FOUNDED 1898
NORTHEASTERN SECTION • AMERICAN CHEMICAL SOCIETY
NESACS

# THE NUCLEUS

*90th Anniversary Issue of The NUCLEUS*

*January 2012* *Vol. XC, No. 5*

## Monthly Meeting

***2008 Nobel Laureate, Osamu Shimomura, to speak at Pfizer, Inc., Cambridge, MA***
***The Discovery of the Green Fluorescent Protein GFP***

## 2012 Chair's Statement

***By Ruth Tanner***

## National Chemistry Week

***By Christine Jaworek-Lopes with photos by Morton Z. Hoffman***

## Summer Scholar Report

***Activation of β-amidoaldeydes Toward Diastereoselective Nucleophilic Addition***
***By Shoshana Bachman and David Haines, Wellesley College***

# From the New Chair

**By Ruth Tanner, 2012 NESACS Chair, Ruth_Tanner@uml.edu**

The "ACS is a congressionally chartered independent membership organization which represents professionals in all fields of chemistry and sciences that involve chemistry at all degree levels". Currently, there are over 162,000 members, of whom approximately 7,300 are in the Northeastern Section of the ACS (NESACS), which is presently the largest ACS Section. It is an honor to have been elected as the Chair of this Section for 2012 and to have served as the Chair-Elect and Program Chair in 2011.

It is likely that the main reasons you joined the ACS were to have access to journals (before access was available online) and to connect with other chemists and to other scientists in related fields. The ACS connects you nationally and globally to members of your profession. The programs and activities of your local Section mirror those of the national organization and bring those connections to your local area and provide a forum for networking and collaboration in your geographical area.

In conjunction with this collaboration, the Northeastern Section promotes industrial and academic research, scientific entrepreneurship, high standards of education, student and young chemist activities, career services, government relations, and professional ethics, among others. It provides you the opportunity to actively engage in all of these areas through its monthly meetings and its committee network.

In addition, the Section sponsors national and local awards to honor outstanding chemists and chemistry educators. NESACS also sponsors grants and scholarships for students and faculty in support of research, travel and other activities. This award winning Section is very active, not only locally, but also has direct input into the program decisions and policies of the national organization.

What is your interest? Connect to the NESACS through the website http://nesacs.org for a complete listing of all of the program, committees, and activities of the Section. For upcoming events and activities, read *The Nucleus,* which is available monthly by mail, by PDF format on the website, or by email via a request form on the website.

In addition, you can join a NESACS discussion group and get updates on the Section's activities at the NESACS LinkedIn® network, which can also be accessed through a

*continued on page 11*

# Contents



**Cover:** *January speaker, 2008 Nobel Laureate, Osamu Shimomura, Professor Emeritus, Marine Biological Laboratory, Woods Hole Oceanographic Institute, Woods Hole, MA (Photo courtesy of Dr. Shimomura).*

**Deadlines:** *March 2012 Issue: January 15, 2012*
*April 2012 Issue: February 15, 2012*

THE NUCLEUS

***90th Anniversary Issue of The NUCLEUS***

*The Nucleus is published monthly, except June and August, by the Northeastern Section of the American Chemical Society, Inc. 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:* | Michael P. Filosa, Ph.D., ZINK Imaging, Inc., 16 Crosby Drive, Building 4G, Bedford, MA 01730 Email: Michael.filosa(at)zink.com; Tel: 508-843-9070 |
| *Associate Editors:* | Myron S. Simon, 20 Somerset Rd., W. Newton, MA 02465, Tel: 617-332-5273, Sheila E Rodman, Konarka Technologies, Inc., 116 John St. Suite 12, Lowell, MA 01852 Email: srodman(at)konarka.com tel 978-569-1414, Mindy Levine, 516-697-9688, mindy.levine(at)gmail.com |
| *Board of Publications:* | Mary Mahaney (Chair), Mindy Levine, Vivian K. Walworth |
| *Business Manager:* | Karen Piper, 19 Mill Rd., Harvard, MA 01451, Tel: 978-456-8622 |
| *Advertising Manager:* | Vincent J. Gale, P.O. Box 1150, Marshfield, MA 02050, Email: Manager-vincegale(at)mboservices.net; Tel: 781-837-0424 |
| *Contributing Editors:* | Morton Hoffman, Feature Editor; Dennis Sardella, Book Reviews |
| *Calendar Coordinator:* | Sheila Rodman, email: srodman(at)konarka.com |
| *Photographers:* | Morton Z. Hoffman and James Phillips |
| *Proofreaders:* | Donald O. Rickter, Vivian K. Walworth, Mindy Levine |
| *Webmaster:* | Roy Hagen |

# National Chemistry Week

***The Northeastern Section: Chemistry – Your Health, Your Future***

By Christine Jaworek-Lopes

In preparation for National Chemistry Week 2011, a volunteer preparation day was held at Museum of Science-Boston on Sunday, October 21, 2011. More than 20 individuals attended this event, which allowed volunteers to practice the hands-on activities and demonstrations in advance of the October celebration.

On Sunday, October 23, 2011, the Northeastern Section of the American Chemical Society sponsored a National Chemistry Week 2011 Kick-Off Event at Museum of Science-Boston (MoS). Volunteers ensured that the more than 500 visitors to the daylong event enjoyed a number of hands-on activities. Among the highlights of the day were the two Phyllis A. Brauner Memorial lectures, presented by Dr. Bassam Shakhashiri, Professor of Chemistry at the University of Wisconsin-Madison. These captivating lectures were enjoyed by children and adults alike. Approximately 300 individuals attended these lectures. At these lectures, a Salutes to Excellence Award was presented by Bassam Shakhashiri, ACS President Elect, and Patrick Gordon, NESACS chair, to David Sittenfeld for his outstanding contributions to NCW. For the last several years, David has been instrumental in planning and organizing NCW events at the MoS-Boston.

Approximately 500 students attended the High School Science Series event at the MoS-Boston on October 27, 2011. The students were from 9 different schools in 7 different communities, including Boston, Cambridge, Malden, Abington, Pittsfield, Peabody and Tynsboro. These students participated in a number of hands-on activities and demonstrations related to the yearly theme and heard lecture demonstrations given by David Sittenfeld.

In addition, an NCW event was held at the Boston Children's Museum on Saturday, October 29, 2011. Approximately 300 individuals participated in NCW hands-on activities and demonstrations.

