Chemistry, honoring Norris as one of the first chemists to develop that field of chemistry. The first award was made to Christopher Kelk Ingold at a national meeting of the ACS at Atlantic City, N.J. in 1965. This ACS award is made annually, being administered by a committee of the national society, with funds supplied by the Northeastern Section. A list of winners is on pp. 24 ff in this issue and appears in the current issue of the Section's Directory.

9. Famous and Infamous Meetings of the Northeastern Section (Edward R. Atkinson and Robert D. Eddy) *THE NUCLEUS* 53, No. 2, 6 (1974).

The authors selected examples found in the minutes of Section meetings and from their own memories dating back to about 1930. Those described in some detail were:

- a visit from Charlie Parsons, greeted in song (see above)
- several meetings addressed by Linus Pauling
- Harold Urey's complimenting our

steamroller election style

- Nobel Laureate Enrico Fermi describing the splitting of the uranium atom in April 1939. This meeting was never reported in *THE NUCLEUS*.
- Golden Jubilee meeting of February 1948 at which Karl Paul Link described the discovery of dicoumarol
- the January 1963 meeting at which Ralph Siu discussed philosophy and told good sexy stories
- the September 1939 national meeting at which a salmonella infection became front-page news
- a meeting of the Board of Directors adjourned without acceptance of a nominating committee report
- [added by the editor] the famous October 1968 reception on the occasion of the first Northeast Regional Meeting at the blacked-out Gardner Museum (no light because of Boston Edison work), described more fully on pp. 20 ff in this issue.

If any reader is interested in receiving copies of the original articles which describe the events abstracted above, see the beginning of this article for details. ◊

Northeastern Section Nobel Laureates

Last Quarter Century Part I

continued from page 15

was underway.

The new regime in 1975 focused on the needs of the individual chemist in industry, and many other national problems became subject of the monthly meetings in that and future years: the pros and cons of nuclear energy, unemployment, ACS actions in professional relations and public affairs, occupational safety and health, chemical toxicity, disposal of chemical wastes, the general topic of chemicals in the environment. (It was in 1975 that the work of Rowland and Molina was reviewed in *THE NUCLEUS*, work which led in 1987 to the first of the Section's Esselen Awards, and in 1995 to the Nobel Prize.)

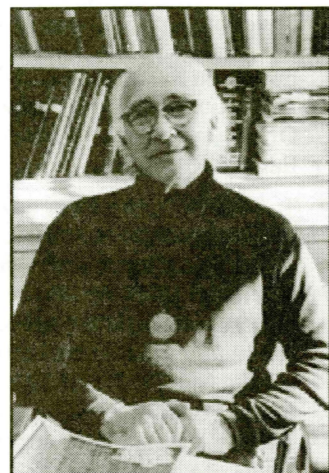
The election of 1976 saw only one petition candidate elected out of fifteen contests, but the die had been cast. The members who had been labelled reactionary, out of touch, were back in power, but they had accepted the views espoused by the "young Turks". The Section and the Board of Directors quietly adopted the goals of the 1974 petition group. This was not, perhaps, as revolutionary as it may seem, because there had been much exaggeration on both sides, and the comfort level for change was not seriously threatened.

Along with chemical subjects, national and world problems that had a scientific aspect became grist for their mills. Professionalism became the main focus of much of the activity at that time, and the "Professional Employment Guidelines" (PEG, printed in the March 1976 *NUCLEUS*) were a source of satisfaction to many members of the Section. The work started by our own Henry Hill had borne fruit.

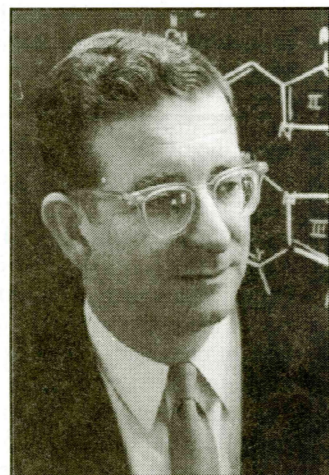
THE NUCLEUS

The Section has the common problem of a large section: There are very many members who take no part in its activities. The only common bond among the 5,300 members has been the Section's publication, *THE NUCLEUS*. Founded in 1924 under the guidance of the Chairman, Gustavus J. Esselen, it

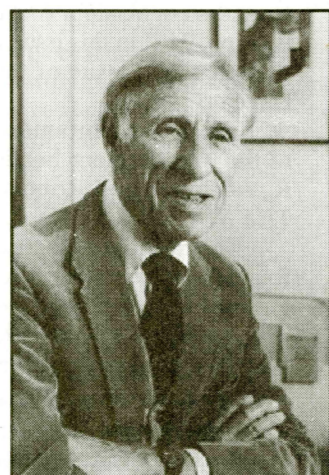
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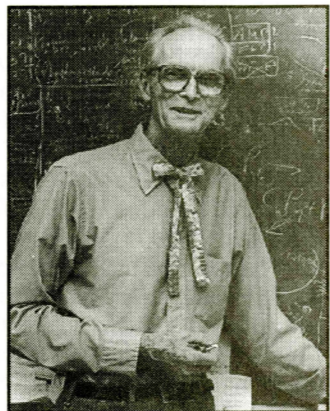
George Wald (Harvard) 1967



Robert B. Woodward (Harvard) 1965



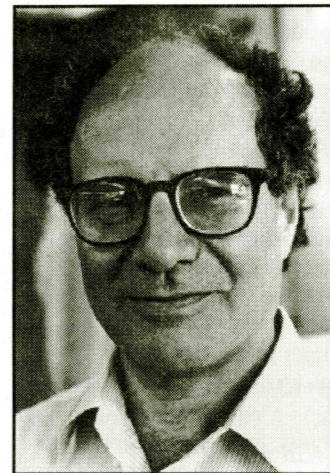
Konrad E. Bloch (Harvard) 1964



William N. Lipscomb (Harvard) 1976



Har G. Khorana (M.I.T.) 1968



Walter Gilbert (Harvard) 1980



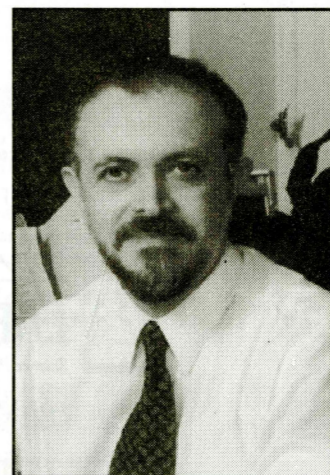
Theodore William Richards (Harvard) 1914



Dudley R. Herschbach (Harvard) 1986



Elias J. Corey, Jr. (Harvard) 1990



Mario J. Molina (M.I.T.) 1995

Last Quarter Century Part I

continued from page 16

now has reached Volume 76. Much of the Section's history reflects the values and efforts of its long-time editor, Avery A. Ashdown, who guided the publication from 1929 to 1970. (see the accompanying article by Edward R. Atkinson in this issue). Since 1970 the editors have been Phyllis A. Brauner (October 1970-June 1971), David M. Howell (October 1971-May 1975), Michael Berger (October 1975-May 1979), Adrienne S. Dey (October 1979-May 1989), and Arno Heyn (August 1989- present). The Section is very proud of the manner in which the publication has represented the Section, both to its members and to the Society beyond.

Northeastern Section Awards

The Gustavus John Esselen Award for Chemistry in the Public Interest

Edward R. Atkinson in an accompanying article in this issue has described the founding of several of the awards given by this Section: The Theodore William Richards Medal for Conspicuous Achievement in Chemistry, the James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry, as distinguished from research, and the A.C.S. James Flack Norris Award for Physical Organic Chemistry, sponsored by the Northeastern Section. A list of recipients of these awards appears elsewhere in this issue.

