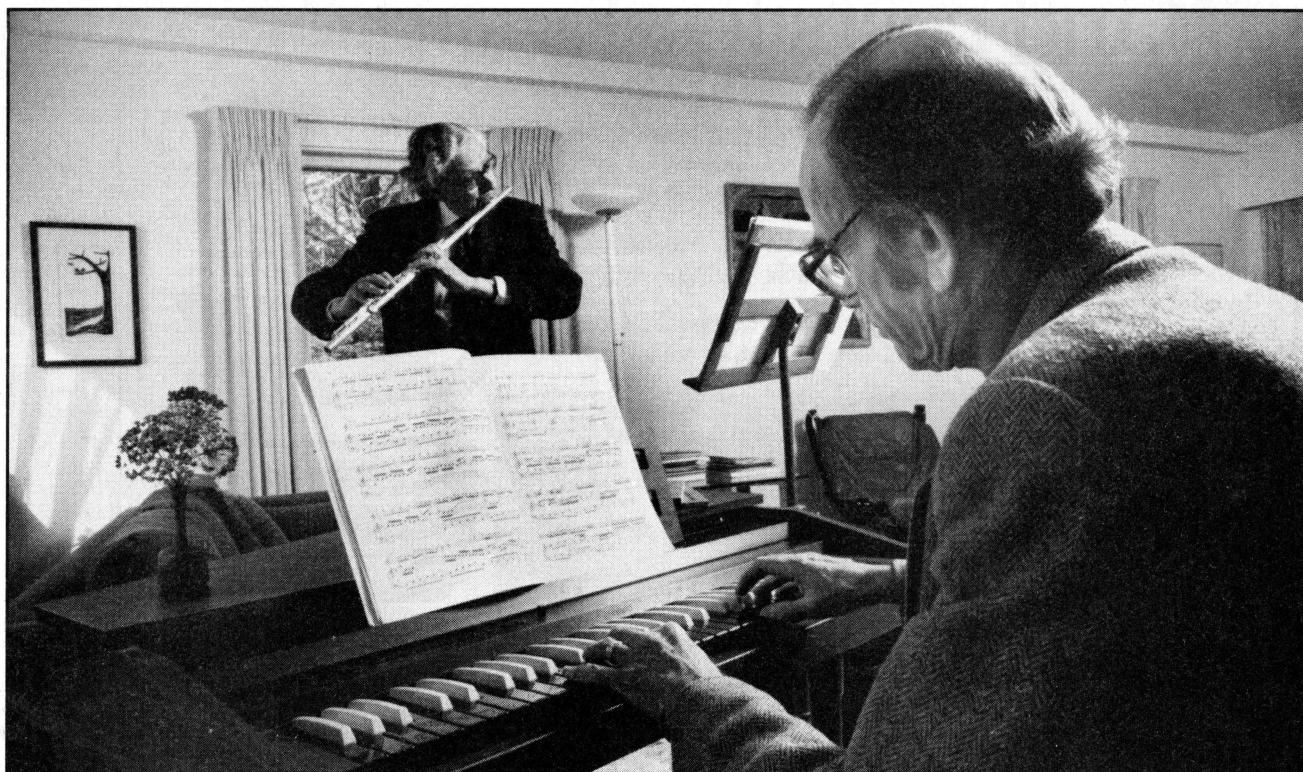


THE NUCLEUS

April 1991

Of the Northeastern Section of the American Chemical Society

Vol. LXIX, No. 7



Monthly Meeting

*Gustavus J. Esselen Award to
Jerrold Meinwald and Thomas Eisner*

Professional Relations Column

*About proposed shifts in the ACS
Committee structure affecting
the Professional Relations Committee*

