THE NATIONAL ACADEMIES

RESEARCH ASSOCIATESHIP PROGRAMS

# NEWSLETTER

Spring 2007

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NATIONAL RESEARCH COUNCIL
*OF THE NATIONAL ACADEMIES*

## *From the Director...*

*Each year I have the opportunity to visit some of the government agency locations that participate in the NRC Research Associateship Programs. In making these visits, I am always struck by two things. The first is the diversity and quality of research that goes on in federal government labs. I expect that most academic scientists and engineers are largely unaware of the scope of this sector of the U.S. research enterprise. Even for someone like me who spent most of their career in a government lab, there was a lack of awareness of the breadth of what was, and is, being accomplished across the entire spectrum of the federal laboratories. The second thing that strikes me during these visits is the quality of the research being done by the NRC Associates and the contributions that are being made to the mission of the laboratory as a result of their research. There is tremendous enthusiasm among the Advisers and administrators for the work of the Associates and it is clear that the Associates have a substantial impact in the mission areas of the various agencies.*

*The NRC Research Associateship Programs play a major role in bringing new science and engineering talent into the federal workforce. Many of the participating agencies look at the Associateship program as a way to bring new staff on board. The postdoctoral period gives each side an opportunity to evaluate the other for a possible long term relationship. Overall almost 40% of Associates remain in the federal workforce following their postdoctoral tenure. At the same time, a productive postdoctoral experience in a federal lab is solid preparation for a permanent position in academia or industry and many of our Associates go on to successful careers in these sectors.*

*The NRC Research Associateship Programs staff is cognizant of the important role we play in facilitating postdoctoral opportunities for young scientists and engineers and take pride in the fact that we are contributing to the research workforce of the future. This Newsletter is our way of highlighting some of the successes of Associates and their Advisers who participate in the NRC Research Associateship Programs. We hope that you will take a few minutes to look through this issue, and consider submitting an article about your research for a future issue.*

*Ray Gamble*


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

This *Newsletter* is published periodically to highlight research and activities of Associates and Advisers who participate in the NRC Research Associateship Programs and to provide general information on these programs. The *Newsletter* is mailed to all NRC Associates on tenure at the time of publication, all active NRC Advisers, and all current agency Program Representatives. It is also posted as a PDF on our website – www.nationaacademies.org/rap. We encourage you to send us articles, profiles, press releases, photos, etc.

Send all submissions to Suzanne White (swhite@nas.edu)

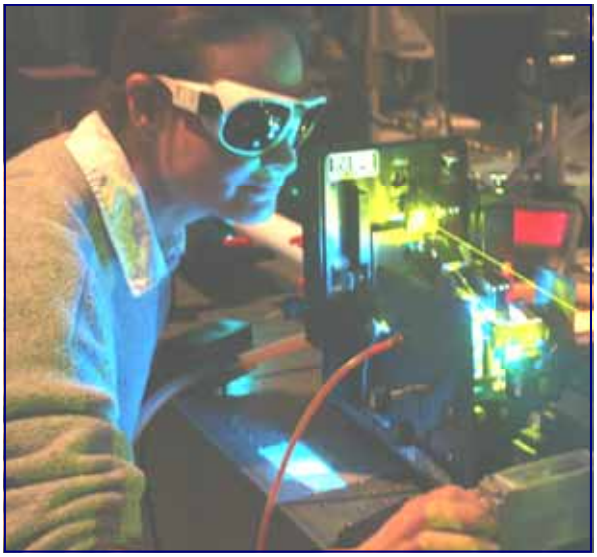
# Energy Transfer in Reactive Flows

Dr. Katherine Essenhigh recently joined Dr. Glen Perram's group as a NRC Associate at the Air Force Institute of Technology at Wright Patterson Air Force Base in Dayton, Ohio to continue her research into energy transfer in reactive flows. Having recently earned her Ph.D. from The Ohio State University, Dr. Essenhigh has taken on the project of characterizing a Mach 2 supersonic nozzle in conjunction with ongoing research at Kirkland Air Force Base in Albuquerque, New Mexico with Dr. Gordon Hager.

The Center for Directed Energy, a joint effort by both AFIT and Kirkland, has many different research topics in reactions in supersonic flows, as well as development of optical diagnostics using lasers for measuring kinetics and observing foreign species. The Missile Defense Agency's Airborne Laser (ABL) mounts a high power Chemical Oxygen-Iodine Laser (COIL) on a Boeing 747-400F aircraft to destroy ballistic missiles in the boost phase. The Chemical Oxygen-Iodine Laser employs a supersonic mixing nozzle to produce gain in atomic iodine at a wavelength of 1.315 microns. This supersonic nozzle, particularly the translational temperature and uniform mixing, is critical to the laser performance. However, non-intrusive methods for characterizing the full spatial dependence of the flow field are not available.

The current development of planar laser induced fluorescence will enable a thorough investigation of the reactive mixing for the COIL gain medium. Katherine's research first focuses on the measurement of the supersonic nozzle's temperature, pressure and velocity distributions. The motivation for this project comes from the need to accurately measure these quantities in environments that are supersonic and at very low pressures, which is characteristic of many gas-dynamic lasers.

Her interest in understanding how chemical reactions release heat was originally sparked while volunteering at the local science museum. During weekends, she performed a range of science demonstrations which included optical illusions, chemistry, and electrostatics. One specific demonstration involved a chemistry reaction that could release heat, and sometimes so much that it could melt the plastic cup. However, her favorite projects usually involved a more in-depth study of the physical processes. One project studied how crystals grow in different environments. Another project in aerodynamics involved designing and building paper wings attached to a paper shuttle which contained an egg to be dropped from thirty feet.



**Katherine Essenhigh, AFRL/AFIT NRC Associate**

Today, her experiments have moved away from plastic cups and construction paper to glass cells and supersonic nozzles. She continues to study the dynamics of physical properties that occur during reactions or flow by monitoring the temperature, pressure, and others properties via various optical techniques. While most of her work has been experimental in nature, her early graduate work was in mathematical modeling of a perfectly stirred reactor. This work was undertaken to study the dynamics and stability of the physical properties occurring during a methane-gas reaction, and to understand the intricate behavior between heat, reactants and pressure changes in the flow which could produce a pulsating behavior.

Mathematical theories in stability were applied to the methane reaction, where the physical properties could be widely fluctuating, possibly in a periodic fashion, and especially when the device is operating near the extinction limits. Computer programs were designed to monitor the eigenvalues of the linearized set of steady-state equations to determine if there were any limit cycles, or Hopf bifurcations. Studying these theories served as a foundation for the experimental work to be done. For her Ph.D. graduate work, she measured the kinetic rate of two vibrationally-excited carbon monoxide molecules reacting to form carbon dioxide and free carbon. It was shown that these reactions could occur in otherwise non-favorable conditions, such as at low temperatures. Experimentally, a kinetic rate was calculated for these vibrationally-activated reactions which occur when energy is transferred and stored under non-equilibrium conditions.

Essenhigh is further expanding and testing ideas by applying earlier sub-doppler optical methods to a new supersonic nozzle, with higher flow capabilities. A dye laser in a ring configuration, pumped by an argon-ion laser, produces a very small line width of less than 1 MHz, much lower than the Doppler broadening, and is tunable over a very large frequency range.

Iodine is used as the seed molecule in the flow because of its dense spectral response due to the hyperfine structure. At these low operational pressures, determination of the temperature is relatively straightforward, but pressure extraction may be difficult. However, saturation spectroscopy may be used to remove the Doppler component, and extraction of pressure may be feasible. Currently, she is also interested in using line profile shapes to determine the physical properties of the supersonic nozzle, and in applying the results to characterize the flow (such as turbulence) or mix and determine the concentration distributions in the nozzle. In many supersonic applications and gas-turbine engines, fuel reactions are taking place in fast flows and can be difficult to maintain at higher speeds. These are important issues to research.

# THz-Wave Generation for Detection of Explosive Materials and Concealed Weapons

Dr. Candace Lynch played a major contributing role at the Air Force Research Laboratory during her NRC Associateship. Her proposal entitled "Terahertz wave generation in quasi phase-matched GaAs: demonstration and characterization", demonstrated an innovative approach, and she was awarded the NRC Associateship at the Sensors Directorate, Hanscom, AFB (SNH). [Gallium arsenide (GaAs), a compound of Gallium and Arsenic, is an important semiconductor used to make microwave frequency integrated circuits, infrared light-emitting diodes, laser diodes, solar cells, and similar devices.] Terahertz (THz)-wave generation for detection of explosive materials and concealed weapons is an emerging concern of the Sensors Directorate.

Candace completed her Ph.D. at Brown University in Materials Science and Engineering in 2004. Her dissertation on strain relaxation during epitaxial crystal growth provided a good basis for crystal growth of GaAs for new sensor applications. Understanding strain relaxation behavior is important for optimizing the growth of relaxed, low defect density semiconductor layers.

Dr. Lynch became involved in all aspects of the SNH materials/device effort developing the ability to measure the optical and electrical properties of crystals. The work she did in the terahertz area, a relatively unexplored region of the electromagnetic spectrum, is important for maintaining Air Force leadership in this emerging area.

Most recently, terahertz technology became an emerging research area where there are multiple opportunities for development. The terahertz (THz) region of the spectrum is an extension of the infrared to very long wavelengths. The capability to generate and measure THz waves using non-linear optics will be critical for future Department of Defense (DoD) *Defense Advanced Research Projects Agency (DARPA)* programs.

Dr. Candace Lynch's work, funded by the Air Force Office of Scientific Research (AFOSR), also contributed to a DARPA program for terahertz signal generation—Terahertz Imaging Focal-Plane-Array Technology (TIFT).

The mission of the Sensors Directorate was greatly enhanced by the NRC Associateship Program, in general, and by Dr. Lynch, in particular. With more than one million dollars invested in crystal growth and characterization equipment here, the group has produced materials that generated significant terahertz output at room temperature. However, there are many challenges that must be overcome soon if the THz program is to be a success. A better understanding of the growth process, and the means to achieving higher power THz signals, will come about only by attracting and holding the best personnel.

Dr. Lynch demonstrated the capability to grow and characterize the crystals, interpret the data, and has helped the Sensors Directorate pave the way to new applications for sensor materials.