The activities and demonstrations that were performed throughout the week included: preparing your own hand sanitizer, learning how soap works, making UV bracelets, writing secret messages using goldenrod paper and ammonia, learning about mood lipsticks, isolating iron from cereal, and testing a variety of foodstuffs for starch and vitamin C.

Children, grades K-12, were able to participate in the national poster competition. Congratulations to Catherine Chen from Newman Elementary School for winning the 3rd-5th grade category and Emily Chen from William Pollard Middle School for winning the 6th-8th grade category.

Special thanks to the Boston Children's Museum, Alissa Daniels, Sharon Horrigan, Museum of Science-Boston, Northeastern Section of the American

*continued on page 13*

**Corporate Patrons**

**$2000 - or more**

AstraZeneca Pharmaceuticals
Eisai Pharmaceuticals
EMD Serono
Genzyme Corp.
Johnson Matthey
Merck & Co.
Novartis
Pfizer Inc.
Schering Corp.
Strem Chemicals, Inc.
Vertex Pharmaceuticals

**$1000-$1999**

Boehringer Ingelheim
GlaxoSmithKline
Irix Pharmaceuticals
Lyophilization Services of NE
Sundia Meditech
Yes Bank

**$300-$999**

Cambridge Major Labs
Girindus
Merrimack Consultants
Organix
PCI Synthesis
Sigma Aldrich
Waters Corp.
Wilmington PharmaTech

# Monthly Meeting

***The 920th Meeting of the Northeastern Section of the American Chemical Society***

**Thursday, January 12, 2012**

**Pfizer, Inc.**
T2003 Seminar Room, 200 Cambridgepark Drive, Cambridge, MA 02140
http://www.pfizer.com

**5:30 pm** Social Hour

**6:30 pm** Dinner

**7:45 pm** *Meeting*:
**Ruth Tanner,** NESACS Chair, Presiding
**Dr. Katherine L. Lee,** Pfizer, Presiding

*Welcome*
**Dr. Mark Bunnage,** Vice President, Head of Biotherapeutics Chemistry, Pfizer

*Speaker*
**Dr. Osamu Shimomura,** Professor Emeritus, Marine Biological Laboratory, Woods Hole; the 2008 Nobel Prize Laureate in Chemistry
**Title:** *The Discovery of the Green Fluorescent Protein GFP*

**Dinner Reservations should be made no later than 12:00 noon, Friday, January 6th. Reservations are to be made using PayPal services.** Use the following link to log on to PayPal. http://acssymposium.com/paypal.html. Select pay with credit or debit card option and follow the additional instructions on the page. Members, $30; Non-members, $35; Retirees, $18; Students, $10; Unemployed $10.
Reservations for new members only, and for additional information, contact the secretary, Anna Singer **between 9 am and 9 pm** at (phone/fax 781-272-1966) or secretary@nesacs.org. Reservations not canceled at least 24 hours in advance must be paid.

**THE PUBLIC IS INVITED**

**Directions to Pfizer:**

**By MBTA:** Take the Red Line to Alewife. Go to the end of Cambridge Park Drive (4 tenths of a mile). Enter the Lobby at 200 Cambridge Park Drive. Security will direct you to the appropriate location.

**Driving from Boston:** Take 93 North to second exit on Storrow Drive West. Continue on Storrow Drive West (~5 miles) to Route 2 (Fresh Pond Parkway). Continue on Route 2 (~2 miles) through the traffic circles. The road name changes to Alewife Brook Parkway. Continue over the bridge (past the shopping center) and take left at second set of lights (in front of large commuter parking garage) to Cambridge Park Drive.

**Parking Directions:**
At the end of Cambridge Park Drive, turn right (wide swing) when entering the cul-de-sac. Stop at the intercom and activate button to speak with Security. Security will direct you toward parking. ◇

# Abstract

***The discovery of the green fluorescent protein GFP***

The green fluorescent protein GFP contained a fluorophore within its primary peptide chain, differing from all previously known fluorescent proteins that are complexes of a protein and a fluorescent substance. Since GFP consists of a single peptide chain, it can be cloned and genetically produced in living organisms. Presently GFP and analogous fluorescent proteins are extensively used as protein markers in biological and medical research.

In my study of the bioluminescent jellyfish *Aequorea aequorea* in 1961, I was able to discover the photoprotein aequorin only after disregarding the luciferin-luciferase hypothesis that was commonly believed at the time. The photoprotein aequorin emitted blue light in the presence of calcium ions even in the complete absence of molecular oxygen.

During the purification of aequorin, I discovered a trace amount of GFP as a byproduct. GFP was a beautiful protein that emits emerald-green fluorescence, but it had no practical use at the time. Thus, my effort was focused on understanding the light-emitting mechanism of aequorin. Despite various technical difficulties encountered, and also the need for more than a half million jellyfish (over 10 tons) for the study, I reached a conclusion in 1978 that the functional chromophore of aequorin must be a peroxidized coelenterazine. This conclusion was confirmed in 2000 by X-ray crystallography.

Ever since the discovery of GFP, the nature of its fluorophore has been a matter of utmost interest. However, my initial efforts to extract the fluorescent moiety from GFP all failed, suggesting that the fluorophore might be covalently bound to the protein. Since the yield of GFP from the jellyfish, as a byproduct of aequorin, was very low (1-2 μg per specimen), I for many years saved and accumulated the minute amounts of GFP acquired dur-

*zcontinued on page 13*

# Biographies

**Mark Bunnage**
Head of Chemistry
Biotherapeutics
Research
Pfizer, Cambridge,
MA, USA
mark.bunnage@
pfizer.com

Mark studied chemistry at the University of Durham, graduating in 1990. Mark then undertook his postgraduate studies with Professor S. G. Davies at the University of Oxford. This was followed by a move to The Scripps Research Institute, La Jolla, California to work with Professor K C Nicolaou as a NATO post-doctoral fellow.

In 1996, Mark returned to the UK to join Pfizer as a medicinal chemist in their research laboratories in Sandwich, Kent. Over the past 15 years at Pfizer, Mark has had a number of roles of increasing responsibility and in November 2010 became Executive Director, Head of Medicinal Chemistry, Sandwich Laboratories. In April 2011, Mark was appointed Vice President, Head of Chemistry, Biotherapeutics Research at Pfizer and is now based in Cambridge, MA, USA.

