MARCH 1986

the nucleus

VOL. LXV, No. 6

OF THE NORTHEASTERN SECTION OF THE AMERICAN CHEMICAL SOCIETY

MARCH MEETING

PRESENTATION OF THE RICHARDS MEDAL TO

PROFESSOR F.A. COTTON

Thursday, March 13,
at Harvard University

(see page 5)

* ROBOTS FOR THE LAB! PAGE 9

the nucleus

Dedicated to the Memory of James Flack Norris

Published monthly from October to May by the Northeastern Section of the American Chemical Society, Inc.

THE NUCLEUS is distributed to the members of the Northeastern Section of the American Chemical Society, to the secretaries of the Local Sections, and to editors of all local publications. Forms close for advertising on the 1st of the month of the preceding issue. Text must be received by the editor six weeks before the date of issue.

Editor: ADRIENNE S. DEY, 215 Fisher St., Needham, MA 02192; Tel: 444-5933
Board of Publications: ARNO H.A. HEYN, JOHN L. NEUMEYER, HARRY ORF.
Business Manager: WILLIAM E. ADAMS, 42 South Pine St., Bradford, MA 01830; Tel: 745-0556 (x2526) or 374-4641
Advertising Manager: WILLIAM E. ADAMS
Contributing Editors: EDWARD ATKINSON, History of Chemistry, Book Reviews; MARYANN SOLSTAD, Health; MARILYN SCHNEIDER, Calendar; TRUMAN S. LIGHT, Membership News; ZVI SZAFRAN, Interviews; BILL ADAMS, Cartoons.
Circulation Manager: G. RICHARD HANDRICK, 516 Concord Ave., Lexington, MA 02173; Tel. 862-9097
Proofreaders: ARNO H.A. HEYN, WALTER J. GENSLER

THE NORTHEASTERN SECTION OF THE AMERICAN CHEMICAL SOCIETY INCORPORATED
Office: 42 Janet Road
Newton Center, MA 02159
Janice Fineman
Tel. 965-5245

Any ACS Business may always be conducted via the business office above.

Officers 1986

Chairman DONALD J. CIAPPENELLI, Chemistry Dept., Harvard University, Cambridge, MA 02138, 495-4283

Immed. Past Chairman MYRON S. SIMON, Polaroid Corporation, Cambridge, MA 02139, 577-3364

Chairman-Elect LLOYD D. TAYLOR, Polaroid Corporation, Cambridge, MA 02139, 577-3160

Secretary DAVID M. HOWELL, Chemistry Dept., Northeastern University, Boston, MA 02115, 437-3952

Treasurer JAMES PIPER, Simmons College, 300 The Fenway, Boston, MA 02115, 738-2181

Auditor ARTHUR H. REIS, Dean of Faculty Office, Brandeis University, Waltham, MA 02254, 647-2826

Trustees JANET PERKINS, G. RICHARD HANDRICK, ARTHUR S. OBERMAYER

Councilors	Alternate Councilors
Term expires 1/1/87	**Term expires 1/1/87**
Phyllis Brauner	Mary Burgess
Adrienne Dey	Esther B. Garber
Wallace Gleekman	Robert D. Stolow
Truman S. Light	Myron S. Simon
Term expires 1/1/88	**Term expires 1/1/88**
Arno H.A. Heyn	Richard N. Hurd
James A. Kaufman	John Neumeyer
Elizabeth J. Rock	Donald O. Rickter
Term expires 1/1/89	**Term expires 1/1/89**
Maryann Solstad	Catherine E. Costello
Esther A.H. Hopkins	Lloyd D. Taylor
Alfred Viola	Valerie A. Wilcox

All Chairmen of standing Committees, the editor of THE NUCLEUS, and the Trustees of Section Funds are members of the Board of Directors. Any National or regional Officer of the American Chemical Society residing within the section area is an ex officio member of the Board of Directors.

In this issue:

May deadline: March 20

Index of Advertisers:

From the Editor's Desk — An Appeal

I would like to point out to our readers a couple of important items contained in this issue of the Nucleus. The first of these is the report of the nominating committee on page 4 which lists the slate of candidates for election to section offices in 1986. It is not too late for anyone wishing to add their name to this list to do so by following the procedure for petition candidates described on the same page. Is it so farfetched to think that there may be a few individuals out there with good ideas about what the section should be doing and with the willingness to follow their words with action?

The other items deserving of some serious study are the proposed 1986 section budget and the report of the trustees. I find the following facts especially fascinating: while the trustees project a net available income through 1986 of $94,625 from interest and dividends accruing to the various trust funds, the budget committee proposes to spend a total of $35,235 thereof (including the Richards Medal award), leaving us at the end of the year with a projected cash balance of $59,390! In 1985, a year in which the Richards Medal was not given, the section spent $32,897 from the income of the trust funds, leaving a cash balance at the end of the year of $43,433. Something doesn't compute here, as the saying goes. It is abundantly clear that we need to put more thought and effort into creative new programs which the section could support with these funds. It is true that the income from some of the trust funds is restricted in how it may be used but it is not written that we must keep the income in the bank forever. Are we saving to build a mausoleum?

continued on p. 18

1986 NOMINATING COMMITTEE REPORT

Candidates for Election, Spring, 1986

The slate of candidates for the balloting for 1987 officers is as follows:

Chairman-elect: Thomas R. Gilbert, James A. Kaufman

Trustee: Walter J. Gensler, Vlasios Georgian

Treasurer: James U. Piper

Councilors and Alternate Councilors: E. Joseph Billo, Phyllis A. Brauner, Mary T. Burgess, Adrienne S. Dey, Beth Duston, Esther Garber, Thomas R. Gilbert, Wallace J. Gleekman, Truman S. Light, Patricia L. Samuel, Myron S. Simon, Robert D. Stolow, Kathleen E. Thrun, Paul Vouros

Nominating Committee: Lawrence B. Friedman, Peter C. Meltzer, Carolyn G. Spodick, Charles Zapsalis

Norris Award Committee: James B. Hendrickson, Dudley R. Herschbach, Frank L. Pilar, Mary Jane Schultz

1986 Nominating Committee: Arno Heyn, Esther Hopkins, Philip LeQuesne, Elizabeth Rock, Myron S. Simon

1986 ELECTION ALERT!

Members of the Northeastern Section who wish to be nominated for an elective office are urged to submit their names according to the following procedure:

PETITION CANDIDATES: "In accordance with the Northeastern Section Constitution, Article VIII, section 3, 'Any group comprising 2 percent or more of the membership of the Northeastern Section may nominate candidates for any elective office provided that such nomination (accompanied by the signature of the nominating group) shall be presented in writing to the Chairman of the Nominating Committee not more than ten days following the March meeting of the Northeastern Section." Accordingly, such petitions are due by March 23, 1986, and should be sent to Dr. Myron S. Simon, 20 Somerset Road, West Newton, Massachusetts 02165. At least 89 valid signatures are required and it is suggested that the petition be sent by registered mail.

SUPPORT
THE NUCLEUS

RECIPIENTS OF THE THEODORE WILLIAM RICHARDS MEDAL AWARD

For Conspicuous Achievement in Chemistry

1932	Theodore William Richards (posthumously)
1932	Arthur Amos Noyes
1934	Gregory Paul Baxter
1936	Charles August Kraus
1938	Gilbert Newton Lewis
1940	Claude Silbert Hudson
1942	Frederick George Keyes
1946	Roger Adams
1947	Linus Pauling
1948	Edwin Joseph Cohn
1950	John Gamble Kirkwood
1952	Morris Selig Kharasch
1954	George Scatchard
1956	Melvin Calvin
1958	Robert Burns Woodward
1960	Robert Sanderson Mulliken
1962	Saul Winstein
1964	Lars Onsager
1966	Paul Doughty Bartlett
1968	George Bogdan Kistiakowsky
1970	William vonEggers Doering
1972	William Howard Stein
1974	Henry Eyering
1976	Frank Henry Westheimer
1978	Edgar Bright Wilson
1980	Henry Taube
1982	John D. Roberts
1984	Ronald C.D. Breslow

T.W. RICHARDS AWARD LECTURE

F.A. Cotton

Recognizing the Importance of Metal-Metal Bonds

Abstract: The coordination theory of Alfred Werner deals with a large part of transition metal chemistry, but it does not take account of the existence of bonds directly between metal atoms. The history leading up to our present day recognition of the importance of metal-metal bonds, including double, triple and quadruple ones will be outlined. A few contemporary developments will be summarized.

F.A. COTTON
Biography

F.A. Cotton was born in 1930 in Philadelphia, where he attended public schools, Drexel University and Temple University (A.B., 1951). He received his Ph.D. from Harvard University in 1955 for work done under the supervision of Nobel laureate Sir Geoffrey Wilkinson and immediately took up an Instructorship at MIT. In 1961 he attained the rank of full Professor, the youngest holder of that rank at MIT up to that time. In 1972 he came to Texas A&M University as Robert A. Welch Professor and he presently holds the positions of Doherty-Welch Distinguished Professor and Director of the Laboratory for Molecular Structure and Bonding.

Professor Cotton is known both for his research and as the author of some of the most important chemistry textbooks of our time. His research has dealt with nearly every important phase of inorganic chemistry, expecially the chemistry of the metallic elements, as well as with the structural chemistry of enzymes. His investigations have resulted in more than 900 research publications, mostly in journals published by the American Chemical Society. He has made major contributions to the area of metal carbonyl compounds and organo-metallic compounds and his work on the structure of staphylococcal nuclease was one of the first high resolution enzyme structure determinations. His greatest contributions, however, are in the field of metal-metal bonding, where he discovered the existence of double, triple and quadruple metal-metal bonds, as well as a host of compounds containing metal atom clusters with single bonds.

His books include "Advanced Inorganic Chemistry," editions 1-4, coauthored with Sir Geoffrey Wilkinson. This book, of which more than a half million copies, in thirteen foreign language translations as well as English, have been printed, has been the leading textbook in its field for a quarter of a century. Cotton's textbook "Chemical Applications of Group Theory" is world famous as the book from which virtually all chemists have learned the mathematics for dealing with molecular symmetry. In addition, he has written a very successful high school text, "Chemistry, An Investigative Approach," a smaller inorganic text (again with G. Wilkinson) and

continued on page 23

MARCH MEETING

THE SIX HUNDRED AND NINETY FIRST MEETING OF THE NORTHEASTERN SECTION OF THE AMERICAN CHEMICAL SOCIETY

Thursday, March 13, 1986
at Harvard University

5:30 pm Social Hour: Faculty Club, 20 Quincy Street
6:30 pm Dinner: Faculty Club, 20 Quincy Street
8:00 pm Lecture: Science Center Lecture Hall D
1 Oxford Street

Presentation of the 30th
Theodore William Richards Medal
for Conspicuous Achievement in Chemistry to
F.A. COTTON
Texas A & M University

Recognizing the Importance of Metal-Metal Bonds

Free parking: Broadway Street Garage, Third Level

Dinner reservations: No later than March 6, 1986. Please call Mrs. Fineman at 965-5245. Reservations not cancelled at least 24 hours in advance will be billed for dinner price.