In 1985 an inquiry was made whether the Section would wish to honor another former leader of the Northeastern Section. The Esselen family proposed to donate a sum of money to provide for an award in the memory of Gustavus John Esselen II, Chairman in 1922, 1923, and a member of the ACS Board of Directors for many years. In 1948 Dr. Esselen received a special award, the James Flack Norris Honor Scroll, "as the person who has done most to advance the interests of the Northeastern Section." A committee consisting of William O. Foye, Truman S. Light, Arthur S. Obermayer, and Myron S. Simon, Sec-

continued on page 18

Last Quarter Century Part I

continued from page 17

tion Chairman, met with Esselen's son, Gustavus J. Esselen, III and recommended to the Board of Directors that the Section accept the offer, which it did. The committee and Mr. Esselen agreed that the award should not be in a specific field of chemistry, but instead should have the special purpose of emphasizing the positive values of chemistry to mankind. In light of the climate of the day with the disaster of Bhopal on every chemist's mind, and the public receiving nothing but negative stories about chemistry from the media, this was to be a small step toward establishing a balance.

Mr. Esselen proposed to add a bronze medal to the monetary award. A prominent sculptor from Newton, Mass., Lloyd Lillie, was selected to prepare the design, which was then approved by members of the Esselen family. The fact that Dr. Esselen had done much work in plastics during his

career led his son to propose that the bronze medal be embedded in block of clear plastic, which was done, to give a very distinctive addition to the ceremonial presentation.

The first award of the Gustavus John Esselen Award for Chemistry in the Public Interest was made in 1987 to F. Sherwood Rowland and Mario J. Molina for their work on the chemical processes which were destroying the stratospheric ozone layer, explaining the formation of the Antarctic Ozone Hole. Since then the award has been given to chemists in several fields of chemistry and has become a much coveted prize.

The Henry A. Hill Award and Lectureship

Henry A. Hill, a most respected former Chairman of the Section, and a Director of the ACS and its President in 1977, died prematurely in 1979. He is remembered by two awards by the Northeastern Section: the Henry A. Hill Award for Outstanding Service to the Northeastern Section, given since

1980, and the Henry A. Hill Memorial Lectureship, presented since 1982 by joint-sponsorship with the National Organization for the Advancement of Black Chemists and Chemical Engineers. The list of awardees is appended.

The Theodore William Richards Award for Excellence in Teaching Secondary School Chemistry, and Aula Laudis

The Section has chosen to encourage excellent teaching at the high school and preparatory school level by making annual awards. It was thought that peer approval in form of awards encourage upgrading of teachers' performance. In 1985 two awards were established to recognize outstanding chemistry teachers: the Theodore William Richards Award for Excellence in Teaching Secondary School Chemistry, and the Honor Society for Teachers, *Aula Laudis*. Eighteen teachers have won the Richards award, and 70 have been inducted into *Aula Laudis* since 1985.

continued on page 19

Last Quarter Century Part I

continued from page 18

Student Prizes and Awards - Education Night

The *Avery A. Ashdown High School Examination Contest* has already been mentioned in Edward R. Atkinson's report. The examination is given annually and many schools in the Section send their five best chemistry students to take part. There are five prizes. The student with the best score wins the Simmons College Prize, followed by second to fifth-place winners, and as many Honorable Mentions as there are students who qualify. These and the following awards are presented at Education Night, at the May meeting of the Section. Teachers of students who have achieved "Honorable Mention" or higher in the contest are invited along with the winning students.

Project SEED students and their sponsors are recognized for their projects on this evening.

At Education Night college level

students are also honored: Those students selected to be *Theodore William Richards and James Flack Norris Summer Research Scholars* are recognized. Similarly, those undergraduates who took part in the *Undergraduate Research Symposium* are recognized, as well as those who receive *Grants-in-Aid* to attend the Division of Chemical Education Undergraduate Research Poster Session at ACS National Meetings. For all of these awards and recognitions, the students' teachers or mentors are invited, as well.

For a few years the Section has given the *Philip L. Levins Prize* for outstanding work by a graduate student in the field of organic analytical chemistry. This prize has been donated by the widow of the late Dr. Levins, a well-known specialist in this field at Arthur D Little Company.

Education Night features a lecture by a speaker, chosen for the ability to appeal to the audience consisting of a large proportion of students. Prof. Dudley Herschbach of Harvard University has been a recent favorite

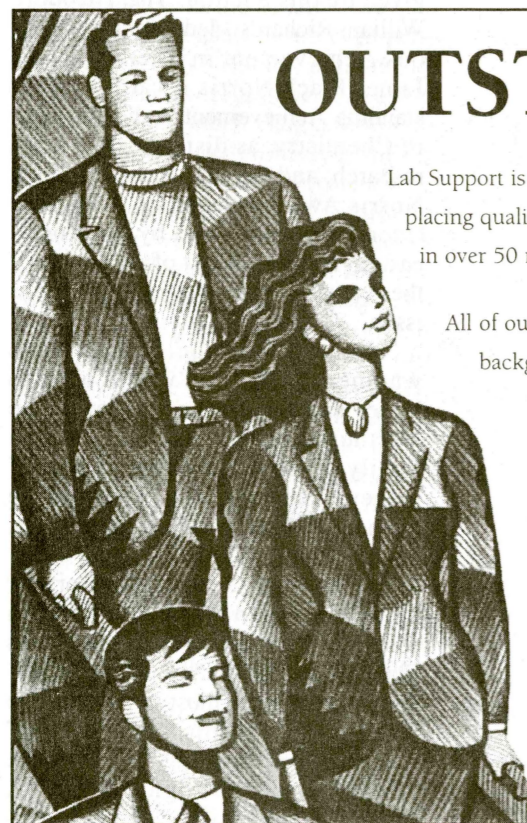
with students.

Not to be overlooked is the achievement of chemists in the Section which have been internationally recognized by the award of Nobel Prizes. The list of these is on p.25 and pictures of these Nobel Laureates are shown in the center-spread, pp. 15-16.

Postscript

During the last twenty-five years large gaps have formed in the ranks of Section members. A particular difficult year was 1979: When I was at the Gordon Conference on Natural Products in New Hampton, N.H., I was summoned to the telephone on July 9. Howard Rogers, the Vice-President for Research at the Polaroid Corporation, my supervisor, was on the line to tell me that my former research professor, Bob Woodward, had died that morning. Elkan Blout had found him and could give me further details. It was almost time for the evening symposium at the Conference, so I asked Ernie Wenkert, the chairman of the

continued on page 20



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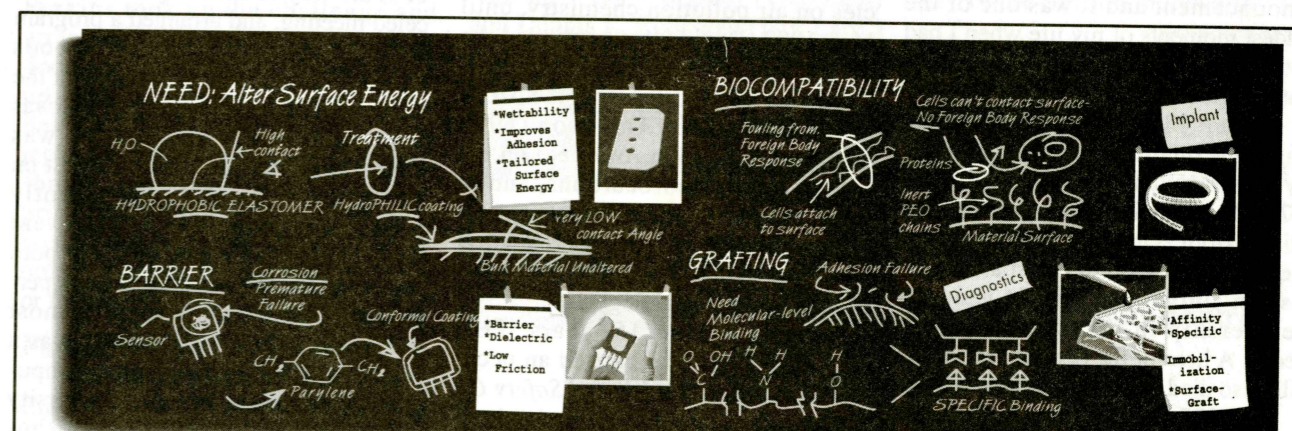


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The Last Quarter Century,

Part II

by Arno Heyn with assistance from E. R. Atkinson, P.A. Brauner, A. Obermayer and M. Simon

The Nucleus

Since November 1975, *THE NUCLEUS* has carried a column by Edward R. Atkinson: Historical Notes, with occasional guest columnists. A 20-year index appeared in *THE NUCLEUS* 74, No. 1, 8 (1995). In addition to noteworthy or little-known historical items which have touched our Section, this column gives biographies of recently deceased chemists and chemical engineers in our Section.