Mark has broad interests in Drug Discovery, is an author or inventor on over 50 publications and patents, and is a member of the editorial board of MedChemComm.

## Osamu Shimomura

Osamu Shimomura was born in 1928 in Fukuchiyama near Kyoto, Japan, and raised in Sasebo, Northeastern China, and Osaka. In 1945, when he was a high school student, he witnessed the Nagasaki atomic bomb from a factory, in which he was working at the time, about 15 km from the epicenter of the blast.

In the aftermath of the war, he idled for nearly 3 years. In 1948, he was admitted into the Nagasaki College of Pharmacy, which had been destroyed by the atomic bomb and moved to a temporary campus near his home. In 1951 he graduated from the college and took a position of lab assistant under Prof. Shungo Yasunaga at the Pharmacy Department, Nagasaki University.

In 1955, Prof. Yasunaga sent Shimomura to the laboratory of Prof. Yoshimasa Hirata, Nagoya University, to do research on the bioluminescence of the ostracod *Cypridina* under the direction of Prof. Hirata. In 1956, Shimomura succeeded in the crystallization of *Cypridina* luciferin, a step crucial in the structural study of this luciferin which, due its extremely unstable nature, had been unsuccessfully pursued at Princeton University for nearly 20 years.

In 1960, Shimomura received his Ph.D. degree in organic chemistry from Nagoya University. He was then invited to work in the lab of Prof. Frank H. Johnson at Princeton University. In 1961, he discovered the photoprotein aequorin and the green fluorescent protein GFP.

In 1963, he was back in Japan as an Associate Professor at Nagoya University, but returned to Princeton in 1965 as a Senior Research Biochemist to continue his work on various bioluminescence systems.

In 1982, he moved to the Marine Biological Laboratory in Woods Hole, as a Senior Scientist with an adjunct professorship at Boston University, and remained there until his retirement in 2001. He was named Distinguished Scientist at the Marine Biological Laboratory in Woods Hole in 2008.

Throughout his active research career, Shimomura's study has been targeted on the chemical understanding of bioluminescence. He studied more than a dozen kinds of different luminescent organisms. His accomplishments include: structure determinations of the luciferins of the ostracod *Cypridina*, the limpet *Latia* and the krills; the discovery of coelenterazine that functions as the luciferins in various marine luminous organisms; the discovery of the green fluorescent protein, and the structure determination of its chromophore.

He received the Pearse Prize from the Royal Microscopical Society (2004), the Emile Chamot Award from the State Microscopical Society of Illinois (2005), the Asahi Prize from Asahi-Shinbun Cultural Foundation (2007), the Nobel Prize in Chemistry (2008), and the Order of Cultural Merits, Japan (2008). ◇

# Call for Nominations

### *The 2012 James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry*

**Deadline: April 15, 2012**

Nominations are invited for the 2012 James Flack Norris Award, which consists of a certificate and an honorarium of $3000, and is given annually by the Northeastern Section of the American Chemical Society (NESACS). The presentation will take place at a ceremony and dinner in November, 2012, and will include a formal address by the awardee. The award was established in 1950 by NESACS to honor the memory of James Flack Norris (1871-1940), a professor of chemistry at Simmons College and M.I.T., chair of NESACS in 1904, and ACS President in 1925-1926.

Nominees should have served with special distinction as teachers of chemistry at any level: secondary school, college, and/or graduate school. Since the presentation of the first award in 1951, awardees have included many eminent teachers at all levels, whose efforts have had a wide-ranging effect on chemical education. The recipient will be selected from an international list of nominees who have served with special distinction as teachers of chemistry with significant achievements.

A nomination in the form of a letter should focus on the candidate's contributions to, and effectiveness in, teaching chemistry. The nominee's curriculum vitae should be included and, where appropriate, a list of honors, awards and publications related to chemical education. Seconding letters may also be included: these should show the impact of the nominee's teaching on inspiring colleagues and students toward an active life in the chemical sciences and attest to the influence of the nominee's other activities in chemical education such as textbooks, journal articles or other professional activity at the local, national and international level.

The nomination materials should consist of the primary nomination letter, supporting letters, and the candidate's curriculum vitae. Reprints or other publications should NOT be included. The material should not exceed thirty (30) pages and should be submitted electronically in Adobe PDF format through **April 15, 2012** to Ms. Anna Singer, NESACS Administrative Secretary secretary@nesacs.org. For more information about the Award, see http://www.nesacs.org/awards_norris.html.

Questions about the award or the nomination process should be directed to the Chair of the Norris Award Committee, Dr. Jerry Jasinski, jjasinsk@keene.edu.

### *Philip L. Levins Memorial Prize*

**Deadline: March 1, 2012**

Nominations for the Philip L. Levins Memorial Prize for outstanding performance by a graduate student on the way to a career in chemical science should be sent to the Administrative Secretary of NESACS, 12 Corcoran Road, Burlington, MA 01803, by **March 1, 2012**.

The graduate student's research should be in the area of organic analytical chemistry and may include such areas of organic analytical chemistry as environmental analysis, biochemical analysis, or polymer analysis.

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

The award will be presented at the May 2012 Section Meeting. ◇

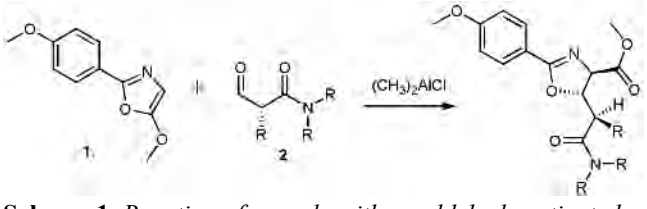
# Summer Scholar Report

## *Activation of β-amidoaldeydes Toward Diastereoselective Nucleophilic Addition*

Shoshana Bachman and David Haines, Department of Chemistry, Wellesley College, Wellesley, MA