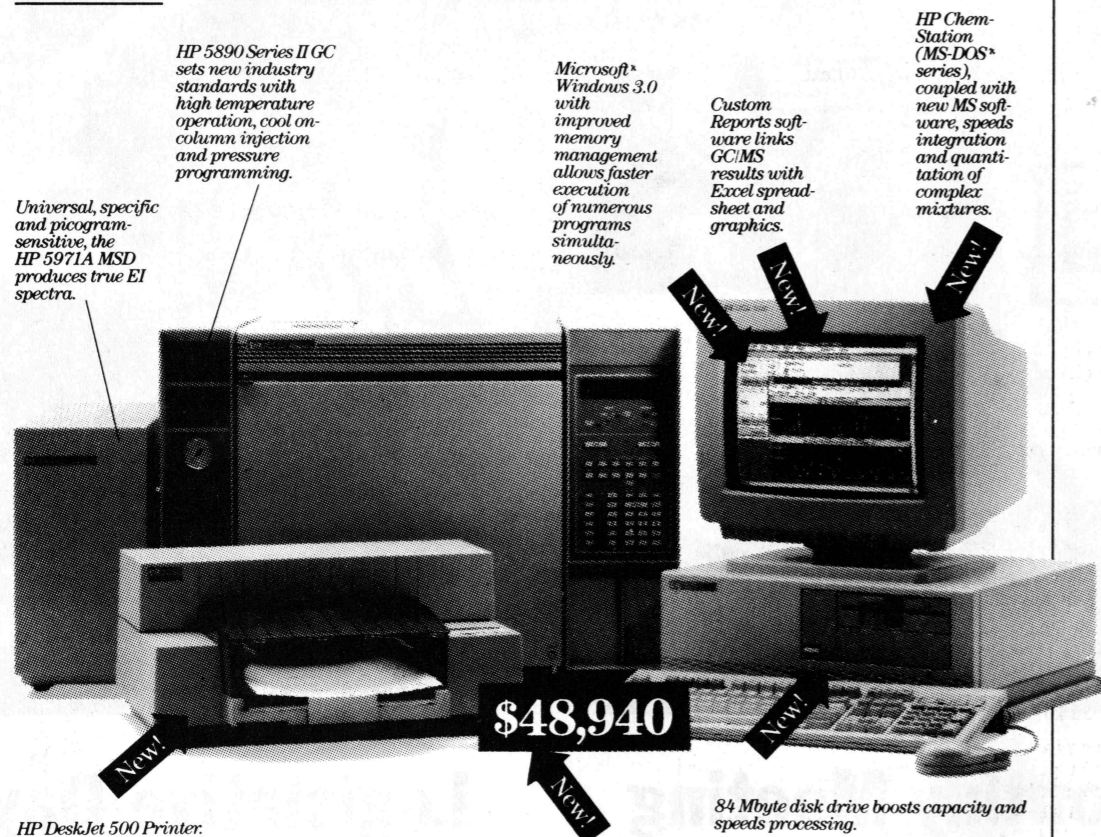
Legislative Day in New Hampshire

*April 11, 1991
NESACS in Concord, NH*

Deglazing the Greenhouse

*Charles E. Kolb's 3rd environmental column
on the greenhouse effect*

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Cover: *Esselen Award recipients Jerrold Meinwald (Flute) and Thomas Eisner (Harpsichord) in harmony. (Photo by C. Harrington, Cornell Univ. Photo)*

Deadlines: *Summer issue: June 20, 1991*

THE NUCLEUS

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



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Editor: Arno Heyn, 21 Alexander Rd., Newton, MA 02161, Tel: 969-5712
Associate Editor: Myron Simon, 20 Somerset Rd., W. Newton, MA 02165, Tel: 332-5273
Board of Publications: Michael E. Strem (Chair), Joseph A. Lima, Catherine E. Costello
Business Manager: Russell F. McCann, 10 Bassett St., Foxborough, MA 02035, Tel: 543-2155
Advertising Manager: Vincent J. Gale, 56 Bartlett Island Way, Marshfield, MA 02050, Tel: 837-0424
Contributing Editors: Edward Atkinson, History of Chemistry, Book Reviews; Maryann Solstad, Health; Cynthia McGowan, Calendar.
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(Photo: Jet Commercial Photographers, Boston)

Russell T. Werby

Russell T. Werby, past Chairman of the Northeastern Section, passed away suddenly while on a vacation trip to Mexico on February 13, 1991.

Werby, a graduate of M.I.T., served as Captain in the U.S. Army Chemical Corps during World War II.

Werby took over Werby Laboratories established by his father. The laboratory, located on Broad Street in Boston, was an analytical laboratory for government, industry, food services and academic research. It also functioned as the New England resource lab for organic and inorganic analysis.

Werby was very active in Northeastern Section affairs and served in a number of elective and appointive positions. He was a Section Trustee, Chairman of the Professional Relations Committee and co-chaired the outstanding television series with the late Arnett Powell. He served as Chairman of the Section in 1970. He also was a member of the national ACS Professional Relations Committee.

Werby acted as advisor and counselor to cooperative students at Northeastern University as well as to other students where his wise counsel encouraged many to continue in chemistry careers.

Werby also was a member of several singing groups and choral societies. For many years he was a Brookline Town Meeting member. ◇

Letters to the Editor

More on Popcorn Chemistry: Responses from two former members of the ACS Committee on Safety and the Division on Chemical Health and Safety, respectively.

Dear Sir:

This letter is in response to the letters of Drs. Tanner and Kaufman, February, 1991, p.5-6, vis-a-vis Mr. Gleekman's use of the popcorn experiment in his high school class in which the students ate the popcorn they had made at the end of the experiment. Their objection was that "no food should ever be eaten in the laboratory".

Safety is a thinking process! Before any experiment is begun each step and stage of the reaction must be considered from the safety standpoint. Only after this process has been carried out and appropriate counter-measures for perceived hazards have been adopted should the experiment be undertaken. Mr. Gleekman had considered safety aspects of every stage of the popcorn experiment - cleanliness, apparatus, and reactions. He had discussed them with the class. Thus, the class had run the experiment safely and learned about safety principles and their applications as well.

Ernest I. Becker

Dr. Becker was on the Committee on Safety 1963-73.

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Dear Sir:

Your distinguished colleague and fellow Northeastern Section member, Ernest Becker, has called my attention to the popcorn exchange in the February issue of *The Nucleus*. Perhaps you will permit the addition of these comments:

It is certainly proper to refer to the safety rule - No eating in the chem lab - as Drs. Tanner and Kaufman affirm. But it is also appropriate to consider the foundation of all safety rules - Compare risks and benefits.

Ordinarily, such a comparison comes down on the side of "No popcorn eating in the lab." However, I know a little bit of Mr. Gleekman's reputation for excellence and creativity in chemistry teaching, as well as his attention to safety matters in the chem lab. Further, it is possible in principle to so improve the pedagogical benefits of the lab study of popcorn chemistry and at the same time to minimize the risks such that the comparison would then come down on the side of "It's OK to eat that popcorn in the chem lab."

Even lab safety has some gray areas; thank goodness it's not all black and white.

Sincerely yours,

Jay A. Young

Dr. Young is a consultant to the A.C.S. Joint Board-Council Committee on Chemical Safety and has been a Chairman of the Division of Chemical Health and Safety. ◇

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April Meeting

The 733rd Meeting of the Northeastern Section of the American Chemical Society

The Esselen Award Meeting

Thursday, April 4, 1991
Harvard University Faculty Club
20 Quincy Street, Cambridge, MA

5:30 p.m. Social Hour

6:15 p.m. Dinner

Harvard University Science Center
1 Oxford Street, Cambridge, MA, Lecture Room B

8:15 p.m. Convening of the Award Meeting - Charles E. Kolb, Jr.

