

RESEARCH ASSOCIATESHIP PROGRAMS

NEWSLETTER

Spring-Summer 2009

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NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES

One line of Dr. Emmons's research focuses on extending surface-enhanced Raman spectroscopy (SERS) into the ultraviolet region of the spectrum. In conventional Raman spectroscopy, the scattering cross sections are generally quite small, so a relatively large amount of sample is necessary in order to obtain a detectable signature of a compound. In SERS, however, the number of scattered photons can be dramatically enhanced by several orders of magnitude. SERS enhancement occurs when a molecule adsorbs to or forms a charge-transfer complex with certain nanostructured metallic surfaces, where the electric field from an incident laser beam can be increased significantly.

*continued on back cover*

ECBC Profile-Emmons

**Dr. Erik Emmons, NRC Associate at the U.S.**

**Army Edgewood Chemical Biological Center**, is working with Dr. Augustus W. Fountain, III. His work focuses on applications of Raman spectroscopy for detection of chemical warfare agents and explosives. Raman spectroscopy is an inelastic light-scattering phenomenon where a photon, typically from an incident exciting laser beam, is scattered from a molecule and in the process excites a vibrational mode of the molecule. By measuring the wavelength of the scattered light, the vibrational energies of the molecule can be obtained. Raman spectra are highly selective in differentiating between different molecules, and hence are potentially very useful for chemical warfare agent and explosives detection.



Dr. Erik Emmons, NRC Associate at ECBC

Ray Gamble, Ph.D., Director, Research Associateship Programs  
Suzanne White, Manager, Newsletter

The NRC Research Associateship Programs *Newsletter* is published quarterly to highlight research and activities of NRC Associates and Advisers who participate in the programs with our many agencies and laboratories. All of our *Newsletters* are posted on our Web site Newsletter Web page in full-color PDFs. In addition, the full-color, high-gloss version is printed by the National Academy Press (NAP); and bulk orders of 10 or more are available from our office for distribution at agencies/laboratories, scientific meetings, NRC meetings, staff visits, and site visits. We accept articles throughout the year-- press releases, profiles, 1 – 2 page articles already written and/or submitted to other publications, images, photos, notices, awards, honors, etc.

Send all inquiries and submissions to Suzanne White  
([swhite@nas.edu](mailto:swhite@nas.edu))

# PROGRAM PROMOTION 2009

## Associateship Programs Staff members will be available at an Exhibit Booth.

American Institute of Aeronautics & Astronautics	AIAA	01/05/09-01/08/09	Orlando	FL
Joint Mathematics Meetings	JMM	01/05/09-01/08/09	Washington	DC
American Meteorological Society	AMS	01/11/09-01/15/09	Phoenix	AZ
Johns Hopkins University Science & Tech Career Fair	JHU-STCF	02/11/09-02/11/09	Baltimore	MD
Nat'l Soc of Black Physicists/Nat'l Soc of Hispanic Physicists	NSBP/NSHP	02/11/09-02/14/09	Nashville	TN
Nat'l Org of Black Chemists & Chemical Engineers	NOBCCHE	03/13/09-03/18/09	St. Louis	MO
Society of Toxicology	SOT	03/15/09-03/19/09	Baltimore	MD
American Physical Society	APS	03/16/09-03/20/09	Pittsburgh	PA
Experimental Biology	EB	03/19/09-03/21/09	New Orleans	LA
American Chemical Society (Spring)	ACS -- Spring	03/23/09-03/25/09	Salt Lake City	UT
National Society of Black Engineers	NSBE	03/26/09-03/28/09	Las Vegas	NV
American Society for Microbiology	ASM	05/17/09-05/21/09	Philadelphia	PA
American Association of Petroleum Geologists	AAPG	06/07/09-06/10/09	Denver	CO
American Chemical Society (Fall)	ACS -- Fall	08/17/09-08/19/09	Washington	DC
Science & Engineering Alliance/Student Tech Conference	SEA/STC	Oct	local	local
Advancement of Chicanos & Native Americans in Science	SACNAS	10/08/09-10/11/09	Dallas	TX
Society of Mexican American Engineers & Scientists	MAES	Oct	TBD	TBD
Hispanic Assn of Colleges & Universities	HACU	10/31/09-11/02/09	Orlando	FL
Florida Education Fund/McKnight Fellows Meeting	FEF/McKnight	TBD	Tampa	FL
American Indian Science & Engineering Society	AISES	TBD	TBD	TBD
Annual Biomedical Research Conference for Minority Students	ABRCMS	11/04/09-11/07/09	Phoenix	AZ
American Society for Tropical Medicine & Hygiene	ASTMH	11/18/09-11/22/09	Washington	DC
Materials Research Society	MRS	12/01/09-12/03/09	Boston	MA
American Society for Cell Biology	ASCB	12/05/09-12/09/09	San Diego	CA
American Geophysical Union	AGU	12/14/09-12/18/09	San Francisco	CA