Last Quarter Century Part I

continued from page 19

conference, to announce the sad news. Ernie insisted that I make the announcement and it was one of the saddest moments of my life when I had to tell one hundred organic chemists that our great scientific hero had died.

George Shannon Forbes, who had taught me qualitative analysis during my undergraduate days, also died in 1979. He seemed to go on forever, first retiring from Harvard at the mandatory age, then going on to teach at Northeastern University. His 74 years of membership in the ACS may be a record. A hero of the Section, Henry A. Hill, also died in 1979, much too soon.

In 1983 the Section lost a great patriot and stellar scientist, George Bogdan Kistiakowsky, and in 1997 we lost a giant in physical organic chemistry, Paul Doughty Bartlett, shortly after he had celebrated his 90th birthday.

Edward R. Atkinson has been very diligent and sensitive in recording the passing of so many other valuable and honored members of the Section: Avery A. Ashdown, Bradley Dewey, Bob Eddy, Larry Powell, Sister Magdalen Julie Wallace... and the list goes on, as recorded in his *Historical Notes*, published in *THE NUCLEUS*. ◇

This column has included a variety of topics of historical interest, including chemical aspects of the Lizzy Borden case, and the report, contributed by Prof. Paul Jones (Univ. of New Hampshire) of a murder among chemists in this area in 1850 described in a letter of the Harvard chemist Horsford to Justus von Liebig. In this letter Horsford describes the murder of a Dr. Parkman by Dr. Webster of Boston during an argument over the repayment of debts by Dr. Webster to his creditor, Dr. Parkman. Dr. Webster was subsequently found guilty, executed, and was buried in Mt. Auburn cemetery "without a funeral". (*THE NUCLEUS* 72, No. 7, 8 (1994))

Starting with February 1991, Charles W. Kolb started a new column on Environmental Chemistry, *THE NUCLEUS* 69, No. 5 (1991). His contribution extended over 8 review articles on air pollution chemistry, until May 1992. David Ham continued the series from November 1992 until December 1993, discussing the ozone hole, the work of Anderson (1993 Gustavus J. Esselen Awardee) on the role of chlorofluorocarbons, and in later columns waste treatment by bioremediation and also by reduction by liquid metals (the ill-fated effort of Molten Metal Technology, Inc).

For the last 15 years *THE NUCLEUS* has also carried an occasional column: *Health and Safety On My Mind* by Mary Ann Solstad to keep members up-to-date on recent developments in chemical health and safety and industrial hygiene issues.

THE NUCLEUS also encourages undergraduates who have received Section support through the Richards and Norris Summer Research Scholarships to publish the research papers resulting from their work in its pages.

Member Services

Since May 1989, the Continuing Education Committee (established that year) has organized a series of all-day *Workshops* in various new fields in

chemistry for the professional benefit of Section members. Among many others, topics have included: *Laboratory Robotics, Microscale Techniques, Waste Management, Modern Methods in Synthetic Organic Chemistry, Microsoft Excel for Chemists, Interpretation of Mass Spectra, and Laboratory Health and Safety*.

Since 1973 the Section has sponsored an event, usually in August, "Summerthing". The Section records and *THE NUCLEUS* contain no record of the early events since announcement was usually by posters and letters to members. Dr. Brauner remembers that the first event occurred in the summer of 1973 and came about in a funny way: She was Chairman-Elect that year and had arranged the "April Meeting" (actually scheduled for March 29 to accommodate the speaker) to be addressed by Prof. Gerold Schwarzenbach (ETH, Zurich, the Swiss MIT) in whose lab she had spent a sabbatical year. On short notice the meeting had to be canceled because of illness of Dr. Schwarzenbach. Dr. Brauner thought of some way to make up for the canceled meeting, and arranged a program with the cooperation of the Woods Hole Oceanographic Institution in the summer. This event was held and was very successful. Your editor was abroad from January to late August on sabbatical leave and consequently missed out on this event. The event was named "Summerthing", and both the event and the name have been perpetuated by similar events in most years since then. Noteworthy was a boat trip to the oceanographic campus (jointly maintained by the University of New Hampshire and Cornell University) on Appledore Island in the group of Isles of Shoals, New Hampshire and Maine. Starting with the 1986 Summerthing, this event was announced in the Summer issue of *THE NUCLEUS* which had appeared sporadically in earlier years, but became a regular feature starting with 1986. Summerthing was held again at the Woods Hole Oceanographic Institution in that year. It featured talks at the Institute about its activities, followed by a clam-bake. Since then, Summerthing has been an annual fea-

Last Quarter Century Part II

continued from page 20

ture at different locations, but always with activities of interest both to chemist-members and their families.

Other Summerthing sites have been at Lowell Historical Park (1989), at Salve Regina College, Newport, R.I. (1990), Salem, Mass., including a Whale Watch and visits to historic houses (1991), Heritage Plantation at Sandwich, Cape Cod (1992), a visit to a plastics plant and a fruit-winery in Clinton, Mass., the Nashoba Valley Winery, and a tour through the National Plastics Museum in Leominster (1993), Quabbin Reservoir (1994), another trip to Lowell (1996) and a visit to Cranberry World and Plimoth Plantation (1997).

ACS night at the *Boston Pops* started in 1965 when Arnet L. Powell was Chairman: He mentioned at a Board of Directors Meeting that it would be a nice thing to have a Northeastern Section night at the Boston Pops. Phyllis Brauner and Janet Perkins took up the challenge and arranged for the sale of tables on the floor, and altogether 150 people signed up, section members and their families, i.e. 30 tables. Although this was repeated in years following, the crowd shrank, especially when Pops raised prices for tables to the point where section members thought twice before ordering tickets for spouses, children, or friends.

Public Service

On November 1, 1989, as a Chemistry-Week event, a reception was held at the Massachusetts State House: Demonstrations and meetings with state legislators and their aides. This event is described in detail in *THE NUCLEUS* 68, No. 4 and No. 5 (1990). In 1992 a similar event of broader scope was held June 9 at the State House. Several local industries, Schools, and Colleges had set up tables, showing their products or posters with recent student research. Demonstrations for school groups were attended by many school classes. A brief description and pictures are in *THE NUCLEUS* 71, No. 1 (1992).

Another special event which has been organized by the Section, this time for the general public, especially youngsters, is the "Holiday Lecture", started in cooperation with the Museum of Science, Boston, in 1986, with both Hubert Alyea and Bassam Shakhshiri as the lecturers and demonstrators. In the following years Dr. Alyea no longer gave these lectures - he had done it for decades, and his health no longer allowed much travelling. Since then, Bassam Shakhshiri, noted chemical educator (and recipient of the James Flack Norris Award for Teaching in 1983) has given several of these holiday events under the title:

*Once upon a Christmas cheery
In the lab of Shakhshiri.*

This event has, at times, been so sought after that Dr. Shakhshiri graciously repeated the event on the following day.

Scientific Controversies

The Section has addressed scientific controversies: At the January 1971 meeting S. Barry Brunner (Tyco Labs) and Dennis L. Rousseau (Bell Labs.)

spoke on *Polywater or poly...?* And more recently both *THE NUCLEUS* and a meeting occupied themselves with the "Cold Fusion" controversy. A series of three papers in *THE NUCLEUS* dealt with an early exponential dilution experiment which tried to show that spectra of dilute solutions of certain electrolytes still exhibited the typical absorption after dozens of exponential (i.e. by the factor of ten) dilutions. This work, reported in a German journal in 1941, without credit to this earlier work, was done again in altered form in recent years, i.e. the controversy about the work of Benevise in *Nature*, where he claimed to have found that even after so many exponential dilutions that less than one molecule would remain per liter, the solutions showed antibody properties, though weaker, yet still detectable which are typical for the parent solute.