Gustavus J. Esselen - Arthur S. Obermayer

The Esselen Award - William O. Foye

Thomas Eisner - Arthur S. Obermayer

Jerrold Meinwald - Myron Simon

Presentation of the Gustavus John Esselen Award to Professors

Meinwald and Eisner - Gustavus J. Esselen III

Award Address *Insect and Human Welfare* - Jerrold Meinwald and

Thomas Eisner

A reception with refreshments will follow the program.

Dinner reservations should be made no later than March 29. Please call Mrs. Karen Piper at (508) 456-8227 or (800) 872-2054. Reservations not cancelled at least 24 hours in advance must be paid. Members, \$21.00; Non-members, \$23.00; Students and Retired Chemists, \$8.00.

THE PUBLIC IS INVITED.

Next Meeting: May 9, 1991 at the Sheraton Tara in Newton Corner: Chemistry Education Meeting. Prof. Dudley R. Herschbach of Harvard University will speak on "Imaginary Gardens and Real Toads".

Abstract

Insect Chemistry and Human Welfare

As "natural products" chemists, and particularly as experts in chemical communication and defense, insects take close to top honors. Their defensive compounds may be as simple as hydrogen cyanide or formic acid, or as complex as the steroidal pyrones found in fireflies. Their signaling agents are no less diverse. An intriguing example will be presented, involving an insect that uses a plant alkaloid and its metabolite for defense, offspring care, and as a criterion for sexual selection.

Chemical ecological insights gained from studies of insects have potential value in fields as diverse as medicine, agriculture, and conservation. ◇

Biographies

Jerrold Meinwald

Jerrold Meinwald has been Goldwin Smith Professor of Chemistry at Cornell University since 1980 where he has spent virtually his entire professional career, beginning as Instructor in 1952. He received bachelor's degrees from the University of Chicago and a Ph.D. under R.B. Woodward at Harvard in 1952.

His research has spanned many topics, including photochemistry, small-ring chemistry and molecular rearrangement mechanisms, as well as the isolation, characterization, synthesis and biosynthesis of natural products and recently, the stereochemistry of anesthetics. His best known work on insect chemical ecology stems from thirty years of close collaboration with his good friend and Cornell colleague Thomas Eisner. Since 1989 Meinwald has offered a new course "Molecular Messengers in Nature" at Cornell, aimed chiefly at introducing non-science majors to the fundamentals of chemistry through an analysis of chemical communication with examples from microbes to mammals.

Meinwald has published widely and lectured world-wide in universities and other science centers. He has received numerous awards and distinctions. He is on a number of editorial boards and advisory committees and is an elected member of the National Academy of Science and the American Academy of Arts and Sciences.

Currently he is on sabbatical leave at Stanford University at the Center for Advanced Study in the Behavioral Sciences.

An enthusiastic amateur musician, he plays the flute in chamber music performances. ◇

Thomas Eisner

Thomas Eisner received a B.A. and Ph.D. in biology from Harvard in 1955. After being a Research Associate at Harvard he was appointed as Assistant Professor at Cornell in 1957. Currently he holds the Jacob Gould Schumann professorship of Biology at Cornell University.

His research interests are in animal chemical ecology, evolution and behavior and the chemical language of insects. He has published 5 books and over 200 papers. He is a member of the National Academy of Science and the American Academy of Arts and Sciences, as well as numerous other organizations.

(continued on page 14)

Health and Safety on My Mind

by M.A. Solstad

Those chemists headed down to the Atlanta meeting, and wanting to separate out the chaff in the harvest of claims about chemical carcinogenicity/teratogenicity, should try to catch Monday's session of the Division of Chemical Health and Safety meeting in the Congress Center.

Dr. Thomas Mark, of Upjohn, the session chair, states:

"Since chemists are more apt to be exposed to chemicals on a regular basis, it appears logical that such people should be aware of the present state of knowledge in the areas of carcinogenicity and teratogenicity. Therefore, the aim of this symposium is to educate; hopefully as a result, the participant will be better able to separate fact from conjecture. The participant should come away with a broad understanding of the areas of carcinogenicity and teratogenicity. He/she will learn how toxicologists assess whether or not a chemical has the potential of being a threat in these areas, and as a result should have a better understanding of how such risks have often been exaggerated. Accurate information in the areas of carcinogenicity and teratogenicity will be presented in an effort to show how one can better assess the relative risks involved in work/home exposures to chemicals. The information given should lead to a better understanding of how society perceives risk, which in turn should enable one to better appraise the situation when confronted with information that often leads to chemophobia.

Every effort will be made to keep this "educational symposium" at a level understandable to people who are not well versed in these areas. General information will be given by seven highly respected experts in their

Historical Notes

by Edward R. Atkinson, Amherst, MA.

Recent obituaries, part II

Helen S. Jones, 87, a lifelong resident of Melrose, died on October 15, 1990. She was a physics graduate of Simmons College in 1923 and became one of the first women employed at the General Electric chemistry laboratory in Lynn. She received the Ph.D. in biochemistry from the University of Toronto in 1930, then was employed in research at the Massachusetts General Hospital, the Shriners Burns Institute, and the Harvard Medical School until retiring in 1980. During the last 10 years of her life she spent 4000 hours of volunteer work in the MGH laboratories; a pediatric research fund was established in her memory. As a Simmons undergraduate and a member of The Skating Club of Boston, Mrs. Jones was National Junior Ladies Figure Skating Champion in 1922.