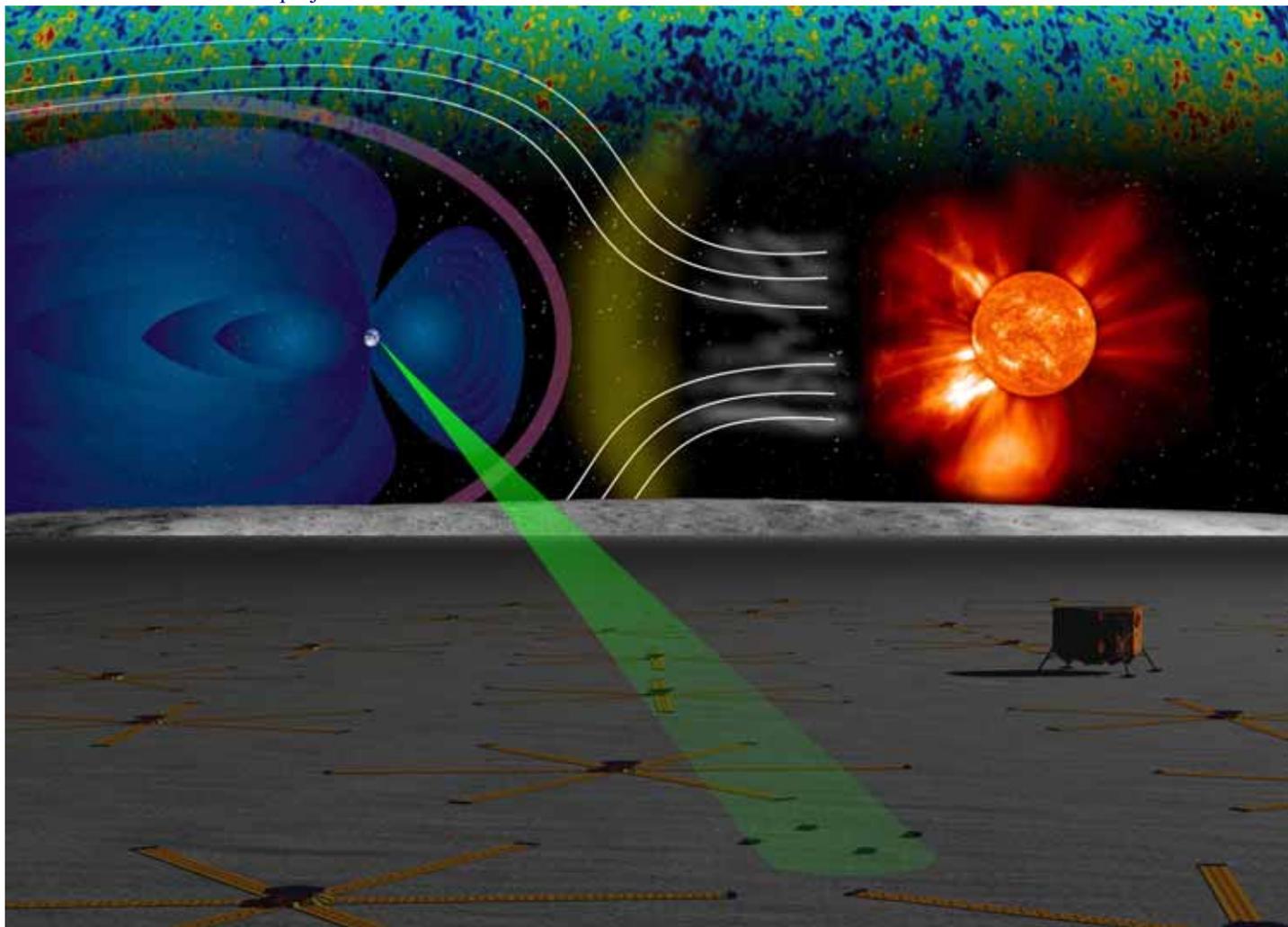
NASA has selected seven academic and research teams as initial members of the agency's Lunar Science Institute (NLSI), and Naval Research Laboratory researchers will play a substantial role on one of the teams. NRL is a leading institution supporting the "Lunar University Node for Astrophysics Research (LUNAR): Exploring the Cosmos from the Moon" team. Dr. Jack Burns at the University of Colorado, Boulder, is the principal investigator for this team. **Dr. Joseph Lazio and Dr. Kurt Weiler from NRL Remote Sensing Div.** head the NRL research effort on this project.

