Alfred University

Department of Chemistry

Scholes Lecture Program

And

Poster Session

April 2011 meeting of the Corning Division of the American Chemical Society
April 12th, 2011
### Itinerary for the evening

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>5:00-6:00</td>
<td>Reception and Poster session</td>
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</table>
| 6:00 | Opening remarks  
Welcome  
Dinner begins |
| 7:30 | Introductions  
Sam R. Scholes, Jr.  
Roy Gephart  
Head table  
Chair’s remarks |
| ~7:35 | Awards presentation  
ACS Outstanding Student awards  
ACS poster awards |
| 7:50 | Adjournment to Nevins theater |
| 8:00 | Lecture |

Roy Gephart  
Pacific Northwest National Laboratory
Poster #1
Towards the Synthesis of Biodegradable Glycopolymers

Houghton College

Abstract
Synthetic glycopolymers, polymers containing sugar moieties as pendant groups, have become targets in an increasingly active field of research, and are most notable for their ability to act as cell surface mimics. Most research on glycopolymers has focused on acrylate- and styrene-based polymerizations. For biomedical applications, biodegradable polymers could have a significant advantage over these polymers, but this area remains largely unexplored. The goal of our research is to develop a method for the synthesis of a new class of biodegradable polymers.

Poster #2
Formation and transformation of amorphous calcium carbonates in synthetic seawater

Jared Wesley Singer¹, Geoffrey M. Bowers¹² & R. James Kirkpatrick³
1. New York State College of Ceramics at Alfred University, Inamori School of Engineering, Department of Material Science and Engineering
2. Alfred University, Department of Chemistry
3. Michigan State University, College of Natural Science

Abstract
Experiments highlight the influence of a synthetic seawater matrix during nucleation, aggregation, and crystallization of amorphous calcium carbonates (ACC). Precipitation of ACC and subsequent transformations in synthetic seawater between 5° and 25°C were followed using powder x-ray diffraction, electron microscopy, and thermal gravimetric analysis. At 5°C and short timescales (seconds to minutes) we observe a diversity of broad diffraction intensities below 20° 2θ (Cu k α) and wide-ranging water of hydration. Aging precipitates at 5°C in contact with synthetic seawater leads to ikaite (CaCO3·6H2O) crystallization. When ikaite crystallization is quenched by filtration we observe disintegration to ACC, crystallization of monohydrocalcite (MHC; CaCO3·H2O), and/or fleeting evidence of sodium-bearing carbonate hydrates. Synthesis at 25°C and sub-seawater Mg concentrations results in 'typical' literature ACC exhibiting broad diffraction features centered on 30 and 45° (2θ), no water of hydration, and crystallization to anhydrous polymorphs. ACC structure is highly sensitive to matrix conditions.

Poster #3
13C Plant Labeling for the Study of Natural Organic Matter Composition and Aggregate Size Characterization

Arielle V. Polakos & Geoffrey M. Bowers
Alfred University

Abstract
Natural Organic Matter (NOM) from decomposed plant material is one of the largest reservoirs of carbon on Earth, yet its structural and chemical details are largely a matter of debate. Recent research, including 1H Diffusion Ordered Nuclear Magnetic Resonance Spectroscopy (DOSY NMR), has hinted that NOM may be aggregates of small molecules rather than the long accepted macromolecular structural model, which could profoundly alter how we view the physicochemical properties of soils such as buffering capacity, stability, and metal-binding capacity. In this study, we undertake the first phase of a multi-year project to perform novel 13C DOSY NMR of 13C-enriched NOM by designing and testing an air-tight incubator for 13CO2 doping and by comparing the effects of elevated CO2 environments on plant growth in the Brazilian Malagueta Pepper Plant. Online monitoring using an infra-red gas analyzer has shown that our initial growth chamber design can hold pressure above atmospheric for ~14 hours, which is longer than our initial estimated doping period. Based on our results and conversations with collaborators, we will also present plans for a new dosing chamber design for hydroponic plant growth.
Poster #4
The effect of latitude on reproductive behavior and timing in the North American river otter (Lontra canadensis)