Dinner Price: $13 Members, $15 Non-members, $5 Students

Letter to the Editor

The Northeastern Section at the Isles of Shoals

A news item in the NUCEUS concerning the recent Section visit to Appledore Island of the Isles of Shoals caught my attention, as we had spent the Labor Day weekend with the New Hampshire Audubon Society at the same campus of Cornell-U.N.H.

Dr. Arthur Borror of U.N.H. (as he spells his name) led our group, and the most interesting part of the weekend was actually holding migrating warblers and other birds in the hand and releasing them after banding by an expert.

This took place between the carefully reconstructed flower garden of Celia (Leighton) Thaxter, hostess and friend of the famous of those days (1870-90), and the former site of Childe Hassam's studio there. He was the portraitist of this famous flower display, among his other celebrated Appledore subjects.

The Isles of Shoals, ten miles southeast of Portsmouth, N.H., are a nearby historical but unspoiled group of nine islands well worth visiting for a day or longer.

Charles S. Frary, Jr.

TECH / PROFESSIONAL SERVICES

This new advertising section is for small ads at small prices. Minimum space is one inch. If more than one inch is needed, additional space can be bought in half-inch increments.
Prices: $15 per column-inch for 8 insertions;
$18 per inch for 3 to 7 insertions;
$25 per inch for 1 or 2 insertions.

Medicinal Chemistry Group Thanks Contributors to the 1985 Program

The Medicinal Chemistry Group wishes to thank the following individuals and institutions whose financial contributions have made our programs possible this year.

Abbott Laboratories
American Cyanamid Company, Lederle Laboratories
Biogen Research Corporation
Boehringer Ingelheim, Ltd.
Bristol-Myers Company
Ciba-Geigy Corporation
Dow Chemical Company
FMC Corporation
Hoechst-Roussel Pharmaceuticals, Inc.
Hoffmann-LaRoche, Inc.
Key Pharmaceuticals, Inc.
Arthur D. Little Foundation
McNeil Pharmaceutical
Merck Sharp & Dohme Research Laboratories
Miles Pharmaceuticals
Norwich-Eaton Pharmaceuticals, Inc.
Ortho Pharmaceutical Corporation
Pfizer, Inc.
Schering Corporation
Seragen, Inc.
Stuart Pharmaceuticals, Division of ICI Americas
Bertil Takman
Uniroyal Chemical Group

MEDICINAL CHEMISTRY GROUP MEETING

Tuesday, March 11, 1986
Boston College
Room 304, Higgins Hall
Chestnut Hill, Massachusetts

Dr. Scott C. Mohr
Department of Chemistry
Boston University

will speak on:

"A, B, C. . .Z,
The Influence of
DNA Conformation on
Ligand Binding"

4:00 Coffee and Refreshments
4:30 Lecture
6:00 Dinner* with Dr. Mohr
Ming Garden Restaurant

*Members: $10.00, Students: $6.00

Biographical Sketch SCOTT C. MOHR

After completing an undergraduate chemistry major at Williams College, Dr. Mohr pursued the Ph.D. in Harvard's chemistry department. His thesis research, carried out in the laboratory of Professor Paul Doty, concerned the enzymatic synthesis of oligoribonucleotides of defined sequence. He carried out postdoctoral research with Professor Gordon Hammes at Cornell, applying fast kinetic techniques to the study of allosteric enzymes. Subsequently he has held a faculty position in the chemistry department of Boston University where he is currently an associate professor. His research in biophysical chemistry deals with small-molecule/ nucleic acid interactions, compact states of nucleic acids, and various problems of protein and enzyme structure-function relationships.

ABSTRACT

Carcinogens known to attack DNA constitute one particularly important category of low-molecular-weight ligand. We have recently completed a study of the interaction of one of the best-known carcinogens with DNA and conclude that in this case at least the conformation of the double helix greatly affects the attachment of a biologically important ligand. In agreement with published experiments, the postulated orientations and rotational freedom of the two observed adducts differ significantly, factors which may contribute to their differing carcinogenicity and susceptibility to repair.

Medicinal Chemistry Group Northeastern Section ACS Officers 1986

Chairman . . . . . **James Quick**
Travenol Genentech Diagnostics
600 Memorial Drive
Cambridge, MA 02139 (617) 492-2526

Immediate Past Chairman . . . . . **Peter C. Meltzer**
H.G. Pars Pharmaceutical Labs, Inc.
763D Concord Avenue
Cambridge, MA 02138 (617)354-2800

Chairman-Elect . . . . . **Debra J. Trantolo**
Dynatech R/D Company
99 Erie Street
Cambridge, MA 02139 (617)868-8050

Treasurer . . . . . **James Mangold**
Section of Medicinal Chem. & Pharmacognosy, University of Connecticut
Storrs, CT 06368 (203) 486-3451

Secretary . . . . . **Richard Milius**
Research Biochemicals, Inc.
P.O. Box 181
Wayland, MA 01778 (617)437-5192

For information on meetings of the Medicinal Chemistry Group call any of the officers of the group listed above.

ROBOTS FOR THE LAB!

by James N. Little

Yes, robots are finding their way into chemistry and biotechnology laboratories at a rapid rate. Laboratory robots were introduced less than 3 years ago by a company located right here in the Northeastern Section, Zymark Corporation in Hopkinton, MA, and it has become the faster growing new technology for the laboratory.

What is Laboratory Robotics?

New technology for analytical measurement (chromatography, spectroscopy, etc.) and data reduction using laboratory computers has developed at a rapid rate. Sample preparation technology has not kept pace. Most chemical samples require one or more preparation steps prior to instrumental analysis, and these sample preparation procedures continue to be performed much as they have in the past. A laboratory robotic system is ideal for automating sample preparation as part of an integrated analytical method.

The great emphasis on instrumental measurement techniques often obscures the importance of sample handling and preparation in achieving quality analytical results. Figure 1 illustrates the complementary role of sample preparation, analytical measurement, and data reduction in analytical methods.

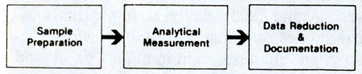


Figure 1. Elements of an analytical method.

Sample automation generally has been limited to automatic sample introduction, such as the use of automatic injectors. Today, sample preparation is the weak element in analytical methods and it is the area that needs improvement if total laboratory automation is to be achieved.

Subtle differences between analytes, interferences and matrices require different sample preparation procedures. Analytical methods also tend to be more varied in the early stages of sample preparation which, until now, have required people using simple apparatus to perform most operations. Therefore, the automation required has to be flexible and probably perform in a similar fashion to a human analyst. These requirements are well suited to automation by the use of robotics.

Automating sample preparation requires automating a sequence of laboratory unit operations (LUO's) as described in Table 1.

A particular analysis would not require all of these operations but generally 3-5 unit operations. A second analysis could not only require different operations but also a different order. Thus, there is a need for flexibility in automating sample preparation.

To be truly effective, sample preparation automation should be an integral part of a total analytical method and ideally should:

- adapt existing manual procedures to minimize the need for new methods development.
- directly interface with existing analytical instruments.
- automate so there is not need for frequent manual intervention

A microprocessor-controlled robotic system meets many of these requirements and is shown in Figure 2.

The robot consists of an arm which can move up and down, in and out, and rotate 360° within a cylinder of space centered around it. On the end of the arm is a hand for picking up vials and test tubes. A real advantage in robotic sample preparation is the ability to change hands automatically so various sizes of containers can be moved or opened, liquids can be pipetted or poured and temperature or pH probes moved to locations for measurement. Various sample preparation stations are placed within reach of the robot arm. The actual steps in a sample preparation procedure are performed at these stations (weighing, centrifuging, dispensing, heating, etc.). When the sample preparation procedure is completed, the robotic arm either introduces the samples directly into the analytical instrument or places them in a rack or carousel for subsequent analysis. Powerful microcomputers, designed as part of the system, manage the interaction of the robot, laboratory stations and the analytical instrument.

continued on page 10

LUO Class	Definition	Examples
Weighing	Quantitative measurement of sample mass	Direct measurement on balance
Grinding	Reducing sample particle size	Homogenizing
Manipulation	Physical handling of laboratory materials.	Pouring Capping and uncapping containers Sample movement
Liquid Handling	All physical handling of liquids - reagents & samples.	Dispense, Dilute & Pipet Transfer (pumping & valving)
Conditioning	Modifying and controlling the sample environment	Time (start & stop) Temperature (heat & cool) Atmosphere (vacuum & gas blanket) Agitation (mix, stir, vortex & shake)
Measurement	Direct measurement of physical properties	pH, Conductivity etc. Absorbance, Fluorescence, etc.
Separation	Coarse mechanical and precision separations.	Filtration - all techniques Partition - liquid-liquid & liquid-solid Centrifugation Precipitation Distillation & Recrystalization Electrophoresis
Control	Use of calculation and logical decisions in laboratory procedures.	Calculate and dispense reagent to dilute to concentration based on weight or volume. Adjust sample to desired pH.
Data Reduction	Conversion of raw analytical data to usable information.	Peak integration Spectrum analysis Molecular weight distribution
Documentation	Creating records and files for retrieval	Notebooks Listings & Computer Files

Table 1. Laboratory Unit Operations.

The general functions of the microcomputers are:

- to allow the user to plan experiments via the keyboard entry
- to control the motions of the robot
- to provide communication between the robot, stations and analytical instrument
- to acquire and process data

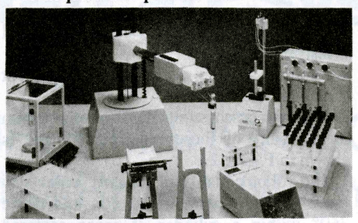


Figure 2. A laboratory robotic system.

Advantages of a Robotic Approach to Sample Preparation

The robotic approach makes possible significant improvements in laboratory operations. For example, analytical precision is improved by eliminating human errors resulting from manually performed, repetitive tasks. Each sample is prepared exactly, according to the programmed procedure. Also, replicate samples, standards, and controls can be prepared routinely and at low cost.

Laboratory productivity is improved by freeing trained, technical personnel from routine tasks. Also, several sample preparation procedures may be programmed for automated, around-the-clock operation, permitting integral scheduling of sample preparation and instrumental analysis. Fast setup combined with unattended operation reduces delays from receipt of sample to completion of analysis. Methods development is improved through ease of running multiple experiments to optimize conditions and identify error sources.

Since robotics emulate manual operations, existing procesures may be directly adapted to the automated system. Physical setup is convenient and easy to change, permitting multiple methods to be performed with a single setup. The compact work area allows greater utilization of available bench space. Using robotics reduces human exposure to toxic or radioactive materials and harsh environments. The electronic and mechanical modularity of a robotic system allows new laboratory stations to be added as user requirements change or as new modules are developed.

Applications of Laboratory Robots

In less than 3 years, over 500 laboratory robotics systems have been installed making it the fastest growing new technology for the laboratory.