## NRL astronomers selected for NASA's Lunar Science Institute

NRL-led concept for a telescope based on the Moon and studying an era of the young Universe, during the first 500 million years of its existence. Although the night sky is filled with stars, these stars did not form instantaneously after the Big Bang. There was an interval, now called the "Dark Ages," in which the Universe

trium, at 21 cm; a wavelength far longer than what the human eye can detect. If these first signals from hydrogen atoms in the Dark Ages can be detected, astronomers can essentially probe how the first stars, the first galaxies, and ultimately the modern Universe evolved.

Because the Universe is expanding, the signals from these distant hydrogen atoms will be stretched (or redshifted) to much longer wavelengths, as large as several meters. While astronomical observations at radio wavelengths have a long history, this portion of the electromagnetic spectrum is now heavily used for various civil and military transmissions, all of which are millions of times brighter than the hydrogen signal



The Lunar University Network for Astrophysics Research will explore astrophysics that can be conducted using the Moon as a platform for observations. Key projects include studies of the theory of gravity using lunar laser ranging, studies of the Sun at radio wavelengths, and cosmological observations at radio wavelengths. NRL will be leading the latter, developing the design for a radio telescope to be deployed on the farside of the Moon in the future.

NRL's role will involve strengthening the science case for, and advancing the technology of, a telescope on the Moon for peering into one of the last unexplored epochs in the Universe's history. The Lunar Radio Array (LRA) is an

was unlit by any star. The most abundant element in the Universe, and the raw material from which stars, planets, and people are formed, is hydrogen. Fortunately, the hydrogen atom can produce a signal in the radio-wavelength part of the spec-

that astronomers seek to detect. Additionally, the upper layers of the Earth's atmosphere are ionized (the ionosphere), which introduce distortions into astronomical signals as they pass through on their way to telescopes on the ground.

With no atmosphere and shielding from the Earth, the far side of the Moon presents a nearly ideal environment for a sensitive Dark Ages telescope. In NRL's LRA concept, scientists and engineers will investigate novel antenna constructions, methods to deploy the antennas, electronics that can survive in the harsh lunar environment, and related technology in preparation for developing a roadmap for research and development of a lunar telescope over the next decade. The team will also build on their experience in developing the Radio Observatory for Lunar Sortie Science (ROLSS), a NASA-funded study of a pathfinding array that would be located on the near side of the



**Dr. Joe Lazio, former NRC Associate, current NRL NRC Adviser**

Moon.

The project leader at NRL, Dr. Joseph Lazio, pointed out that LRA will be one of the most powerful telescopes ever built and will bring us closer than we have ever been to understanding where our Universe came from and where it is going. The NLSI's goal is to address key questions about lunar science in preparation for the resumption of human visits to the moon about a decade from now. The institute supports scientific research to supplement and extend existing NASA lunar science programs in coordination with U.S. space exploration policy. The selection of the members encompasses academic institutions, non-profit research institutes, private companies, NASA



Former NRC associate Joseph Lazio holds a future lunar radio antenna. One of the concepts being explored for a future lunar radio telescope is to construct the antennas out of polyimide film, on which metal has been deposited. Polyimide film is flexible, lightweight, and rugged, so antennas could potentially be rolled for transport, and deployment would be as easy as unrolling them on the lunar surface. The Naval Research Laboratory is leading the effort to develop this concept further with both simulations and field tests. In the background is a composite image, produced by NRL's Clementine spacecraft, of the Moon's far side, which cannot be seen from the Earth. The far side has long been recognized as an ideal platform for a radio telescope. (Image credit: NRL)

centers and other government laboratories.

Selections were based on a competitive evaluation process that began with the release of a cooperative agreement notice in June 2008. The next solicitation opportunity for new members will take place in approximately two years.

**The selected initial NLSI member teams are:**

**Lunar University Node for Astrophysics Research**

**(LUNAR): Exploring the Cosmos from the Moon; principal investigator Jack Burns, University of Colorado in Boulder.**

**The Moon as Cornerstone to the Terrestrial Planets: The Formative Years; principal investigator Carle Pieters, Brown University in Providence, R.I.**

**Scientific and Exploration Potential of the Lunar Poles; principal investigator Ben Bussey, Johns Hopkins University Applied Physics Laboratory in Laurel, Md.**

**Impact Processes in the Origin and Evolution of the Moon: New Sample-driven Perspectives; principal investigator David Kring, Lunar and Planetary Institute in Houston.**

**Dynamic Response of the Environment at the Moon; principal investigator William Farrell, NASA Goddard Space Flight Center in Greenbelt, Md.**

**Understanding the Formation and Bombardment History of the Moon; principal investigator William Bottke, Southwest Research Institute in Boulder, Colo.**

**NASA Lunar Science Institute: Colorado Center for Lunar Dust and Atmospheric Studies; principal investigator Mihaly Horanyi, University of Colorado in Boulder.**

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Teams were selected from 33 proposals. Based and managed at Ames, the NLSI is a virtual institute, enabling the newly selected members to remain at their home institutions. Partnerships and collaborations among members are highly encouraged and facilitated through a variety of proven networking tools, such as frequent videoconferences.