Edward E. Langenau, 75, died at New London, N.H. on February 23, 1990. A Brooklyn native, he received the B.S. in chemistry from Harvard in 1935, then was employed for 38 years by Fritzsche, Dodge and Olcott of New York City where he became an authority on the manufacture of essential oils, es-

pective areas and will include scientists from academia and government, as well as industry. *In vitro* as well as *in vivo* assays, routinely employed to assess carcinogenicity, mutagenicity, or teratogenicity, will be outlined. Embryonic/fetal development and risk assessment methods also will be summarized, as will cancer and birth defects disinformation. Every effort will be made to dispel many of the myths associated with cancer and birth defects, while giving a broad overview of these areas. As the result, even people well versed in such field should come away with a better understanding of these highly controversial areas." ♦

sences and perfumes. He was a contributor to E.S. Guenther's "The Essential Oils." At the time of his retirement in 1974 Mr. Langenau was vice president and technical director of the company. At Harvard he was a champion intercollegiate fencer and remained a member of the Friends of Harvard Fencing throughout his life. A longtime resident of Wilmot and Wyckoff, N.J., he came to New London in 1985.

Norman D. Loud, 78, died on August 8, 1990 while visiting a daughter in Houston, Texas. He was a native of Weymouth, Mass. and lived in that town most of his life. He was a non-degree member of the class of 1933 in chemical engineering at M.I.T. After teaching appointments at Wellesley High School and Clarkson College he received the Ed.D. degree from Boston University in the late 1940s, then taught chemistry and physics at Weymouth High School until retiring to Florida in 1970.

Howard O. McMahon, 75, retired president of Arthur D. Little, Inc., died on August 5, 1990. He was a native of Alberta, Canada, and received the B.A. (1935) and M.A. (1937) degrees from the University of British Columbia and the Ph.D. in physical chemistry from M.I.T. in 1941. In 1943 he joined the staff at ADL where he carried out research in low temperature physics and chemistry and served as president in the 1964-1977 years, succeeding Gen. James M. Gavin.

During his graduate work at M.I.T. McMahon became associated with Samuel C. Collins who at the time was developing the first helium cryostat, a device that has since 1963 been enshrined in the Smithsonian. When McMahon went to ADL he continued his association with Collins and marketed the famous ADL-Collins Helium Cryostat in 1948. The machine was simpler and more efficient than anything available previously and was a great commercial success. McMahon's continuing research led to the founding of a subsidiary of ADL, now known as Helix Technology Corporation, 70% of

continued on page 16

Legislative Day

Hall of Flags, N.H. State House

Thursday, April 11, 1991

11:00am - 2:00pm

The following activities have been planned:

Hands-on chemical demonstrations.
Display of recent activities of the Northeastern Section.

Meeting with Government Affairs Specialist from the National ACS office.

Dr. Robert Harriss, environmental chemist from the Institute for the Study of Earth, Oceans and Space at UNH, will speak at 12:30pm on "Chemical Aspects of Environmental Change." He will also provide an exhibit of his current research.

All NESACS members, especially

(continued on page 14)

Consulting Chemists Group

Open Meeting

April 23, 1991 7:00 p.m.
Simmons College, 300 The Fenway
Science Bldg., Room S-183
Dr. Steve Fine will speak on:
"FineChem Associates...The Evolution of a New Consulting Business"

Dinner available at 5:00 at a nearby restaurant. For information about the meeting or for dinner reservation call Debra Saez (508) 521-1327 by April 19.

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Membership in the Professional Consulting Chemists Group is open to members of the American Chemical Society. Yearly dues are \$ 30.00, payable now for the 1990-1991 season and due on October 1 for the 1991-1992 season. Membership privileges include invitations to special events not open to non-members, and reduced costs for attendance at functions, workshops and networking events. Make membership checks payable to "Debra J. Saez/P.C.C. Group" and send them to Dr. Saez at 9 Bartlett St., Suite 11, Andover, MA 01810.

Individuals are still needed for positions of Recording Secretary and President-Elect of the Group. **Work done by officers will be kept minimal.** If you are interested to get in on the policy-making level of the Group, contact Debra Saez at (508)521-1327.

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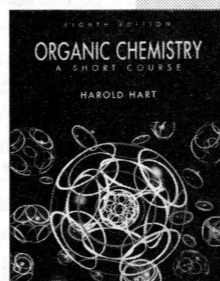
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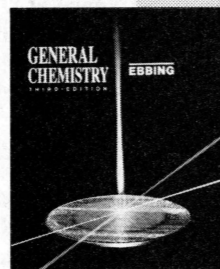


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Professional Relations Column

Myron S. Simon, Chairman,
Professional Relations
Committee

A hot issue is brewing in the halls of the ACS.

If you have been reading the ACS Comment columns in C&EN by Don Berets (12/3/90) and John Connolly (2/18/91), 1990 chairmen of the ACS Council Committee on Professional Relations (CPR) and the Joint Committee on Economic Status (CES) respectively, you will realize that the Committee on Committees is expected to recommend a restructuring of ACS which would, among other things, abolish both of these committees in favor of a Society Committee on Professional Affairs. Other groups which would be included in this restructuring are the Board Committee on Professional and Member Relations and the Joint Committee on Professional Program Planning and Coordinating. A formal proposal may come at the spring meeting in Atlanta. An expected advantage to this action would be to give increased visibility and "clout" to the professional and economic interests of the Society's members.

As you might guess, not everyone is in favor of this restructuring. One argument against the proposed merger of activities is that a Society Committee will not be able to function as independently as the present set-up allows, and that certain actions of the CPR, such as monitoring employers' compliance with ACS guidelines in terminations, may be controversial enough to inhibit the action at the Society Committee (SC) level.