Another notable event was the April 1990 National ACS Meeting in Boston, for which a special issue of *THE NUCLEUS* was made available to registrants. Articles about the history of the Section, noteworthy sites

continued on page 22

Q:

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Last Quarter Century Part II

continued from page 21

and sights in and around Boston, historic walking trips, how to use the "T", location of museums and other noteworthy locations, and guide to recommended restaurants and to shopping were included. Since we will have another National Meeting in Boston, this time the "Fall" meeting (August 23-27, 1998), a similar special issue will be prepared. There have been several recurrences of the Northeast Regional Meeting in Boston, the most recent one being June 22-25, 1993, jointly held with the Analytical Chemistry Summer Conference at Northeastern University.

The chief problem in our Section is one common to the other large local sections: Lack of participation by most of the members. Of our 5300 members, only about 10 to 15% vote for officers in the annual election, and meeting attendance is usually between 1-2%. Yet, member surveys have shown no great dissatisfaction with the activities of the Section. The large cities, with their many colleges and graduate schools offer such a rich menu of seminars and meetings that local section meetings are just another meeting one may go to, or most likely skip. In small locations the picture is different: Meetings of the nearest Local Section, especially if there is an ACS Tour Speaker, may be the only way a chemist can keep some sort of personal contact with colleagues and with the field. Consequently, many of the smaller sections have a high percentage of attendance, even from members who have to drive an hour or more to get to meetings.

An "Infamous" Event

As briefly mentioned in the history of the first 75 years of the Section, there was the infamous event of the gala reception without electric power or lights.

The occasion was the first Northeast Regional Meeting, hosted by our Section in 1968, the year in which your editor was Chairman of the Section. The meeting was very successful,

The Northeastern Section and the Nuclear Test Ban

by Myron S. Simon

In the 1970's and until his death George Kistiakowsky of Harvard University was a major voice in the chemical community in speaking against the possibility of nuclear warfare. As a senior figure in the Section with impeccable credentials as a man who had served the country in World War II Atomic Bomb Project and as a Scientific Advisor to Pres. Eisenhower, in early 1982 he asked the Section to endorse the position of the Federation of American Scientists (FAS) as stated in its petition on nuclear war. The petition read: "*Our nation ought not base its policies or its weapon program on the belief that it can limit, survive, or win a nuclear war.*"

almost a thousand registrants, many papers were presented, with most of the meeting events hosted by Simmons College. However, the gala event was to be a reception in the Isabella Stewart Gardner Museum, which was to be open at night for this event. The Gardner Museum was built early in the century by the Boston socialite Isabella Stewart Gardner, to be the re-creation of a Venetian palace, but roofed over in deference to the New England climate, and filled with the art works which had been collected for her by Bernard Berenson, the famous art historian of Italian renaissance art, and others. As my wife and I approached the museum it appeared to be strangely dark. I had the sinking feeling: 'did I make a mistake in the date?', then we were greeted at the door by a guard with a flashlight: "We have no power, Boston Edison is working in the next street." Obviously, we could not go upstairs to the exhibit rooms in the dark, but we could stay under the arcades of the garden court which surrounds the roofed-over central garden. So there we stood and chatted, and waited, and waited. Finally the caterer

continued on page 29

This proposal by George Kistiakowsky to adopt the FAS petition was presented to the Board of Directors of the Section February 1982 by Saul Cohen and was referred to the National ACS Office by him and Esther Hopkins to determine if this was an appropriate measure for a Local Section to take up. The ACS Executive Director, Raymond P. Mariella, indicated that this was a matter of national importance, properly referred to the National Office, and comments from members of the ACS Board of Directors supported this stand. The NESACS Board of Directors took up the question at the March 1982 meeting and voted to endorse the FAS petition. The Board voted to notify other sections and the congressional science counselors of its endorsement of the FAS petition.

In the following year Glenn Seaborg proposed that the ACS adopt a statement that nuclear testing should be stopped completely. This Comprehensive Test Ban (CTB) had been strongly supported by George Kistiakowsky earlier, and the Northeastern Section's Board of Directors honored his memory after his death by supporting his known position on the Comprehensive Test Ban. At the October 1983 Board meeting, the new Chairman-Elect, Myron Simon proposed that the Section study the Seaborg proposal, as stated in the June, 1983 *C&EN*. Upon request he presented copies of this statement to the members of the Large Sections at their Section Officers Conference in Chicago in November. The Northeastern Section voted to adopt the proposal in December 1983 and so notified the National Office and other Local Sections. During 1984 the other sections which joined our Section in supporting the Seaborg proposal of a Comprehensive Test Ban were: Connecticut Valley, Ames, Peoria, Indiana, Akron and San Antonio Sections. The ACS Board of Directors received

continued on page 23

Nuclear Test Ban

continued from page 22

and discussed the petition. On April 8, 1984 it voted against the proposal, ten to four. But it did vote to go on record as suggesting to the Council Policy committee that it provide, at the August 29 Council Meeting in Philadelphia, a forum on the Comprehensive Test Ban. The forum would be preceded by the publication of arguments for and against in *C&EN* and introduced at the Council Meeting in talks by experts on both sides of the issue. At the conclusion of the forum the Council might pursue several paths, i.e., 1. Take no action; 2. Act in support of a CTB, 3. Hold a referendum of the membership.

The Council Policy Committee's response to the Board's suggestion, was never made public. Thus the Seaborg proposal was never heard of again.

Well, almost never: In 1984 President-Elect Ellis Fields, being aware of the proposal, and knowing that it had the backing of the Northeastern, and several other local sections, felt that the subject should have an airing. As a result he announced that he would schedule a Presidential Plenary Session at the August 1985 National Meeting on the Comprehensive Test Ban question. M. Simon, as Chairman of the Northeastern Section in 1985, scheduled a special meeting in June 1985 to give the Councilors who would be attending the fall National Meeting the background on the subject. Faculty members of Harvard's Kennedy School of Government and of MIT had reviewed the pros and cons of the Seaborg proposal. The meeting was attended by many chemists and non-chemists alike. At Pres. Fields' Presidential Plenary Session the issue had a thorough airing as speakers on both sides of the proposal presented their views. However, the ACS as such did not take an action either for or against the Seaborg proposal. There the matter died, as far as the ACS was concerned. Was an opportunity lost to assert moral and rational leadership by the largest scientific society in the United States?

The Medicinal Chemistry Group 1964-1998

by John L. Neumeyer

In 1963 several chemists of Arthur D. Little's (ADL) Chemical Sciences Section in the R&D Division met over many cups of coffee to discuss the possibility of starting a topical medicinal chemistry group within the Northeastern Section of the American Chemical Society. They then met with other medicinal chemists in the area (Astra Pharmaceutical Corp., Children's Hospital, Mass. College of Pharmacy, Mass. General Hospital, Northeastern University, Tufts Medical School, The Kendall Company, University of Rhode Island, Worcester Foundation) and it was decided that there was sufficient interest and enough potential members to establish this group. The first meeting of the Medicinal Chemistry Group of the Northeastern Section was held on November 17, 1964 at Arthur D. Little Co, in Cambridge, Mass., and John L. Neumeyer, then at ADL, served as the first and founding Chairman. The late Gloria Lyle, then at the University of New Hampshire, served as its first secretary. Louis S. Harris, then Senior Research Biologist in Pharmacology at Sterling Winthrop Research Institute, Rensselaer, N.Y. spoke at that meeting on "*Pain, Analgesia and Addiction - A Pharmacological and Medicinal Chemical Approach to the Problem.*"

At the time of its founding there also existed the Analytical Group, the Elastomer Group and the Electrochemical Society (the last was not under the auspices of the Northeastern Section,

Now, in 1998, the Comprehensive Test Ban has been signed by all the nuclear nations, so it is now international law, unless the treaty were to be rejected by the U.S. Senate, which has not, as yet, scheduled a vote on the treaty. ◇

ACS). All but the Medicinal Chemistry Group have disbanded, which makes the Medicinal Chemistry Group the longest surviving topical Group in the Northeastern Section. Many of the original members are still active in this group and in the Northeastern Section.

The group rapidly grew to about 120 dues paying members and met six times per year, generally at ADL, except for the joint meeting with the Northeastern Section. At that first joint meeting, which was held on February 11, 1965, the speaker was Russell A. van Dyke of the Dow Chemical Company, speaking on "*Activity of Drugs at the Cellular Level.*"

The first year included such renowned speakers as Gregory Pincus of the Worcester Foundation, "*Steroids and the Control of Fertility*"; Seymour Ehrenpreis of Georgetown University, "*An Approach to the Molecular Basis of Nerve Activity*"; Ori Friedman of Collaborative Research, "*Biochemical Approaches to Cancer Chemotherapy*"; Julius Vida, then at Kendall Company; and Alfred Burger of the University of Virginia.