The NLSI opened in April 2008 and the facility is modeled after the NASA Astrobiology Institute, also based at Ames. That institute is a virtual facility that has successfully sustained a productive research program for more than a decade. The newly selected Lunar Institute teams, along with the international associate and affiliate teams, have members working together throughout the world. The institutes are supported by the Science Mission Directorate and Exploration Systems Mission Directorate at NASA Headquarters in Washington.

# Fish passage structures for downstream migrants requires knowledge of behavioral response to accelerating flow

Dr. Eva Enders joined the Fish Ecology Division as an **NRC Associate at the NOAA National Marine Fisheries Service Laboratory in Seattle, WA** to continue her research on the effects of turbulent flow on migratory fish. Her interest in the effects of anthropogenic climate and hydro regime changes on fish began while studying at the University of Bangor, Wales. While pursuing her Master degree at the University of Hamburg, Germany, Eva learned about the plight of Newfoundland cod stocks, which collapsed in the early 1990's and have never recovered, cementing a desire to help conserve fisheries for future generations. She completed her Ph.D. at the Université de Montréal in Fish Ecology in 2004. Her dissertation on the effects of turbulence on juvenile salmonids presented one of the first studies on behavior and energetics of fish in turbulent flow and revealed that swimming costs increased significantly with turbulence intensity. Comprehension of fish swimming performance in turbulent flow environments is important for optimizing bioenergetics models and fish passage facilities.



**Dr. Eva Enders, NRC Associate at the NOAA National Marine Fisheries Service**

Dr. Enders has now taken on the project characterizing the behavior of Chinook salmon smolts to accelerating flow at the Experimental Flume Facility

at McNary Dam on the Columbia River with Dr. John Williams and Mike Gessel. The Northwest Fisheries Science Center has a long tradition in effective fish passage facility designs especially for migrant adult Pacific salmon. However, much less is known about the flow preferences of juvenile salmonids. The solution to developing effective passage facilities at dams requires understanding swimming capability of individual fish and developing criteria for flow conditions that fish seek or avoid. Eva's research focuses on the behavioral avoidance response of Chinook salmon smolts to a range of accelerating flows. The motivation for this project comes from the need to accurately estimate velocity gradients to which these fish react to in order to improve fish bypass systems at hydropower dams.



**The study organism: Chinook salmon (*Oncorhynchus tshawytscha*) from the Columbia River**

Construction of dams and other barriers on rivers and streams have substantially altered the natural flow regime and migratory pathways under which fishes evolved. Migratory fishes, and also a whole suite of resident fishes that may use different habitats during their life-cycle or during different seasons, are affected by the more than 45,000 large dams (> 15 m in height) that are constructed worldwide (World Commission on Dams 2000) by blocking the historic migratory pathways or delaying fish migration. Concerns about the status of native fish populations have led in recent years to more focus on alleviating effects of barriers on fish passage (Endangered Species Act - United States, Species at Risk Act - Canada, and EU Water Framework Directive - EU); and world-

wide, increased efforts are undertaken to improve the connectivity of rivers for fish. However, key for the development of successful fish passage strategies is the understanding of how different species respond to hydraulic conditions.

While the behavior of upstream migrants for many species has been studied extensively and has led to the development and installation of many effective passage facilities, much less is known about the behavior of downstream migrants. The lack of behavioral knowledge for downstream fish has limited the ability to develop effective passage systems. Field observations suggest that if fish bypass facilities create areas of rapidly accelerating flow, they do not effectively guide the fish.

The results from Eva's research project on the avoidance behaviour of actively migrating fall Chinook salmon to flow accelerations showed that the velocity gradient over the body length of the fish, at the instant at which smolts displayed an avoidance, response was similar over the range of accelerating flows tested. Results from her study present the first quantitative information about the avoidance behaviour of fish to flow acceleration and should provide data needed to help engineers and biologists develop effective systems to alleviate anthropogenically altered flow regimes. Furthermore, the devised experimental setup provides a valuable means to test worldwide the effects of accelerating flow on any downstream migrant fish species.



**The Juvenile Bypass System at McNary Dam on the Columbia River**

Scientists at the **Naval Research Laboratory** recently reported the detection of toxins with unprecedented speed, sensitivity, and simplicity. The approach can sense as few as a few hundred molecules in a drop of blood in less than 10 minutes, with only four simple steps from sample to answer.