**Candace Lynch, former AFRL NRC Associate, and the Low-Pressure Hydride Vapor-Phase Epitaxial Reactor at AFRL Sensors Directorate - Hanscom Research Site**

## As posted on www.NRC-RAP.org — Web Board

**"... we've had so much fun at our Happy Hours, we're going to try to schedule one each month! If you're interested in joining us, please contact Melissa Hornstein at Melissa.hornstein@nrl.navy.mil"**

# Advanced Geospatial Technology uses Open-Source GIS

Dr. Helena Mitasova, ARO senior NRC Associate, devoted three years (2001-2004) of her fellowship stay at the North Carolina State University (NCSU) and Army Research Office (ARO) to the development and application of open source geospatial tools for analysis of rapidly changing coastal topography. During her fellowship she closely collaborated with Dr. Thomas Drake and Dr. Overton, NCSU, and Dr. Russell Harmon, ARO to extend her expertise in terrain analysis and modeling to specific problems of coastal areas using modern mapping technologies such as airborne laser scanning (lidar) and real-time kinematic GPS (RTK-GPS).

The joint ARO-NCSU research resulted in the development of a set of state-of-the-art 3-D geospatial analytical tools that have been evaluated at several coastal locations along the Outer Banks of North Carolina. The work yielded new and unique insights into the evolution of coastal topography under strong anthropogenic influences resulting from both beach preservation efforts, associated activity related to the creation and modification of nearby offshore bathymetry, as well as efforts to manage terrestrial dunes sand migration. The better understanding of coastal dynamics in these areas will support the Army military mission of logistics-over-the-shore as well as the important civil works objectives of sustainable coastal management and cost minimization of coastal protection and disaster management.

A new method for comprehensive spatial temporal analysis of sand dune evolution first identifies a comprehensive set of features used as indicators of dune evolution; and it then defines techniques based on surface analysis, using principles of differential geometry, to extract these features (dune crests, ridges, slip faces and active dune areas) and quantify their change. This unique methodology allowed them to study various aspects of complex evolution of a sand dune field at Jockey's Ridge State Park, Nags Head, NC (Figure 1.) that included rotation, translation and deflation, evolution of new slip faces, and transformation from crescent to parabolic dunes (Figure 2). Complex interactions between human impacts and natural processes were identified: the impact of large numbers of visitors freely moving over the dune has proven to be minimal; on the other hand, the naturally expanding vegetation and urban development surrounding the dune, reducing the sand supply, had a major impact. It appears that the combination of climate change and indirect human activities are having more significant impact than the direct interaction. Quantification of dune evolution provided critical information for park management and selected results of the research will be included in the visitors center. Published peer reviewed papers resulting from this research describe a methodology for processing and analyzing multitemporal lidar data (Mitasova et al. 2005a) and a geographic information system (GIS)-based methodology for quantification of sand dune evolution (Mitasova et al. 2005b). Several aspects of the methodology were also included in the second edition of the book "Open Source GIS: the GRASS GIS Approach", by Neteler and Mitasova (2004), with the third edition under way.

The research has also included development of a methodology for cost effective 3-D surveys of beach topography using RTK-GPS conducted in collaboration with D. Bernstein and C. Freeman of Geodynamics, LLC (a limited liability corporation). The high accuracy of the spatial interpolation method known as 'regularized spline with tension' (RST) was fully confirmed for sparse RTK-GPS data by performing a comprehensive assessment of accuracy of the resulting elevation surfaces using high-density lidar to-

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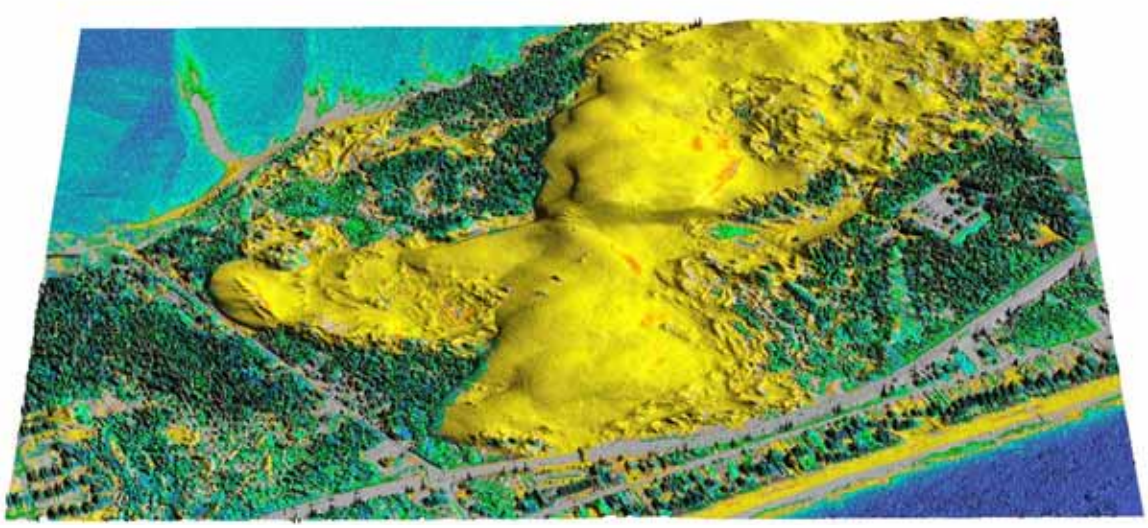

**Figure 1. The largest active sand dune on North America's east coast, located in the Jockey's Ridge state park on Outer Banks, North Carolina: Lidar-based 1m resolution digital elevation model with color, representing land cover, derived from infrared digital orthophoto.**

**Mitasova *continued***

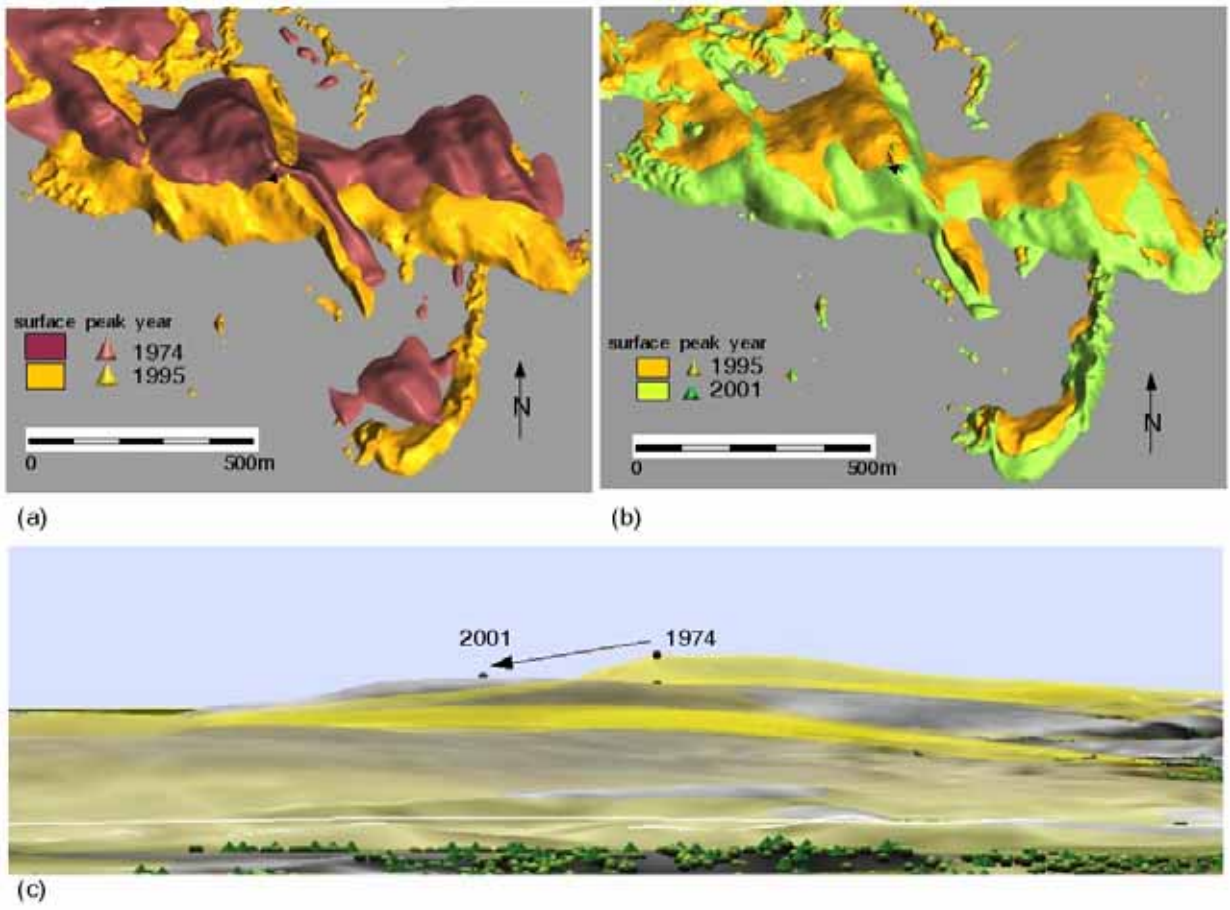


**Figure 2. Overlays of digital dune models created from photogrammetric and lidar surveys show the complex dune evolution (a) between 1974 and 1995; (b) 1995 and 2001; (c) long term dune deflation and horizontal migration – view from east.**

pographic data. The analysis of various survey designs has shown that longshore+crosshore profile combination leads to the most accurate DEM, whereas the standard crosshore profiles are sensitive to the selection of interpolation method and often result in DEMs with artificial features.

The most comprehensive and systematic application and testing of the new methods was conducted at Bald Head Island, NC and the adjacent offshore area. The quarterly monitoring conducted since 2001 at Bald Head Island, combined with the analysis of four years of lidar data, has demonstrated that erosion rates should be monitored and analyzed as highly nonlinear phenomena because neither periodic snapshots nor long-term erosion rates give the full picture of coastal topography evolution through time. This research was conducted in collaboration with D. Bernstein (Coastal Carolina University and Geodynamics LLC.); J. McNinch (Virginia Inst. Marine Sciences); and H. C. Miller (U.Ss Army Corps of Engineers Coastal Field Research Facility). In this work, terrestrial lidar and RTK GPS elevation data for the beach and dune areas were combined with offshore interferometric sonar soundings to create an integrated spatio-temporal model of the nearshore beach and offshore topography; then to capture its evolution in response to recent canal dredging by the U.S. Army Corps of Engineers, and the consequent storage of the dredged material on the beach or in offshore underwater mounds. The results of the analysis demonstrated a dramatic increase in beach erosion rates during the first year after the combined dredging-renourishment project was completed in the area where the new channel of the Cape Fear River crosses the Bald Head Island shoals. This situation contrasted markedly with the temporal evolution of the east section of the Bald Head Island beach, which was closer to the state typical for an equilibrium beach.