A common application performed for most chromatography and spectroscopy analyses involves the following steps: weigh the sample and record the weight; add solvent to dissolve sample; mix sample thoroughly; filter sample solution and place an aliquot into the chromatograph or spectroscopy instrument. Interfaces are available for the robot to place samples in a GC, LC, IR, UV/VIS, ICP, AA, etc. The above procedure can be totally automated requiring no human intervention. In addition, the robotic system can analyze the data and reinject the sample or a standard, reconstruct a new calibration range or completely reprepare the sample. Thus, a robotic system can ensure that valid results are obtained on an around-the-clock basis.

Other important applications involve automated titrations, drug metabolism studies and residue and kinetic analysis. In pharmaceutical studies, automation of tablet assay, dissolution studies, radioimmuno or ligand binding assays are routine.

A robotic system can be used as an autosampler for a variety of instruments such as DSC, superconducting NMR and physical testing instruments (tensile, burst, etc.). Automating microbiological procedures is a new and fast growing use of laboratory robots.

This technology is still in its infancy, but the growing use of such systems in chemical laboratories will lead us further down the path to the totally automated laboratory.

1985 NORRIS SUMMER SCHOLAR REPORT

Proton Catalyzed *Cis-Trans* Stereomutation of *Cis*-1,2-Diarylcyclobutanes

Mark A. Dombroski and Lee A. Flippin
Department of Chemistry, Northeastern University, Boston, MA 02115

Abstract. *Cis*-1,2-Diphenylcyclobutane, *1*, undergoes rapid *cis-trans* stereomutation in the presence of trifluoromethanesulfonic acid at 0°C. *Cis*-1-(4′methoxyphenyl)-2-phenylcyclobutane, *3*, reacts in trifluoroacetic acid at 25°C to give the corresponding *trans* diastereomer, *6*.

When cyclopropanes that possess vicinal aryl groups are treated with strong protic acids, they often undergo *cis-trans* stereomutation much more rapidly than they ring open.[1,2] Several studies of this unusual reaction have shown that: 1) aryl rings with electron-donating substituents in the *para* position greatly enhance the rate of stereomutation[1,2] and, 2) when the stereomutation reaction is carried out in deuterated acids the recovered cyclopropane products are generally isotope-free.[2] The mechanism of this reaction is not yet settled, however, one plausible hypothesis invokes a diaryl-Cope rearrangement mechanism that requires acid catalysis.[2]

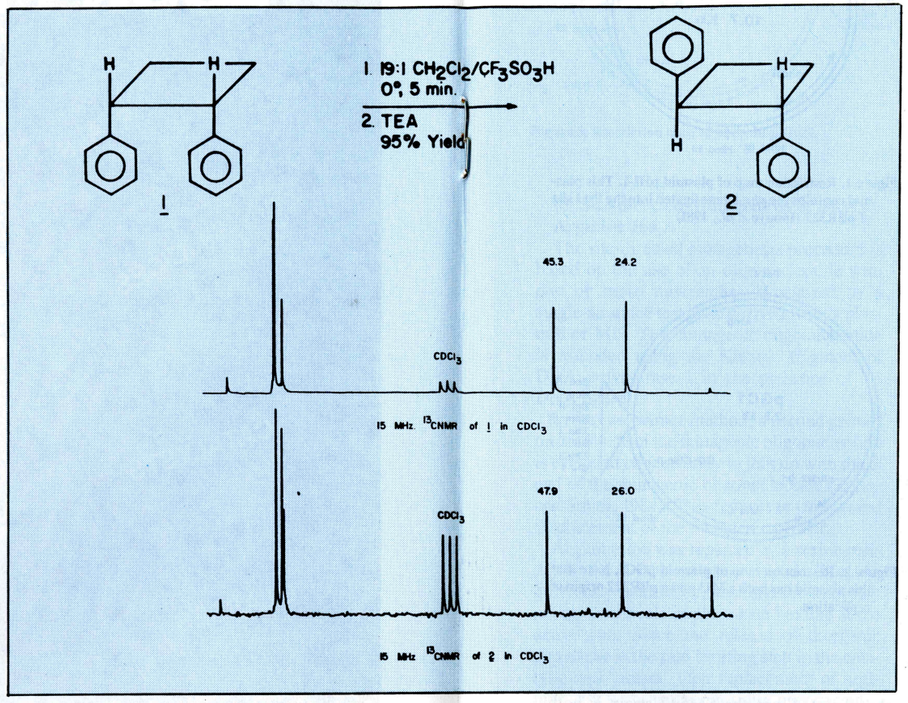
An intriguing corollary of the acid catalyzed diaryl-Cope rearrangement hypothesis is that 1,2-diarylcycloalkanes other than cyclopropanes should also be susceptible to *cis-trans* stereomutation catalyzed by protic acids. We considered the 1,2-diarylcyclobutane system to be a prime candidate in our search for new examples of the acid catalyzed *cis-trans* stereomutation reaction because of its palpable similarity to the 1,2-diarylcyclopropane system.

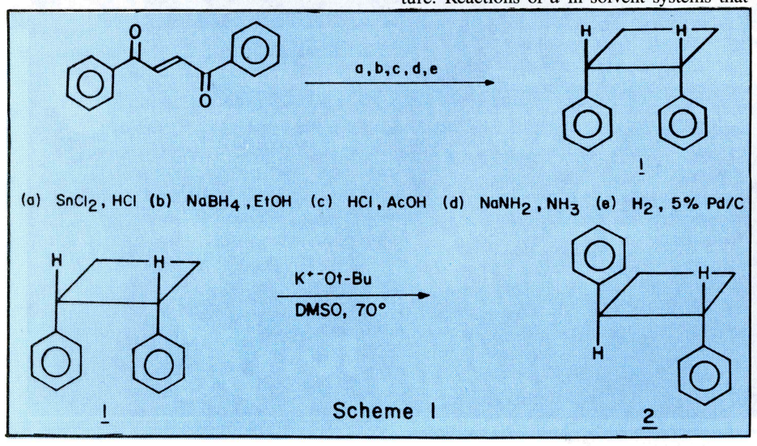
Our initial work in this area focused on the reactions of *cis*-1,2-diphenylcyclobutane, *1*, in protic acids. Cyclobutane *1* was prepared by the method of Dodson and Zielske[3] from readily available dibenzoylethylene in 43% overall yield. An authentic sample of the corresponding *trans* diastereomer, *2*, was prepared by treatment of *1* with potassium *t*-butoxide in DMSO[3] (Scheme 1).

An attempt to induce stereomutation of *1* in trifluoroacetic acid[4] at room temperature over several days was unsuccessful. However, when *1* was allowed to react in 19:1 methylene chloride-trifluoromethanesulfonic acid at 0°C for 5 min, followed by a triethylamine quench, analytically pure *trans* diasteromer, *2*, was isolated in 95% yield!

The stereomutation of *1* was also carried out in 9:1 methylene chloride-trifluoromethanesulfonic acid-d at 0°C and the reaction quenched after one half life. A carbon-13 NMR spectrum of the crude product mixture showed extensive deuteration of the aryl rings with essentially no deuterium incorporation in the cyclubutane ring system. Somewhat surprisingly, mass spectrometric analysis of the separated *cis* and *trans* diasteromers from this reaction showed extensive deuteration (~98%) of both.[5] In fact, both diasteromers incorporated up to ten deuterium atoms, with approximately equal amounts of d_4 and d_5 species predominating in each.

Unfortunately, even 19:1 methylene chloride-trifluoromethanesulfonic acid is partially heterogeneous at 0°C. We desired to study the stereomutation reaction under homogeneous conditions, however, *cis*-1,2-diphenylcyclobutane proved unreactive in trifluoroacetic acid or chlorosulfonic acid at room temperature. Reactions of *a* in solvent systems that contained fluorosulfonic acid or sulfuric acid generally produced intractable side products. We therefore prepared *cis*-1-(4′methoxyphenyl)-2-phenylcyclobutane, *3*, in the hope that the potential rate accelerating effect of the *para* methoxy group would allow us to study the catalyzed stereomutation of this compound under milder, homogeneous reaction conditions.

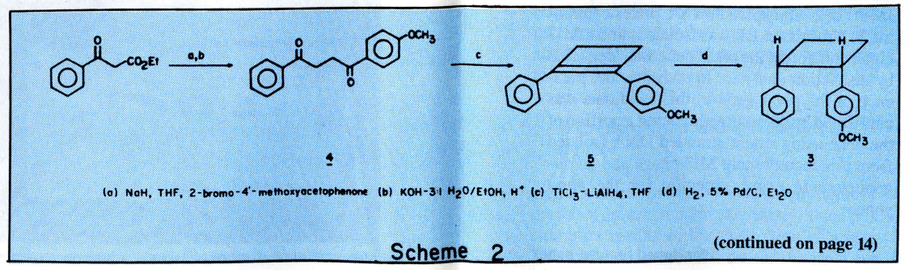




Scheme 1

Treatment of ethyl benzoate with sodium hydride and 2-bromo-4′methoxyacetophenone afforded a diketo ester which was saponified and decarboxylated to afford 1-(4′methoxyphenyl)-4-phenylbutane-1,4--dione, *4*.[6] Diketone *4* underwent a modified McMurray reaction ($TiCl_3$-$LiAlH_4$)[7] to give 1-(4′methoxyphenyl)-2-phenylcyclobutene, *5*, which was hydrogenated (H_2, 5% Pd/C) to produce *3* in 27% overall yield (Scheme 2) Treatment of *3* with potassium *t*-butoxide in DMSO gave the corresponding *trans* diastereomer, *6*, in unambiguous fashion.

As we had hoped, cyclobutane *3* proved to be much more reactive toward acid catalyzed stereomutation than *1*. When *3* was allowed to react in trifluoroacetic acid at room temperature for 3h, a 2:1 mixture of *cis* and *trans* 1-(4′-methoxyphenyl)-2-phenylcyclobutanes,

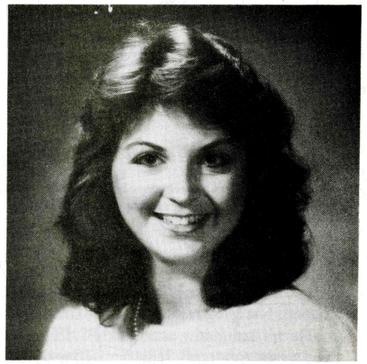


Scheme 2

(continued on page 14)

Probing the Active Site of *E. Coli* Alkaline Phosphatase

Donna Jean Brezinski
Evan R. Kantrowitz, Faculty Advisor
Chemistry Department, Boston College



Donna Jean Brezinski

Alkaline phosphatase is a unique and ubiquitous enzyme produced in both eukaryotic and prokaryotic organisms which catalyzes the non-specific hydrolysis of phosphate monoesters. In humans, the levels of this enzyme have important medical ramifications. Hypophosphatasia, a potentially fatal hereditary disease, is the result of a lack of bone alkaline phosphatase (Rasmussen and Barter, 1978); also, alkaline phosphatase levels in human serum are an important diagnostic tool in physiological and pathological processes involving the skeleton, the hepatobilary system, and the placenta. It has been estimated that serum alkaline phosphatase tests constitute 24% of all enzyme activity determinations in clinical laboratories.