**Ms. Kristina Myers, Nova Research, Inc; Dr. Paul Sheehan, NRL NRC Adviser, and Dr. Shawn Mulvaney, former NRL NRC Associate, currently Nova Research, Inc..**

The sensitive new test builds on NRL's patent-pending Fluidic Force Discrimination™ (FFD) assay. In a FFD assay, a chip has arrays of receptor molecules such as antibodies that capture toxins or other target molecules that have been labeled with micrometer-sized beads. By encapsulating the chip in a microflow chamber, the fluid flow can be controlled to apply just enough force to remove beads that are resting on the array but not truly labeling a toxin. "In this way," explains lead author **Dr. Shawn Mulvaney, former NRC Associate**, "very few molecules can be detected, because there is almost no background signal. And because we can get the background so low, FFD assays are very specific, with very few false positives."

In the current report, the NRL researchers have adapted FFD assays to detect a protein toxin at concentrations as low as 35 attomolar - over 1000 times more sensitive than existing commercial tests for proteins. In the new assay, dubbed "Semi-Homogeneous Fluidic Force Discrimination," the antibody-coated microbeads are mixed directly with the sample and rapidly collect the dilute toxin molecules. The toxin-coated beads are then injected into the microflow chamber where they are captured by the receptor designed for that target.

## Forceful New Method Sensitive Detects Proteins

Finally, beads that don't belong are removed with fluid forces. The remaining beads are all attached by the toxin to the surface and may be counted to indicate the toxin concentration. NRL has developed both electronic and optical systems to count the beads, along with reusable plastic test cartridges. The paper won the award for Most Original Contribution at the Tenth World Congress on Biosensors, held in Shanghai, China, May 14-16, 2008 out of 978 competing papers.

The awards committee noted that it was the combination of outstanding performance and modeling that set the NRL paper above the competition.

The researchers developed a detailed mathematical model that includes every step of the assay, which was critical to maximizing the capture and the overall sensitivity they thereby achieved. "When very few molecules are present in a sample, such as a drop of blood," comments NRL's **Dr. Paul Sheehan, NRL NRC Adviser**, "it is critical to try and capture and count every single one." Dr. Paul Sheehan emphasized that "target capture and delivery tends to be a neglected aspect of biosensor design."

"A key advantage of the NRL platform," explains **Dr. Lloyd Whitman, former NRL NRC Adviser**, now an Adviser in the NRC program at the National Institute of Standards and Technology (NIST), "is that it can be applied simply even to the most challenging samples, such as serum, blood, urine, or food. We expect it to have broad applications in medical and veterinary diagnostics, food and water testing, and national security."

Dr. Mulvaney concludes, "Based on the simplicity of the method, we envision small, portable systems for point-of-care testing, field monitoring, and use by first responders." The paper, "Attomolar protein detection in complex sample matrices with semi-homogeneous fluidic force discrimination assays," by S. P. Mulvaney, K. M. Myers, P. E. Sheehan, and L. J. Whitman, appears in the January 2009 issue of *Biosensors & Bioelectronics*. The research was supported by the U.S. Office of Naval Research and the Defense Threat Reduction Agency's Joint Science and Technology Office for Chemical and Biological Defense.

**The compact Bead Array Sensor System (cBASS) is a biosensor that labels biological recognition events with paramagnetic microbead labels and detects captured labels with an array of Giant Magnetoresistive (GMR) sensors**



# 2008 NRC Postdoctoral Research Publication Awards Naval Research Laboratory

Honored March 27, 2009

“Electrochemically Controlled Conductance Switching in a Single Molecule: Quinone-Modified Oligo(phenylene vinylene)”  
*S. Tsoi, I. Griva, S. A. Trammell, A. S. Blum, J. M. Schnur, N. Lebedev*

“Experimental and Theoretical Evaluations of Electron Temperature in Continuous Electron Beam Generated Plasmas”  
*E H Lock, R F Fernsler, S. G. Walton*

“Nonlinear Dynamical Systems Section, Plasma Physics Division”  
*E. Forgoston, L.B. Schwartz*

“Stand-Off Detection of Trace Explosives Via Resonant Infrared Photothermal Imaging”  
*R. Furstenberg,<sup>1</sup> C. A. Kendziora,<sup>2</sup> J. Stepnowski,<sup>2</sup> S. V. Stepnowski,<sup>2</sup> M. Rake,<sup>2</sup>  
M. R. Papantonakis<sup>2</sup> V. Nguyen,<sup>2</sup> G. K. Hubler,<sup>2</sup> and R. A. McGill<sup>2</sup>*

Captain Paul Stewart Presents Postdoctoral Publications Awards to NRC Associates



Dr. Evgeniya Lock, NRC Associate



Dr. Eric Forgoston, NRC Associate



Dr. Stanislav Tsoi, NRC Associate

**ATTENTION:** the 2009 Postdoc Conference (Career Fair) for the Washington DC metro area will be held on Wednesday, July 22, 2009 at the Bethesda North Marriott/Montgomery County Conference Center. If the S.T. E.M. Web site is inaccessible, you may contact Rayna Glucksman at [www/RockvilleREDI.org](http://www/RockvilleREDI.org)