This research has demonstrated the high degree of spatial and temporal variability that coastal landscapes can exhibit in response to anthropogenic changes, and the work has provided crucial data for future management of the island's shoreline environment. Systematic continuous monitoring is needed for effective management of dynamic coastal areas, particularly those influenced by engineering projects and/or frequent large storms.

# The Best & the Brightest 2006 Career Expo

Each year, our brightest, most highly vetted scientists drift away from the region as they finish their federal laboratory or university post-doctoral fellowships.


Approximately 1,500 to 2,000 scientists who have recently received their Ph.D.'s come to this region annually for fellowships in some 30 federal laboratories such as NIH and NIST. An equal number become fellows at local universities. Fellowships are extremely competitive, with up to 10 applicants for any given fellowship.

Fellows spend one to four years working on some of the world's thorniest problems in cutting-edge fields such as neuropsychology, astrophysics, biomedical engineering, and radio wave telecommunication. When their fellowships end, most of them find jobs elsewhere, thus depriving the region of thousands of the most highly trained individuals in their fields.

Many local fellows would love to stay in this area. They have professional connections with local scientists, enjoy local cultural opportunities, have spouses who are employed locally, and many have children that enjoy excellent local schools. So, why are they leaving? Individuals at this level have spent most of their lives in academic environments, and have largely assumed that their careers lie in academe. With few primary academic research institutions in the Washington area, postdocs seeking tenure-track positions will most likely have to leave this area to find academic jobs.

Unfortunately, this academic job shortage is nationwide. A 2005 Sigma Xi publication, "Doctors Without Orders," concluded that *"growth in the number of science and engineering postdocs over the past decade (2.8 percent per year) has out-stripped the rate of increase in the number of full-time science and engineering faculty positions (0.8 percent per year). … Most of the postdocs we surveyed will probably not become faculty members at a research university. Indeed, they will likely end up outside of academia altogether."*

Herein lies an opportunity for the Washington metropolitan region. There are hundreds of scientific companies in this area. There is an enormous wealth of technology transfer assistance available here to help scientists become entrepreneurs. And the federal presence creates many alternative career possibilities such as science writing or patent and trademark protection. So how can the Washington region's postdocs learn about the many possibilities open to them here?

An unusual consortium of federal, state and local organizations may have found a way. In May 2006, 330 local postdoctoral fellows convened at the Universities of Maryland at Shady Grove for the first-ever regional Postdoc Conference and Career Expo. This all-day conference was free to federal laboratory post-doctoral attendees. Dr. Carol Nacy, Founder & CEO of Sequella, Inc., was the keynote speaker. She related the way that her postdoctoral work had prepared her to start a successful biotechnology company, even though that was not her intent at the time. Her opening was followed by a general session on interviewing skills, and then attendees followed one of three career tracks: traditional, entrepreneurial and alternative.

The *traditional* track was for individuals who wish to practice their science at a company or in the laboratory of a federal agency. The *entrepreneurial* track was for individuals wishing to start their own companies with their own discoveries or by licensing someone else's technology. The *alternative* track was for individuals who want to apply their science background in fields including science policy, intellectual property, and venture capital funding. The postdocs who attended these seminars revealed that they were excited to learn about real-world job opportunities, including alternative careers, and entrepreneurial avenues.

The afternoon half of the conference featured a career expo, where attendees met representatives from thirty companies interested in hiring postdoctoral fellows. Not surprisingly, companies such as Westat, SAIC, MedImmune and GenVec used this opportunity to recruit carefully-vetted talent. One of the remarkable facets of the Postdoc Conference is the collection of organizations that planned it. Rockville Economic Development, Inc. served as overall conference organizer. The following organizations helped structure and publicize the event: NIH Office of Technology Transfer; NRC Research Associateship Programs; NRL; NIST; USAMRIID; NASA; the Federal Lab Consortium; AAAS; and Montgomery County Department of Economic Development and its County Workforce Services. The state of Maryland, through the Maryland Technology Development Corporation, coordinated registration and logistics.

The following is from the agenda of the September 2006 Federal Lab Consortium Mid-Atlantic Regional Meeting, "Linking Technology Transfer to End-User Needs".

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***"Post-Doc Placement as a Means of Technology Transfer:*** *Each year, 1,500-2,000 post-doctoral fellows in the federal laboratories will complete their fellowships and consider their future career options. They know their technology and have numerous personal contacts in the laboratories. An opportunity exists for post-docs to assist in more effectively transferring the technology from the labs. This year [2006], a group of federal technology transfer managers partnered with local economic development organizations to produce a conference and career expo for the post-docs. The conference specifically included information on entrepreneurship and tech transfer. The group learned that some introductory training on these topics needs to happen earlier. The labs should realize that the post-docs, with extensive knowledge of the lab technology, are 'seeding' industry. Labs should consider how they can prime their post-docs to better transfer their technology to the commercial sector by providing more information on transfer mechanisms, entrepreneurship, and available business assistance."*

**Jane Dell'Amore , left, and Gwen Roby, background, NRC Staff, at the 2006 Career Expo**


**Montgomery County Department of Economic Development and George Mason University, of northern Virginia, are now planning the Career Expo for June 27, 2007 at the NIST campus, Gaithersburg, Maryland. https://techcouncilmd.com/events**

# New Research Associateship Programs

## NETL-MHFP

The U.S. Department of Energy's National Energy Technology Laboratory (NETL) announced a new Research Fellowship Program designed to support the development of METHANE HYDRATE science and enable highly qualified graduate and postgraduate students to pursue research in an area of increasing importance to the nation. Their 2– or 3-year fellowships will be made available to support work towards M.S. and Ph.D. degrees, or in a postdoctoral appointment. The Methane Hydrates Fellowship Program (MHFP) Application and Support Document forms can be found on our website under *Application Information*. **The application for NETL-MHFP should be submitted in hard copy.**

## NIOSH-MLP

The National Institute for Occupational Safety and Health (NIOSH) announced a new Master's Level Program (MLP) for individuals with a Master's Degree in public health and related disciplines. MLP Fellowships are awarded for one year and renewable for one additional year. MLP Internships are awarded for 12 weeks, with an extension possible. The MLP Application and Support Document forms can be found on our website under *Application Information*. Individual NIOSH research and career development opportunities can be found, also on our website, under "NIOSH-MLP". **The application for NIOSH-MLP should be submitted in hard copy.**

## CBD

The Joint Science and Technology Office (JSTO) of the Defense Threat Reduction Agency and the National Research Council announce a special focus area for research related to the Department of Defense (DoD) Chemical and Biological Defense Program.

JSTO will provide funds directly to sponsoring DoD Laboratories/Centers to support selected NRC Postdoctoral Research Associates as Chemical and Biological Defense (CBD) Postdoctoral Fellows. The purpose of this program is to augment the recruitment and advancement of talented, new scientists and engineers to perform CBD-related research in DoD Laboratories/Centers and support the labs in their efforts to develop and exploit new technologies to defend the warfighter. If you would like to learn more, please visit our website http://www.dtra.mil/rd/cbt/index.cfm. The following link to our current research solicitations should give you insight into the needs and concerns of CB defense http://www.arl.army.mil/main/main/default.cfm?Action=6&Page=8.

A competitive selection process will identify candidates eligible to become CBD Postdoctoral Fellows from those highly-rated applicants to the NRC Postdoctoral Research Associateships Program who have proposed research related to CBD at a DoD Laboratory/Center. Selection as a CBD Postdoctoral Fellow will be based on many factors, including the potential of the proposed research to contribute to the mission of the CBD Program.

To be considered for this Fellowship, you must apply for a NRC Postdoctoral Research Associateship using an existing, relevant Research Opportunity at a DoD Laboratory/Center, and indicate your interest in this program to your proposed Advisor prior to submission. Your proposed Advisor must contact JSTO for instructions at CB-NRC@dtra.mil for how his/her Laboratory/Center can participate. (See Instructions for Advisors [linked to information on following page].)

Note that even if you are not selected as a CBD Postdoctoral Fellow, you may still be eligible for an award as a regular Postdoctoral Research Associate, subject to the availability of such positions at the host DoD Laboratory/Center.

# The Civil Aerospace Medical Institute (CAMI) — FAA's best kept secret

*"The Civil Aerospace Medical Institute (CAMI) is probably one of the Federal Aviation Administration's best kept secrets,"* says CAMI Director, Dr. Melchor Antuñano. As one of the world's premier aviation research facilities, CAMI, located at the FAA Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma, conducts critical aerospace research that focuses on the safety of pilots, passengers, air traffic controllers, and the entire human support system that embraces civil aviation. Over 200 physicians, researchers, educators, pilots, technicians, and administrative personnel work in CAMI's state-of-the art facilities.

CAMI's mission is to assure civil aerospace safety through excellence in medical certification, education, aerospace medical and human factors research, and occupational health services. To support that mission, the facility has multiple laboratories that allow the researchers to perform real time simulations and/or experiments that are identical to real world aircraft situations. According to Dr. Antuñano, *"CAMI's researchers are global leaders in aerospace medical and human factors research. Our researchers are pioneering new aviation-related technologies, procedures and scientific developments that are leading the way to new global safety standards as we translate research into operations."*

Since 1961, CAMI researchers, many of whom hold M.D. and/or Ph.D. degrees, have published over 1,000 FAA technical research reports and scientific articles in the open literature, helping the civil aviation community understand the medical and human factors challenges of aviation operations. The results of this work have had immediate impact on civil aviation safety. At CAMI, researchers specialize in either aerospace human factors or medical research. The aerospace human factors researchers focus on the design, operation, and maintenance of components of the National Airspace System (NAS). They investigate and study human performance under various environmental conditions with the goals of improving NAS effectiveness, efficiency, and safety. Their primary emphasis is on enhancing human performance through equipment design, interface design, management practices, and human resource procedures including personnel selection and training.

CAMI's aerospace medical research focuses on the biomedical aspects of flight. In highly specialized and sophisticated medical laboratories, these scientists conduct aviation safety research associated with biomedical, pharmacological, and toxicological issues. They also conduct research into environmental factors that influence human physiology and performance, such as the study of protective breathing equipment for use in emergency situations aboard aircraft. Although the majority of the CAMI activities are geared to improving aviation safety now, researchers are also identifying future issues as they look towards the next giant step from civil aviation into civil space operations. And, again, CAMI is leading the way by examining the medical and human factors safety issues associated with commercial space travel.