A significant amount of data has shown that there is a great similarity between eukaryotic and prokaryotic alkaline phosphatases (Coleman and Gettins, 1983; Coleman and Chlebowski, 1979; Reid and Wilson, 1971). This fact, combined with the comparative ease of purifying the prokaryotic enzyme, has made *E. coli* alkaline phosphatase the prototype for the study of all alkaline phophatases. Additionally, a profusion of biochemical data, the DNA and protein sequences, and the X-ray crystallographic structure of the *E. coli* enzyme have made it an ideal candidate for study by site-directed mutagenesis.

The goal of my research this summer was to examine the effects of certain amino acid substitutions at the active site of *E. coli* alkaline phosphatase. The advent of the technique of site-directed mutagenesis has made possible the selected alteration of particular amino acid residues by introducing changes in the gene coding for the enzyme. Investigation of the changes in enzymatic activity subsequent to *in vitro* modification of the gene could not only enhance our insight to the catalytic mechanism of the enzyme, but also have the potential of providing additional information concerning the cooperativity of its subunits.

In particular, two amino acid residues have been changed in the active site of alkaline phosphatase. The first residue changed was arginine 166, which is believed to be involved in the binding of phosphate at the active site. The second residue changed was serine 102, which is believed to be directly involved in the catalytic mechanism of the enzyme. Purification and analysis of these mutant enzymes is now in progress.

Results

(a) Construction of pEK29

The gene for alkaline phosphatase is *phoA*, which is located at 9 minutes on the *E. coli* genetic map (Bachmann, 1983). Site-directed mutagenesis on the *phoA* gene was to be accomplished in an M13 phage-based system (Zoller and Smith, 1982). Therefore, in order to undergo site-directed mutagenesis, the *phoA* gene must be cloned into the filamentous phage M13. As the first step in this construction, the gene was moved from pHI-1 (Inouye *et al*, 1981) into pGC1. The pGC1 plasmid was chosen because it has a M13 origin of replication as well as the Col E1 origin found in pBR322, the backbone into which the *phoA* gene was inserted to form pHI-1 (see Figures 1 and 2).

The initial step in cloning the *phoA* gene into pGC1 was to cut both pGC1 and pHI-1 with the restriction enzymes HindIII and XhoI. The linearized pGC1 backbone and the 2.5 Kb fragment from pHI-1 containing the *phoA* gene were separated subsequent to 1% agarose gel electrophoresis by direct removal from the gel with NA-45 paper (Schleicher and Schuell). Following ligation, the mixture was transformed into compotent SM547 cells [Δ (*phoA*$^-$*proC*), *proB*$^+$,*phoR*$^-$,tsx: : Tn5, Δ*lac, galK, galU, leu, str*^{r}]. Colonies were selected by spreading on YT plates containing 25μg/mL ampicillin and 40μg/mL 5-bromo-r-chloro-3-indolyl phosphate (X-phosphate).

(continued on page 14)

DIARYCYCLOBUTANES
continued from page 12

and *6* respectively, was obtained in 83% yield.

Our results can be rationalized by a catalytic diaryl-Cope rearrangement mechanism (Figure 1). In this scheme, protonation of one of the aryl rings is followed by rearrangement of the *cis* isomer to a cyclooctenyl carbenium ion *7.* Ring closure of *7* would regenerate the protonated *cis* diastereomer; however, *7* can

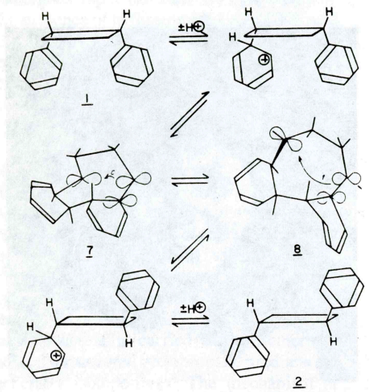


Figure 1. The Proton Catalyzed Diaryl-Cope Rearrangement, 1⇌2.

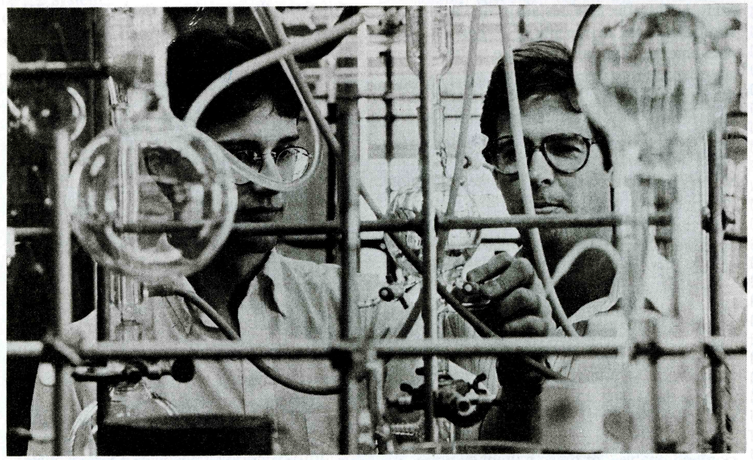
also undergo a conformational change to carbenium ion *8.* Ring closure of this ion would result in the protonated *trans* diastereomer. Finally, loss of a proton from the ion affords the observed product, *2*. The fact that no *cis* diastereomer, *1,* could be detected[8] *in the reaction mixtures which were allowed to approach equilibrium apparently reflects a large* (≥3 kcal/mole) free energy difference between *1* and *2*.

Unlike the corresponding reaction of *cis*-1,2-diphenylcyclopropane, the rate of stereomutation of *1* is slower than the rate of hydrogen-deuterium exchange on its aryl rings. This may be 1) the consequence of a relatively high barrier to cyclization of protonated *1*, 2) the interconversion of cyclooctenyl cations, *7,* and *8,* may be slow compared to analogous interconversion of cycloheptenyl cations implicated[2] in the proton catalyzed stereomutation of 1,2-diarylcyclopropanes, or 3) both of these factors could affect the stereo-mutation rate. In our laboratory, further studies of the proton catalyzed stereomutation of 1,2-diarylcycloalkanes are aimed at resolving these and other questions surrounding this unusual reaction-type.

In conclusion, the present observations consitute the first evidence of a *general*, proton catalyzed diaryl-Cope rearrangement in cycloalkanes possessing vicinal aryl groups.

References and Notes

1. (a) Sharbarov, Ys.S.; Stepanova, I.P.; Subbotin, O.A. *Dokl. Akad. Nauk SSR, 1972, 202,* 116. (b) Stepanova, I.P.; Loim, N.M.; Parnes, Z.N.; Shabarov, Yu.S. *Zh. Organ. Khim., 1973, 9,* 521. (c) Shabarov, Y.S.; Stepanova, I.P.; Protasova, E.L.; Subbotin, O.A. *Zh. Organ. Khim., 1973, 9,* 936.
2. Flippin, L.A., Ph.D. Thesis, University of Colorado, Boulder, 1980.
3. Dodson, R.M.; Zielske, A.G. *J. Org. Chem., 1967, 32,* 28.
4. Trifluoroacetic acid is sufficient to fully equilibrate *cis* and *trans*-1,2-diphenylcyclopropane at 25°C after about ½ day.
5. We are indebted to Mr. Phil Briggs of Harvard University for obtaining mass spectra of these compounds.
6. Dennis, R.D.; Gallo, D.G.; Lawson, J.E.; Majewski, R.F. *J. Med. Chem., 1974, 17,* 383.
7. Baumstark, A.L.; Mechara, E.J.H.; Semigran, M.J. *Tetrahedron Lett., 1976,* 3265.
8. Reaction mixtures were analyzed by HPLC (reverse phase column, refractive index detection). Detection limits >200:1.



Mark Dombroski in the laboratory at Northeastern University with his advisor, Dr. Lee Flippin. Photo by Bob Kramer, Northeastern University.

ALKALINE PHOSPHATASE
continued from page 13

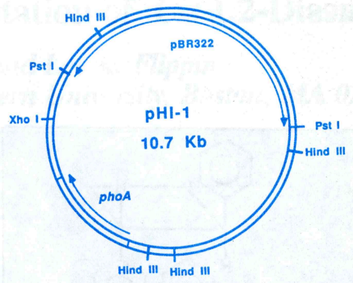


Figure 1. Restriction map of plasmid pHI-1. This plasmid contains the *phoA* gene ligated into the Pst I site of pBR322 (Inouye *et al.*, 1981)

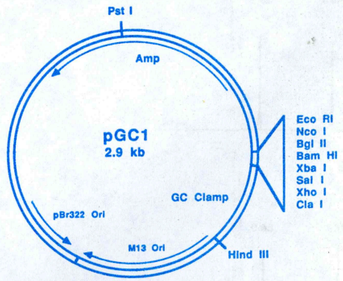


Figure 2. Restriction map of plasmid pGC1. Note that this plasmid has both a M13 and a pBR322 origin of replication.

phosphate). Since the SM547 strain is both *phoR*$^-$ and *phoA*$^-$, only cells acquiring a plasmid containing a functional *phoA* gene and ampicillin resistance will produce a blue colony. Plasmids were isolated from ten candidates by alkaline lysis and analyzed by 1% agarose gel electrophoresis. Plasmid pEK29 showed the correct restriction pattern (see Figure 3).

(b) Construction of M13/*phoA*

The initial step in moving the *phoA* gene into an M13 system was to digest both M13mp8 RF and pEK 29 with HindIII and BamHI, followed by ligation. The ligation mixture was then transformed into competent JM101 cells and spread on YT plates containing X-phosphate. RF was isolated, and a M13 clone containing the *phoA* gene was identified by restriction analysis. In addition, the presence of the *phoA* gene in this candidate was confirmed by dideoxy sequencing a portion of the gene using single-stranded DNA isolated from this recombinant M13 phage and an oligonucleotide primer specific for the *phoA* gene.

(continued on next page)

ALKALINE PHOSPHATASE
continued from page 14

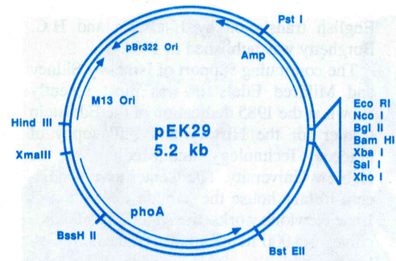


Figure 3. Restriction map of plasmid pEK29.

(c) Site-directed Mutagenesis of *phoA* at Arginine 166

The site-directed mutagenesis procedure is based on the use of an oligonucleotide with one or more mismatches hybridized to a single-stranded template derived from a plasmid or M13. This mutagenic oligonucleotide is extended using the Klenow fragment of DNA polymerase I in the presence of T4 DNA ligase.

In the two primer method, a second primer on the 5′ side of the mutagenic oligonucleotide is extended concurrently to join up with the 5′ end of the mutagenic oligonucleotide (Zoller and Smith, 1984), This reduces *in vitro* strand displacement of the mutagenic primer.