**Background:**

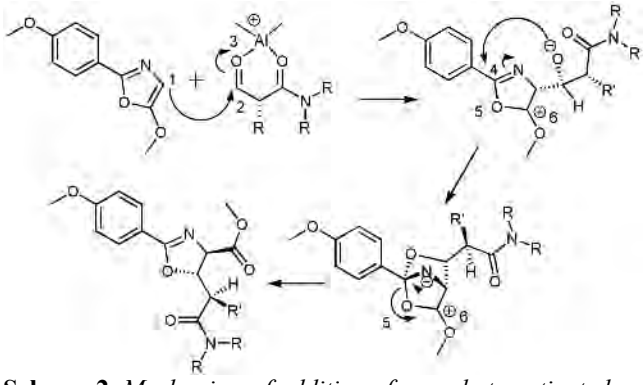
Our work on amino acid analogs, and the biological effects of their incorporation into biologically active species, has led us to investigate the preparation of a series of α-hydroxy amino acid analogs. While there are a variety of methodologies that allow the preparation of such species, we were intrigued by the application of metallic Lewis acids to the stereospecific addition of aldehydes to activated methoxyoxazoles. Some methods, such as Evans'[1] use of a salen-Al to catalyze the addition of benzaldehyde to 2-(4-methoxyphenyl)-5-methoxyoxazole, generate the stereoselectivity from the ligands attached to the metal. We, on the other hand, have studied the stereoselective addition of an aldehyde to an activated oxazole, using chirality within the aldehyde to generate high diastereoselectivity. Because chirality in a ligand may operate against the chirality of the aldehyde, and because the Evans salen-Al worked well for aromatic aldehydes, but not well for aliphatic aldehydes, we chose to begin our work with the achiral dimethylaluminum chloride. We have utilized the dialkyl aluminum catalyst for the addition of chiral amidoaldehydes to activated aryl oxazoles. The catalyst is a divalent Lewis acid, allowing it to complex to the bidentate amidoaldehyde and enforce conformational rigidity of the aldehyde. The reaction results in a diastereoselective addition to achieve an oxazoline product.




**Scheme 1.** *Reaction of oxazole with an aldehyde activated by an aluminum catalyst*

In the mechanism of the addition of the aldehyde to the oxazole (**Scheme 2**), carbon 1 acts as a nucleophile on aldehyde carbon 2, pushing electron density to oxygen 3 and leaving carbon 6 positively charged. The electron density from oxygen 3 attacks carbon 4, pushing the pi electrons toward the nitrogen. The pi electrons reform the double bond between carbon 4 and nitrogen, causing the bond between carbon 4 and oxygen 5 to break and forming a carbonyl between oxygen 5 and carbon 6. In this rearrangement, a new five membered ring is formed.

The aluminum catalyst is effective for the stereospecific addition of chiral amidoaldehydes to activated oxazoles because it is a divalent Lewis acid, thereby constraining the conformation of the bidentate amidoaldehyde and increasing the aldehyde's electrophilicity (**Figure 1**).[5,6] The aldehyde **2** may have variable R groups bonded to the amide nitrogen



**Scheme 2.** *Mechanism of addition of oxazole to activated aldehyde.*

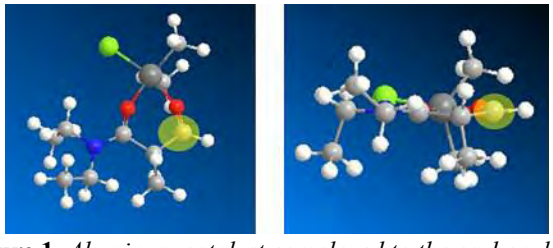
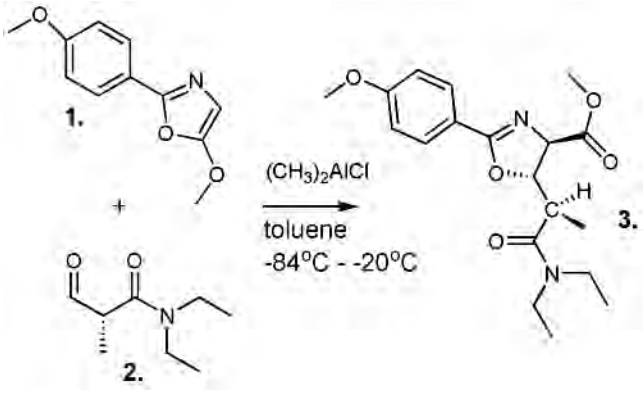


**Figure 1.** *Aluminum catalyst complexed to the carbonyls of the amidoaldehyde, with the spot of nucleophilic attack circled.*




**Scheme 3**. *Reaction of oxazole with aldehyde.*

that will be removed later in the synthesis, and either a hydrogen or methyl group can be bonded to the carbon alpha to both carbonyls.

**Synthetic Methods:**

All glassware was oven dried. The 2-(4-methoxyphenyl)-5-methoxyoxazole **1** (0.218 g, 0.001 moles, 1.0 eq) was dissolved in anhydrous toluene and the reaction flask was flushed with Ar. The mixture was cooled to -85° C, stirred

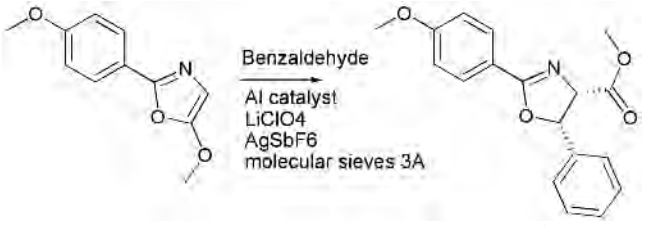
# Summer Scholar

*continued from page 8*

for 10 minutes, and $(CH_3)_2AlCl$ (0.135 mL, 0.134 g, 0.0015 mol, 1.5 eq) was added. 2R-N,N-diethyl-2-methyl-3-oxo-propionamide (0.15 g, 0.001 mol, 1.0 eq) was added in 2 mL toluene. The reaction was stirred and warmed to room temperature over 24 hours, after which MS showed the desired product. The product was purified by silica gel chromatography in 1:1 to 3:1 ethyl acetate:hexanes. $^1$H NMR (300 MHz, CDCl3) δ 6.89 (d, J=6.9 Hz, 2 H), 7.89 (d, J=6.9 Hz, 2 H), 5.15 (dd, J=6.6 Hz and J=7.8 Hz, 1 H), 4.74 (d, J=6.6 Hz, 1 H), 3.63-2.99 (series of complex multiplets, 11 H), 1.9-1.1 (series of multiplets, 9 H, 3 methyl groups).