**Melchor Antuñano, FAA/CAMI LPR and former NRC Associate**

Melchor Antuñano, M.D., M.S. has been the Director of the Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI) since January 14, 2001.

Dr. Antuñano provides executive direction and is responsible for the administrative oversight of FAA Office of Aerospace Medicine's programs in Medical Certification, Medical Education, Medical Research, Human Factors Research, and Occupational Health Services, that are critical and integral elements of the Office of Aviation Safety.

He is the focal point in leading the activities of a professional, technical, and clerical team engaged in policy development, planning, evaluating, and administering of: (1) a program to fulfill the medical certification needs of approximately 620,000 holders of U.S. pilot certificates; (2) a program for the selection, designation, training, and management of about 5,000 Aviation Medical Examiners (AMEs) appointed to conduct physical examinations and issue FAA medical certificates to pilot certificate holders throughout the U.S. and in 93 countries worldwide, (3) medical education programs in aviation physiology, global survival, and aviation human factors for FAA flight crews and civil aviation pilots, (4) medical publications and other didactic materials used to disseminate medical information to promote aerospace safety, (5) a highly specialized library system in support of a broad range of aerospace medical and safety reference/research programs, (6) an integrated program of field and laboratory performance research in organizational and human factors aspects of aerospace work environments, (7) an applied research program to identify human tolerances, capabilities and failure modes (physiological, psychological, and performance) both in uneventful flights, and during civilian inflight incidents and accidents, (8) an occupational medicine program to improve the safety of FAA employees, and (9) a medical clinic that provides health services to employees and students at the MMAC.

Since he joined the FAA in 1992, Antuñano served as the Manager of CAMI's Aerospace Medical Education Division, including a special 9-month assignment as Acting Manager of the Aerospace Medical Certification Division.

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**FAA/CAMI *continued***

Melchor Antuñano was born in Mexico City, Mexico in 1960.He is a graduate of the National Autonomous University of Mexico School of Medicine, and completed post-graduate training in Aviation Medicine at the Mexican Government's National Center of Aviation Medicine in Mexico City, Mexico. He is a graduate of the Residency Program in Aerospace Medicine at Wright State University School of Medicine in Dayton, Ohio and was awarded an NRC Research Associateship (1988-1990) at the USAF School of Aerospace Medicine in San Antonio, Texas.

Melchor is credited with 374 professional presentations and invited lectures at national and international conferences in aerospace medicine in 26 countries, and with 48 scientific publications covering a variety of aerospace medicine topics. He is a Fellow and Past-President of the U.S. Aerospace Medical Association, Past-President of the Space Medicine Branch, Past-President of the Iberoamerican Association of Aerospace Medicine, member and past-selector of the International Academy of Aviation and Space Medicine, member of the International Academy of Astronautics, Honorary Member of the Greek Aerospace Medical Association, Honorary Member of the Colombian Society of Aviation Medicine, Honorary Member of the Slovenian Aerospace Medical Association, Honorary Member of the Mexican Society of Aviation Medicine, and a member of other national and international professional societies in aerospace medicine.

He is a faculty member at Wright State University School of Medicine, the University of Texas Medical Branch in Galveston, and the National University of Colombia School of Medicine; and a former faculty member at the Medical Sciences Division of Oak Ridge Institute for Science and Education, the University of Oklahoma Health Sciences Center, and at the Santa Casa de Sao Paulo Medical School in Brazil.

Antuñano has received 56 awards and recognitions for his academic, administrative, and research achievements including:

(1) “DOT Secretary’s Award for Meritorious Achievement: Silver Medal” granted by the Secretary of the U.S. Department of Transportation for outstanding accomplishments in promoting aviation safety in the U.S. and abroad, through aeromedical education; (2) "Outstanding Manager Award" granted [3 times] by the FAA Office of Aerospace Medicine; (3)"Arthur S. Flemming Award" granted by the George Washington University for outstanding accomplishments in the promotion of aviation safety in the U.S. and abroad through the exercise of inspiring leadership and professionalism; (4) "Eric Liljencrantz Award" granted by the Aerospace Medical Association for excellence as an educator in aerospace medicine; (5) "John A. Tamisiea Memorial Award" granted by the Aerospace Medical Association and the Civil Aviation Medical Association for unique contributions to the aviation medical examiner activities through the introduction of innovative and creative teaching procedures for AMEs; (6) “Young Investigator Award" given by the Space Medicine Branch of the Aerospace Medical Association for authorship of the most outstanding paper by a young investigator; (7) “Congressional Certificate of Recognition for Contributions to Improve Aviation Safety in Colombia through Continuing Medical Education” granted by the House of Representatives of the Republic of Colombia; and (8) “Honorary Federal Air Surgeon” granted by the Director General of the Civil Aviation Authority of the Dominican Republic.

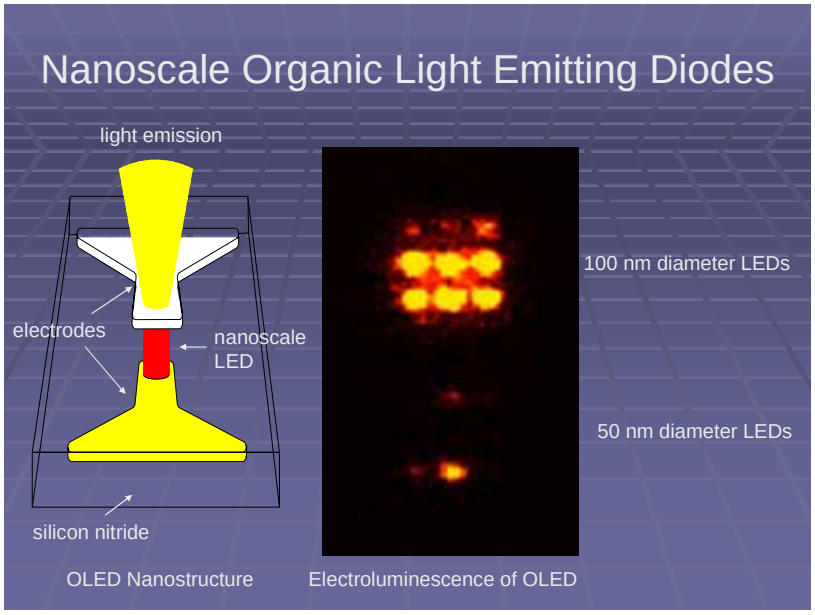
**http://www.faa.gov/about/office**



# Optoelectronics: Light on the Matter

Miniature organic light-emitting diodes (OLEDs), some as small as 60 nanometers across, could help scientists to make light work of nanoscale tasks. The tiny lights, their inventors say, may prove useful for quantum communication or in photo patterning nanomaterials.

The OLEDs, made by Zakya Kafafi, NRL NRC Adviser and her colleagues at the Naval Research Laboratory in Washington DC, rely on a light-emitting polymer called MEH–PPV.

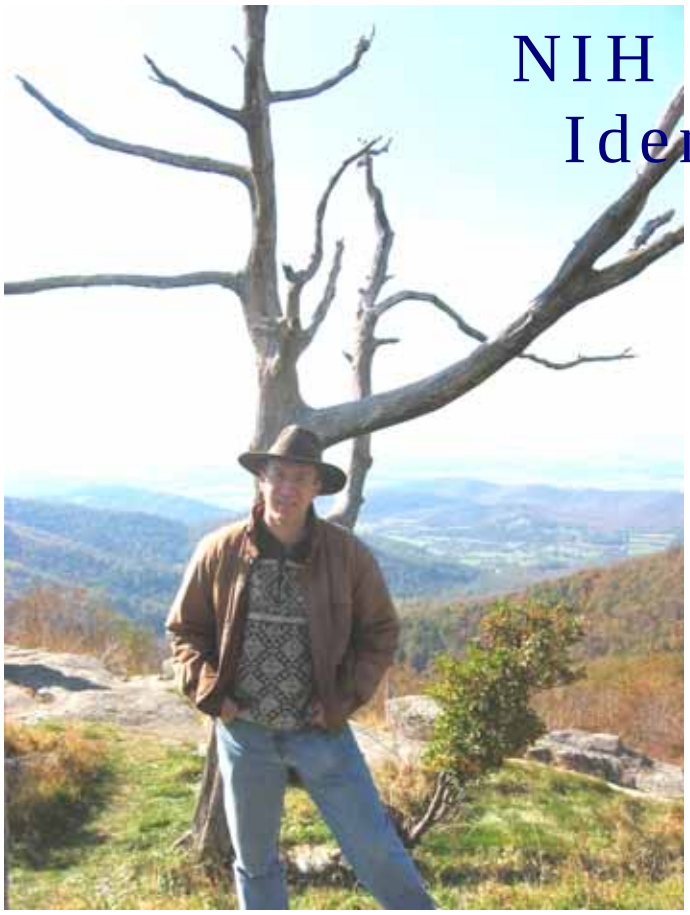



The polymer is packed inside cylindrical nanoholes etched about 100 nanometers deep into a film of silicon nitride. Each cylinder acts as an independent OLED.

Tests showed that the nanodiode's electrical and light emitting properties are much like those of a larger reference OLED.

***noLetters* doi:10.1021/nl051811+ (2005)**

***See related article on pages 30-31.***



David Goldman, NIH NRC Adviser

# NIH Researchers Identify OCD Risk Gene

Scientists at the National Institutes of Health's (NIH) National Institute on Alcohol Abuse and Alcoholism (NIAAA) have identified a previously unknown gene variant that doubles an individual's risk for obsessive-compulsive disorder (OCD). The new functional variant, or allele, is a component of the serotonin transporter gene (*SERT*), site of action for the selective serotonin reuptake inhibitors (SSRIs) that are today's mainstay medications for OCD, other anxiety disorders, and depression.

*"Improved knowledge of SERT's role in OCD raises the possibility of improved screening, treatment, and medications development for that disorder,"* said Ting-Kai Li, M.D., Director, NIAAA. *"It also provides an important clue to the neurobiological basis of OCD and the compulsive behaviors often seen in other psychiatric diseases, including alcohol dependence."*

Approximately 2 percent of U.S. adults (3.3 million people) have OCD, the fourth most prevalent mental health disorder in the United States. Individuals with OCD have intrusive, disturbing thoughts or images (obsessions) and perform rituals (compulsions) to prevent or banish those thoughts. Many other individuals demonstrate obsessive-compulsive behaviors that do not meet OCD diagnostic criteria but alter the individuals' lives.