Michell Flannery & Heather Zimbler-DeLorenzo
Alfred university

Abstract
The North American river otter (Lontra canadensis) is a carnivorous mammalian species that is found throughout Canada and the United States. River otters are very sensitive to changes in environment, especially those that affect their habitat. Due to habitat destruction caused by land development and pollution from humans, river otter populations have significantly decreased or have even been depleted from areas where they once thrived. Previous research has suggested that birth latitude has an effect on the time of year that river otters will mate. With these conservation programs trying to reintroduce otters into the wild, it is important to understand how much latitude effects breeding timing and success. In addition, it is essential for facilities to understand how the reproductive behavior of otters is affected if they are moved to an area that has a different latitude than where they were born. The North American river otter studbook compiled by David B. Hamilton of the Seneca Park Zoo in Rochester, NY, was used to determine a relationship between latitude and the time of reproduction in the North American river otter. The data includes 1452 otters from zoos and conservation programs in the United States, Canada, and other areas, and provides information such as birth date, birth, transfer, and death locations, and reproductive history. Analysis of the data has shown that river otters located at latitudes further South tend to breed during the winter months, while those at Northern latitudes breed in the early spring.

Poster #5
Incorporating pH Sensing Nanoparticles Into Poly(Lactic Acid)/Poly(Lactic Acid)-Poly(Ethylene Glycol) Electrospun Fibers

Larissa Buttaro & Steven M. Pilgrim
Kazuo Inamori School of Engineering, Materials Science and Engineering, Alfred University

Abstract
This research focused on incorporating pH sensing fluorescing nanoparticles into electrospun polymer poly (lactic acid) (PLA) combined with copolymer PLA – poly(ethylene glycol) (PEG). The eventual function is a non-invasive perspiration monitor. PLA was electrospun into fibers with pH sensing nanoparticles as a control to verify that PLA is less hydrophilic, and less responsive to pH change than the PLA/PLA-PEG fibers. It was found that with the addition of PEG, there was an increase in hydrophilicity. This was determined by measuring the wettability of the fibers via the water wicking rate. It was also found that by increasing the weight percent and/or molecular weight of PLA-PEG, and thereby increasing the hydrophilic nature of the fibers, the sensor fibers showed greater sensitivity to pH change. This was concluded based on confocal microscopy and Matlab analysis. The research performed proved it is possible for pH-sensing nanoparticles to be incorporated into electrospun PLA/PLA-PEG fibers to ultimately function as a fabric perspiration monitor.

Poster #6
Thermochemical Controls of Cement Degradation in Alfred, NY

Melissa Haahr & Geoffrey Bowers
Alfred University

Abstract
Cement is a very important engineering material used in a wide variety of applications, particularly in infrastructure such as roadways, bridges, and buildings. Although ordinary Portland-type cement is ubiquitous in modern society, some of the chemical properties are not entirely understood, such as the detailed mechanisms and controls over its degradation in the environment (Sharp, 2006). Two factors that influence the decay of concrete structures are acid precipitation-related chemical attack, and natural variations in temperature that influence chemical reaction rates or contribute to mechanical fracture (freeze-thaw cycles of entrapped H2O). Acidic precipitation is a known problem in Alfred, New York, which also experiences large temperature variation between seasons. This project examines whether the average seasonal sulfate-to-nitrate ratio of acidic precipitation or the average seasonal temperature variations in Alfred, New York has a greater influence on the chemical degradation of cement. Cement plugs of uniform size and composition were exposed to solutions mimicking the range of sulfate-to-nitrate ratios in precipitation and stored at the average fall, spring, summer, and winter temperatures of Alfred, New York for one month. The supernatant sulfate and calcium content were monitored using ion chromatography and flame atomic absorption spectrometry since sulfate is responsible for three of the major chemical mechanisms of cement breakdown and because calcium is a major
cationic component of cement. It is anticipated that the sulfate-to-nitrate ratio will have a greater effect on the chemical cement degradation than the temperature.