Arginine 166 was replaced by a serine residue by the *in vitro* mutagenesis procedure. As previously mentioned, arginine 166 may play an important role in phosphate binding at the active site. Since the release of inorganic phosphate is the rate-limiting step in the catalytic mechanism, then replacement of arginine 166 with another residue may increase the rate of the entire reaction by increasing the rate of the slow step. This substitution also introduced a new XhoI site within the gene. To convert arginine to serine at position 166, a 17 base oligonucleotide was synthesized with a single T-C mismatch (see below).

```
                    166
   Val  Thr  Ser  Arg  Lys  Cys  Tyr
5′ GTG  ACC  TCG  CGC  AAA  TGC  TAC  3′
   ·  ·   ·  ·   ·  ·   | ·  ·   ·  ·
3′ AC  TGG  AGC  TCG  TTT  ACG   5′   (mutagen)
                C  TCG  TTT
                [ XhoI Site ]
```

The mutagenesis was performed using the two primer method (Zoller and Smith, 1984) employing the standard M13 sequencing primer as the second primer. After extension and ligation, the reaction mixture was transformed into competent JM101 cells. M13 RF was isolated by alkaline lysis.

(d) Confirmation of the Mutation at Site 166

The replacement of arginine 166 with serine was confirmed by restriction digest of the RF of several mutant candidates, since this alteration results in the generation of a new XhoI restriction site. The candidates were cut with EcoRI and with both EcoRI and XhoI. If the XhoI site is present, digestion with the two enzymes would result in the appearance of a 230 bp fragment not present when digesting with EcoRI alone. Due to the relatively small size of the identifying fragment, the digestion mixture was separated by electrophoresis on a 6% polyacrylamide gel. Of the 32 candidates, 5 appeared to contain the XhoI site. DNA sequencing will be used to further confirm that the desired mutation had occurred at the proper position.

(e) Recloning of the Serine 166 Mutation

The construction of a plasmid containing the serine 166 mutation is now underway. The M13/*phoA* RF containing the mutation at site 166 will be digested with BssHII and BstEII. This digestion produces two fragments, the smaller of which contains the mutation. Plasmid pEK29 (see Figure 3) will also be digested with BssHII and BstEII. The larger of the two fragments resulting from this digestion does not contain site 166 in the *phoA* gene. This fragment will be isolated using NA-45 paper (Schleicher and Schuell) and ligated with the M13/*phoA* digestion. The ligation mixture will then be transformed into component SM547 cells and spread on YT plates containing 25μg/mL ampicillin and 40μg/mL X-phosphate. Since the *phoA* gene could only form from ligation of the pEK29 backbone with the fragment containing the mutation, all alkaline phosphatase produced would be mutant.

(f) The Mutation at Site 102

The mutation at site 102 was accomplished in the same manner as the mutation at site 166. As previously mentioned, this residue is believed to accept the transfer of the phosphate group from the substrate (Coleman and Gettins, 1983). This phosphoserine undergoes hydrolysis, and the subsequent release of the phosphate from the enzyme-product complex is the rate-limiting step. This residue has been changed to alanine, which should destroy the catalytic activity of the enzyme. Any remaining activity could be attributed to an alternate mechanism, such as direct hydrolysis by a water molecule. The exact mutation that was selected involves the substitution of a single nucleotide:

```
Ser – – – – – – – – – – – – Ala
(TCG)                      (GCG)
```

The mutant was selected by hybridization of ^{32}P labelled oligonucleotide mutagen primer to the candidates which had been spotted on nitrocellulose paper. Since the labelled mutagen oligonucleotide will adhere more strongly to the mutant sequence than the wild-type sequence, the mutants have an identifying characteristic of adhering the labelled probe at higher temperatures than their wild-type precursors which contain a mismatch. Approximately 5% of the spots showed hybridization at a temperature in which DNA with a mismatch washes off (see Figure 4).

The alanine 102 mutant will be ligated into pEK29 using the same principles as the serine 166 mutant. A XmaIII to BstEII fragment

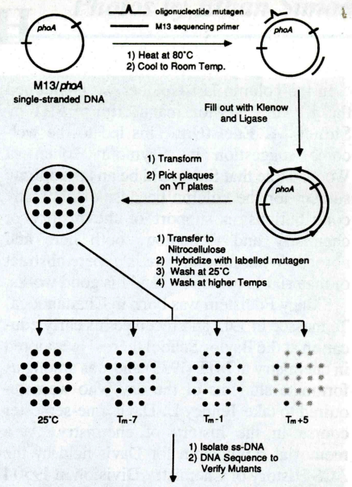


Figure 4. Site-directed mutagenesis as performed at site 102 using the two primer method.

containing the mutation at site 102 will be removed from the mutant *phoA* gene and ligated into the pEK29 backbone which has the analogous XmaIII to BstEII fragment removed. The verification of the desired ligation will be by restriction digest and, ultimately, DNA sequencing.

(g) Conclusion

With the construction of two plasmids containing mutants in the *phoA* gene at positions 102 and 166 nearing completion, it is time to plan the next step in this study of *E. coli* alkaline phosphatase. I am extending my research on this project as my senior thesis, and specifically aim to characterize both mutants, gaining insight to functions of these residues in the active site of alkaline phosphatase. I also plan to ultimately create an enzyme that has one mutant subunit and one wild-type subunit, and study any aberrations in cooperativity.

References

Bachmann, B.J. (1983) *Microbiol. Rev.*, **47,** 180-230

Coleman, J.E. and Chlebowski, J.F. (1979), *Adv. Inorg. Biochem.* **1,** 1-66

Coleman, J.E. and Getting, P. (1983), In *Advances in Enzymology,* (Meister, A., ed.) **55,** John Wiley and Sons, New York), 381-452

Rasmussen, H., and Barter, F.C. (1978) In *The Metabolic Basis of Inherited Disease,* (Stanbury, J.B., Wyngaarden, J.B., and Fredrickson, D.S. eds.) McGraw-Hill Book Company, New York, p. 1340

Reid, T.W. and Wilson, I.B. (1971) In *The Enzymes*, (Boyer, P.D., ed.), **4,** (Academic Press, New York), 373-415

Zoller, M.J. and Smith, M. (1982) *Nucleic Acid Res.*, **10,** 6487-6500

Zoller, M.J. and Smith, M. (1984) *DNA,* **3,** 479-488

HISTORICAL NOTES

In the column last October we mentioned the gift of a Newton manuscript to MIT by **Sidney M. Edelstein.** This led to the welcome suggestion by Seymour Cohen of Woods Hole that Sid would be an appropriate subject for the column because of his many contributions in support of the history of chemistry and technology both here and abroad. What follows here is a mere abstract of material I have on Sid and his good works.

Sidney Edelstein was born in Chattanooga, Tennessee in 1912 and received his early education at the Baylor School there. He majored in chemistry at MIT (1932) and was among us fortunate students of the day who were required to take Tenney L. Davis' one-semester course in the history of chemistry. At a memorial symposium for Davis held by the ACS History of Chemistry Division in 1950 I recall hearing Sid remark that, despite Davis' devotion to historical matters, he had never managed to establish a "school" of historians at MIT. However, I suspect that Sid shares with me the belief that it was the Davis influence that got us both started in this most attractive avocation.

During the period 1932-1939 he was employed at a number of textile concerns in the south and also served as a research associate with the AATCC for three years. In 1939 he became technical director of a small company in New Jersey where, because of his knowledge of mercerizing cotton, he soon became involved in supplying chemicals to the Quartermaster Corps for treating a billion yards of fabric. By the end of World War II he had supplied 98% of all the finished camouflaged netting to the Allied forces. This work was made possible by his invention and development of cellulose zincate solutions and application of pigments therein.

In 1945 Sid and his associate Joseph Evans founded the Dexter Chemical Corporation to supply ideas and technical service ability to the textile industry. The partners flipped a coin and Sid became president. The company name came from Aaron Dexter, the first professor of chemistry at Harvard. During the past 40 years the company and its technical staff have made many significant contributions to the dye and textile industry, and has branched into other areas as well. Its market is world-wide and it is a very successful business. It remains an independent and privately-owned company.

Sidney M. Edelstein

Throughout his professional career, Sidney Edelstein has pursued his interest in historical matters. He built up a library devoted to the history of science, particularly to that of early chemistry, alchemy, and dyeing. The library contains not only books but manuscripts, letters, engravings, etchings, medals, etc. The Edelstein Collection contains about 5000 items worth several million dollars. In 1976 it was given to the Jewish National and University Library of the Hebrew University of Jerusalem. Its major divisions include alchemy and chemistry, dyeing, dry cleaning, chemical technology, and an unusual collection of Americana. The prize possession is the complete editions of Rosetti's "Plictho de l'arte de tentori," first published in 1548. An English translation by Edelstein and H.C. Borghetty was published in 1969.

The continuing support of Israel by Sidney and Mildred Edelstein was most recently shown at the 1985 dedication of the Edelstein Center for the History and Philosophy of Science, Technology, and Medicine at the Hebrew University. The Center and its adjacent library house the Yahuda Collection of Isaac Newton's works, the Albert Einstein Archives (45,000 items) and the Edelstein Collection.

In 1922 Edgar F. Smith, Tenney L. Davis, and Charles A. Browne organized what later (1927) became the ACS Division of History of Chemistry. In 1948 Sidney Edelstein volunteered to take over the job of secretary-treasurer from Ralph Oesper and for the next 17 years served as an officer who held the section together during a period when the original founders were disappearing and the newer history enthusiasts were making their appearance. It goes without saying that Sid subsequently played an important role in the establishement of the Center for the History of Chemistry at the University of Pennsylvania.

In 1956 Sidney Edelstein established the Dexter Award to recognize workers in the history of chemistry. the award is supported by the Dexter Chemical Corporation and includes an honorarium and a plaque. It is administered by the ACS Division of History of Chemistry and is made annually. The 30 recipients to date have come from several countries. The Dexter Chemical Corporation also contributes an annual Dexter Prize granted by the Society for the History of Technology for the most worthy publication in this field.

Sidney Edelstein's devotion to the history and philosophy of science is based on his conviction that "we all stand on the shoulders of those who have gone before us, and unless we have respect for them we shall be nothing."

Edward R. Atkinson
Amherst, Massachusetts

The Creative Process: Saturday Lectures for High School Students and Teachers

All lectures are open to the public and will be held at 10:00 am in Room 123 of Gerstenzang Building, Brandeis University, Waltham, Massachusetts. There is no charge for the lectures. Refreshments will be served.

For more information contact
Arthur H. Reis, Jr., Ph.D.
Dean of the Faculty Office
617-647-2826.