Dr. David Goldman, NIH NRC Adviser**,** and Xianzhang Hu, Research Scientist, in NIAAA's Laboratory of Neurogenetics discovered the linkage aided by new functional analyses of the *SERT* genetic variant. The researchers first compared the genotypes of 169 OCD patients to those of 253 controls in a large U.S. patient population and found that the OCD patients were twice as likely to have the variant. Then they studied transmission and non-transmission of the variant in a Canadian population of 175 OCD parent-child trios (two healthy parents and a child with OCD) and found that the risk variant was twice as likely to be transmitted from a parent to a child with OCD. Specifically, of 86 informative trios, 48 children carried the new risk variant and 26 did not.

*"Whereas most genetic diseases are caused by variations that lead to reduced gene function, we found that a common SERT variant that increases SERT activity also increases risk for OCD,"* said Dr. Goldman. The same research team previously identified a rare gain-of-function variant at a different location in *SERT*. It, too, is linked to OCD but has been studied only in two families with a severe, treatment-resistant form of the disease. *"That earlier study suggested that we should test the common gain-of-function variant for OCD linkage,"* Goldman said.

The new variant is located at a well-recognized site in the *SERT* gene. Also known as HTTLPR, the site is the most heavily studied polymorphic site (those that may display differing DNA sequences) in psychiatric genetics. For years, HTTLPR has been known to have two variants--S and L--that alter expression of the *SERT* gene and are common across all human populations. The loss-of-function S variant exerts a small effect on a person's risk for anxiety, depression, and suicidality, especially in response to environmental stressors. The S allele exerts a larger effect on the intermediate neurobiology of anxiety and depression, specifically, by disrupting the structure and functional coupling of key brain regions. The gain-of-function L allele, on the other hand, enhances *SERT* activity and functional coupling. The current study differentiates the L variant into two--LA and LG--and shows that LA exerts a greater influence on *SERT* expression.

> *"The gain-of-function L alleles appear to inhibit connections between emotion and repetitive behaviors and such executive brain functions as task-switching,"* Goldman said. *"These neurobiology relationships should be further tested in combined genetic-neuroimaging studies."*

# Genetics of Late-Onset Alzheimer's Disease (LOAD)

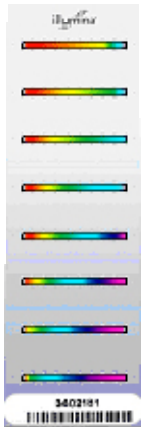
By the year 2020, the World Health Organization (WHO) predicts there will be nearly 29 million people with Alzheimer's disease (AD). At an average cost to Medicare of $3,700 more for persons having a diagnosis of AD, it represents a significant current and future health burden to the US economy.

Since our laboratory has been at NIH, it has been studying the genetics of late onset Alzheimer's disease (LOAD). There is a strong genetic component to AD risk, yet so far only one gene (apolipoprotein E, APOE) is confirmed across multiple studies to increase risk for late onset AD (LOAD).

We published positive findings 2005-2006 associating different genes (both novel and those that were implicated from pathology) with risk for LOAD; however, for any of the genes we examined during my Associateship, none of the risk variants were coding changes. The question then became how are these novel risk variants acting if they are not changing the coding sequence within a gene? It is suspected that these variants act by changing either expression and/or splicing and thus determining the effect of these variants will involve an analysis of such splicing and/or expression. This of course can be done using cell culture and in-vitro analysis.

**Amanda Myers,**
**Former NIH NRC Associate**

However, these types of experiments are always one step removed from what is really going on in human brain.



This is because usually one has to exploit the splicing and or expression machinery of a different cell type than human neurons. This is also because only segments of the entire sequence of interest are examined, rather than the entire architecture of the risk locus at hand.

My focus, as an NIH NRC Research Associate, was to establish a neuropathological human brain series by which we can examine the correlation between DNA changes and changes in RNA transcripts and/or protein. We had approximately 1000 samples of human cortex collected from approximately 20 NACC funded brain banks across the United States.

We prepared both DNA and RNA from approximately 800 of these samples. We performed full genome chip analysis of DNA variation and RNA expression on these samples to look for changes in the DNA that might correlate to changes in the RNA. The next step was to look for three things. *First*, in collaboration with the Translational Genome Research Institute in Phoenix, AZ, we examined the DNA differences between the LOAD cases and the controls in our sample. We found 20 novel genes which appear to increase risk and replicate across three different sample sets. The lab is continuing to study those genes.

*Second*, we looked at how the RNA expression profile of each sample correlates to the DNA variation profile, to elucidate whether any of the risk variants found might be causing LOAD by changing expression.

*Third*, in addition to examining cases and controls, we looked at the correlations between expression and DNA changes in the control population. Any correlations found that do not map to LOAD risk genes might be important for other neurological diseases.

Dr. Amanda Myers completed her NRC Associateship in September of 2006. She is currently working in the Department of Psychiatry at the Miller School of Medicine, Miami, Florida

## DC METRO AREA CIVIC CLUB

There used to be an ASEE postdoc in the Chemistry Division at the Naval Research Laboratory (NRL) who organized many events with local DC folks in the name of a "DC Metro Area Civic Club". They worked with the DC Calvary Women's Shelter (CWS) to refurbish a few rooms there. They participated in the CWS annual Walk for the Homeless, signing up for this event under the banner of CWS in order to allow that organization to receive portions of the proceeds and outside donations. The 'Metro Area Civic Club' also participated in other events with local organizations—Cap Food Bank, Columbia Light House for the Blind, and Christmas in April. If you are interested in carrying forward this type of civic participation, please post a notice on

**www.NRC-RAP.org**

# N I H

Dr. Gisela Storz: *"I have been an Investigator and Senior Investigator in the National Institute of Child Health and Human Development at the National Institutes of Health (NIH) for the past 15 years and have had the privilege of having three NRC fellows in the laboratory. Matthew Wood has moved on to a faculty position at the University of California, Davis, while Elizabeth Fozo and Brian Paul are on still tenure in my lab. Matt, Liz, and Brian share with you how the NRC fellowships have allowed them to pursue unique research projects."*

**Matt Wood,**
**former NIH NRC Associate**

Dr. Matt Wood: 2000-2005 were busy years. In 2000, I interviewed for postdoctoral positions, my first child was born, I applied for numerous postdoctoral fellowships (including the NRC), wrote my Ph.D. dissertation, and moved with a 7- month old baby and apprehensive wife from San Diego, California, to Bethesda, Maryland, to start my NRC Associateship. In 2005 I was on the academic job market in search of a faculty position. After sending out countless applications, 13 job interviews and a few nerve-wracking job negotiations, I am currently starting my first independent position as an Assistant Professor of Environmental Toxicology at the University of California, Davis. Between 2000 and 2005, I enjoyed continuous support from the NRC, which allowed me to intensely focus on my research without interruption and worry. In addition, the NRC provided support for my travel to scientific meetings where I was able to give talks, exchange ideas and network with my peers. My NRC Associateship research in the laboratory of Dr. Gisela Storz at the NIH focused on understanding the molecular mechanisms by which the biological activity of a transcription factor known as Yap1 is regulated by oxidative stress. I determined the three-dimensional molecular structure of the Yap1 domain that is activated by oxidative stress and controls its location within the cell. The structure revealed that the cellular localization signal (molecular zip code) of Yap1 becomes masked in cells stressed by reactive oxygen species. This results in Yap1 retention in the cell nucleus and increased transcription of antioxidant genes. This work uncovered a novel cellular regulatory mechanism and was published in the journal Nature (2004, 430, 917-921). My research also has implications for the development of biosensors to monitor the oxidative stress in live cells and organisms.

Now at the University of California, Davis, my laboratory is currently working on achieving this goal along with understanding additional fundamental aspects of oxidative stress biology.

**Liz Fozo and Brian Paul**
**NIH NRC Associates**

Dr. Liz Fozo: In this competitive field of funding dollars, many postdocs are forced into "bread & butter" projects, projects that yield results, but are not necessarily innovative. I wanted my NRC Associateship (2005—2007) project to be challenging so as to expand both my technical skills and scientific knowledge. Through the support of the NRC, postdocs are able to work on new, exciting areas of research, without the stress of financial worries. Specifically, I am elucidating the function(s) of a family of highly homologous non-coding RNA molecules known as the QUAD RNAs in the bacterium *Escherichia coli* (*E. coli*) in the laboratory of Dr. Gisela Storz at the NIH. Non-coding RNAs have been shown to play important roles in bacterial cell survival, pathogenesis, and have been linked to both normal cellular development as well as cancer development in eukaryotes. Unlike the majority of *E. coli* non-coding RNA genes, which are present as only a single copy, there are five highly similar copies of the QUAD RNA genes. I am using a combination of biochemical, genetic, as well as physiologic assays [analytical procedures to test the properties and/or composition of organic substances, metals, drugs, or other materials by chemical means] to determine why the bacteria would maintain multiple, homologous, non-coding RNA sequences. This multi-faceted approach has helped expand my technical skills greatly, an additional benefit of such a unique and challenging project. Ultimately, this project should lead to a better understanding of RNA biology in both prokaryotes and eukaryotes.

*continued on page 17*

# NOAA / ARL

## Silver Spring, Maryland / Washington, DC area, Paris, and the University of Hawaii

Dr. Benedicte Dousset, former NRC Senior Associate, focused on urban climates, and the characterization and temperature of urban surfaces and their measurements through remote sensing. In January 2005, she joined the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory in Silver Spring, Maryland, in the Washington, DC area. She worked with Dr. Julian Wang on the climatic impact on environmental quality and human health, including extreme conditions such as summer-time heat stress.

During the summer 2003 heat wave, which was caused by a persistent anticyclone over Western Europe, Dr. Dousset studied the surface temperatures of the Paris basin. This heat wave was characterized by nine days of high daytime and nocturnal temperatures, and resulted in a death toll exceeding 4,800 in the Paris region; a mortality anomaly of 60%.