Would a SC be as sympathetic to issues faced by individual chemists since the committee, presumably, would attract executive level chemists to its membership?

(continued on page 10)

Symposium on Waste Management

Presented by the Northeastern Section Committee on Continuing Education

Saturday, April 27, 1991, Northeastern University, 360 Huntington Ave., Boston, MA, Room 129 Hurtig Hall

In recent times federal, state, and local authorities have issued a plethora of regulations creating a new environmental industry. These regulations affect today's chemist in laboratories small and large, in industrial production and research as well as in academia. This symposium is designed to give chemists a basic overview of the impacts and opportunities involved with environmental management.

Program:

8:30 – 8:55 a.m.	Registration and Coffee
8:55	Opening Remarks
9:00	Environmental Regulation – An Overview Kathy Doyle, Clean Harbors Environmental Services Cos. Basic regulations are now being applied to small laboratories, both commercial and academic. Federal, state, and local regulations will be considered.
10:00	Waste Minimization/Elimination William B. Dixon, Digital Equipment Corporation The best way to dispose of wastes is to eliminate their production in the first place. Examples will illustrate how this can be accomplished in waste water treatment systems.
11:00	Coffee Break
11:15	Disposal Technologies George L. Curtis, Clean Harbors Environmental Services Cos. The merits of on-site and off-site disposal will be presented, together with a discussion of the economic tradeoffs and the liabilities involved.
12:15	Lunch: A cold Deli-Buffer will be provided.
1:15	Topic to be selected from the following: <i>Basics of Emergency Response/Toxic Use Reduction in Commercial Industry/Laboratory Chemical Disposal Options</i> Speaker to be announced
2:15	Panel Discussion (bring your questions) The panel will address the likely future for waste management.
3:15	Closing Remarks

Registration Fees:

A.C.S. Members.....	\$60.00
Non-A.C.S. Members	\$75.00
Retirees, Students, High School Teachers	\$10.00
High School students accompanied by their teacher	free

For further information contact: Prof. Alfred Viola – (617) 437-2809

Advanced Registration Required by April 15, 1991 – use form below:

Registration form for SYMPOSIUM ON WASTE MANAGEMENT

Name: _____ Tel.: _____

Address: _____

Mail with remittance to: Prof. Alfred Viola, Chair
NESACS Continuing Education Committee
Department of Chemistry, Northeastern University
Boston, MA 02115

Professional Relations Column

continued from page 9

Will a SC have the success that the presently constituted committees have had in attracting volunteers to work on issues of importance to the individual ACS member?

The suggested change could sharply focus the Society's activities in professional relations, helping the Society do a better job for its members. Overlap and misunderstandings and costs could be reduced and timetables for action significantly improved.

SC members may be chosen from a wider pool: Council Committees can only be made up of councillors while a Society Committee can include any ACS member. A more rigorous standard for effectiveness could be applied in selecting SC members.

Judging from past history, this issue will be kicked around from meeting to meeting before any final vote will be taken, although the subject will be discussed at the Atlanta meeting

this month. At the earliest, a vote on bylaw amendments could be taken by the Council in the fall. I hope that you will read the cited ACS Comments and will follow this in future C&EN reports because one of the most important aspects of ACS to the individual chemist is the often unseen work it does in professional relations. Do let your councillor know how you feel about this issue. ◇

Board of Directors

Annual Meeting, January 3, 1991

by Michael Hearn, Secretary

E.J. Billo chaired the Annual Meeting of the Board.

Officers' Reports: Annual reports of the Chairman and Secretary were received. The Treasurer reported that

there was \$ 5,170 on hand at the end of 1980, compared to \$ 253 at the start of 1990. The detailed reports are available through the Section Office.

Committee Reports: Annual reports of the respective chairs of the Section's standing and special committees were received and are available for inspection through the Section Office.

It was VOTED to recess the meeting to be reconvened at a future date for receiving the Auditor's report.

Board Meeting, January 3, 1991

C. Kolb assumed the chair.

Officers' Reports:

Chairman: C. Kolb shared his thoughts of goals for the Section: Growing out of the recommendations of the Long-Range Planning Committee, the implementation of an Education Task Force "to design and implement a series of chemistry lessons and demonstrations which will be presented on a regular basis by Section members in the elementary and sec-

ondary schools..." in the area of the Section. He raised questions about the interaction of such a Task Force with other components of the Section. The second goal is for the Section to get environmental information of a positive sort to the general public such as "the role chemical professionals should play in their (i.e. environmental problems') definition, mitigation and prevention".

Treasurer: J. Piper provided the status of current funds of the Section. The cash position is sound. He also distributed a draft proposal for the 1991 budget, to be acted on at the February board meeting.

Committee Reports:

Awards: W. Foye suggested a possible award for science teachers below the secondary school level.

Board of Publications: M. Strem named two major goals for 1991: (1) strong support for the staff and editor of *The NUCLEUS* to keep it financially and intellectually viable, and (2) to begin planning for a 1992 Section Directory.

Editor: A. Heyn stated that the February issue of the *NUCLEUS* would be 24 pages and start the new environmental column with an article by C. Kolb.

Hospitality: A possible name change of the committee was discussed, but no action taken.

Membership: I. Hartman stated that it would be useful to give new members information about the Section Committees so that new members would feel encouraged to participate actively in the affairs of the Section.

Nominating will report in February.

Program: K. Stygall shared her thoughts on an afternoon in-laboratory session at the May meeting which is devoted to Chemistry Education. The September meeting will be at Bradford College on environmental chemistry and hopes to attract members from southern New Hampshire, especially nearby University of New Hampshire which has a strong environmental program. The October meeting is to be a night to

celebrate Nobel Award winners.