William Foye of The Massachusetts College of Pharmacy was elected as the Group's second Chairman in 1966 with Albert Soloway, then at Mass. General Hospital, as Secretary. Speakers in 1966 included George Wald of Harvard University, Thomas Eisner of Cornell University, and Hans Corrodi of Astra Pharmaceuticals, Sweden.

In 1997 Edward J. Modest of Children's Hospital served as Chairman, followed in subsequent years by Albert Soloway who had moved to Northeastern University by then, Xenon Pappanastassiou of ADL, Howard Bond of the University of Rhode Island, André Rosowsky of Children's Hospital, Julius Vida of the Kendall Company, and Roy Kisliuk of

continued on page 24

Award Recipients

ACS Award sponsored by the Northeastern Section

ACS James Flack Norris Award in Physical Organic Chemistry (Sponsored by the Northeastern Section)

1965 Sir Christopher Kelk Ingold	1974 Gerhard Ludwig Close	1983 Glen Allan Russell	1992 Joseph F. Bunnett
1966 Louis Plack Hammett	1975 Kurt Martin Mislow	1984 Michael James Steuert Dewar	1993 Keith U. Ingold
1967 Saul Winstein	1976 Howard Elliot Zimmerman	1985 Paul G. Gassman	1994 George M. Whitesides
1968 George Simms Hammond	1977 Edward McCollin Arnett	1986 John I. Brauman	1995 William P. Jencks
1969 Paul Doughty Bartlett	1978 Jerome Abraham Berson	1987 Paul von Rague Schleyer	1996 Thomas C. Bruice
1970 Frank Henry Westheimer	1979 John D. Roberts	1988 Nicholas J. Turro	1997 Julius Rebek, Jr.
1971 Cheves Walling	1980 Ronald C.D. Breslow	1989 William von Eggers Doering	
1972 Stanley Jerome Cristol	1981 Jay Kazuo Kochi	1990 Normal L. Allinger	
1973 Kenneth Berle Wiberg	1982 Andrew Streitwieser, Jr.	1991 Kendall N. Houk	

Northeastern Section Awards

Theodore William Richards Medal for Conspicuous Achievement in Chemistry

1932 Theodore William Richards (posthumously)	1947 Linus Pauling	1964 Lars Onsager	1982 John D. Roberts
1932 Arthur Amos Noyes	1948 Edwin Joseph Cohn	1966 Paul Doughty Bartlett	1984 Ronald C.D. Breslow
1933 Gregory Paul Baxter	1950 John Gamble Kirkwood	1968 George Bogdan Kistiakowsky	1986 F. Albert Cotton
1936 Charles August Kraus	1952 Morris Selig Kharasch	1970 William von Eggers Doering	1988 Walter H. Stockmayer
1938 Gilbert Newton Lewis	1954 George Scatchard	1972 William Howard Stein	1990 Rudolph A. Marcus
1940 Claude Silbert Hudson	1956 Melvin Calvin	1974 Henry Eyring	1992 John F. Waugh
1942 Claude Silbert Hudson	1958 Robert Burns Woodward	1976 Frank Henry Westheimer	1994 Richard H. Holm
1942 Frederick George Keyes	1960 Robert Sanderson Mulliken	1978 Edgar Bright Wilson	1996 JoAnne Stubbe
1946 Roger Adams	1962 Saul Winstein	1980 Henry Taube	1998 K. Barry Sharpless

James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry

1951 George Shannon Forbes	Laurence Edward Strong	1975 Leonard Kollender Nash	1987 Joseph Buckley Lambert
1953 John Xan	1965 Walter John Moore	1976 Malcolm MacKenzie Renfrew	1988 Dana W. Mayo
1955 Harry Nicholls Holmes	1966 John Arrend Timm	1977 Anna Jane Harrison	Ronald M. Pike
1956 Norris Watson Rakestraw	Edgar Bright Wilson	1978 Paul Doughty Bartlett	1989 Jerry Robert Mohrig
1957 Mary Lura Sherrill	1967 Edward Lauth Haenisch	Henry Cecil McBay	1990 Joseph A. Schwarz
Farrington Daniels	1968 Samuel Edward Kamerling	1979 Harry Hall Sisler	1991 John W. Moore
1959 Hermann Irving Schlesinger	William Campbell Root	1980 Robert Crocker Brasted	1992 Jerry A. Bell
Louis Frederick Fieser	1969 Joseph Edward Mayer	1981 Fred Basolo	1993 Arthur C. Breyer
1960 Louis Plack Hammett	1970 Hubert Newcombe Alyea	1982 William Thomas Lippincott	1994 Samuel P. Massie
1961 Joel Henry Hildebrand	1971 Charles Lester Bickel	1983 Bassam Zekin Shakhshiri	1995 Michael P. Doyle
1962 Ralph Lloyd Shriner	1972 Saul Gerald Cohen	1984 Henry Albert Bent	1996 Mary Virginia Orna
1963 Avery Allen Ashdown	1973 Eugene George Rochow	1985 Derek A. Davenport	1997 A. Truman Schwartz
1964 James Arthur Campbell	1974 Grant Hopkins Harnet	1986 Glenn Arthur Crosby	

Gustavus John Esselen Award for Chemistry in the Public Interest

1987 F. Sherwood Rowland	1989 Carl Djerassi	1992 Bruce N. Ames	1996 Roy G. Gordon
Mario J. Molina	1990 Thomas J. Dougherty	1993 James G. Anderson	1997 R. Srinivasan
1988 Alfred P. Wolf	1991 Jerrold Meinwald	1994 Kary B. Mullis	1998 K. C. Nicolaou
Joanna S. Fowler	Thomas Eisner	1995 Howard J. Schaeffer	

Medicinal Chemistry

continued from page 23

Tufts University.

It was gratifying, although surprising, that the Medicinal Chemistry Group flourished and continued to attract members since, at that time, there were no major pharmaceutical companies doing research in this area, except for Astra Pharmaceuticals, which had a modest research group in Worcester. The meetings generally attracted an audience of thirty to fifty individuals which was probably due to

the high quality of the speakers.

Reviewing the list of speakers at the Medicinal Chemistry Group meetings during the first ten years, the following lecturers were most prominent: Edward E. Smisman, "Drug Architecture"; David P. Jacobus, "The Problem of Drug Resistant Falciparum Malaria"; Barry Bloom, "Molecular Viewpoints on Drug Receptor Interactions"; Werner Herz "Recent Work with Terpene Chemistry"; John H. Blei and Robert Schultes, "Search, Structure- Activity and Pharmacology of Psychotomimetic Drugs"; Bernard

Witkop, "The NIH Shift: Intramolecular Migration During Hydroxylation of Aromatic Substances" and Joseph Weinstock, "SAR of Some Diuretics." Other important speakers during this period included Gerald Fassman, Walter Gensler, John Sheehan, Ralph Hirschman, Arnold Becket, Leon Goodman, and James Hendrickson.