# 2008 NRC Postdoctoral Research Publication Awards Naval Research Laboratory

Honored March 27, 2009

“The Detection of Low-Mass Companions in Hyades Cluster Spectroscopic Binary Stars”

*C. F. Bender, M. Simon*

“Optically Induced Spin Gates in Coupled Quantum Dots Using The Electron-Hole Exchange Interaction”

*S. E. Economou, T. L. Reinecke*

Captain Paul Stewart Presents Postdoctoral Publications Awards to NRC Associates



Dr. Sophia Economou, NRC Associate



Dr. Chad Bender, NRC Associate

# 2007 NRC Postdoctoral Research Publication Awards Naval Research Laboratory

Honored March 28, 2008

NRC Associates: Nadia Kulagina, Michael Martin, Cara Rakowski, Sophia Economou  
NRC Advisers: Brian Houston, Chris Taitt, Fran Ligler, Tom Reinecke

## NRC Staff Profiles

### Marley McDermott...



...joined The National Academies in September 2008 as a Financial Associate for the Fellowships Office. She works primarily with the Ford Foundation Diversity Fellowship Program, the Jefferson Science Fellowship Program, and Associate Programs with the EPA and Air Force. Marley graduated from Lehigh University with a B.S. in Accounting and M.S. in Accounting and Information Analysis. She is a Certified Public Accountant (CPA) and worked as an auditor with a public accounting firm prior to joining The National Academies. Outside of work, Marley is actively involved in charitable work with the Avon Foundation and Higher Achievement.

### Julie Parker ...serves as the

Finance and Administrative Officer with the Fellowship Office and joined the National Academies in 1996. She has served as the financial officer on several projects within the Policy and Global Affairs Division and is currently responsible for the financial management of the ARO Research Associateship Program, the Ford Diversity Fellowships Program, the Jefferson Science Fellows, and the Vietnam Education Foundation Fellowship Program. Julie returned to the Fellowship Office in 2007 after serving as the Director of Finance and Admin for the Vietnam Education Foundation. She received her B.A. from Penn State University.



### Jane Dell'Amore ...has

been on the staff of the National Research Council of the National Academies since 1974. Her first five years were spent in the Office of International Affairs working on the exchange program with the former USSR and its aligned countries. After transferring to the Associateship Programs office in 1979, she assumed the position of Supervisor of Operations, which included overseeing the processing of all applications for Postdoctoral Research Awards.

Moving on, Jane became responsible for promoting the Programs in the scientific community, including coordinating attendance at professional scientific meetings and conferences. With the recent merger of the Research Associateship Programs Office with the Fellowships Office, Ms. Dell'Amore assumed the responsibility for coordinating **all** publicity and outreach activities for the Ford Fellowship Programs in addition to the Postdoctoral Research Associateship Programs.

Also with the merger, the Associateship Programs has added seven meetings to its list of outreach activities, all of which target minority audiences. Jane is looking forward to the challenge of working with the staff in recruiting more minority applicants to the Programs.



In her spare time, Jane enjoys doing volunteer work with the elderly, working out at the gym, and creating beaded jewelry.

**Maria P. Crocco...**is the Supervisor of Operations, handles all support documents for applications received during four reviews each year, assists in processing Research Opportunity booklets, oversees electronic application questions and monitors the electronic office mailbox. She received her B.S. degree in Early Childhood Education from the California University of Pennsylvania.



# Tracking Northern Fur Seals to Aid in Conservation



**Figure 1:** Dr. Carey Kuhn, NRC Associate, NOAA, equipping a northern fur seal with a Wildlife Computers instrument with Fastloc™ GPS capabilities. The instrument will track the female's at-sea behavior for a single foraging trip during the summer breeding season to characterize foraging strategies and important foraging habitat. All research was conducted under Marine Mammal Protection Act permit number 782-1708-04.

Over half of all northern fur seal pups are born on the Pribilof Islands (AK) in the southern Bering Sea in June and July each year. However, over the past 10 years, pup production on these islands has been declining at a rate of 5.2% annually and the species was listed as “depleted” under the Marine Mammal Protection Act after the population dropped below 50% of historical observed levels. To identify the potential causes for the decline and determine the action needed for conservation, the National Marine Fisheries Service developed a conservation plan with the goal of “returning the species to its optimal sustainable population.” The plan identified critical information gaps which included the need for an understanding of adult female at-sea foraging behavior, including the determination of foraging habitats and the relationship between fisheries and prey resources in foraging areas.