March 1, **Creating Ourselves: Culture and the Origins of Humanity,** Judith F. Zeitlin, Professor of Anthropology

March 8, **Keeping Creativity Alive,** Teresa M. Amabile, Ph.D., Associate Professor of Psychology

March 15, **The New Aesthetics of the Skyscrapers,** Gerald S. Bernstein, Ph.D., Associate Professor of Fine Arts

March 22, **The Creative Process in a Closed Society,** Robert Szulkin, Ph.D. Professor of Russian

March 29, **Moral Facts and Moral Creativity,** David Wong, Ph.D., Associate Professor of Philosophy

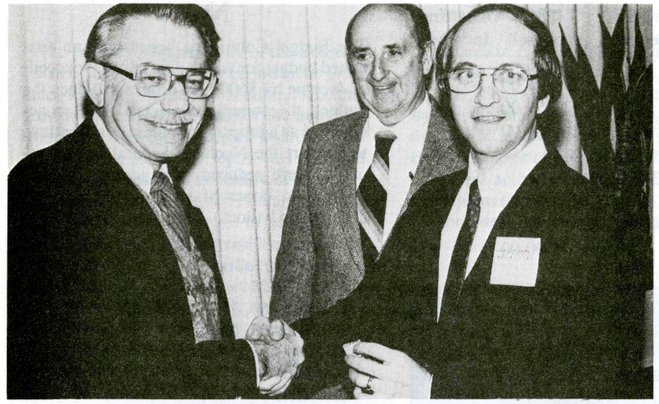
April 5, **Artistic Perception: Thinking with Both Sides of the Brain,** James H. Clay, Ph.D., Professor of Theater Arts

April 12, **The Biological Basis of Language and Thought,** Ray S. Jackendoff, Ph.D., Professor of Linguistics

April 19, **Quiet, Genius at Work! or How the Masters Composed,** Robert L. Marshall, Ph.D., Professor of Music

SEEN IN JANUARY

Photos by Ethan Simon

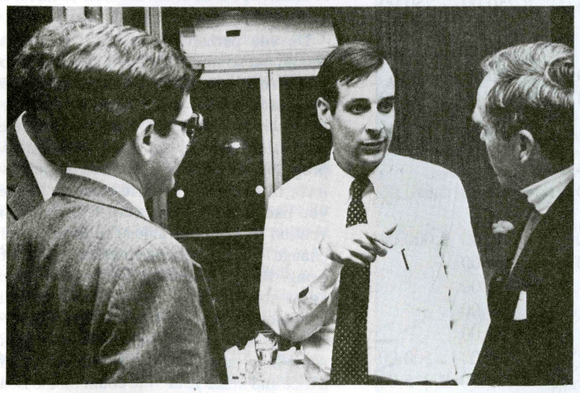


Dr. Myron Simon, 1985 Chairman of the Northeastern Section, receives the ACS award pin from his successor, Dr. Donald Ciappenelli, as Chairman-Elect Dr. Lloyd Taylor looks on.

Dr. Ivan Mefford spoke at the section meeting on January 9.

Myron Simon and David Catone signing the petition to create new Beer and Winemakers Group.

Dr. Cathy Stupak listening to Jim Koch at dinner on January 14.



Jim Koch, maker of Samuel Adams beer: "You can fool everyone but the guy who drinks your beer."

Marge Leahy tries Jim Koch's beer.

NORTHEASTERN SECTION, AMERICAN CHEMICAL SOCIETY
1986 Preliminary Budget

		1985 Actual	1986 Requests	1986 Proposed	Offsetting Income
INCOME					
National Allotment	10.	12,902.00		13,108.00	
Travel Grants	11.	1,382.73		1,250.00	
Local Dues	12.	16,905.00		16,900.00	
New-Member Commission	13.	97.50	100.00		
Contributions			3,000.00		
Ashdown Awards	15.	2,645.00		3,000.00	
Continuing Education	16.	4,761.41	4,000.00		
Hospitality	17.	3,650.00		4,500.00	
Savings Interest	18.	950.98	800.00		
Miscellaneous	19.	1,170.00			
Trustees: Cons. Acct.	20.	811.50		1,040.00	
Perm. Inc. Acct.	21.	4,010.34		6,375.00	
Norris Inc. Acct.	22.	16,582.22		17,228.00	
Publ. Inc. Acct.	24.	7,483.09		300.00	
Hill Award	25.	414.86		1,300.00	
Nerm	26.				
Summer Programs	27.	2,477.00		2,500.00	
TOTAL		76,243.63		84,393.00	
EXPENSE					
Chairman	50.	433.18	150.00	150.00	
Business Office	51.	1,987.66	2,200.00	2,200.00	
Treasurer	52.	117,37	125.00	125.00	
Archivist	53.	27.36	125.00	35.00	
Publication	54.	8,400.99		75.00	
Nucleus	55.	10,862.56	10,265.00	10,265.00	
Program	56.	3,004.14		1,000.00	
Ballots	57.	2,566.89		1,500.00	
Public Relations	58.	341.75		600.00	
Education	59.	322.14	500.00	500.00	
Newell Awards	60.	492.68	600.00	600.00	600.00
Ashdown Awards	61.	2,702.33	3,000.00	3,000.00	3,000.00
Continuing Education	62.	4,163.54		4,000.00	4,000.00
Hospitality	63.	4,623.08		5,000.00	4,500.00
Hill Award	64.	414.86	1,300.00	1,300.00	1,300.00
Norris Award	65.	9,032.30		9,000.00	9,000.00
Speaker's Bureau	66.	1,333.69	470.00	470.00	470.00
Summer Scholars	67.	5,628.18	7,750.00	7,750.00	7,750.00
Richards Medal	68.			9,000.00	9,000.00
Travel Grants	69.	4,203.05		5,000.00	1,250.00
Adm. Secretary	70.	9,949.16	10,350.00	10,350.00	
Directory Maint.	71.	66.12	300.00	300.00	300.00
Miscellaneous	72.	1,494.25		600.00	
Summer Programs	73.	3,018.63		3,000.00	2,500.00
Mass. Eng. Council	74.		100.00	50.00	
Trustees	75.	818.66	1,040.00	1,040.00	1,040.00
Nerm	76.				
Safety Committee	77.	3,498.89	3,800.00	3,500.00	3,000.00
High School Group	78.	26.20	100.00	100.00	
Chairman-Elect	79.	323.00		300.00	
Membership Committee	80.	324.54		300.00	
Aula Laudis	81.	419.07		150.00	
Esselen Award	82.			500.00	500.00
Sec. School Award	83.	517.66	2,275.00	2,275.00	2,275.00
TOTAL		81,113.93		84,035.00	50,485.00

Notes

The Budget Committee began with an estimated budget for which expenditures exceeded income by $6000. In order to balance the budget, the committee placed $3000 in account 14 as a proposal to obtain contributions to support the Nucleus. Several budget requests were reduced, and account 57 was reduced in hopes of reducing the printing costs of the ballots.

#20-25 The Trust funds directly offset expenditures as follows:
- 20 offsets 75
- 21 offsets 60, 77, and 83
- 22 offsets 65, 66, and 67
- 23 offsets 68
- 24 offsets 71
- 25 offsets 64

55 The estimated total cost of the Nucleus for 1986 is $21,000. Income from advertising is estimated as $6300 (the same as in the past two years) with the remainder of the costs budgeted in accounts 55, 65 (one issue) and 68 (one issue)

70 This represents a 5% increase in remuneration for the Administrative Secretary. The budget is based upon $8.13 per hour for fifty 20-hour weeks (one of which is a paid vacation week) plus rent of $125 per month.

61, 62, 63, 69, 73 These accounts contain expenditures which are partially or totally offset by revenues in accounts 15, 16, 17, 11, and 27, respectively. The intent is to define revenue/expenditure differences rather than absolute amounts.

Respectfully submitted,
D. Ciappenelli, G. Handrick, J. Piper,
M. Simon, L. Taylor

FROM THE EDITOR'S DESK
continued from page 3

Do you perhaps agree with me that we should put some of our funds into a vigorous public relations effort (involving quite possibly a professional public relations person) to improve the image of chemists and their profession? Or can you think of some good programs which would result in an improvement in secondary science teaching? Would you like to see a new award for creative invention to go to an industrial chemist for a change? Or do you have other ideas which the Long Range Planning Committee should know about? Please communicate these immediately to the Chairman of the section so that we may go forward and accomplish something more in 1986. Better yet, run for office and make your vote count on the Board of Directors.

BOARD OF TRUSTEES REPORT FOR 1985

The primary responsibility of the Board of Trustees is to manage the endowment Trust funds for the Northeastern Section, ACS, that provide the income to support the activities associated with the numerous awards of the Section. This particular report was prepared expressly to present to the Board of Directors at their regular meeting of February 6, 1986.

One of the major changes in our Trusts in 1985 was the addition of an endowment donated to establish the Gustavus John Esselen Award, which is to be made to a chemist whose outstanding scientific work has contributed to public well-being and promotion of the chemical profession. This gift comes from his son, Gustavus J. Esselen III; the first of the annual awards is planned for 1987.

The Table below summarizes the income and expenses for the six Trust Funds, compares the year-end market values of the investments with those from 12-months previous, outlines the income to the several "income Tursts," and presents an estimate of the dollars available during 1986 for these special activities.

The cash balance sheet shows that the income exceeded the ordinary expenses for awards, etc., leaving a total cash balance for the beginning of 1986 considerably greater than at the beginning of the year. The Richards Medal Trust accounts for the majority of this increase, because the award was not made in 1985. 95% of the Norris Award income for 1985 was paid out, and the publishing of the 1985 Directory consumed twice the income from the Publications Trust for the year. Less demands were made on the Permanent and the Hill Award Trusts.

The market value of the combined portfolios has grown during the year to $652,925 on 12-31-85 (exclusive of the new Esselen Trust), an increase of 20% over the comparable value on 12-31-84. The improved status is largely the result of changes made in the portfolio of the Trust Funds during the year, enhanced by the general bullishness of the market in 1985. In the course of making these changes, $6240 was added from available cash to enlarge slightly the cost basis of the investments. The overall value of the Section assets, as of 1-1-86, is thus a shade more than $800,000.

The income anticipated from dividends and interest in 1986 appears to be the same as it was for 1985, if the money-market rates for the CMA accounts keep to the same range of 7-8%. In any case, adequate sums seem to be available for anticipated awards in 1986, particularly the Richards Medal and the Hill Award. The Norris Award Trust can be considered comfortably off for the time being. The Permanent Trust Fund has done particularly well, which the Long Range Planning Committee should consider in its next deliberations.

Trustees in 1985 were Drs. Janet S. Perkins (re-elected in 1985), Arthur S. Obermayer, and G. Richard Handrick. They held three formal meetings during 1985—one early in the year to review the portfolio with our Account Manager at Merrill Lynch, and others to review activities during the year and to make plans for 1986.

More detailed balance sheets were prepared for the Section's Annual Report to National. Tables showing portfolio status, income, and expenses in greater detail have also been prepared for the Trustees and the Section Treasurer. All of these are open to examination upon request.