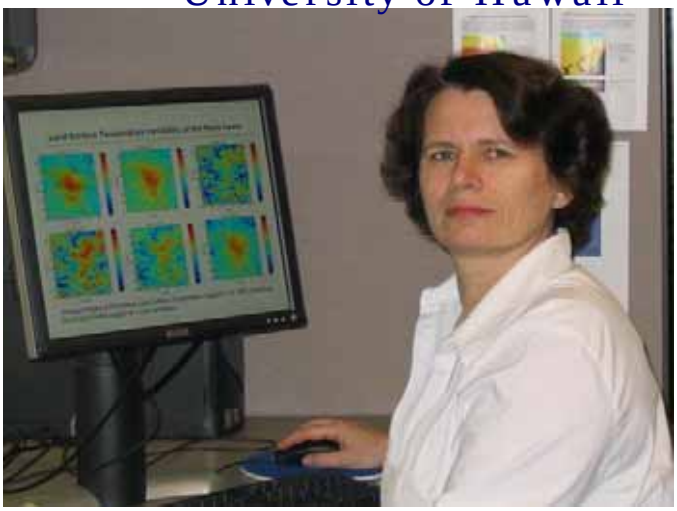
Using satellite observation, Benedicte retrieved the diurnal variations of surface temperature and its spatial distribution. Combined with land-cover classification, this showed the climate impact of buildings density, land use and surface properties, and the complex distribution of heat islands. Areas most vulnerable to heat stress were identified to help issue public safety alerts in heat-wave situations. A comparison between a normal summer and 2003 confirms the impact of high minimum nocturnal temperatures on heat stress and mortality.

This research is timely. Recent observations of global temperature evolution show a pronounced warming during the past 150 years, with a significant increase in heat-wave frequency, strength and duration. Results were presented at conferences sponsored by the American and European Meteorological Societies, and the International Association for Urban Climate.

Benedict is now investigating the surface properties and temperature variability of Washington, DC. She is contributing to the NOAA/Air Resources Laboratory (ARL) program called "DC-Net", an experiment set up to observe the urban atmosphere of Washington, DC in real time.

Understanding the exchange between the urban surface and atmosphere and how cities are altering the local and regional climate is an important issue, given that 50% of the world population is currently urbanized. This percentage will rise to 60% by 2030, the largest urbanization occurring in developing countries.

Dr. Dousset left the Air Resources Laboratory in autumn 2006, returning to the Hawaii Institute of Geophysics and Planetology. According to her, the NRC Research Associarteship at NOAA/ ARL was a productive and enjoyable experience. Collaboration continues on the Washington DC-Net experiment, between NOAA / ARL and the Urban Remote Sensing Laboratory at the University of Hawaii.



Benedicte Dousset, former NRC Associate, NOAA/ARL

*"ARL's focus on the urban impact on regional climate, rate of dispersion and surface / atmosphere interaction, is complementary to my work. Discussions on global climate system and decadal climate trends with Drs. Jim Angell, Melissa Free, Dian Seidel and Julian Wang were very instructive. Being in DC, where environmental decisions and policies are made, allowed me to broaden my research and to consider projects that I would not have envisioned otherwise."* Benedict Dousset

**...from the 2nd Annual NRL NRC/ASEE Postdoctoral Publication Awards...**

**Friday, March 9, 2007**
**Bolling Air Force Base**

**FIRST AUTHORS**

**Amanda Haes, NRC**
**Brandy Johnson White, NRC**
**Eric Stinaff, NRC**
**Joshua Robinson, NRC**
**Matt Doty, NRC**

# Satellite Wind Research

at the National Oceanic & Atmospheric Administration

NOAA/National Environmental Satellite, Data, and Information Service (NESDIS) has been researching improved Satellite Wind Retrievals since the inception of geostationary imaging. Having first worked on wind retrieval algorithms during her Ph.D. at the Bulgarian Academy of Sciences in Sofia, Dr. Iliana Genkova joined the research team as a NRC Associate in 2006. At the Cooperative Institute for Meteorological Satellite Studies, she expanded on her earlier work to explore novel ways of deriving winds from satellite imagers and sounders. Her first project was the to explore deriving atmospheric motions in images of sounder moisture retrievals. This innovative work—to prove the feasibility of deriving winds at multiple constant pressure levels from the retrieval fields, thus overcoming the problem of assigning an accurate height to the atmospheric motion vectors,—is part of the GOES-R Risk Reduction Program. Such a solution will benefit NWP forecasts. She presented early results of her work at the 8th International Wind Workshop (8IWW) in Beijing, China in April 2006.

Much to the delight of Dr. Genkova and her CIMSS colleagues Chris Velden, Steve Wanzong, and Paul Menzel, their collaborative work was recognized by the 8IWW as one of the significant achievements in the Satellite Wind Retrievals community.

In Iliana's own words,

> *"Working at NOAA NESDIS and collaborating with people at CIMSS is a great experience. I have the opportunity to work with the best scientists in the field and learn a lot in a short time. It is a very stimulating and nurturing work environment."*

Iliana Genkova, NOAA NRC Associate, at the Eighth International Wind Workshop (8IWW) held in Beijing, China, April 24-28, 2006 and hosted by the National Satellite Meteorological Center (NSMC) of the China Meteorological Agency (CMA) Chinese Meteorological Administration, Beijing. On the background - real time image retrieval from the Chinese FY-2 geostationary satellite.

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Dr. Correigh Greene, former National Oceanic and Atmospheric Administration (NOAA) NRC Associate, graduated with his Ph.D. from the University of California at Davis in August 2001. The start of his NRC Associateship at the Northwest Fisheries Science Center (NFSC) in Seattle, Washington, was tragically unforgettable – his second day of work was 9/11. Despite the rocky start, his Associateship in the Watersheds Program working under Dr. Tim Beechie, NRC Adviser, quickly turned into a very positive experience.

Dr. Greene was charged with constructing a life cycle model for Chinook salmon that integrated the habitat transitions used during their migration. After five to six months of incubation, Chinook salmon emerge from eggs in nests laid in mainstems of Washington's large rivers, and thereafter rear for variable periods of time in the river, tidal delta, and nearshore before migrating out into marine-dominated waters. Explicitly incorporating these transitions would provide a means to examine how different types of restoration would affect populations in the Puget Sound area, most notably populations using the Skagit River. The work required compilation of a lot of natural history information about populations of which he initially knew little, and combining population modeling techniques in novel ways.

# Estuary Restoration and the Skagit River Chinook Salmon

In a paper published in *The Canadian Journal of Fisheries and Aquatic Sciences*, Correigh and Tim found that the best types of restoration depended upon underlying density-dependent mechanisms controlling recruitment. These findings supported restoration in the tidal delta—habitat that has undergone substantial conversion to agriculture and urbanization since the 1800s—if populations are largely controlled by density-dependent migration (i.e., competition forces individuals to move downstream).

In doing this research, Dr. Greene started working closely with tribal groups, interactions which have since been extremely valuable in charting his research program. His life-cycle modeling research led him to conduct field experiments to test for density-dependent movement, and to look for these patterns in monitoring data collected by the tribes. These collaborations have led to a 10-year monitoring grant to examine the effects of estuary restoration on Skagit River Chinook salmon. During his Associateship, Correigh also started working with a number of different researchers in the Watersheds Program, and in doing so expanded his research to study habitat use by a number of salmonids in river systems.

These collaborations also resulted in an internal grant and several publications. As a consequence, the NRC Associateship enabled Correighto interact with his peers, establish himself as a scientist, and to obtain a permanent position at NFSC.

**Juvenile Chinook salmon caught in the Skagit River estuary. Photo courtesy of Eric Beamer.**

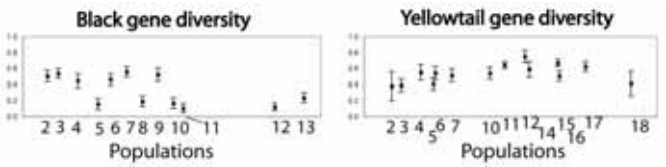
**A portion of the Skagit River estuary, a complex that includes tidally influenced habitat as well as wildlife preserve and farmland , both of which were historically tidally inundated**

Jon Eric Hess, NOAA NRC Associate at NWFSC (2005-2007)

Explanations for the finding of genetic diversity between black and yellowtail rockfish species and other results of a recent genetic study are currently being investigated by scientists at the National Oceanic and Atmospheric Administration's (NOAA) Northwest Fisheries Science Center (NWFSC) in Seattle, Washington.

Many rockfish species are commercially and recreationally important and have suffered population declines due to over fishing.

Population genetic studies can be used to delineate stock units and estimate gene-flow. Therefore, understanding the reasons behind population genetic differences among rockfish are an essential component to their conservation.




# Genetic Diversity—Black and Yellowtail Rockfish Species

Black and yellowtail rockfish are closely related rockfish that co-occur, being broadly distributed along the eastern Pacific coastline. Their close taxonomic ties and co-occurrence make them an especially interesting pair for a comparative genetic study for one central reason: determination of rockfish life-history effects on gene flow. These two species differ in a life-history characteristic of depth preference. Depth preference is hypothesized to restrict gene flow in shallower-dwelling species compared to deeper-dwelling and this life-history characteristic varies widely across rockfish species. If closely related rockfish are shown to have significantly different rates of gene flow this may affect the way we manage rockfish and other species in the future. One revolutionary shift in the way managers are thinking about fishery sustainability is the establishment of marine protected areas (MPAs). MPAs would be off limits to fishing in the hope that fish within the areas would thrive and recruit in relatively high numbers to neighboring areas. Therefore, knowledge about relative rates of gene flow is essential to effective management using these MPAs.

Dr. Jon Hess, a National Oceanic and Atmospheric Administration (NOAA) NRC Associate with the NWFSC's Conservation Biology Division, is continuing his research on the population genetics of black and yellowtail rockfish. Dr. Hess's results showing variable gene diversity in black compared to yellowtail rockfish may be best explained by a relatively high susceptibility of black rockfish to dramatic local declines in abundance. He is investigating a wide range of non-mutually exclusive explanations that could account for these genetic results including: differential fishing pressure, life-history differences, and even putative post-glacial northward range expansion.

In addition, Jon is exploring methods to generate spatial maps of genetic data. These methods are recent innovations used to test immense genetic data sets for correspondence of genetic breaks with geographical features. Because gene flow is so high in most marine fish species, barriers that inhibit gene flow are subtle and difficult to detect with conventional population genetic statistics. Therefore, methods that allow visualization of genetic data on geography may increase our ability to detect these subtle gene flow barriers and in turn advance our understanding of what landscape features are biologically significant in the fish world.

Together, Dr. Hess and his NWFSC NRC Adviser, Dr. Paul Moran, have submitted a proposal to NOAA Sea Grant for funding to expand application of this tool and other population genetic techniques to aquatic invasive species in Puget Sound. If successful, these techniques will help increase NOAA's involvement in exotic invasive tunicate (Sea-squirt) research. Progress in this area is critical due to the growing concern that these invasive species will severely negatively impact shellfish aquaculture and entire marine ecosystems worldwide.

A potential leap from rockfish to tunicate species does not faze Jon. The past decade of his education in the field of genetics has consisted of similar large leaps between seemingly disparate species including fruit flies (*Drosophila melanogaster*), naked mole-rats (*Heterocephalus glaber*), and collared lizards (*Crotaphytus collaris*).