**Poster #7**

*Putting Zebra Mussels to the Test: Can This Invasive Species Be Exploited for Good?*

Felicia L. Lenzo, Joseph M. Spulick, Michael V. Keck & Timothy W. Sellers.
Keuka College

**Abstract**

*Dreissena polymorpha* (Zebra Mussels) and *Dreissena bugensis* (Quagga Mussels) are the predominant invasive species in the Finger Lakes of central New York. These small bivalves filter the lake water through their incurrent siphon and expel water, waste and pseudo-feces from their excurrent siphon, which gives them the potential to become biological filters. We are investigating strategies to take advantage of this filtering property of zebra mussels for pollutant remediation. Our present focus is to determine the longevity of the mussels with varying concentrations of salt and detergents, both independently and in combination. Our hypothesis is that under the right conditions, the mussels will survive while filtering the micelles that are formed by the detergents. These micelles can trap pollutants in the water; when the mussels filter these micelles out of the water and expel them as pseudo-feces, the pollutants will be removed and expelled as well. Trapping pollutants in this pseudo-feces would be useful because it a) settles to the bottom of the water column and b) is not digested by the animal. The pollutant micelles would be at the bottom of the water column whereas the top of the column would be cleaned. Micelle formation can be affected by different concentrations of salts. The addition of salt lowers the critical micelle concentration (CMC). If this CMC is lowered, then less detergent is needed to form the micelles, which would be beneficial to the mussels. However, the higher the concentration of salts will negatively affect the mussels. Thus, a clear understanding of the viability of zebra mussels with varying combinations of salt and detergent is necessary, and has been explored in this study.

**Poster #8**

*Determining if Microcystis Strains in Keuka Lake and Honeoye Lake have the Microcystin A Gene*

Dominique Derminio, Tim Sellers & Marianne Jahnke
Keuka College

**Abstract**

Field collection, lab experiments, and collaboration with other researchers across the globe were used to look at the organism *Microcystis*, a cyanobacterium found in freshwater lakes. The *Microcystis* gene, *mcy*-A, is one of the genes involved in the production of microcystin, a toxin which can affect the liver and cause a variety of complaints from skin reactions to liver cancer in humans and in other animals. A host can be exposed to microcystin by drinking contaminated water, by direct skin contact, or by breathing airborne droplets. Keuka Lake, as well as other Finger Lakes, has this specific microorganism. Public access to Honeoye Lake was restricted in the summer of 2010 due to a *Microcystis* bloom that apparently produced microcystin. (Honeoye Lake is one of the Finger Lakes, and is less than 35 miles from Keuka Lake.) Our lab wants to determine if *Microcystis* strains isolated from Keuka Lake have the potential of producing a dangerous *Microcystis* bloom in the future. We collected surface samples from Keuka Lake in the summer of 2010, filtered the samples to collect organisms larger than 53 µm, and then grew them in BG 11 medium. *Microcystis* was tentatively identified using microscopic examination. DNA was then extracted using the Marmur extraction method. PCR was performed for rDNA and for microcystin A. RFLP analysis was performed on the rDNA, and then compared to published *Microcystis* DNA sequences. If it is concluded that *Microcystis* is the organism which we have isolated, and that we have also successfully amplified the mcy-A gene from our samples, we will sequence the mcy-A amplicon we produce. We hope to develop a molecular procedure by which *Microcystis* can be identified, and which will determine if any strains present in a lake (e.g., Keuka Lake) may have the potential for producing toxins that can harm people.
Poster #9  
Learning, Imitation, and Time-Expenditure Frequencies in Lontra canadensis (North American River Otter)  
Caroline Jones & Heather Zimbler-DeLorenzo  
Alfred University  

Abstract  
This preliminary project investigated the learning mechanisms and time-expenditure of Lontra canadensis (North American River otters) in captivity. Little research has been done on the learning aspects behavior of river otters but rather otter activity and the behaviors themselves. Observations for this research were recorded from three individuals at the Binghamton Zoo at Ross Park throughout the summer of 2010; a male and female mated-pair, and their new male offspring. It was hypothesized that L. canadensis learn primarily by mimicking other otters and that juvenile L. canadensis will imitate their parent(s) behavior more than 80% of the time. Also, L. canadensis should spend the majority of their time chasing, wrestling, and interacting with provided enrichment (categorized as playing) and imitated playing, locomotion, and foraging behaviors most often. Based on the data collected, the results yielded a 74% imitation segment of the juvenile’s total recorded behavior. The juvenile was recorded to have displayed playing behaviors the most, although only 8% of the time, after foraging (9%), out-of-sight (9%), locomotion (14%), and resting (37%) behaviors. Behaviors which the juvenile mimicked most often included resting and locomotive behaviors. Imitation was presumed to be the method of learning and was support by the percentage revealed by the juvenile’s behaviors. In conclusion, from these observations, L. canadensis learn primarily by imitation and imitate their parent(s) often, but not more than 80% of the time; most time was spent resting (in all otters), and resting and locomotive behavior were imitated most often.