**Results and Discussion:**

The addition of **1** to **2** generated a single adduct as seen by 'H NMR, demonstrating that the reaction was stereospecific. The relative stereochemistry of the two protons on the five-membered ring has not been fully elucidated, but can




**Scheme 4**. *Reaction of oxazole with benzaldehyde.*[1]

be predicted based on molecular modeling and a similar reaction done by Evans (**Scheme 4**).[6]

In the Evans reaction, a salen-aluminum catalyst was used to stereospecifically add benzaldehyde to the oxazole, resulting in the two protons on the five-membered ring being cis. The coupling constant for the two protons in our reaction of **1** and **2** is 6.6 Hz, while that of the two protons in the Evans reaction is 10.8 Hz. Based on the differing coupling constants, as well as modeling the interaction of **1** and **2**, we predict the stereochemistry of the two protons on the five-membered ring in our product to be trans. The results of this reaction suggest that the divalent nature of the catalyst and its ability to act as a Lewis acid are important to achieving stereospecificity.

This aluminum-catalyzed reaction results in the desired stereospecificity of the adduct, but in low yield, with the major side product being a result of interactions of the catalyst with aldehyde **2**. The methyl groups on the catalyst are fairly nucleophilic and react with the aldehyde to form 2R, 3?-N,N-diethyl-3-hydroxy-2-methylpropionamide: $^1$H NMR (300 MHz, CDCl3) δ 4.15 (d, 1 H, J=5.1, -OH), 3.81 (complex multiplet, 1 H, proton on alcohol carbon), 3.35 (4 H, overlapping -$CH_2$'s on nitrogen), 2.59 (doublet of quartets, 1 H, J=6.3 and J=5.1, proton alpha to carbonyl), 1.42-1.0 (series of doublets and triplets, 12 H, 4 methyl groups). The spectrum shows a clean doublet of quartets for the proton alpha to the carbonyl, which suggests that the reaction resulted in a single diastereomer. The coupling constant of 5.1 suggests that the two protons are either 60° or 120° from one another, based on the Karplus relationship.[7] The favored conformation of the aldehyde will change by 180° between the aluminum complexed aldehyde and the uncomplexed aldehyde, leading us to predict that nucleophilic attack in these two states would lead to differing diastereomers. Molecular modeling of the products of the addition of the methyl group to the amidoaldehyde in both the catalyst constrained conformation and the unconstrained conformation, shows that the protons will exist gauche to each other in the energy minimized (MM2) conformation in either case. In conclusion, the side product from this reaction shows stereospecific addition of the methyl group, but the application of coupling constants in the NMR is inadequate to allow us to determine the absolute stereoisomerism of the addition, and therefore we cannot claim with certainty the mechanism by which the methyl addition product is generated.

**Future Directions:**

An effective catalyst for this reaction must be relatively stable and show bidentate complexation to amidoaldehydes similar to **2**. A bis(oxazoline) (box) copper(II) catalyst (**Figure 2**) is a promising alternative to the aluminum catalyst because it has shown activation of aldehydes for stereospecific addition of nucleophiles weaker than the oxazole (**Table 1**) and it is a divalent Lewis acid.[8]

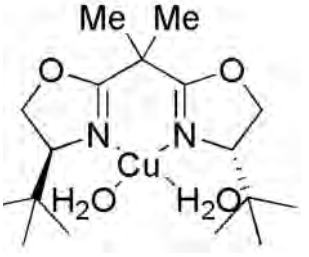



**Figure 2.** *Bis(oxazoline) copper(II) catalyst.*[8]

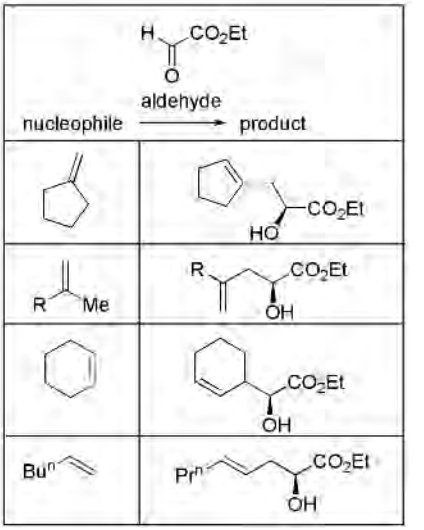



**Table 1.** *Nucleophiles used for addition to aldehydes activated by box catalyst.*[8]

We have synthesized a chiral box-copper catalyst that will be tested on a variety of amidoaldehydes **2**. The chiral catalyst is predicted to be effective when used with achiral aldehyde **2A (Figure 3),** but introducing chiral aldehydes, such as **2B,** to the chiral catalyst may cause unintended stereointeractions. An achiral catalyst is also being synthesized, that may be effective in activating chiral amidoaldehydes **2B** such that the chirality of the alde-

*Continued on page 10*

# Summer Scholar

*continued from page 9*

hyde produces the desired stereoselectivity in the product, as was seen with

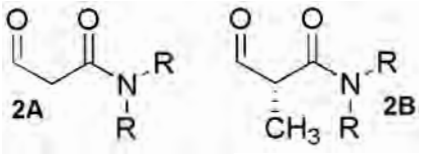



**Figure 3**. *Possible amidoaldehydes for addition to oxazoles activiated by box catalyst.*

the aluminum catalysis.

When the coupling of the aldehyde to the oxazole has been optimized, we will use this reaction to prepare a series of stereospecific α-hydroxy amino acid derivatives.

**Acknowledgements:**
I would like to thank the Norris/Richards Undergraduate Summer Research Scholarship program, my supervisor, Dr. David R. Haines (Wellesley College), as well as former students who have contributed to this project: Lisa Jacob, Halle Ritter, Cecilia Flatley, and Curtis Frantz.