Professional Relations: M. Simon stated that job-help should be a major area for the committee. A second October meeting will again be dedicated to professional relations. J. Perkins suggested that several professional societies should cooperate to help our members through these difficult economic times

Public Relations: K. Stygall announced that there would be a spring reception for New Hampshire legislators.

Continuing Education: A. Viola mentioned the several programs planned for 1991. Much more work is needed before these programs will be realized and additional committee members are needed.

Legislative Affairs: Massachusetts has legislation in the works for making it easier for chemists to teach in public schools.

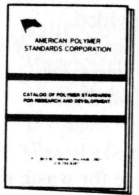
Safety: F. Wagner is the new chairman.

Speakers Bureau: M. Solstad inquired whether the board would ap-

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Environmental Chemistry

Deglazing the Atmospheric Greenhouse

by C.E. Kolb,
Center for Chemical and Environmental Physics
Aerodyne Research, Inc.

The temperature of the Earth's surface is determined by the balance between heating due to absorption of incoming solar radiation, which peaks in the visible portion of the electromagnetic spectrum, and radiative cooling of the surface due to infrared emission. The gaseous atmosphere is essentially transparent to incoming solar visible radiation, although condensed phase clouds and aerosol particles do scatter sunlight back into space. The gaseous atmosphere is not, however, transparent to key portions of the infrared spectrum; a number of trace atmospheric species have strong infrared absorption bands which cause the atmosphere to intercept a significant portion of the outgoing infrared radiation, returning some to the surface and reducing the amount lost to space. These infrared active trace gases thus function somewhat like the glazing in a greenhouse, passing incoming visible sunlight but partially trapping outgoing infrared.

This atmospheric "greenhouse effect" is very much in the current news. It was the major focus of the Second World Climate Conference held in Geneva, Switzerland last fall and is the central topic of the World Climate Convention which convened in Washington during February to start international negotiations on a treaty to

restrict atmospheric emissions of important infrared active trace gases. A major scientific assessment by a United Nations sponsored Intergovernment Panel on Climate Change (IPCC) has just been published in support of this international effort.

While it is a topic of current debate, the "greenhouse effect" is not a new issue, either as an environmental fact or a topic for scientific investigation. The most important greenhouse gas is water vapor, whose abundance in the lower atmosphere is controlled by the hydrological cycle. The second most important greenhouse gas is carbon dioxide (CO₂) which has both large natural and anthropogenic sources. Models indicate that natural levels of atmospheric water vapor and pre-industrial levels of CO₂ make the earth habitable, raising the global mean temperature to about +15°C rather than the -18°C estimated for an Earth whose atmosphere had no infrared radiative trapping or clouds.

The worry that industrial and other human activity may increase the level of infrared active gases, overheating the surface by giving us too much of a good thing, is not new. The famous Swedish physical chemist, Svante Arrhenius published a paper in 1896 where he both predicted that increased

levels of fossil fuel burning would raise atmospheric CO₂ levels and attempted to calculate the resulting increase in surface temperature.

Today we know that several atmospheric trace species, in addition to CO₂, play an important and growing role in the atmosphere's infrared radiation transport. These other greenhouse gases include methane (CH₄), nitrous oxide (N₂O), and various chlorofluorocarbons and chlorocarbons, most importantly CFC-11 (CFCl₃) and CFC-12 (CF₂Cl₂). The table shown below is adapted from the ICPP report and shows the current atmospheric levels of these key greenhouse gases, their pre-industrial levels determined from measurements of air trapped in glacial ice cores, their current rate of increase, and their atmospheric lifetime (the time an average molecule will stay in the atmosphere). Atmospheric chemical reactions and/or photodissociation control the chemical lifetimes of all but CO₂. The CO₂ lifetime is controlled by surface uptake by vegetation, soils and the oceans and is not precisely known.

Atmospheric models indicate that the growth in the gases summarized in the table have increased the mean global temperature by about 0.5°C since 1800 AD. Unfortunately, this small change would be very difficult to reliably measure given the natural variability in the earth's weather. However, the same models predict that the mean temperature will increase by a more easily measurable 2 to 5°C by the year 2100 AD if the rate of change of greenhouse gases is not slowed. Such a change in mean temperature may well have profound effects on the viability of vegetation, storm and rainfall patterns and many other natural phenomena.

All greenhouse gases are not equal, models indicate that about half of the currently calculated warming attributed to greenhouse gas increases is due to CO₂ and half to the other gases in the table. However, on a molecule-by-molecule basis, one CH₄ is responsible for about 25 times the initial warming due to one CO₂; furthermore, after its average twelve year lifetime the CH₄ will be oxidized to CO₂. This

difference in molecular "global warming potential" is due primarily to the fact that the atmosphere's CO₂ absorption bands are "optically thicker" than the other greenhouse gases' absorption bands. The less abundant molecules can increase the atmosphere's ability to absorb infrared radiation more easily than the more abundant molecules. The chlorofluorocarbons have very strong absorption bands in the 8 to 12 μm region where the atmosphere is very transparent, so they have very large global warming potentials. An insidious aspect of the greenhouse issue is caused by the long atmospheric lifetimes of the gases in the table; decades will elapse between a reduction in source emissions and a concomitant reduction in atmospheric content.

Atmospheric chemists and physicists are expending a lot of effort to determine what controls the growing trace gas levels documented in the table. We know carbon dioxide is increasing due to both higher fossil fuel use and increased burning of fields and forests for agriculture. Some atmospheric methane comes from sources associated with natural gas and petroleum production processes, natural gas distribution systems, and coal mining. Methane is also produced by anaerobic bacteria in landfills, rice paddies, natural wetlands, sewage treatment facilities, and the intestines of ruminants and termites. Nitrous oxide is produced in soils and water by bacteria processing both ammonium and nitrate. The chlorofluorocarbons are produced industrially; CFC-11 and CFC-12 are currently being phased out of production by international treaty, due to their impact on stratospheric ozone.