Written and submitted by
G. Richard Handrick, Trustee

TABULAR SUMMARY

A. Cash Balance Sheet

	net cash balance		net income 1985		expenses 1985	
	12-31-84	12-31-85	cash	sale of securities	ordinary	buy of securities
Consolidated	2,604.72	8,868.50	11,198.67	49,503.78	861.50	53,755.21
Richards	4,491.97	12,875.41	8,426.77	15,671.25	50.00	15,664.58
Norris	4,743.81	6,654.09	21,572.15	9,575.00	19,947.22	10,181.98
Publications	6,512.10	2,121.89	3,668.71	5,740.00	7,513.09	6,265.83
Permanent	5,991.53	9,632.04	8,564.50	12,451.25	4,060.34	13,314.90
Hill	2,032.39	3,281.07	1,713.54	–	464.86	–
	26,376.52	43,433.00	55,144.38	92,941.28	32,897.01	99,182.50

B. Market Value of Assets

	December 31, 1984			December 31, 1985			
	sec.	cash + CMA	total	sec.	cash + CMA	total	%change in totals
Consolidated	435,707	2,783	438,490	526,460	8,868	535,328	+22
Richards	43,690	4,492	48,182	49,435	12,875	62,310	+29
Norris	34,268	5,636	39,904	42,073	6,654	48,727	+22
Publications	5,100	6,512	11,612	6,347	2,122	8,469	−27
Permanent	23,242	5,991	29,233	28,610	9,632	38,242	+30
Hill	–	2,032	2,032	–	3,281	3,281	+61
	542,007	27,446	569,453	652,925	43,432	696,357	+22
Esselen	–	–	–	107,074	–	107,074	
				759,999		803,431	

C. Cash Income—Securities + CMA

	1985 (actual)			1986 (est.)			
	income	by distr.	net total	income[a]	by distr.	net total	distr. % of Consol.[b]
Consolidated	41,198	(30,000)	11,198	41,131	(40,031)	1,100	
Richards	4,832	3,594	8,426	3,989	4,796	8,785	11.9819
Norris	4,070	17,503	21,573	2,941	23,354	26,295	58.3394
Publications	1,219	2,449	3,668	620	3,268	3,888	8.1642
Permanent	3,608	4,956	8,564	2,512	6,613	9,125	16.5204
Hill	215	1,498	1,713	-0-	2,000	2,000	4.9941
	55,142		55,142	51,193		51,193	

a) Does not include dividends from CMA, which are variable. At 7-8% of the monthly balances, dividends in 1985 were $3512 from this "money market" source.
b) These numbers represent the portion of the securities in the Consolidated Account owned by each of the "income accounts."

D. Net Available Cash for Expenses During 1986

	Net on hand 1-1-86	Est. net income 1986	Total $
Consolidated	8,868	1,100	9,968
Richards	12,875	8,785	21,660
Norris	6,654	26,295	32,949
Publications	2,122	3,888	6,010
Permanent	9,632	9,125	18,757
Hill	3,281	2,000	5,281
	43,432	51,193	94,625

BOARD OF DIRECTORS MEETING
Northeastern Section, ACS
January 2, 1986

The January meeting of the Board of Directors of the Northeastern Section, ACS was called to order at 5:15 pm. The following membrs of the Board were present: E. Joseph Billo, Phyllis Brauner, Michaeline Chen, Catherine Costello, Donald Ciappenelli, Adrienne Dey, Lawrence Duffy, Christ Filer, Wallace Gleekman, Arno Heyn, David Howell, James Kaufman, Truman Light, Janet Perkins, James Piper, Arthur Reis, Donald Rickter, Elizabeth Rock, Myron Simon, MaryAnn Solstad, Robert Stolow, Lloyd Taylor and Valerie Wilcox.

Secretary's Report—The minutes of the December meeting were approved after corrections were made.

Treasurer/Budget—The Treasurer presented the proposed budget to the Board. This budget was designed to be a balanced budget. Some of the income for the NUCLEUS was designated as arising from contributions (and increased advertising).

D. Ciappenelli mentioned that the Medicinal Chemistry Topical Group had been able to raise funds for its operation in amounts up to $5000 by making solicitations for this purpose on the Northeastern Section letterhead. The question of subsidizing the NUCLEUS from funds related to the subject of a given meeting was discussed.

Awards—It was brought up that the Richards Medal Committee is assumed to continue its activities since the medal presentation will be in March this year. A short discussion was held as to who would be invited guests for the ceremonies. The process of casting the medal needs to be started in the very near future, so that it may be presented on time.

The Henry A. Hill Award will be presented in October. The Esselen Award will be made for the first time in April 1987. The committee to supervise this first selection and presentation of the Esselen Award will be comprised of 5 people, three of the members of the committee are in place already. The Board of Directors was asked for other suitable persons who might serve on this committee. When the question of the legality of this committee in the light of a different apparatus for selection and presentation of the award to be put in place later, A. Heyn pointed out that the Directors have a duty to act in an ad hoc method until the appropriate Bylaws are in place. T. Light inquired about the mechanism for securing the outside people for the selection committee from C&E News and National Academy of Sciences. The official name of the award will be the Gustavus John Esselen Award. T. Light asked for advice in his wording of the amendment to the Bylaws establishing the award. One of the matters to be clarified is the length of terms of those members of the Northeastern Section who will serve on the committee. A discussion was held as to the matter whether membership in the selection committee should be restricted to members of the Board of Directors or should the selection committee membership be open to any member of the Northeastern Section who is so elected. T. Light mentioned that the award will be restricted to chemists residing in the United States or Canada. A motion was made that "the four members from the Northeastern Section for the G.J.E. Committee be elected by the members of the Section. The motion PASSED.

Trustees—J. Perkins told the Board that the Trustees should be asked to make some funds available while waiting for the Richards Medal funds to be officially transferred to the Section.

Board of Publications—Dr. Harry Orf of Mass. General Hospital has been appointed to the Board of Publications.

Professional Relations—Thomas J. Bazzone of Harvard has been appointed Chairman of the Professional Relations Committee.

Continuing Education—P. Brauner has reported that she received six replies about possible uses of our tape library.

Hospitality—M. Chen again brouth up the matter of locations and costs for meals accompanying our meetings. This was discussed at length by members of the Board along with the total costs of student subsidies. The motion to continue a student charge of $5 was passed.

The NUCLEUS—Some Board members have not yet received their copies of the NUCLEUS. It was suggested that those members contact their local branch post offices to see if they can accelerate delivery. A. Dey pointed out that satisfactory pictures of speakers need to be sent in to the Editor with sufficient leadtime so that they may appear in the NUCLEUS.

Speakers Bureau—M.A. Solstad mentioned that she now has 30 speakers, 4-5 more since the Speaker's booklet was published. The new listing of speakers which her committee has prepared lists 58 speeches which are available. She thought the cost of $1200 for three years was quite reasonable.

Safety—J. Kaufman told the board of a new edition of "Safety in the Academic Chemistry Laboratory." Single copies are free to the inquirer. Multiple copies are $1.00 each.

New Business—The Section should be required to provide with the announcements of each month's business meeting, a calendar to the Board members with all the meetings proposed for the Section listed by day and year. This would include the various awards and other activities. This motion was passed by the Section.

A. Dey asked for a list of committee appointments so that she could publish them in the NUCLEUS as soon as it is practical. This request was seconded by a number of other officials of the Section who also need the list to fulfill their duties.

The meeting was adjourned at 6:35pm.

Respectfully submitted,
David M. Howell, Secretary

HELP OUR SECTION GROW!

Recently a new member told us, "I would have joined earlier, but no one ever asked me!" Help the ACS and our section grow by passing along the enclosed application to one of your colleagues with a personal invitation to join the ACS.

Remember, ACS National Affiliation is open to U.S. residents working in chemistry who do not have a bachelor's or higher degree in the chemical sciences.

ACS Membership Application 1986

AMERICAN CHEMICAL SOCIETY • 1155 Sixteenth Street, N.W., Washington, D.C. 20036/(202) 872-4600
TTY: (202) 872-8733

Applicant

Mr., Mrs. (Name) _____
Dr., Miss, Ms. (Please type or print) Family Name First Middle

Mailing Address _____
Number and Street

_____ Telephone _____
City State Zip Code / Country Area Code

Academic Training

Name of College or University (including current enrollment)	City and State	Curriculum Major	Years of Attendance	Title of Degree(s) Received or Expected	Date Degree Received or Expected

Courses Completed

Please list completed courses (by title) in the chemical sciences (Attach separate sheet or transcript if more space is needed.)
Not required of those with a bachelor's, masters or doctor's degree in a chemical science or those with a doctor's degree in a science closely related to chemistry with demonstrated significant experience in the practice of a chemical science.

Quarter hour credits should be multiplied by two-thirds. If school did not use a credit hour system, please estimate credits on basis of 15 lecture clock hours or 45 laboratory clock hours as equivalent to one semester hour credit.

Course Title	Semester Hours	Course Title	Semester Hours	Course Title	Semester Hours

Nomination

Nomination by two ACS members (not necessary for former members; student affiliation does not constitute former membership). If this presents difficulty, please contact the Washington office.

We recommend _____ for membership in the American Chemical Society.
(Name of Applicant)

ACS Member: _____
(Signature) (Printed Name)

ACS member: _____
(Signature) (Printed Name)

This space for use of:
ADMISSIONS COMMITTEE

1 2

3 4 N

Local Section/Division NORTHEASTERN SECTION
109

Statistical Information

Mr., Mrs. (Name) _____
Dr., Miss, Ms. (Please type or print) Family Name First Middle

Mailing Address _____
Number and Street

_____
City State Zip Code/Country

Date of Birth _____ Sex ☐ F ☐ M
(Information needed for statistical purposes)

Previous Membership

I have ☐ have not ☐ previously been a member.

I have ☐ have not ☐ previously been a student affiliate.

Office Use Only

AMC _____
MJR _____
DEL _____
MED _____
CSD _____
PNI 6119K
CLD _____
CNS _____
CNR _____
TEC _____
WTD _____

Professional Experience

Employer	Job Title	Functions	% Time on Chemical Work	Inclusive Dates of Employment (Mo. & Yr.)

Dues/Subscriptions/Divisions

There are four start dates for membership: 1 January, 1 April, 1 July and 1 October. We are anxious to begin your membership as soon as possible and will therefore enroll you immediately upon approval by the Admissions Committee. Dues for 1986 are $72.00. Your membership will begin at the nearest quarter and you will be billed accordingly. *Please send no money now.*

Student Dues

If you are a student majoring in the chemical sciences a 50% reduction on membership is available. To apply you must be registered for at least six credit hours as an undergraduate or be enrolled as a full-time graduate student.

I am ☐ an undergraduate student enrolled as described above.
☐ a graduate student enrolled as described above.
_____
Name of College or University

National Affiliation

National affiliates pay three-quarters dues (i.e. $54.00) and likewise will receive a prorated bill based on the quarter national affiliation begins.

Husband/Wife Dues

If you are the spouse of a member receiving C&EN, 23% (or the prorated amount) will be deducted from your bill. This is the portion that is allotted for C&EN. If you are eligible, please give the name of your spouse and his/her membership number.

_____
Spouse's Name Membership Number

If you wish to subscribe to an ACS publication or join an ACS division please list the publication(s)/division(s) below.

_____ _____
_____ _____

Remember, send no money now.

Agreement

I agree to restrict for my own personal use all publications to which I subsribe at member rates. I understand that membership dues are payable annually unless my signed resignation is received by the Executive Director before January 1 of the year for which the resignation is to take effect.