Poster #10  
The Effect of Diet and Hydration on Reproduction in the Female House Cricket Acheta domesticus.  
Leanne Combs & Heather Zimbler-DeLorenzo  
Alfred University  

Abstract  
House crickets are a versatile insect to work with. They can be fed to reptiles, fish, and frogs, and require limited space and resources to survive. These characteristics, along with the house cricket’s availability and ability to maintain a colony under proper care, make them an ideal candidate for laboratory study. This study will investigate the relationship of diet and water intake on the reproductive success of the female house cricket, Acheta domesticus. A cricket colony will be created using adult crickets. Newly-hatched nymphs will be reared in separate containers on different diet and hydration levels, with two control groups set on a constant diet and hydration level. After maturation, female crickets will be weighed and their ovipositors and overall length measured. They will then be introduced to randomly assigned males of the control group to mate. The number of eggs each female lays will be counted, as well as the number of offspring that hatch. At the completion of this particular study, the cricket colony will be available for other undergraduate research.

Poster #11  
Cockroach Pheromones as Potential Green Pest Control Agents  
Kalcy O’Keefe, Heather Zimbler-DeLorenzo & John G. D’Angelo  
Alfred University  

Abstract  
We have prepared Blatellaquinone, the sex pheromone of the female German cockroach. The preparation of derivatives is underway and we anticipate having at least 3 total derivatives to test in the fall. The synthesis of these derivatives will be presented as well as an evaluation plan for their efficacy as green pest control agents.
Poster #12
Diagenetic Cycling of Si in Shallow Water Carbonate Sediments: Role of Seagrasses, Mangroves, and Bioturbation.

Isaac Klingensmith,1 Robert C. Aller,2 & Qingzhi Zhu2
1. Alfred University
2. SOMAS at The State University of New York at Stony Brook

Abstract
Silica cycling in shallow water carbonate sediments is potentially strongly regulated by mangroves (Rhizophora), seagrasses (Thalassia, Syringodium), and benthic macrofauna. Sampling sites within ray feeding pits, seagrass beds, and mangrove prop roots off the southeast tip of South Bimini, Bahamas revealed low dissolved Si and biogenic Si, with ranges (upper ~ 15 cm) of ~10 – 200 μM (seagrass bed average ~ 10 μM) and 5 – 35 μmol Si/g respectively. Ammonification rates (high) and silica dissolution rates attenuated sharply with depth, supporting net production fluxes of ~ 4.6 – 8.8 mmol N/m2/d and 0.6 – 0.8 mmol Si/m2/d (0 – 15 cm; T = 28℃). Solute and solid phase concentration distributions are consistent with a subsurface transport sink at ~ 5 to 10 cm, and rapid recycling of Si within the surface litter and root zone (dissolved Si turnover times ~ 1.5 – 2 days in seagrass beds). Planar optode measurements of O2 distributions revealed dynamic rhizosphere interactions with subsurface deposits consistent with the intense recycling of Si. Si may be an important limiting nutrient governing seagrass and mangrove production in carbonate systems.

Poster #13
Kinetics of the Thaumasite Forms of Sulfate Attack on Cement and Concrete

Michael Tomick & Geoffrey Bowers
Alfred University

Abstract
Cement is a construction material used commonly across the globe. The degradation of cement through sulfate attack is a major problem in areas where cement comes into contact with flowing water containing high amounts of sulfate and carbonate ions. The thaumasite form of sulfate attack on ordinary Portland-type cements (OPC) is possibly the most hazardous since the reaction deteriorates the calcium silicate hydrate gel (C-S-H), which serves as the main binder in the mixture. C-S-H, being the main binder, also contributes more significantly to the mechanical strength in OPC than any other chemical component. To date, the kinetics of the thaumasite form of sulfate attack is poorly understood; if a greater understanding was reached however, it would allow us to design more durable OPC as well as alternative construction materials. In this study, we use the fact that thaumasite has an unusual six-coordinate Si environment that resonates at a unique 29Si chemical shift to explore the kinetics of thaumasite formation via solid-state NMR. In particular, we will present data discussing the roles that sulfate concentration and ionic strength play in thaumasite formation.
Samuel R. Scholes, Jr. Biography