One other important potential greenhouse gas is ozone (O₃). Unlike the gases in the table, ozone is not released into the atmosphere, but is produced in situ by photochemical processes. Current measurements indicate ozone is increasing near the surface over Europe and North America at a rate of 1 to 3% per year. Historical records indicate that average ozone levels in Europe were at least a factor of two lower a hundred years ago. The topics of increasing photochemically

The Secondary School Teacher's Column

The Microscale Laboratory

by Reen D. Gibb

Interest has recently focussed on microscale experiments in place of the conventional experiments we have long been doing in the high school laboratory. Lab experiments are a very important part of the student's chemistry education and often their favorite part. Due to safety concerns, disposal concerns, time and money limitations, many teachers find themselves cutting back on the number of labs they do. Microscale experiments address many of these concerns.

Microtechniques involve "Beral pipettes" instead of burets. Beral pipettes resemble medicine droppers and contain only a few millimeters of the reagents. One can save the Beral pipettes with the solutions inside them from year to year. The amount of reagent solution used is determined by weighing the pipette before and after delivery of the reagent.

Reaction plates comprising many thimble-shaped reaction wells in a slab of plastic replace beakers and test tubes.

produced ozone in the lower atmosphere and a decreasing stratospheric ozone layer will be the subject of future columns.

Several individual scientists and research groups located in the Northeastern Section have made significant contributions to our understanding of greenhouse gases. These include Steven Wofsy of Harvard University and Robert Harriss of the University of New Hampshire who made key inputs to the recent IPCC report. Their research groups have led in efforts to quantify global sources and sinks of atmospheric methane and nitrous oxide. Recent efforts at Harvard and UNH to quantify methane fluxes have utilized a novel, highly sensitive real-time methane measurement instrument

continued on page 14

This equipment can be reused and is relatively inexpensive. Because very small amounts of the reagents are employed the cost of the chemicals and the time to prepare the reagents are greatly reduced.

The students usually like microscale experiments because they are much faster to do than their conventional counterparts and the student has time to repeat a procedure should the results be unsatisfactory. These lab experiments take less space per student and storage space in the stockroom is reduced.

Microscale laboratory experiments are safer to do since the amounts of potentially harmful chemicals at each lab station are smaller. Much less chemical waste is produced resulting in a great saving in disposal costs.

A single milligram digital balance with tare is sufficient for an entire class of twelve laboratory groups. Students weigh the Beral pipets supported in a small beaker or wire holder before and after titration. A centigram balance can also be used but accuracy will of course be reduced. Concentrations are based on mass of solution rather than volume and are expressed in moles of solute per gram of solution, rather than moles of solute per liter of solution. This concept needs to be addressed with the students before they begin the lab, since this concentration expression is not covered in most high school textbooks. Stir the solutions by vibrating the plastic plates or simply stirring with toothpicks.

An easy, nonquantitative lab to begin microscale experiments is the identification of six unknown solutions by their precipitation behaviors and color. Each student group receives six Beral pipets labelled one through six filled with six different unknowns. The stu-

continued on page 14

Key Greenhouse Gases Affected By Human Activity

	CO ₂	CH ₄	N ₂ O	CFC-11	CFC-12
Current Concentration (parts per million/volume)	353	1.72	0.310	2.80 x 10 ⁻⁴	4.84 x 10 ⁻⁴
Pre-industrial Concentration (ppmv - 1750-1800 AD)	280	0.8	0.288	0	0
Current Rate of Change (% per year)	0.5	0.9	0.25	4	4
Atmospheric Lifetimes (years)	50-200	12	150	65	130

Biographies

continued from page 5

He has received honorary degrees from the University of Würzburg, the University of Zürich and the University of Göteborg and many awards and distinctions both in the USA and abroad.

He has written and presented a nature film "Secret Weapons", produced by the BBC, for which he has received several awards.

He is also actively interested in conservation and is an advisor or consultant to the World Environment and Resources Program of the MacArthur Foundation, the Committee of Concerned Scientists, the World Resources Institute and other organizations. As this month's cover shows, he is an enthusiastic amateur harpsichordist. ◇

Legislative Day

continued from page 7

the New Hampshire members, are encouraged to attend and support this event. This is a unique opportunity for chemists to meet informally with N.H. legislators and to offer technical and scientific expertise for any legislative issues. New Hampshire's legislature will be considering several bills this session which have chemistry implications. Legislators must be well informed to act on these and other chemistry-related issues. Our support and assistance will promote good public relations.

For additional information call Beth Duston, (NESACS Legislative Chair) at Information Strategists, Manchester, N.H. (603) 624-8208. ◇

Board of Directors

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prove videotaping one of the speakers who is an especially good one, but unable to travel outside of greater Boston. The board asked for more details and a cost estimate.

Consultants Group: D. Saez stated that the group is growing. Workshops such as on writing contracts are planned. A newsletter for the group is being considered.

New Business: It was MOVED and VOTED to thank Past Chairman E.J. Billo for a successful 1990 operating year. ◇

Environmental Chemistry

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developed by Paul Keabian and Barry McManus of Aerodyne Research, Inc. Ronald Prinn's group at MIT has taken a lead role in measuring and analyzing global distributions and trends of chlorofluorocarbons and nitrous oxide. Finally, scientists at Atmospheric and Environmental Research, Inc. in Cambridge have played an important role in determining the global warming potential of greenhouse gases other than carbon dioxide.