**References:**

1. Evans, D. A.; Janey, J. M.; Magomedov, N.; Tedrow, J. S. Chiral Salen-Aluminum Complexes as Catalysts for Enantioselective Aldol Reactions of Aldehydes and 5-Alkoxyoxazoles: An Efficient Approach to the Asymmetric Synthesis of *syn* and *anti* α-hydroxy β-amino Acid Derivatives. *Angew. Chem. Int. Ed.* **2001**, 40, 1884-1888
2. Centers for Disease Control and Prevention. Sexually Transmitted Diseases: Chlamydia CDC Fact Sheet. http://www.cdc.gov/std/chlamydia/stdfact-chlamydia.htm (accessed October 9, 2010).
3. Dong, F.; Sharma, J.; Xiao Y.; Zhong Y and Zhong G.; Intramolecular Dimerization is Required for the Chlamydia-Secreted Protease CPAF to Degrade Host Transcriptional Factors. *Infect. Immun.* **2004,** *72*, 3869-3875.
4. Corey, E. J.; Li, W.D Z.; Nagamitsu, T.; Fenteany, G.; The Structural Requirements for Inhibition of Proteasome Function by the Lactacystin-Derived Beta-Lactone and Synthetic Analogs. *Tetrahedron Let.* **1999**, *55*, 3305-3316.
5. Corey, E.J.; Li, W.D..Z; Nagamitsu, T.; An Efficient and Concise Enantioselective Total Synthesis of Lactacystin. Communications*, Angew. Chem. Int. Ed*. **1998**, *37*, 1676-1678.
6. Evans, D. A.; Allison, B. D.; Yang, M. G. Chelate-Controlled Carbonyl Addition Reactions. The Exceptional Chelating Ability of Dimethylaluminum Chloride and Methylaluminum Dichloride. *Tetrahedron Lett*. **1999,** 40, 4457-4460.
7. Minch, M.J. Orientational dependence of vicinal proton-proton NMR coupling constants: The Karplus relationship. *Concepts in Magnetic Resonance.* **1994,** 6(1), 41-56.
8. Evans, D. A.; Johnson J. S. Chiral Bis(oxazoline) Copper II Complexes: Versatile Catalysts for Enantioselective Cycloaddition, Aldol, Michael, and Carbonyl Ene Reactions. *Acc. Chem. Res.* **2000,** 33(6), 325-335.
9. Soucy, Francois; Grenier, Louis; Behnke, Mark L.; Destree, Antonia T.; McCormack, Teresa A.; Adams, Julian; Plamondon, Louis. A Novel and Efficient Synthesis of a Highly Active Analogue of clasto-Lactacystin β-Lactone. *J. Am. Chem. Soc.* **1999**, 121(43), 9967-9976. ◇

# January Historical Events in Chemistry

**by Leopold May, The Catholic University of America, Washington, DC**

**January 1, 1852**
Eugène A. Demarçay, who was born on this date, discovered europium from samarium magnesium nitrate in 1901 and gave spectroscopic proof of the discovery of radium. He did vacuum studies of volatility and low temperatures followed by high temperature spark spectra.

**January 2, 1889**
Roger Adams, a researcher in organic chemical synthesis, was born on this date. He directed 184 doctoral theses.

**January 4, 1891**
Henry H. Dow prepared bromine from brine on this date.

**January 7, 1794**
Eilhardt Mitscherlich, who did research on crystalline structure, catalysis, and benzene and its derivatives, was born on this date. He also discovered isomorphism.

**January 9, 1868**
Sören P. L. Sörensen, who was born on this date, is known as the "Father of pH", He did research on proteins, amino acids, and enzymes.

**January 10, 1923**
Chemical and Engineering News was started on this day as the bimonthly News Edition of Industrial and Engineering News. It was changed to CEN in 1942 and became weekly on January 6, 1947.

**January 11, 1875**
Frederick M. Becket, an inventor in electrochemistry and electrometallurgy, was born on this date. He received more than one hundred patents covering a wide range of electric furnace and chemical products, notably ferro-alloys, calcium carbide, and special chromium steels.

**January 12, 1912**
Konrad E. Bloch, who waas born on this date, was a researcher on cholesterol and fatty acid metabolism. He shared the Nobel Prize in Physiology or Medicine in 1964 with Feodor Lynen for their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism.

**January 13, 1780**
Pierre J. Robiquet, who discovered asparagine with Nicolas-Louis Vauquelin, was born on this date. He also measured the codeine content of opium.

**January 14, 1851**
Ludwig Claisen, who developed reactions such as the condensation of esters and the rearrangement of allyl vinyl ethers, was born on this day.

**January 15, 1784**
Henry Cavendish presented the quantitative composition of water before the Royal Society on this date.

**January 17, 1706**
Benjamin Franklin, who was born on this date, was a researcher in electricity, and an inventor, a statesman. He also described marsh gas to Priestley.

**January 18, 1861**
One hundred and fifty years ago, Hans Goldschmidt was born. In 1893 he discovered the aluminothermite process (Goldschmidt Process) and he patented it in 1895. He was interested in producing very pure metals by avoiding the use of carbon in smelting but realized its value in welding.

**January 22, 1936**
Seventy-Five years ago, Alan J. Heeger was born on this date. He shared the Nobel Prize in Chemistry in 2000 with Alan G. MacDiarmid and Hidaki Shirakawa for their discovery and development of conductive polymers.

**January 23, 1929**
Twenty-five years ago in 1986, John C. Polanyi shared the Nobel Prize in Chemistry with Dudley R. Hershbach and Yuan T. Lee for their contributions concerning the dynamics of elementary chemical processes. Born on this date, he is a researcher using infrared chemi-luminescence to follow excited reaction products.

**January 26, 1881**
Claude S. Hudson, who did research in the chemistry of sugars, was born on this date.

**January 27, 1865**
August F. Kekulé presented his benzene structure to Société Chimique, Paris on this date.

**January 28, 1843**
Henry C. Bolton, who was a writer and bibliographer of the history of chemistry, was born on this date. He studied the action of organic acids on minerals.

**. January 31, 1881**
Irving Langmuir, who was born on this date, did research on surface chemistry, for which he received the Nobel Prize in 1932. He introduced gas-filled tungsten lamps and the use of the atomic hydrogen blowpipe for welding. He and Gilbert N. Lewis evolved the electronic theory.

Additional historical events can be found at Dr. May's website, faculty.cua.edu/may/history.htm. ◇

## Chair's Statement

*continued from page 2*

link at the NESACS website. Check out our blog at http://blog.nesacs.org .

This is your Section. Participate! Make connections with other members through the Section's activities, including the monthly meetings which offer networking, connections for collaboration, and evenings of cutting-edge chemistry. Stay connected by staying involved. ◇

# Impossible Crystals, Quasicrystals: Nobel Prize in Chemistry, 2011

B y Leopold May
The Catholic University of America
Washington, DC

Quasicrystals that were supposed not to exist were discovered by Daniel Shechtman of the Technicon Institute of Haifa, Israel. Examining the electron diffraction pattern of a rapidly solidified alloy of aluminum and manganese on April 8, 1982, he found that the atoms were not packed in symmetrical patterns which repeated periodically in the crystal. This was in contrast to what was found with crystals previously.