**Dr. Carey Kuhn, a National Oceanic and Atmospheric Administration (NOAA) NRC Associate with the National Marine**

**Mammal Laboratory** (NMML, Alaska Fisheries Science Center), is working closely with NMML staff to investigate the at-sea behavior of female northern fur seals. Dr. Kuhn joined the NMML team in September 2007, with Dr. Tom Gelatt as her NRC Adviser, after completing her Ph.D. at the University of California, Santa Cruz. Dr. Kuhn's previous research described at-sea foraging behavior of elephant seals and California sea lions using Argos satellite tracking to locate animals at sea and dive recorders to monitor underwater behavior. Although this technology has been instrumental in increasing the understanding of marine species behavior, recent technological advances have now made it possible to obtain more frequent, higher quality at-sea locations which can be used to more accurately define important foraging habitat.

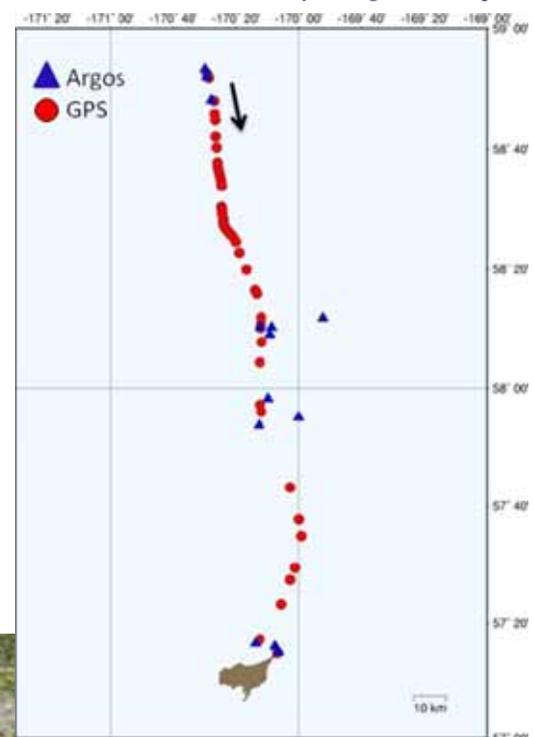
To define fine-scale movement patterns and habitat use of northern fur seals, Dr. Kuhn is using innovative GPS technology to track females during the breeding season (Figure 1 and 2). For marine species that spend long periods of time underwater and limited time on the surface, traditional terrestrial GPS instruments are unable to acquire locations before the animal resumes diving. New Fastloc™ GPS technology has overcome the limitations of traditional GPS allowing researchers to obtain the more accurate, consistent locations previously available only for animals in the terrestrial environment. In an upcoming publication, Dr. Kuhn presents the results of a study aimed at quantifying the differences between Fastloc™ GPS and Argos satellite tracking methods on northern fur seals (Figure 3). In addition, she tests the effectiveness of using movement models to account for the



location error and extensive periods without locations found in Argos satellite data.

Now that the GPS instruments have been validated, Dr. Kuhn is using the at-sea locations along with diving patterns to characterize foraging strategies and important foraging habitat during the breeding season. Since the tracking instruments also collect data about environmental conditions she plans to integrate this information with remotely-sensed data to determine the oceanographic characteristics of preferred foraging areas. The ultimate goal is to use these data to inform managers about adult female foraging behavior to help address one of the key information gaps identified by the fur seal conservation plan.

**Figure 3:** A track of a northern fur seal female returning home from a foraging trip to St. Paul Island (AK) in the southern Bering Sea (Inset). Although overall tracks appear similar, satellite (Argos, blue triangles) locations often fall outside of the general path due to location error. In addition, while satellite locations were acquired in clusters, GPS locations (red circles) were obtained more consistently throughout the trip.



**Figure 2:** A northern fur seal female with a Wildlife Computers instrument with Fastloc™ GPS capabilities. The instrument will track her at-sea behavior for a single foraging trip during the summer breeding season to characterize foraging strategies and important foraging habitat.