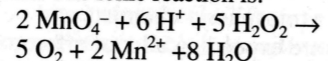
C.E. Kolb is president of Aerodyne Research, Inc. and chairman of the National Research Council's Committee on Atmospheric Chemistry. ◇

The Secondary School Teacher's Column

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dent then use the reaction plates to carry out the mixings (1-2 drops per mix), record their results, and then identify the solutions. A possible set of solutions would be: K_2CrO_4 , $AgNO_3$, $BaCl_2$, $CaCl_2$, KNO_3 , $(NH_4)_2CO_3$.

Another introductory laboratory would be the quantitative determination of percent hydrogen peroxide in a solution by microscale titration. The "3% H_2O_2 " commercial antiseptic solution can be used as an unknown. The amount of H_2O_2 is determined by titrating it with a known solution of potassium permanganate. The ionic reaction is:



A convenient standard permanganate solution can be made using 0.70g potassium permanganate in 80ml distilled water (ca 5.48×10^{-5} mole/gram of solution). By using the stoichiometry of the reaction and the amounts of potassium permanganate solution and hydrogen peroxide solution used, one can calculate the percent of hydrogen peroxide. Students should fill one Beral pipet with the unknown H_2O_2 solution and a second Beral pipet with the deep red-purple $KMnO_4$ solution. Weigh each pipet and record. Add 10 drops of the hydrogen peroxide solution to a small test tube, add an equal volume of 3M H_2SO_4 to the test tube and then begin adding the potassium permanganate solution dropwise until a faint pink color persists. Weigh each pipet again, record values and calculate the amount of each solution used.

These are but two examples of some common high school labs that can be microscaled. I suggest you microscale some of your favorite labs. The speed of some reactions may be different on the microscale. Avoid experiments where the conventional version requires weighing the solid precipitate product.

Reen D. Gibb teaches at Brookline High School. She was elected to the Aula Laudis Honor Society for Exemplary Teaching of chemistry and has won the Northeast Regional Award for chemistry teaching. ◇

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Historical Notes

continued from page 6

whose revenues are based on McMahon inventions. To honor McMahon, Helix in 1988 sponsored the establishment of the Howard O. McMahon Fund to support physical chemistry at the Institute in the form of fellowships, new equipment, and seed research support.

During his career McMahon received the Longstreth Medal of the Franklin Institute (1951), the Frank Forrest Award of the American Ceramics Society (1952), and the S.C. Collins Award of the Cryogenic Engineering Conference (1979). In 1969 he played a leading role in efforts of the AAAS to organize discussions among scientists, students, and the public on the social and political implications of science. He was president of the Greater Boston Youth Symphony Orchestra. His 22 patents included one (granted during his undergraduate years) for bubbling Christmas tree lights. In his early days at ADL he was also known as the occupant of the only office at Acorn Park that was air conditioned, a self-supplied service derived from his interest in cryogenics.

Elizabeth M. Pillion, 69, died on June 8, 1990. She was a native of Lawrence, Mass. and received the B.A. degree in chemistry from Trinity College, Washington, D.C. Until 1976 Mrs. Pillion was employed as a research chemist at the U.S. Army Natick laboratories.

to be continued

Calendar

For additional information, call:

Boston University – (617)353-2500
Harvard University (Chemistry) –
(617)495-4076
Tufts University – (617)381-3441
Tufts University Health Sciences
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Tuesday, April 2

Dr. Christopher Miller (Brandeis)
“Structure and Function of Potassium Channels”
Tufts University Health Sciences Campus
DeBlois Auditorium A at 4:00 pm

Monday, April 8

Prof. Myron Rosenblum (Brandeis)
“Synthesis, Structure, and Properties of Structurally-Constrained Stacked Metallocenes”
Boston University
Science Center Auditorium, SCI 107
at 4:00 pm

Tuesday, April 9

Dr. Warner Greene (Duke U.)
“Transcriptional Regulation by Human Immunodeficiency Virus”
Tufts University Health Sciences Campus
DeBlois Auditorium A at 4:00 pm

Monday, April 15

Professor Peter G. Schultz (U. of California, Berkeley)
“New Opportunities at the Interface of Chemistry and Biology”
Harvard University
Mb-23 at 4:15 pm

Tuesday, April 16

Prof. Phyllis R. Brown (U.R.I.)
“HPLC Techniques for Biochemistry and Biotechnology”
Tufts University
Pearson Memorial Laboratory, Room 104
at 4:00 pm

Monday, April 22

Professor John Brauman (Stanford)
“Rates and Mechanisms of Gas-Phase Ionic Reactions”
Harvard University
Mb-23 at 4:15 pm

Prof. Peter Jacobi (Wesleyan)
“Linear Tetrappyrroles: Nature’s Light Harvesting Chromophores”
Boston University
Science Center Auditorium, SCI 107
at 4:00 pm

Tuesday, April 23

Dr. Darren Toohey (Harvard)
“Atmospheric Chemical Measurements: The Role of Airplanes and Balloons in the Satellite Age”
Tufts University
Pearson Memorial Laboratory, Room 104
at 4:00 pm

Dr. Alan Frankel (Whitehead Institute)
“Trans-activation by Human Immunodeficiency Virus TAT Protein”
Tufts University Health Sciences Campus
DeBlois Auditorium A at 4:00 pm

Notices for the Nucleus Calendar should be sent to:

Cynthia McGowan
Department of Chemistry
Wellesley College
Wellesley, MA 02181
(617)235-0320 x3112 Fax (617) 237-1571
(Note: Material should be sent so that it arrives before August 19 for the October issue. There will not be a calendar in the summer issue.)

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