He had prepared the first quasicrystal. Aperiodic mosaics that are found in medieval Islamic mosaics of the Alhambra Palace in Spain and the Darb-I-Imam Shrine in Iran help to understand the appearance of quasicrystals at the atomic level. The patterns are regular but never repeat themselves.

In the course of defending this very controversial discovery, he was asked to leave his research group. As more examples of quasicrystals were found in the laboratory and in mineral samples from a Russian river, the concept of quasicrystals was accepted, thus leading to the awarding of the 2011 Nobel Prize in Chemistry to Daniel Shechtman for the discovery of quasicrystals**.** Who said that there is nothing new under the sun? ◇



# National Recognition for NESACS Student Chapters[1]

The ACS Committee on Education has selected the following student chapters in the Northeastern Section to receive special recognition for the programs and activities described in their 2010-2011 reports:

**Commendable Recognition**

- Gordon College, Wenham, MA; Benjamin Stewart and Ariel Guiguizian, chapter co-presidents; Prof. Joel Boyd, faculty advisor.
- Northeastern University, Boston, MA; Philip Hamzik and Rhiannon Thomas, chapter co-presidents; Prof. Victoria Berger, faculty advisor.

**Honorable Mention**

- Bridgewater State College, MA; Melissa Brulotte and Christopher Goncalo, chapter co-presidents; Profs. Edward Brush and Steven Haefner, faculty advisors.
- Stonehill College, North Easton, MA; Natalie Dogal and Meghan Harley, chapter co-presidents; Profs. Cheryl Schnitzer and Marilena Hall, faculty advisors.
- Suffolk University, Boston, MA; Andrew Alexander, chapter president; Prof. Doris Lewis, faculty advisor.

Student involvement in applying green chemistry principles and practices is essential to the integration of environmentally benign technologies in academia and industry. The ACS Green Chemistry Institute distributes a Green Chemistry Award to ACS student chapters who have engaged in at least three green chemistry activities during the academic year. Listed below are the 2010-2011 Green Chemistry Award

*continued on page 13*

# Abstract

*continued from page 5*

ing the purification of aequorin.

In 1979, I finally determined the accumulated GFP to investigate the nature of the fluorophore. The result surprised me; the fluorophore was found in the primary structure of the protein. This implied some possible important uses of GFP.

GFP was cloned by Douglas Prasher in 1992, and successfully expressed in living organisms by Martin Chalfie in 2004, which triggered a trend of vigorous study on GFP. Various forms of modified and improved GFP were genetically produced by Roger Tsien and other investigators.

Red fluorescent proteins of the GFP family were found in corals in 1999, and more recently far-red fluorescent proteins were obtained from a sea anemone. The improvements and applications of the GFP-family fluorescent proteins are still in progress. ◇

# National Recognition

*continued from page 12*

recipients located within the Northeastern Section.

- Gordon College, Wenham, MA
- Northeastern University, Boston, MA
- Suffolk University, Boston, MA

All chapters receiving special recognition will be honored at the 243rd ACS National Chemistry Meeting in San Diego, CA, on Sunday, March 25, 2012.

[1] All information and award descriptions from "inChemistry" magazine, November/December 2011 issue. ◇



# NatChem Week 2011

*continued from page 4*

Chemical Society, David Sittenfeld, Dr. Bassam Shakhashiri, and the Phyllis A. Brauner Memorial Lecture Committee.

The events would not have been possible without the help of the volunteers listed below! Individuals from Emmanuel College, Gordon College, Massachusetts Institute of Technology, Northeastern University, Salem State, Sigma-Aldrich, Stonehill College, Suffolk University, Tewksbury Memorial High School, Tufts University, University of Massachusetts-Boston, Whitman Hanson High School.

## *Thank you NCW volunteers!**

Daniel Adam, Greg Ainsworth, Justin Andrews, Lee Andrews, Alysha Ardagna, Ivan Barrera , Eric Batista, Victoria Berger, Mohini Bhakta, Lauren Blair, Joel Boyd, Holly Boyle, Matthew Burris, Hillary Butts, Susan Brauner, Alex Bressette, Amanda Carey, Ruth Chadwick, Christine Cuddemi, Katie Dapsis, Amy D'Entremont, Nick Dibenedetto, Eva Dixon, Christine Dunne, Kristen Entwistle, Sarah Faulkner, Carlo Fierimonte, Lauren Gagnon, Ariel Guiguizian, Keeve Gurkin, Allison Harbottle, Charlie Hoyt, Pei Yi Huang, Sarah Iacobucci, Jennifer Ide, Mirian Isreb, Erin Johnson, Katie Kelly, Stephanie Laurer, Becky Leifer, Rebecca Leising, Becky Lewis, Doris Lewis, Irv Levy, Yan Lin, Michael Lynch, Leann Mackay, Gianna Mancuso, Thomas McGrath, Kerry Merchant, Krista Mignon, Mark Naniong, Elsy Naveo, Moses Njogu, Jackie O'Neil, Brian Pelletier, Anna Piccolo, Maha Ranga, Jayashree Ranga, Chris Ricciardi, Justin Roberts, Victoria Robinson, Derrick Rousseau, Andrea Schneider, Laura Schneider, Meaghan Sebeika, Colleen Shea, Heather Siart, Arianna Smith, Emma St. Marie, Stacy Strobel, Kyle Swerdlow, Kelly Tan, Heidi Teng, Kristina Vailonis, C. Danielle Walker, Jenna Whalen, Devan Willans, Jen Winters, Deborah Zorn

*I apologize if your name is not on this list.

The 2012 theme for NCW is nanotechnology. ◇

**Photos from National Chemistry Week 2011 at the Museum of Science By Morton Z. Hoffman**

*(l-r) Zach G., Kyle G., Olivia F., and Sydney F. enjoying chemistry.*

*Zach L. with Kerry Merchant (at left) and Ariel Guiguizian of Gordon College.*


*Doris Lewis (at left) with Susan Brauner.*


*Bassam Shakashiri during the Phyllis Brauner Memorial Lecture.*

# BUSINESS DIRECTORY

## SERVICES





## SERVICES





**TELL OUR ADVERTISERS**

Membership surveys show that you want more articles in our newsletter. If you tell our advertisers that you saw their ad here, they will provide more financial support and this will allow us to add more articles.