_____
(Date) (Signature of Applicant)

CALENDAR
continued from page 24

WEDNESDAY, MARCH 26
Sir John Vane, F.R.S.
"Adventures in Bioassay—The Road to Prostacyclin"
Tufts University School of Medicine
Sackler Auditorium at 4:00 P.M.
Call 956-6884 for more information

Professor Richard R. Durand (University of Rhode Island)
"Electrochemical Study of CO2 Reduction"
University of Connecticut
CEW, Room 100 at 4:00 P.M.
Refreshments at 3:30 P.M., Room 131
Call (203) 486-3214/2012 for more information

THURSDAY, MARCH 27
Sir John Vane, F.R.S.
"The Mechanisms of Action of Anti-Inflammatory Drugs"
Tufts University School of Medicine
Sackler Auditorium at 4:00 P.M.
Call 956-6884 for more information

Notices for the NUCLEUS Calendar should be sent to:
Marilyn J. Schneider
Department of Chemistry
Wellesley College
Wellesley, MA 02181
Phone: 235-0320, ext. 3031

Note: Material should be sent so that it arrives by the first of the month prior to the month for which the event is scheduled.

F.A. COTTON
continued from page 5

with R.A. Walton is most notable.

Professor Cotton has received many forms of recognition for his work. He was elected to the U.S. National academy of Sciences at the age of 37 and is currently Chairman of the Class of Physical Sciences. He is also an honorary member of the Göttingen Academy, the Royal Danish Academy, the Indian Academy of Sciences and the Indian National Science Academy, the Societa Chimica Italiana and the Royal Society of Chemistry, as well as being a member of the American Academy of Arts and Sciences, and an honorary life member of the New York Academy of Sciences. He has received the Baekeland, Kirkwood, Gibbs, Nichols and Pauling gold medals from ACS sections. He was the first recipient of the ACS Award in Inorganic Chemistry and has also received the ACS Award for Distinguished Service in the Advancement of Inorganic Chemistry (making him the first person to receive both ACS inorganic awards). Professor Cotton received the National Medal of Science from President Reagan in 1983 and also in the same year the Award in Physical and Mathematical Sciences from the N.Y. Academy of Sciences. He holds ten honorary doctorates.

Professor Cotton has served on many editorial boards, including those of the Journal of the American Chemical Society, Inorganic Chemistry and Organometallics. He has been Chairman of the Inorganic Division of the ACS and was an ACS Councillor for five years. During 1985-86 he is serving as the Alexander Todd Professor at Cambridge University.

The Greater Boston Mass Spectroscopy Discussion Group extends an invitation to anyone interested in mass spectroscopy. Meetings are held at A.D. Little/ Cambridge on a Wed. evening approx. once a month. For further information or to be placed on the mailing list call either Lauren Yelle at Arthur D. Little (864-5770) or Gerald Dudek at Polaroid/Cambridge (577-2542).

TWENTY-SIXTH ANNUAL COLLEGE RESEARCH SYMPOSIUM

Final Call for Papers

The 26th Annual College Research Symposium will be held at Boston College on Saturday, April 26, 1986, from 1:30 to 5:30 P.M. Research papers by undergraduates in Chemistry, Biochemistry and Chemical Engineering are eligible for consideration. Abstracts, giving title, name(s) of student author(s), faculty sponsor and institution, should be typed on the standard ACS abstract form and be submitted no later than April 4 to:

Dr. E.J. Billo, Department of Chemistry,
Boston College, Chestnut Hill, MA 02167, 552-3619

Authors whose papers are accepted for presentation will be notified in writing as soon as possible.

THE DIVISION OF PROFESSIONAL RELATIONS

Among the 34 ACS divisions, the Division of Professional Relations (DPR) is unique. It is the only one not devoted to a branch or sub-discipline of chemistry. Rather it exists for chemical scientists and their professional welfare. However, it is surprising in that 1) one does not need a specific or particular interest to be a member, 2) every ACS member ought to be interested in enhancing his own and others' professional well being, and 3) the ACS is a PROFESSIONAL as well as a scientific and educational society.

In contrast to the obvious differences above are its similarities to other divisions—its members conduct symposia and present papers at natinal meetings, it published monographs and a newsletter, and gives awards to worthy recipients. But it it is all done for a different reason and with a different goal. Without seeming arrogant or pompous, we believe our purpose is to be the conscience of the ACS (along with the Council Committee on Professional Relations) and the ethical watchdog for practitioners of the chemical sciences.

A sampling of some symposia presented recently (beginning with the fall meeting in Chicago) is listed below:

Financial Planning for Chemical Scientists
Leaping the Technology Transfer Barrier
Reducing Stereotypes in the Workplace
Economic Climate and Retirement
Education For a Professional Life
Changing and Conflicting Personal Needs in a Chemical Career
Compensation for Employed Inventors
Projections of Supply and Demand for Chemists
Industrial—Academic Interfacing (ACS Monograph No. 161)
The Legal Rights of Chemists and Engineers (ACS Monograph No. 161)

We celebrated our tenth anniversary last year, experienced a 23% increase in membership, and gained a second Councilor. We presented the first HENRY HILL AWARD to Dr. Alan C. Nixon for distinguished service to professionalism.

If our programs seem interesting to you and you want to be a part of a dynamic group, then join with us. DO IT NOW!

Margil W. Wadley, PhD
Chairman

DPR MEMBERSHIP APPLICATION

I am a member of the American Chemical Society.
Enclosed is $4 to cover dues through December 31, 1986

My ACS membrship number is: _____

Signature: _____

Printed Name: _____

Address: (As it appears on my C&EN mailing label)

_____

_____

_____

Mail to: Paul A. Rebers, Secretary, Division of Professional Relations, P.O. Box 70, Ames, Iowa 50010

CALENDAR

TUESDAY, MARCH 4
Dr. Steven Harrison (Harvard University)
"Simple RNA Viruses: Structure and Assembly"
Tufts University School of Medicine
Sackler A Auditorium at 4:00 P.M.
Refreshments at 3:45 in Sackler 204
Call 956-6884 for more information

WEDNESDAY, MARCH 5
Professor Martin Saunders (Yale University)
"Structures and Rearrangements of Stable Carbonium Ions: Use of the Isotopic Perturbation Method"
University of Connecticut
CEW, Room 100 at 4:00 P.M.
Refreshments at 3:30 P.M., Room 131
Call (203 486-3214/2012 for more information

Dr. Sylvia Ceyer (MIT)
"Dynamics of Molecular Chemisorption, Site Conversion, and Activated Dissociative Adsorption on Ni (III)"
Harvard University
Mallinckrodt Room MB 23 at 4:00 P.M.

Richard Hui
"Carboxylation of Cyanocuprate Reagents-Direct Nucleophilic 1,4-acylation of α,β-unsaturated Ketones and Aldehydes"
MIT Inorganic Seminar
Room 4-231 at 4:00 P.M.
Refreshments at 3:30 P.M.
in Moore Room (6-321)

THURSDAY, MARCH 6
Dr. Evan Kantrowitz (Boston College)
"The Use of Site-Directed Mutagenesis to Investigate the Mechanism of Aspartate Transcarbamylase"
Southeastern Massachusetts University
Room 305, Science & Engineering Building, at 11:00 A.M.
Call 999-8246 or 999-8232 for more information

Professor Michael Johnston (University of Chicago)
"Conscripting Beta-Lactamase for Use in Drug Delivery: Design, Synthesis and Biological Activity of Antibiotic Peptidyl Esters of Cephalothin"
Dartmouth College
Room 107 Steele at 10:30 A.M.
Coffee at 10:15 A.M.
Call (603) 646-2501 for more information

Professor E.J. Ariens (University of Nijmegen)
"Neglect of Stereochemistry a Source of Problems in Drug Development and Pharmacotherapeutics"
MIT, Room 4-270 at 4:00 P.M.
Refreshments in Norris Room 18-290 at 3:30 P.M.
Call 253-1844 for more information

Professor Peter G. Wolynes (University of Illinois)
Title to be announced
Harvard-MIT Physical Chemistry Colloquium
MIT, Room 4-270 at 8:00 P.M.
Refreshments after seminar

FRIDAY, MARCH 7
Dr. Arthur Dyck (Harvard Divinity School & School of Public Health)
Title to be announced
Wellesley College
Science Center, Room 278 at 4:00 P.M.
Refreshments at 3:45 P.M.
Call 235-0320, ext. 3149 for more information

TUESDAY, MARCH 11
Professor Sue Powers-Lee (Northeastern University)
"Structure and Function of Carbamoyl Phosphate Synthetase"
Northeastern University
Room 129 Hurtig Hall at 4:30 P.M.
Refreshments at 4:00 P.M.
Call 437-2847 for more information

WEDNESDAY, MARCH 12
Dr. Jim Weisshaar (University of Wisconsin)
"Gas Phase Transition Metal Ion Chemistry"
Harvard University
Mallinckrodt Room MB 23 at 4:00 P.M.

Professor O.T. Beachley (SUNY Buffalo)
"Group 13 Organometallic Compounds"
MIT Inorganic Seminar
Room 4-231 at 4:00 P.M.
Refreshments at 3:30 P.M. in the Moore Room (6-321)

TUESDAY, MARCH 18
Dr. Abraham Worcel (University of Rochester)
"Assembly of Dynamic Chromatin *In Vitro*"
Tufts University School of Medicine
Sackler A Auditorium at 4:00 P.M.
Refreshments at 3:45 in Sackler 204
Call 956-6884 for more information

WEDNESDAY, MARCH 19
Professor Colin A. Fyfe (University of Guelph, Ontario)
"Analytical Chemical Applications of Solid State NMR"
University of Connecticut
CEW, Room 100 at 4:00 P.M.
Refreshments at 3:30 P.M., Room 131
Call (203) 486-3214/2012 for more information

Dr. Mariana Vertenstein (Harvard University)
"Microscopic Theory of Membrane Transport"
Harvard University
Mallinckrodt Room MB 23 at 4:00 P.M.

THURSDAY, MARCH 20
Dr. Paul Willard (Brown University)
"A Crystallographic Look at the Aldol Reaction"
Southeastern Massachusetts University
Room 305, Science & Engineering Building, at 11:00 A.M.
Call 999-8246 or 999-8232 for more information

Professor T.A. Miller
(Ohio State University)
Title to be announced
Harvard-MIT Physical Chemistry Colloquium
Harvard University
Malinckrodt Room MB-23 at 8:00 P.M.
Refreshments after seminar

Professor Philip P. Power (University of California at Davis)
Title to be announced
Harvard-MIT Inorganic Seminar
Harvard University

continued on page 23

Northeastern Section
American Chemical Society
42 Janet Road
Newton Center, Mass. 02159

NONPROFIT ORG.
U.S. POSTAGE
PAID
BOSTON, MASS.
PERMIT NO. 336

John R. Williams
70 Outlook Drive
Lexington, MA 02173

DATED MATERIAL INSIDE—PLEASE DO NOT DELAY