*"I look forward to each new project,"* remarks Jon. *"I'll work on anything with genes."* Jon Hess

NIH/Storz on Wood, Fozo, Paul *continued*

Dr. Brian Paul: I was initially exposed to research at the NIH through the Post-baccalaureate IRTA program; a program designed to provide opportunities for recent college graduates to engage in research at the NIH prior to graduate or medical school. After working at the National Cancer Institute, I decided to go to graduate school to further my career in research. Once I completed my Ph.D., I chose to come back to the NIH to pursue my post-doctorate training because of the scientific environment that is provided there. Not too many places can offer the resources, both experimental and intellectual, that the NIH does. The support I receive from the NRC Associateship (2006—2008) allows me to pursue my research interests in basic prokaryotic molecular biology in the laboratory of Dr. Gisela Storz. Our lab is involved in some unique projects that study the functions of small, non-coding RNA molecules and small proteins (less than 50 amino acids long) in the model organism *E. coli*. Much is still to be learned about these two classes of molecules because they are often missed in genomic projects and genetic screens due to their small size and unique characteristics. Non-coding RNAs appear to function by base pairing to target mRNAs affecting their translation or message stability, or by binding to target proteins to modulate their activity. Less is known about the modes of action of the proteins we study because of the technical challenges associated with working with proteins of such a small size. We anticipate that some of the small proteins may act by binding to other proteins and affecting their conformation or blocking binding sites. My current project is particularly interesting because it involves determining the cellular role of a novel RNA that encodes a small protein (28 amino acids) and potentially functions as a non-coding RNA.

# Movement of Billfishes—Spatial and Temporal Behavior Characteristics

Dr. John Hoolihan began his NRC Associateship at NOAA's Southeast Fisheries Science Center (SEFSC) in Miami, Florida, in January 2006, after completion of his Ph.D. at the University of New South Wales (Sydney, Australia). Under the guidance of NRC Adviser, Dr. Eric Prince, John is investigating the spatial and temporal behavior characteristics associated with the movement of billfishes (marlins, sailfish, spearfishes and swordfish) in the Atlantic Ocean. Billfish are large, highly migratory predators that have decreased in abundance over the past few decades, mostly as a bycatch by pelagic longline fleets targeting other species, such as tuna and swordfish. In the US Atlantic, they are regarded as an important recreational resource.

Dr. Hoolihan previously researched the biology, movement and migration of sailfish in the Arabian Gulf, where he discovered that resident sailfish are genetically isolated from those outside the Gulf – an unusual circumstance for large, highly mobile species such as billfish.

Because billfish are highly migratory species capable of traveling great distances in short time periods, the logistics and funding necessary to physically track and study them in the open ocean is prohibitive. To remedy this, researchers at SEFSC employ pop-up satellite archival tag technology (PSATs) to collect information. PSATs are high-tech data loggers that, while attached to a marine animal, record depth, ambient water temperature, and light levels. The light levels allow geographical positions to be calculated, providing an approximate horizontal swimming track of the animal. At a pre-programmed date, the PSAT detaches (via a corrosive link) from the animal and floats (pops up) to the surface. It then communicates with an orbiting Argos satellite and uploads the data, which is subsequently emailed to the researcher. The PSAT's self-detachment feature is fisheries independent, meaning it does not require recapture for data retrieval.

Using this technology provides new insight into the behavior and environmental preferences of billfish species. This information is needed for establishing the parameters of essential fish habitat and other characteristics required for effective management.

> *"I am grateful to take part in the NRC Associateship Program"*, comments John, *"as the tenure provides me with a valuable opportunity to work with leading researchers in a world-class institution, while using cutting-edge technology to improve our knowledge about large pelagic fishes."* John Hoolihan


**John Hoolihan, NOAA NRC Associate**

# Impact of Harmful Algal Blooms on Planktivorous Fish Populations

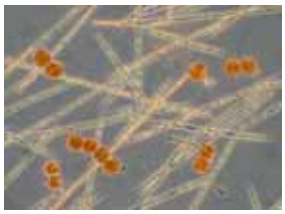


**Figure 1**

**The photo depicts pennate diatoms (*Pseudo-nitzschia sp.*) and dinoflagellates (*Alexandrium sp.*) that naturally produce the neurotoxins domoic acid and saxitoxin, respectively. These toxins are produced during harmful algal blooms (HABs) and are responsible for severe neurotoxic illnesses known as Amnesic Shellfish Poisoning (ASP) and Paralytic Shellfish Poisoning (PSP).**

**Figure 2**
**Kathi Lefebvre, former NWFSC NRC Associate, has buckets with anchovies swimming in them. She exposes some of the fish to toxic algae to see how it affects them. (photo by Ellen M. Banner/The Seattle Times)**

Dr. Kathi Lefebvre, former National Oceanic and Atmospheric Administration (NOAA) NRC Associate (2001—2003) at the Northwest Fisheries Science Center (NWFSC), is interested in the impacts of harmful algal blooms (HABs) on planktivorous fish populations [Figure 1]. Her research encompasses four main topics: (1) trophic transfer of algal toxins through marine food webs to higher level consumers via planktivorous fish vectors, (2) dynamics of toxin accumulation, uptake, and tissue distribution in fish vector species under changing bloom conditions, (3) neurotoxic effects of dietary intake of algal toxins in fish, and (4) sublethal developmental and neurosensory effects of aqueous toxin exposure in early embryonic and larval stages of finfish.

Kathi's work provides critical information needed to understand the relationships between harmful algal blooms and the productivity of marine fish populations. Fish populations that are at risk include planktivorous species that are vital to marine food webs and commercial fisheries such as anchovies and herring [Figure 2]. Her research has predictive benefits for natural resource managers developing mitigation strategies that are designed to protect public health and maintain sustainable fisheries.

As a NRC Associate at NWFSC, Dr. Lefebvre developed a laboratory model for HAB toxin studies using zebrafish (Figure 3). She exposed embryonic zebrafish to HAB toxins to characterize neurodevelopmental effects of HAB toxin exposure on early life history stages in fish. In addition, Kathi performed field experiments in which she exposed anchovies to real time HABs while onboard an Ecology and Oceanography of Harmful Algal Bloom –Pacific Northwest (ECOHAB-PNW) research cruise (Figure 4), to determine if Pacific Northwest HABs impact local economically and ecologically valuable fish populations.

Kathi was awarded the 2005 Presidential Early Career Award for Scientists and Engineers (PECASE) at a White House ceremony for her many accomplishments in promoting the conservation of endangered fish stocks, the development of a model for studying the impacts of algal toxin exposure on fish and marine mammals, and for outreach efforts to foreign scientists, policymakers and fisheries managers. This award is the nation's highest honor for professionals at the outset of their independent research careers. Kathi was one of two NOAA recipients of PECASE 2005, and won a $50,000 grant over five years to further her research on understanding the chronic health impacts caused by algal toxin exposure in both humans and fish.

Her work with the NWFSC's Harmful Algal Bloom Program helped lay the groundwork for this important research through a collaborative pilot study between NOAA's West Coast Center of Excellence in Oceans and Human Health at the NWFSC and the Pacific Northwest Center for Human Health and Ocean Studies at the University of Washington. In addition to her NRC funding, early support in Kathi's career from the ECOHAB (Ecology and Oceanography of Harmful Algal Blooms) program\helped NOAA Fisheries attract and sustain such emerging scientists of high caliber.

**Figure 3**
**Zebrafish Embryo**

# Exploring the Role of Food Webs in in Salmon Recovery

As part of her National Oceanic and Atmospheric Administration (NOAA) NRC Associateship, Dr. Kate Macneale is examining the feeding ecology of endangered salmon, with the aim of understanding the role of food in the conservation and restoration of these fishes.

Finishing her Ph.D. in Entomology at Cornell University in 2003, Kate began her NRC Associateship at NOAA's Northwest Fisheries Science Center (NWFSC) in the Environmental Conservation Division in Seattle, WA. She worked with Dr. Beth Sanderson and NOAA NRC Adviser, Dr. Peter Kiffney, studying the impacts of non-native brook trout on endangered juvenile chinook salmon in the Snake River Basin in Idaho.

In these low nutrient streams, wild salmon must avoid being eaten by brook trout. If they succeed, they then must compete with them for territories and food (primarily aquatic insects) before migrating over 900 miles to the ocean. Dr. Macneale quantified chinook and brook trout feeding behaviors as well as aggressive interactions by observing thousands of fish while snorkeling in the frigid waters of the Salmon River, Idaho. She discovered that chinook are particularly aggressive, but brook trout are generally much larger than chinook. This size advantage allows brook trout to displace chinook from their territories nearly 75% of the time.

This displacement likely has an energetic cost. In addition, the analyses of behavior and diets indicate intraspecific (i.e., chinook vs. chinook) competition may be intense and also limiting juvenile chinook growth. Consequently, non-native predators and competitors may exacerbate stresses already faced by chinook – and for some of these chinook, there aren't enough bugs to go around.

In pursuing her interests in salmon and their food webs, Kate also worked with Dr. Kiffney and Nat Scholz, former NOAA NRC Associate, on issues relating to the effects of contaminants on salmonid prey. Dr. Scholz's lab focuses on the direct effects of contaminants on fish. Recently, they have expanded the research to include the indirect effects of contaminants on salmon via their prey.

Because many of the currently used pesticides are designed to kill the very insects on which salmon depend, there is growing concern that pesticides incidentally reaching aquatic habitats may limit salmon recovery by killing off their prey. Dr. Macneale has developed conceptual models regarding insect responses to pesticide exposure and is working to incorporate these into salmon population growth models; however, "...there may not be enough bugs to go around!"

**Kate Macneale, former NOAA NRC Associate**

Kate Macneale says of her NRC tenure (2003—2006):

*"I feel incredibly fortunate to have had the opportunity to conduct original research that will eventually help fill critical gaps in our understanding of how best to protect salmon and their habitats. The NRC Associateship and my experience at the NWFSC have only strengthened my commitment to doing research on pressing ecological questions."*

**Kate snorkling**

# NOAA National Oceanic & Atmospheric Administration

NOAA's National Centers for Coastal Ocean Science (NCCOS) conduct and support research, monitoring, assessments and technical assistance to meet NOAA's coastal stewardship and management responsibilities. NCCOS' Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston, South Carolina provides scientific information required to resolve important issues related to the health of coastal ecosystems. Major environmental issues explored at this center include: coastal ecology, coral reefs, environmental genetics, harmful algal blooms, invasive species, marine biotoxins, marine diseases, marine ecotoxicology, marine forensics, marine mammals and land use and presence of chemical contaminants in the marine environment. The Oxford Cooperative Lab, affiliated with the Center, specializes in shellfish pathology and habitat restoration research.