Since those early days of the Medicinal Chemistry Group, younger members have taken leadership roles and have continued to maintain an active presence in the Northeastern Section. It is worth noting that the pro-

continued on page 29

Henry A. Hill Award for Outstanding Service to the Northeastern Section

1980 Henry Aaron Hill (posthumously)	1989 Wallace J. Gleekman
1981 Edward Redmond Atkinson	1990 James U. Piper
1982 Robert Devereux Eddy	1991 Valerie Wilcox
1983 Arnet Lawrence Powell	1992 Ernest I. Becker
1984 G. Richard Handrick	1993 Truman S. and Arlene Light
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1965 Robert B. Woodward (Harvard)	1976 William N. Lipscomb (Harvard)	1990 Elias J. Corey, Jr. (Harvard)	

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Prof. James Golden of University of Massachusetts-Dartmouth presenting a workshop on "Hands-on Chemistry with Children"

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Summer Scholar

Practical Synthesis of Enantiomerically Enriched Glycidol by Kinetic Resolution of (\pm)-Epichlorohydrin and Dynamic Kinetic Resolution of (\pm)-Epibromohydrin

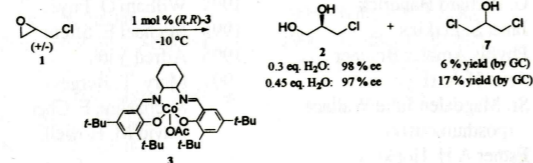
Michael E. Furrow, Scott E. Schaus, and Eric N. Jacobsen
Harvard University, October 1997

Abstract: Enantiomerically enriched glycidol was prepared by hydrolytic kinetic resolution of epichlorohydrin catalyzed by (salen)-Co(III)-OAc complex **3**, followed by base-catalyzed cyclization. Conditions were found by which both hydrolysis adduct 3-chloro-1,2-propanediol (**2**) and unreacted epoxide are obtained in good yield and high enantiomeric excess (ee). When the reaction was carried out with greater than 0.5 equivalents of water, unreacted epichlorohydrin was obtained in >99% ee. Lowering the temperature and the equivalents of water provided diol (**2**) in >98% ee. Epibromohydrin was found to racemize under the reaction conditions allowing for a dynamic kinetic resolution in which all the epoxide reacted to give 3-bromo-1,2-propanediol (**5**) in 96% ee. Because the catalyst is recyclable and the reagents are inexpensive, this represents a practical route to enantiomerically enriched glycidol and epichlorohydrin, both useful chiral building blocks for organic synthesis.

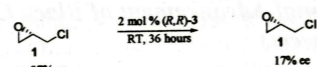
Experimental Section

(R)-3-Chloro-1,2-propanediol (96% ee); (S)-epichlorohydrin (96% ee) - An oven dried 500 mL 3-neck flask equipped with a stir bar, addition funnel, and thermometer was charged with 6.81 g (10.0 mmol) of (*R,R*)-**1**. The catalyst was dissolved in THF and cooled to 0 °C. (\pm)Epichlorohydrin (39.1 mL, 500 mmol, 99% Aldrich) was added in one portion after which the temperature rose to 2 °C. Water (4.50 mL, 250 mmol) was then added over 1 h maintaining the temperature between 0 °C and 4 °C. The reaction solution was then allowed to stir at 4 °C for 17 h at which time the THF and remaining epichlorohydrin were transferred under reduced pressure to a 500 mL flask. The THF was removed on the rotary evaporator (20 °C) to yield 20.5 g (*S*)-epichlorohydrin (221 mmol) in 96% ee (b-TA, 65 °C for 30 min). The catalyst/diol mixture was diluted with 40 mL H₂O and 40 mL CH₂Cl₂ and the aqueous layer was separated. The organic layer was extracted with 4 X 15 mL H₂O and 4 X 10 mL H₂O. The organic layer was concentrated *in vacuo* and the remaining residue was triturated with 20 mL H₂O. The aqueous layers were collected and concentrated *in vacuo*, yielding a mixture of (*R*)-3-chloro-1,2-propanediol, water, and catalyst, which was then vacuum-filtered to remove the catalyst. The resulting aqueous solution was concentrated *in vacuo* and purified by vacuum distillation to give 27.8 g of (*R*)-3-chloro-1,2-propanediol (251 mmol). Chiral GC analysis of the corresponding acetal (formed from 2,2-dimethoxypropane and catalytic *p*-toluenesulfonic acid) indicated that the product was obtained in 96% ee (cyclodex-b, 75 °C for 15 min). The catalyst fil-

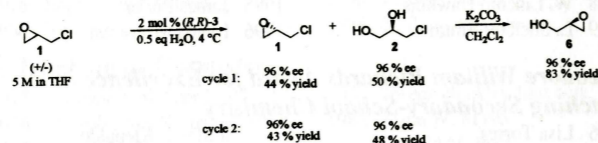
continued on page 27



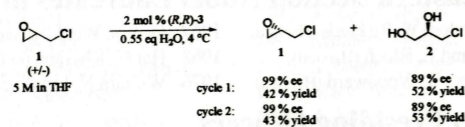
Scheme 1. Kinetic resolution of epichlorohydrin in the absence of solvent.



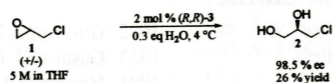
Scheme 2. Racemization of enantiomerically enriched epichlorohydrin.



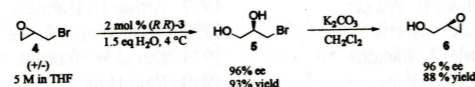
Scheme 3. Optimized kinetic resolution of epichlorohydrin and formation of glycidol.



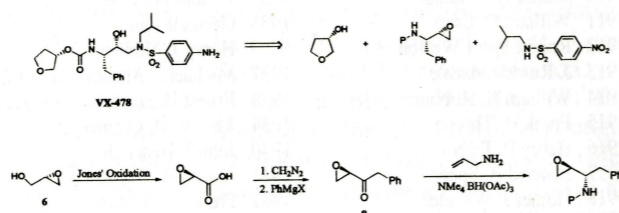
Scheme 4. Kinetic over-resolution of epichlorohydrin.



Scheme 5. Optimized conditions for obtaining **2** in high ee.



Scheme 6. Dynamic kinetic resolution of epibromohydrin and formation of glycidol.



Scheme 7. Retrosynthetic analysis of VX-478 and proposed synthesis of epoxyketone **8** from glycidol.

Summer Scholar

Continued from page 26

trate was dissolved in CH₂Cl₂, added to the rest of the catalyst, and concentrated *in vacuo*.

The procedure was repeated using the recovered catalyst under identical conditions to yield 20.0 g (*S*)-epichlorohydrin (216 mmol, 96% ee), and 26.8 g (*R*)-3-chloro-1,2-propanediol (242 mmol, 96% ee).

(R)-3-Chloro-1,2-propanediol (98% ee) - An oven dried 250 mL flask equipped with a stir bar, and thermometer was charged with 1.47 g (2.15 mmol) of (*R,R*)-**1**. The catalyst was dissolved in THF and cooled to -10 °C. (\pm)Epichlorohydrin (8.45 mL, 108 mmol, 99% Aldrich) was added in one portion. Water (.584 mL, 32.4 mmol) was then added over 1.5 h via syringe pump. The reaction solution was then allowed to stir at -10 °C for 24 h at which time the reaction solution was cooled to -78 °C and diluted with 250 mL CH₂Cl₂. The solution was then transferred to a separatory funnel and 75 mL of water were added. The aqueous layer was separated and extracted with 2 X 15 mL CH₂Cl₂, and then vacuum-filtered to remove the remaining catalyst. The resulting aqueous solution was concentrated *in vacuo* to give ___ g of (*R*)-3-chloro-1,2-propanediol (___ mmol). Chiral GC analysis of the corresponding acetal (formed from 2,2-dimethoxypropane and catalytic *p*-toluenesulfonic acid) indicated that the product was obtained in 98.5% ee (cyclodex-b, 75 °C for 15 min).

(S)-Epichlorohydrin (> 99% ee) - An oven dried 50 mL flask equipped with a stir bar, was charged with 1.47 g (2.16 mmol) of (*R,R*)-**1**. The catalyst was dissolved in THF and cooled to 0 °C followed by the addition of (\pm)epichlorohydrin (8.45 mL, 108 mmol, 99% Aldrich). Water (1.07 mL, 59.4 mmol) was then added in one portion. The reaction solution was then allowed to stir at 4 °C for 17 h at which time the THF and remaining epichlorohydrin were transferred under reduced pressure to a 25 mL flask. The THF was removed on the rotary evaporator (20 °C) to yield 4.16 g (*S*)-epichlorohydrin (45.0 mmol) in > 99% ee (b-TA, 65 °C for 30 min). The catalyst/diol mixture was diluted with 4 mL H₂O and 4 mL CH₂Cl₂ and the aqueous layer was separated. The organic layer was extracted with 4 X 5 mL H₂O and 4 X 10 mL H₂O. The organic layer was concentrated *in vacuo* and the remaining residue was triturated with 4 mL H₂O. The aqueous layers were collected and concentrated *in vacuo*, yielding 6.31 g (*R*)-3-chloro-1,2-propanediol (57.1 mmol). Chiral GC analysis of the corresponding acetal (formed from 2,2-dimethoxypropane and catalytic *p*-toluenesulfonic acid) indicated that the product was in 89% ee (cyclodex-b, 75 °C for 15 min).