## SERVICES

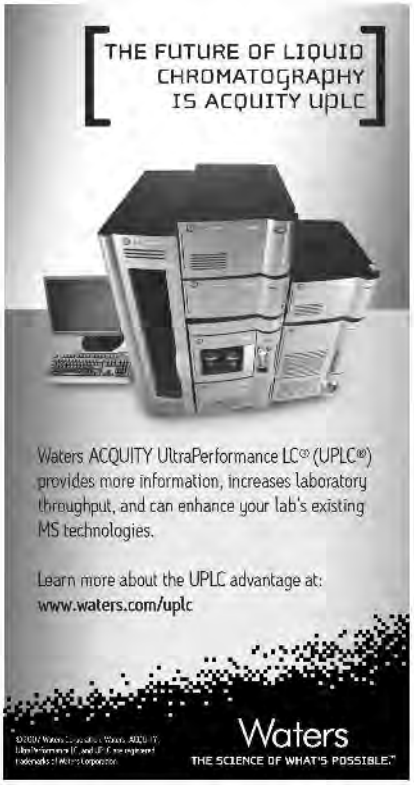
# BUSINESS DIRECTORY

## SERVICES

**PolyOrg, Inc.**
Chemical Solutions for the Life Science Industry

- Custom Organic Synthesis
- Process Development
- Contract R & D
- Pharmaceutical Intermediates
- Medicinal Chemistry Support
- Biotechnology Specialty Reagents
- Solid Support Reactions
- Process Validation
- Gram to Multi-Kilogram Synthesis

**PolyOrg Inc.**
10 Powers Street, Leominster, MA 01453
Phone: 978-466-7978 1-866-Poly-002
Fax: 978-466-8064 info@polyorginc.com
www.polyorginc.com




## CAREER SERVICES

### CAREER DEVELOPMENT

Being an active participant in NESACS activities will enable you to network with major institutions and corporations in our area and can open up new career opportunities.

The NESACS Board of Publications, which is responsible for both the *Nucleus* newsletter and the NESACS website, is looking to increase its activities in this arena.

We would like to expand our capabilities for keeping our membership informed on what is happening in our field and how to adapt to changing times and new technologies.

You can help us do that. All we ask of you is a few hours a month and a smile.

Call or email to see what opportunities are available.

contact -- Vivian Walworth
NESACS Board of Publications
Phone - 978-369-3735

Email vwalworth@comcast.net

### PROMOTE YOUR PRODUCTS AND SERVICES • ADVERTISE IN *THE NUCLEUS*

***The Nucleus*** readership is greater Massachusett's largest source for chemical and biochemical buyers. ***The Nucleus*** reaches more than 7,000 readers each month. It has been estimated that these buyers annually purchase more than $3,500,000 of:

- EQUIPMENT
- SUPPLIES
- CONSULTING SERVICES

Placing an advertisement in ***The Nucleus*** is the lowest cost method of reaching this select audience.

**For further information and other options for promoting your company's products and services visit:**
**www.mboservices.net**

## CAREER SERVICES

### WOULD YOU BELIEVE?

- Our Section (NESACS) is the largest in the ACS.
- We have more volunteers than any other Section.
- We have more activities than any other Section.
- The Nucleus has been voted at several ACS National meetings to be the best Section newsletter.
- We are expanding Nucleus and NESACS web site coverage of activities.

***The Following positions are open***

1. ***Photo Journalists***
2. ***Book Reviewers***
3. ***Corporate and Local news reporters***
4. ***Copy Editors***
5. ***Volunteer Coordinator***

**If you would like to be active in this vibrant organization, please contact Board of Publications member Vivian Walworth vwalworth@comcast.net**

***No experience needed Just a willingness to participate and a sense of humor***

## Index of Advertisers

THE NUCLEUS
19 Mill Road
Harvard, MA 01451

NONPROFIT ORG.
U.S. POSTAGE PAID
NORTHEASTERN
SECTION
AMERICAN CHEMICAL
SOCIETY

# Calendar

## Check the NESACS home page for late Calendar additions: http://www.NESACS.org

**Note also the Chemistry Department web pages for travel directions and updates.**
These include:
http://chemserv.bc.edu/seminar.html
http://www.bu.edu/chemistry/events/
http://www.chem.brandeis.edu/colloquium.shtml
http://www-chem.harvard.edu/events/
http://web.mit.edu/chemistry/
www.chem.neu.edu/web/calendar/index.html
http://chem.tufts.edu/seminars.html [CHEM.]
http://ase.tufts.edu/chemical/seminar.htm
[CHEM. ENGG.]
http://www.chem.umb.edu/
www.umassd.edu/cas/chemistry/seminars.cfm
www.uml.edu/Dept/Chemistry/speakers.html
http://www.unh.edu/chemistry/seminars.html

### Jan. 24
Jimmy Wu, Dartmouth University
Univ. New Hampshire, Room N104 (L103)
11:10 am

### Jan 26
Prof. Tohru Fukuyama, Univ. Tokyo
MIT, 6-120
4:00 pm

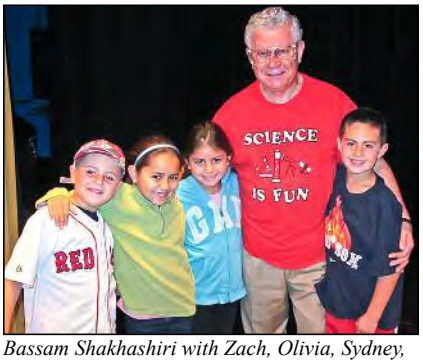
### Jan 27
Prof. Tohru Fukuyama, Univ. Tokyo
Boston College, Merkert 130
4:00 pm,

## Notices for The Nucleus Calendar of Seminars should be sent to:

Sheila E Rodman
Konarka Technologies, Inc.
116 John St. Suite 12, Lowell, MA 01852
email: srodman(at)konarka.com ◇

# NatChem Week 2011

*continued from page 13*




*Bassam Shakhashiri with Zach, Olivia, Sydney, and Kyle.*

*Bassam Shakhashiri and Doris Lewis presenting the ACS Salutes to Excellence Award to David Sittenfeld (Museum of Science Boston) "in appreciation for extraordinary contributions to National Chemistry Week and in recognition of excellence in science education for all ages."*

Photos from National Chemistry Week 2011 at the Museum of Science By Morton Z. Hoffman