# Agencies / Laboratories Participating in the NRC Research Associateship Programs

**Air Force Research Laboratory (AFRL)**

**Armed Forces Radiobiology Research Institute (AFRRI)**

**Chemical and Biological Defense (CBD)**

**FAA/Civil Aerospace Medical Institute (CAMI)**

**Federal Highway Administration/Turner-Fairbank Highway Research Center (FHWA)**

**Institute for Water Resources (IWR)**

**National Energy Technology Laboratory (NETL)**

**National Energy Technology Laboratory Methane Hydrates Fellowship Program (NETL/MHFP)**

**National Institute for Occupational Safety and Health (NIOSH)**

**National Institute for Occupational Safety and Health Associateship Faculty Fellowship Program (NIOSH/FFP)**

**National Institute for Occupational Safety and Health Master's Level Program (NIOSH/MLP)**

**National Institute of Standards and Technology (NIST)**

**National Institutes of Health (NIH)**

**National Institutes of Health (National Institute of Biomedical Imaging and Bioengineering) (NIH/NIBIB) /**

**National Institute of Standards and Technology (NIH [NIBIB]/NIST)**

**National Oceanic and Atmospheric Administration (NOAA)**

**Naval Medical Research Center/Naval Health Research Center (NMRC/NHRC)**

**Naval Postgraduate School (NPS)**

**Naval Research Laboratory (NRL)**

**Navy Marine Mammal Program (MMP)**

**US Army Aviation and Missile Command (AMCOM)**

**US Army Edgewood Chemical Biological Center (ECBC)**

**US Army Medical Research and Materiel Command (AMRMC)**

**US Army Natick Soldier Research, Development and Engineering Center (NSRDEC)**

**US Army Research Laboratory (ARL)**

**US Army Research Office (ARO)**

**US Army Research, Development & Engineering Command, Night Vision & Electronic Sensors Directorate (NVESD)**

**US Army Res., Dev., and Engr Command/Armament Res., Dev., and Engr Center (RDECOM/ARDEC)**

**US Environmental Protection Agency (EPA)**

**US Environmental Protection Agency Associateship Faculty Fellowship Program (EPA/FFP)**

**US Marine Mammal Commission (MMC)**

**US Military Academy/US Army Research Laboratory (USMA/ARL)**

# 2009 SCHEDULE

## February Review

Submission deadline - February 1  
 Transcripts and Reference Reports deadline - February 15  
 The Board meets March 9—10  
 Agencies will be notified within two weeks

## May Review

Submission deadline - May 1  
 Transcripts and Reference Reports deadline - May 15  
 The Board meets on June 19  
 Agencies will be notified within two weeks

## August Review

Submission deadline - August 1  
 Transcripts and Reference Reports deadline - August 15  
 The Board meets on September 25  
 Agencies will be notified within two weeks

## November Review

Submission deadline - November 1  
 Transcripts and Reference Reports deadline - November 15  
 The Board meets on January 8, 2010  
 Agencies will be notified within two weeks

*continued from front cover*

Most research on SERS focuses on excitation in the visible region of the spectrum. However, there are potential advantages to using ultraviolet excitation, including inherently larger cross sections and possible additional resonance enhancement when the incident laser can also excite an electronic transition of the molecule. Nanostructured surfaces of elements such as palladium, platinum, and aluminum are being explored as potential SERS substrates in the ultraviolet

Dr. Emmons is also working on applications of conventional Raman spectroscopy to detect explosives, especially for forensic applications in the anti-terrorism and law enforcement fields. Much of this work focuses on the detection of explosives in contaminated fingerprints. Raman chemical imaging is being used in order to detect and map out the spatial distribution of explosives in simulated contaminated fingerprints. Raman spectroscopy has a distinct advantage in this field since it requires no sample preparation and is non-destructive. After a Raman spectrum is obtained, the fingerprint is still available to obtain further biometric information, such as the identity of the person who handled the explosive. Hopefully this research could evolve into a technology that is useful both for soldiers and law enforcement officials in the field.

## ECBC Profile

## NRL/NRC Semi-Annual Postdoctoral Spring Poster Session

NRL WISE, NRC and ASEE held its fifth semi-annual spring Postdoctoral Networking Poster Session, April 9, 2009, 3-5 p.m., Exhibits Hall, NRL campus. The conference-style Networking and Poster Session is a chance for Fellows to socialize while presenting their research accomplishments to a lab-wide audience. NRL supervisors with positions to fill are encouraged to use the session for locating job candidates with on-site experience. Refreshments are served. All NRL campus is invited to attend.

Eight (8) National Research Council (NRC), American Society for Engineering Education (ASEE) and university supported post doctoral associates presented their research to the Naval Research Laboratory (NRL) community. The associates represented various NRL Divisions, representing a broad range of topics. The event was well attended, as usual, with approximately 40—60 attendees, viewing and discussing the posters.

David Walker, Code 5312 NRC: *"Novel detector schemes based on sound amplification in optical fibers"*

John L. Kulp III, Code 6176, ASEE: *"Peptide nanopores as stochastic sensing elements"*

Richard Flynn, Code 61778, NRC: *"Surface Plasmon propagation length measurement for optically thick Plasmon waveguides"*

Bradley De Gregorio, Code 6366, NRC: *"Variety of organic matter in stardust return samples from comet 81P/Wild2"*

Pavel Ivanov, Code 6361, ASEE: *"The surface of half-metallic CrO<sub>2</sub>"*

Evgeniya Lock, Code 6752, NRC: *"Polymer processing by electron beam generated plasma in nitrogen and Ar/N<sub>2</sub> mixtures"*

Mira Baraket, Code 6752, NRC: *"Plasma diagnostics of new continuous wave electron beam source"*

Yu Yu Khine, Code 7120, ASEE: *"Modeling of soliton propagation in uncertain ocean environment"*