The procedure was repeated using the recovered catalyst under identical conditions to yield 4.37 g (*S*)-epichlorohydrin (47.2 mmol, > 99% ee), and 6.44 g (*R*)-3-chloro-1,2-propanediol (58.2 mmol, 89% ee).

(R)-3-Bromo-1,2-propanediol (96% ee) - An oven dried 500 mL 3-neck flask equipped with a stir bar, addition funnel, and thermometer was charged with 6.81 g (10.0 mmol) of (*R,R*)-**1**. The catalyst was dissolved in THF and cooled to 0 °C. (\pm)Epibromohydrin (42.8 mL, 500 mmol, 99% Aldrich) was added in one portion after which the temperature rose to 2 °C. Water (13.5 mL, 750 mmol) was then added over 1 h maintaining the temperature

between 0 °C and 4 °C. The reaction solution was then allowed to stir at 4 °C for 48 h at which time the reaction solution was diluted with 80 mL benzene and 80 mL H₂O and the aqueous layer was removed. The benzene layer was extracted with 2 X 25 mL H₂O, concentrated *in vacuo*, and triturated with 25 mL H₂O. The aqueous extracts were concentrated *in vacuo* to yield a mixture of 3-bromo-1,2-propanediol, water, and catalyst which was then vacuum-filtered to remove the catalyst. The resulting diol-water solution was concentrated *in vacuo* to give 71.7 g of (*R*)-3-bromo-1,2-propanediol (463 mmol). Chiral GC analysis of the corresponding acetal (formed from 2,2-dimethoxypropane and catalytic *p*-toluenesulfonic acid) indicated that the product was obtained in 96% ee (cyclodex-b, 75 °C for 25 min). The catalyst filtrate was dissolved in CH₂Cl₂, added to the rest of the catalyst, and concentrated *in vacuo*.

The procedure was repeated using the recovered catalyst under identical conditions to yield 73.4 g (*R*)-3-bromo-1,2-propanediol (474 mmol, 96% ee).

(R)-glycidol (96% ee; from 3-chloro-1,2-propanediol) - An oven dried 100 mL flask equipped with a stir bar was charged with 3g (27.1 mmol) of (*R*)-3-chloro-1,2-propanediol (96% ee). This was followed by the sequential addition of methylene chloride (30 mL) and by K₂CO₃ (9.40 g, 67.8 mmol). The flask was sealed and allowed to stir at room temperature for 24 h at which time it was vacuum filtered through 5mm Celite. The filtrate was concentrated *in vacuo* to yield a mixture of (*R*)-glycidol and water. This was then azeotroped twice with 5 mL benzene to give 1.79 g (*R*)-glycidol (24.2 mmol). Chiral GC analysis of the corresponding acetate (formed from acetyl chloride in pyridine) indicated that the product was obtained in 96% ee (g-TA, 55 °C for 0 min, 1 °C/min to 85 °C).

(R)-glycidol (96% ee; from 3-bromo-1,2-propanediol) - An oven dried 100 mL flask equipped with a stir bar was charged with 3g (19.4 mmol) of (*R*)-3-bromo-1,2-propanediol (96% ee). This was followed by the sequential addition of methylene chloride (30 mL) and by K₂CO₃ (9.40 g, 67.8 mmol). The flask was sealed and allowed to stir at room temperature for 18 h at which time it was vacuum filtered through 5mm Celite. The filtrate was concentrated *in vacuo* to yield a mixture of (*R*)-glycidol and water. This was then azeotroped twice with 5 mL benzene to give 1.27 g (*R*)-glycidol (17.2 mmol). Chiral GC analysis of the corresponding acetate (formed with acetyl chloride in pyridine) indicated that the product was obtained in 96% ee (g-TA, 55 °C for 0 min, 1 °C/min to 85 °C).

A current focus of the Jacobsen research group is the asymmetric catalytic additions of various nucleophiles to epoxides using chiral catalysts. The goal is to find a catalyst that promotes addition of a nucleophile to one enantiomer of epoxides significantly faster than to the other. Ideally, the rate difference will be great enough that the reaction will give exclusively one enantiomer of epoxide from a racemic mixture. This method of obtaining one enantiomer of substance by reacting the other is known as "kinetic resolution." If the rate difference is large enough it is possible to

continued on page 28

Summer Scholar

continued from page 27

obtain the reacted enantiomer in high enantiomeric excess (ee) as well. For reactions in which the addition rates to each enantiomer are closer, it is still possible to obtain the unreacted epoxide in high ee by carrying the reaction beyond 50% reacted. Any of the more reactive enantiomer that remains will react to form the product, leaving the less reactive enantiomer in high ee. The disadvantage of this method is that the ee of the product decreases with the extra conversion, so only reactions with very high inherent selectivity are efficient enough for practical use. Enantiomerically enriched epoxides and the adducts from nucleophilic attack represent important classes of chiral building blocks, so a practical synthetic route to such compounds would be valuable.

The Jacobsen research group has reported kinetic resolutions of racemic and meso epoxides using TMSN₃ and water as nucleophiles.^{1,2} Using water as the nucleophile is attractive for both economic and environmental considerations. This paper reports the hydrolytic kinetic resolution of (±)-epichlorohydrin (**1**), an inexpensive epoxide, to give both unreacted epoxide and adduct **2** (3-chloro-1,2-propanediol) in high ee and high yield using chiral catalyst (R,R)-**3**. Also reported is the dynamic kinetic resolution of epibromohydrin (**4**) to give bromo-diol **5**, and the further conversion of **2** and **5** to enantiomerically enriched glycidol (**6**). Glycidol is a useful building block that in the synthesis of chiral complex molecules.³

The kinetic over-resolution of epichlorohydrin to high ee has been reported, but the product **2** was produced in <90% ee.² The reactions were run at room temperature in the absence of solvent with 0.3 mol % (S,S)-**3** and optimized to give high ee unreacted epichlorohydrin. In order to obtain diol **2** in ee higher than reported, the amount of water was reduced and the temperature of the reaction was lowered. The enantiose-

lectivity of the reaction increased, but a large amount of byproduct **7** was isolated, and the fraction of product **7** produced increased with higher equivalents of water (Scheme 1). The formation of this achiral byproduct suggests that a pathway might exist for the racemization of epichlorohydrin, as the hydroxyl group can theoretically eliminate chloride in either direction to give both enantiomers of epoxide. With TMSN₃ as the nucleophile, it is reported that racemization occurs through a similar achiral intermediate at a fast enough rate that dynamic kinetic resolution gives 96 % ee of product adduct in 76 % yield.³ In order to assess the possibility for dynamic kinetic resolution under the conditions for water addition, epichlorohydrin enriched in the less reactive enantiomer was allowed to stir under the conditions shown in Scheme 2. Higher catalyst loading and temperature were used than before in hopes of obtaining a rate of racemization that was of the same order as the kinetic resolution. However, the rate of racemization was very slow, and attempts at a dynamic kinetic resolution failed to yield diol **2** in greater than 50%.

An alternate approach to making the rate of racemization competitive with the rate of nucleophilic substitution is to slow down the addition of nucleophile. To slow down the rate of nucleophilic addition of water, hydrophobic solvents were tested on the theory that the limited solubility of water would slow its reaction rate. The results showed that solvents actually slowed down the racemization pathway and eliminated the formation of byproduct **7**. This discovery was applied to optimize the kinetic resolution to produce epichlorohydrin and product diol in 96 % ee and good yield (Scheme 3). Higher ee epichlorohydrin is obtained by over-resolution; using 0.55 equivalents of water yields epichlorohydrin in > 99% ee (Scheme 4). Higher ee diol (**2**) was produced by lowering the temperature and conversion; using 0.3 equivalents of water at -10 °C gives **2** in 98.5 % ee

(Scheme 5). These reactions were scaled up to a multigram scale and the catalyst was shown to be recyclable under the reaction conditions.

In order to address the possibility for dynamic kinetic resolution, epibromohydrin (**4**) was examined in similar reaction conditions. Because bromide is both a better nucleophile and leaving group than chloride, it was thought that the pathway for racemization would be much faster. Under the conditions for the kinetic resolution of epichlorohydrin, the diol **5** was produced in similar ee, but the epibromohydrin was racemized at a reasonable rate. The conditions were then optimized for the dynamic kinetic resolution to give **5** in 96 % ee and 93 % yield (Scheme 6).