Samuel R. Scholes, Jr. was born on June 5th, 1915 and first came to Alfred in 1932 when his father joined the faculty of the New York State College of Ceramics at Alfred University. He graduated from the Alfred High School and received his bachelor’s degree from Alfred University in 1937. He earned a Ph.D. in 1940 from Yale University under the direction of Professor Herbert S. Harned. He taught chemistry at Alfred University during the 1940-1941 academic year and then took a position at Tufts University from 1941-1946. He then came home to Alfred and joined the chemistry department where he taught continuously for 34 years until his retirement in 1980. He taught general chemistry, physical chemistry and analytical chemistry to science majors and engineers and organic chemistry to the nursing students during his outstanding career and he continued to teach various courses for the Chemistry Department for an additional 6 years after his retirement.

A member of the ACS for over sixty years, Sam served as the chairman of the Corning section in the early 1950’s and as chair of the chemistry department at Alfred University from 1956 to 1970. He is a life member of the Alfred Fire Department, serving as chief from 1955-1957, and was an elected trustee on the Village Board of Alfred for seven consecutive terms. He continues to maintain an active social life, making coffee every morning at the Church Center.
Josh Fierer Biography

The benefactor for the Samuel R. Scholes Jr. lecture is the late Joshua A. Fierer. Dr. Fierer is a 1959 graduate of Alfred University. After Alfred he earned an M.D. degree from SUNY Health Science Center in Brooklyn and then served in the Air Force Medical Corps.

Dr. Fierer was an instructor at Columbia Presbyterian Medical Center, a professor at Columbia University College of Physicians and Surgeons, a professor and director of anatomy and pathology at Creighton University, and professor and chair of Pathology at the University of Illinois in Peoria.

In 1998 he announced his support for this lectureship honoring Dr. Samuel R. Scholes Jr. The first Samuel R. Scholes, Jr. lecture was in 1999. Dr. Fierer is a former member of the Alfred University Board of Trustees from May 2003 until December 2005. He sadly passed away in 2007.
History of Scholes lecture

The Samuel R. Scholes Jr. endowed lectureship started in 1999 and was established by the very generous donation of Joshua Fierer to honor his mentor and long time friend. Since that time, we have had the privilege to honor Sam in this way each year. Sam has attended each of the lectures in his honor. In 2011, Sam will reach the impressive age of 96. Traditionally, the Scholes lecture also serves as a meeting of the Corning division of the ACS. Starting in 2010, a poster session has been held during the reception prior to dinner. Below, you will find a list of all of the past speakers.

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<thead>
<tr>
<th>Year</th>
<th>Speaker</th>
<th>Title</th>
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| 2010 | Dr. Larry Bowers  
Chief Science Officer, United States Anti-Doping Agency | Lessons from 18 Years of Testing for Performance-Enhancing Drugs in Olympic Sport: Communicating Technical Findings in an Increasingly Non-technical World |
| 2009 | David Corcoran  
Assistant science editor of the New York Times | Science times: How We Put It Out, Why It’s in Danger, and Why the World Needs it More Than Ever |
| 2008 | Dr. Paul Anastas  
Yale University | Green Chemistry: Current Status and Future Direction |
| 2007 | Dr. Eric R. Scerri  
UCLA | The Periodic Table: Its Story and Its Significance |
| 2006 | Dr. Mary Ellan Bowden  
Chemical Heritage Foundation | The Changing Lives of Women Chemists |
| 2005 | Dr. Terry A Michalske  
Sandia National Lab, AU grad 1975 | Integrated Nanotechnology-Putting Small Things to Work |
| 2004 | Dr. Carleton Moore  
Arizona State, AU grad 1954, honorary Ph.D. 1977 | The Chemistry of Meteorites: Messengers from Time and Space |
| 2003 | Dr. Madeline Jacobs  
Editor-in-Chief, C & E News | The Two Cultures, Zen and the Art of Motorcycle Maintenance |
| 2002 | Dr. Lawrence M. Principe  
The Johns Hopkins University | Robert Boyle and the Philosopher’s Stone: Taking Alchemy Seriously |
| 2001 | Dr. Carl Djerassi  
Stanford University | Noble Science and Nobel Lust: Disclosing Tribal Secrets |
| 2000 | Dr. Roald Hoffmann  
Cornell University, Nobel Laureate, 1981 | One Culture or the Commonalities and Differences Between the Arts and the Sciences |
| 1999 | Mary Virginia Orna  
College of New Rochelle and Chemical Heritage Foundation | The Shroud of Turin and Other Mysteries: Uncovering Traces of the Past through Science |
This Year’s Outstanding Student Awardees