The kinetic resolutions of epichlorohydrin and epibromohydrin provide a practical and easy route to enantiomerically enriched glycidol as diols **2** and **5** are converted cleanly to glycidol in good yield in basic solution. This product is an attractive chiral building block and the Jacobsen research group is exploring the use of it in the synthesis of epoxy ketone **8**, a potential precursor to protease inhibitor VX-478 (Scheme 7).

References:

1. Schaus, S. E.; Jacobsen, E. N. *Tetrahedron Lett.* **1996**, *37*, 7937. Tokunaga, M.; Larrow, J. F.;
2. Kakiuchi, F.; Jacobsen, E. N. *Science* **1997**, *277*, 936.
3. Hanson, R. M. *Chem. Reviews* **1991**, *91*, 437.

Notes:

1. For leading references on kinetic resolution, see E. L. Eliel, S. H. Wilen, L. M. Mander, *Stereochemistry of Organic Compounds* (Wiley-Interscience, New York, 1994), pp. 395-415; H. B. Kagan and J. C. Fiaud, in *Topics in Stereochemistry*, N. L. Allinger and E. L. Eliel, Eds. (Interscience, New York, 1987), vol. 14, p. 249.
2. This work was supported by an undergraduate research grant from the Northeastern Section of the American Chemical Society to M. Furrow. ◇

Nominations Last Quarter Century Part II

Philip L. Levins Memorial Prize

continued from page 22

Nominations for the Philip L. Levins Memorial Prize for outstanding performance by a graduate student on the way to a career in chemical science should be sent to the Executive Secretary, NESACS, 23 Cottage St., Natick, MA 01760 by **March 1, 1998**. The graduate student's research should be in the area of organic analytical chemistry and may include other areas of organic analytical chemistry such as environmental analysis, biochemical analysis, or polymer analysis.

Nominations may be made by a faculty member, or the student may submit an application. A biographical sketch, transcripts of graduate and undergraduate grades, a description of present research activity and three references must be included. The nomination should be specific concerning the contribution the student has made to the research and publications (if any) with multiple authors.

The award will be presented at the May 1998 Section Meeting. ◇

Medicinal Chemistry

continued from page 24

grams of the Group have been largely self-supporting. The generosity of the pharmaceutical industry, in large part, has been responsible for sustaining the high quality of the programs.

The ongoing increase in the establishment of biotech and new pharmaceutical companies in the Northeastern Section should bode well for the continued presence and activity of the Medicinal Chemistry Group for many years to come. ◇

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Index of Advertisers

Advanced Surface Technology	19
Am. Instrument Exchange.....	30
Am. Polymer Standards Corp.	30
Chemir/Polytech Laboratories	31
Desert Analytics Laboratory	30
Eastern Symposium.....	2
EChem Consulting & Outsourcing.....	30
Front Run Organics	30
Jordi Associates, Inc.....	31
Lab Support	18
Mass Consortium Corp.	13
Mass-Vac, Inc.	12
MassTrace Inc.	31
Micron Inc.	30
Northern Analytical Laboratory	7
Numega Lab	30
Oneida	21
Organix, Inc.....	30
Phasex	11
Phylos, Inc.	31
Prime Organics	30
Quantitative Technologies, Inc.	31
Schwarzkopf Microanalytical	30
Scientific Bindery	30
Spectral Data Services, Inc.	30
Surfaces Research & Apps, Inc.....	31
Yasui Seiki Co.....	30

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Check the NESACS Homepage for late additions:

<http://www.tiac.net/users/obermayr/nesacs>

Jan. 27

Prof. Axel Brunger (Yale Univ.)
"TBA"
Brandeis University
Gerstenzang, Rm 122, at 4:00 PM

Prof. Jack Szotak (Mass. General Hospital)
"In-Vitro Directed Evolution of RNA and Proteins"
Tufts Univ.
Pearson Hall, Rm 106, at 4:30 PM

Jan. 28

Prof. Andrew P. Laudano (Univ. New Hampshire)
"Synthetic Peptides as Probes to Detect Cancer-Causing Proteins"
Univ. Mass, Dartmouth
Science & Eng. Bldg, Rm 305, at 4:00 PM

Jan. 29

Prof. Wenbin Lin (Brandeis Univ.)
"Self-Assembled Chromophoric Multilayers as Second Order Nonlinear Optical Materials"
Univ. Mass., Lowell
Olney Hall, Rm OH-428, at 3:30 PM

Feb. 3

Prof. Hai-Lung Dai (Univ. Pennsylvania)
"Collisional Dynamics and Energy Transfer of Highly Excited Molecules"
Brandeis Univ.
Gerstenzang, Rm 122, at 4:00 PM

Prof. Stacey Bent (New York Univ.)
"Understanding the Chemistry of Electronic Materials"
Tufts Univ.
Pearson Hall, Rm 106, at 4:30 PM

Feb. 10

Prof. Tim Swager (Mass. Inst. of Tech.)
"Transition Metal-Conducting Polymer Hybrid Materials"
Brandeis Univ.
Gerstenzang, Rm 122, at 4:00 PM

Prof. Michael Ward (Univ. Minnesota)
"Electrochemical Growth of Epitaxial Molecular Films"
Tufts Univ.
Pearson Hall, Rm 106, at 4:30 PM

Feb. 11

Prof. Colleen Crovello (Harvard Med. School)
"Signalling by Growth Factor Receptor Tyrosine Kinases"
Univ. Mass, Dartmouth
Science & Eng. Bldg, Rm 305, at 4:00 PM

Feb. 12

Prof. Eric Jacobsen (Harvard Univ.)
"New Strategies and Discoveries in Selective Catalysis"
Boston College
Merkert Chemistry Ctr., Rm. 127, at 4:00 PM

Dr. Robert Lloyd (Visible Genetics)
"HIV-1 Genotyping in Clinical Samples"
NEACC dinner meeting
DoubleTree Guest Suites Hotel, Waltham at 6:00 PM
RSVP Dr. David Drum (617-732-6987, page 11161
e-mail: dedrum@bics.bwh.harvard.edu)

Feb. 17

Prof. Timothy Swager (Mass. Inst. Tech.)
"The Molecular Wire Approach to Enhanced Sensitivity in Sensor Materials"
Tufts Univ.
Pearson Hall, Rm 106, at 4:30 PM

Feb. 18

Dr. Frances Smith (Shriver Ctr. for Mental Retardation.)
"Rat α 1,3 Fucosyl Transferase IV Gene Encodes Both Long and Short Isoforms"
Mass. Inst. of Tech.
Faculty Club, Glycobiology Dinner Meeting at 6:30 PM
Call (617) 642-0025 for reservations

Prof. Roy G. Gordon (Harvard Univ.)
"Chemical Vapor Deposition"
Univ. Mass, Dartmouth
Science & Eng. Bldg, Rm 305, at 4:00 PM

Feb. 24

Prof. John Wood (Yale Univ.)
"Recent Advances in the Synthesis of Indolocarbazole and Indole Natural Products"
Brandeis Univ.
Gerstenzang, Rm 122, at 4:00 PM

Prof. Rein Kirss (Northeastern Univ.)
"Electrocyclic Reactions and Thin Film Deposition Using Metal Pentadienyl Compounds"
Tufts Univ.
Pearson Hall, Rm 106, at 4:30 PM

Feb. 25

Prof. Thomas Gilbert (Northeastern Univ.)
"The *Pilayella* Problem: Converting an Environmental Nuisance into a Natural Resource"
Univ. Mass, Dartmouth
Science & Eng. Bldg, Rm 305, at 4:00 PM

Feb. 26

Prof. David Britt (Univ. California, Davis)
"Electron Paramagnetic Resonance: Studies of Photosynthetic Oxygen Evolution"
Boston College
Merkert Chemistry Ctr., Rm. 127, at 4:00 PM

Prof. Dale Boger (Scripps Res. Inst.)
"TBA"
Mass. Inst. Tech.
Room 6-120, at 4:00 PM

Notices for the Nucleus Calendar should be sent to:

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