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<th>Student Name</th>
<th>Institution</th>
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<tr>
<td>Michele Miles</td>
<td>Alfred State College</td>
<td>Jerry Fong</td>
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<tr>
<td>Melissa Haahr</td>
<td>Alfred University</td>
<td>Garrett McGowan</td>
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<tr>
<td>Susan Stage-Derick</td>
<td>Corning Community College</td>
<td>John Novinski</td>
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<td>Timothy Repas</td>
<td>Elmira College</td>
<td>Pierre Bouthyette</td>
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<td>Joshua Scott Wallace</td>
<td>Houghton College</td>
<td>Irma Howard</td>
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<tr>
<td>Felicia Lenzo &amp; Dominique Derminio</td>
<td>Keuka College</td>
<td>Thomas Carroll</td>
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<tr>
<td>Sara Grove</td>
<td>Mansfield University</td>
<td>Shaker Ramasamy</td>
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Past Poster Session Award Winners

We are very grateful that the Corning Division of the ACS has decided to support the poster session by offering a cash prize and copies of the Merck Index to the top two posters.

<table>
<thead>
<tr>
<th>Year</th>
<th>1st place</th>
<th>Institution</th>
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<tbody>
<tr>
<td>2010</td>
<td>Eric Miller</td>
<td>Alfred University</td>
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<td></td>
<td>Kyle Rugg</td>
<td>Rochester Institute of Technology</td>
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Across Generations: The Environmental Legacy of the Hanford Site

Roy E. Gephart
Environmental Scientist, Pacific Northwest National Laboratory, Richland, Washington

Abstract
The Hanford Site located in Washington State once produced plutonium for nuclear weapons. It was the first site in the world to release large amounts of radioactive contamination into the environment, thus exposing those who lived downwind and downriver. Hanford now contains the largest accumulation of nuclear waste and materials in the western hemisphere. Generations will face this legacy. Today, Hanford’s sole mission is environmental cleanup. Although the site played a crucial role in securing the military strength of the United States, Hanford is now judged by a new social consciousness—one critical of how waste was handled after the first concerns were voiced. However, therein lies a lesson: no generation is immune to pretense.

Dr. Roy Gephart biography
Roy Gephart is a Chief Environmental Scientist at the Pacific Northwest National Laboratory in Richland Washington and an award winning author with 35 years experience in the geohydrologic sciences. He is a nationally recognized expert and sought after lecturer on the Hanford Site, environmental history, and radioactive waste management issues. Roy has written 50 publications, including two well-received books about Hanford. He is involved in several Pacific Northwest science education activities and is an environmental resource for the regional and national news media. Roy earned a BA in geology from Miami University and an MS in geohydrology from Wright State University.
Acknowledgements

The Department of Chemistry at Alfred University extends its warmest thanks to Ms. Julia Elder, secretary of Math and Chemistry and Ms. Jessie Jordan, Chemistry lab technician for assisting us in the planning and execution of this annual event. Without their assistance, we would not be able to host this lectureship. We also thank the Alfred University Food Services for their services during the reception hour and the dinner. We also acknowledge the generous donation of the late Joshua Fierer (AU grad '59), which continues to fund this lectureship. The Alfred University Chemistry Club, which is affiliated with the ACS, deserves hearty acknowledgement for their financial support of all of the Alfred University chemistry students who attended the dinner. We also thank the Corning Division of the American Chemical Society for their continued support of the Outstanding Student award, awarded at this lecture and for their continued support of the poster session associated with this event. Finally, we are thankful to Samuel Scholes, Jr. Sam has attended each of the lectures and without his inspirational teaching, we would not be here tonight celebrating his career. We also gratefully acknowledge Ms. Marlene Wightman, Director of Continuing Education and Outreach for her assistance in organizing the Poster session.