**Dayton Wilde, NRC Senior Associate, Marine Biotoxins**

Dr. Dayton Wilde received his Bachelors degree in Botany in 1979 from Duke University and his Ph.D. in Plant Molecular Biology in 1988 from Texas A&M University. His interests are in the biological mechanisms that control the growth, aggregation, and persistence of blooms of the red tide dinoflagellate, *Karenia brevis*. His research involves the development and application of functional genomic tools, such as gene transfer and gene suppression. These techniques complement an ongoing gene discovery program that has identified *K. brevis* genes with similarity to cell cycle and signal transduction genes from other organisms. Particularly, RNA interference-based gene suppression is used to investigate the role of a receptor for blue light, which influences the cell cycle and vertical migration.

# PROFILES

**Alexander Vershinin, NRC Senior Associate, Marine Biotoxins**

Dr. Alexander Vershinin received his Ph.D. in biology in 1992 from Moscow M.V.Lomonosov State University. As an NRC Associate, his research is a continuation of long-term collaboration involving the investigation of Black Sea phytoplankton composition and its annual succession, the role of harmful algal blooms (HAB) and toxic species in planktonic communities, and shellfish toxicity rendered by toxic algae. Diarrheic (DSP) and paralytic (PSP) shellfish toxicity were first found in the Black Sea. *Prorocentrum lima*, an epiphytic dinoflagellate, was found to be the main causative species for DSP in the Black Sea. Yessotoxins of dinoflagellate origin were found for the first time in Black Sea shellfish. Toxins of the saxitoxin group were discovered in wild and farmed bivalves from the Black Sea, and *Alexandrium* sp. was found to be the causative species. Extensive study of the potentially ASP-toxic diatoms of the genus *Pseudonitzschia* in the Black Sea have revealed the absence of toxin production in the dominant (and blooming) species *Pseudonitzschia pseudodelicatissima*. However, the more rare species *P. pungens* was found for the first time in the Black Sea and requires further investigation.

**Faisal Radwan, NOAA NRC Associate, Marine Biotoxins**

Dr. Faisal Radwan received his Ph.D. in Marine Biology and Toxicology in 2000 from the University of Maryland, and was a research fellow in marine toxicology from 2000 until 2002 at the University of Hawaii. His research at CCEHBR focuses on the metabolic strategies of mammals in detoxifying and eliminating brevetoxins. Marine mammals, fish, birds and invertebrates differ uniquely in their acute and delayed responses to brevetoxin exposure, as well as humans. Identification of the molecular nature of the toxin metabolites produced by victim species would not only improve the biomonitoring and diagnostic capability of laboratories, but also would produce valuable tools for understanding the adverse effects of brevetoxins – a valuable asset for better risk assessment of harmful algal blooms. A variety of biological and biochemical analyses are employed in the laboratory to detect brevetoxin metabolic pathways after *in vivo* and *in vitro* toxin exposures. New metabolites such as brevetoxin epoxides were confirmed, for the first time, to be formed in rat hepatocytes in response to brief exposure to brevetoxin-2. Research is in progress to assess the pharmacological activity of these epoxides as a potent electrophilic radical capable of inducing genotoxic effects by binding to DNA.

NOAA PROFILES

**NOAA Profiles *continued***

**Mike Twiner, former NOAA NRC Associate, Aquatic Toxicology**

Dr. Mike Twiner received his Ph.D. from the University of Western Ontario in plant sciences and environmental science in 2002. His research at CCEHBR is divided into two main areas concerning harmful algal blooms (HABs). The first area is the mitigation and control of *Karenia brevis*, a brevetoxin-producing HAB species. Algicidal bacteria are currently being investigated as potential biological control agents. Projects involve (1) identifying the bacterial toxins capable of lysing algal cells, (2) monitoring the changes in brevetoxin localization during lysis, and (3) observing algal gene expression changes during and following bacterial-induced lysis. The second line of HAB research focuses on determining the mechanism of action of azaspiracid-1 (AZA). For this, a variety of pharmacological, cellular and molecular tools such as DNA microarrays and fluorometric imaging have been employed.

**Hui-Chen W. Stavros, NOAA NRC Associate Living Marine Resources**

Dr. Hui-Chen Stavros received her Masters degree in 1997 in Sea Turtle Biology from the Institute of Marine Biology, National Taiwan Ocean University in Keelung, Taiwan and her Ph.D. in wildlife and fisheries science from Texas A&M University in 2005. Her postdoctoral research focuses on developing a methodology for determining trace metals in marine mammals. Marine mammals occupy the top trophic level in the food chain and serve as good indicators of contaminant accumulation because of their long life-span and long biological half-time to eliminate pollutants. Various physiological and ecological factors including geographic location, age, gender, diet, tissue and metabolic rate affect the potential accumulation of metals. No trace metal concentrations have been reported in the live free-ranging bottlenose population from the U.S. Atlantic. This is probably due to the logistical problem of working to obtain samples. It is important to assess metal loading and understand the impact on the health of bottlenose dolphin for the exploration of potential management and conservation strategies in coastal ecosystems. The research objectives include (1) determining trace metal concentrations and accumulation in blood and skin samples as well as spatial and temporal distribution of two live free-ranging bottlenose dolphins along the southeastern Atlantic coast; (2) correlating data on health and immune function of bottlenose dolphins and association with metals; and (3) examining the correlation between metal concentrations in bottlenose dolphin and prey species.

NOAA PROFILES

**Arpita Choudhury, NOAA NRC Associate, Marine Forensics**

Dr. Arpita Choudhury received her Ph.D. from the University of Rhode Island in environmental science in 2005. Her postdoctoral research is focused on creating a molecular method to determine ploidy in triploid and diploid *Crassostrea ariakensis*, an oyster species indigenous to southern China that is being considered for introduction in the Chesapeake Bay in order to develop a new oyster fishery. Only triploid individuals will be introduced as their sterile state will reduce the chance of overtaking the Bay. In order for this endeavor to succeed, validation of triploidy must be ascertained throughout the life history of *C.ariakensis*. This is particularly important as *Crassostrea* species tend to exhibit chromosomal instability as triploids and shed chromosomes with time thus developing into genetic mosaics with possible reproductive capability.

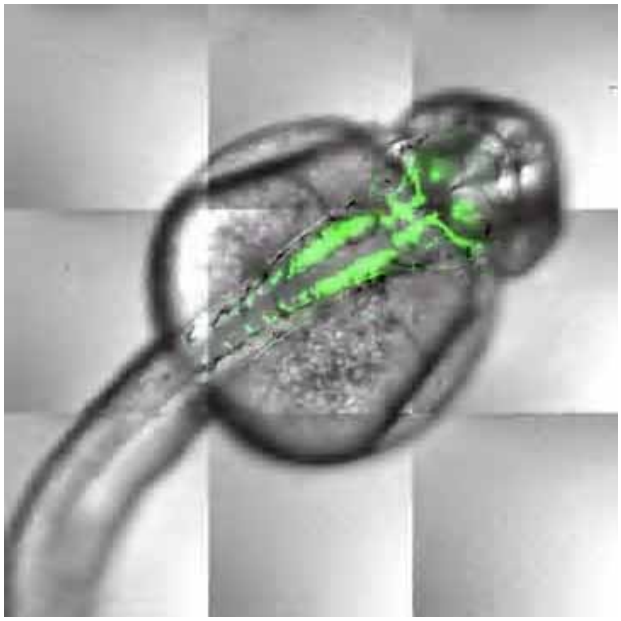
Dr. Choudhury is creating a molecular method to determine ploidy of *C.ariakensis* by quantifying relative gene copy number at multiple loci with quantitative polymerase chain reaction (Q-PCR). Comparisons are made between gene copy numbers detected in diploid and triploid individuals across all loci used. The level of accuracy of this assay is determined by comparing the results to flow cytometry. Absolute copy numbers will also be calculated by Q-PCR and the results will be compared to Southern blot analysis.

# Conservation of Coastal and Marine Species in the Pacific Northwest

Dr. Nat Scholz, former National Oceanic and Atmospheric Administration (NOAA) NRC Associate, was facing a difficult conundrum in the mid-1990's. He was nearly finished with his doctoral dissertation in the Department of Zoology at the University of Washington, and he needed to prepare for life after graduate school. The problem was that he had been investigating the chemical neuromodulation of flexible neural networks for several years, and this type of expertise was a poor fit for his true passion—marine conservation biology. Moreover, after years of working on esoteric neurobehavioral questions, he was eager to switch to applied problems and to conduct research that would help conserve coastal and marine species in the Pacific Northwest.

Where can a neurophysiologist go to learn how to become a marine ecosystem researcher? For Nat, the answer was NOAA's Northwest Fisheries Science Center in Seattle, Washington, with the NRC Associateship Program serving as the all-important catalyst. Nat received an NRC Associateship in 1998, and joined the Center's Ecotoxicology Program under Dr. Ed Casillas, NRC Adviser. At the time, wild populations of Pacific salmon and steelhead were increasingly being listed as either threatened or endangered under the Endangered Species Act. The ESA listings, in turn, raised concerns about the impact of toxic pesticides that were frequently detected in salmon habitats. Many current-use pesticides target the salmon nervous system, and Nat developed a study to investigate the neurobehavioral impacts of the insecticide diazinon on the olfactory nervous system of chinook salmon. Using a combination of behavioral assays and field experiments, Nat and his colleagues found that diazinon disrupts a salmon's sense of smell, and that fish exposed to the pesticide were unable to detect predators or navigate home to their natal stream to spawn. These results generated considerable public attention, as well as regional and national media coverage.

Nat quickly found a home with the Ecotox Program. He was hired to a permanent position in 1999,



**Confocal micrograph of a transgenic zebrafish embryo**

and charged with building a new team with expertise in neurobiology and behavior as well as developmental biology. Over the next few years he actively established collaborations with academic partners and other federal scientists. Successful grant submissions provided the funding needed to build new core facilities at the Center for molecular biology, optical imaging, fish embryology, and neurophysiology. These new capabilities attracted top talent, including several new federal hires, NRC postdoctoral Associates, graduate students, and interns. The focus of Nat's research expanded to include other stormwater-associated contaminants (i.e., dissolved metals and petroleum hydrocarbons) and other fish species, and he has published more than 25 peer-reviewed papers and book chapters since he joined the Center as a permanent employee.

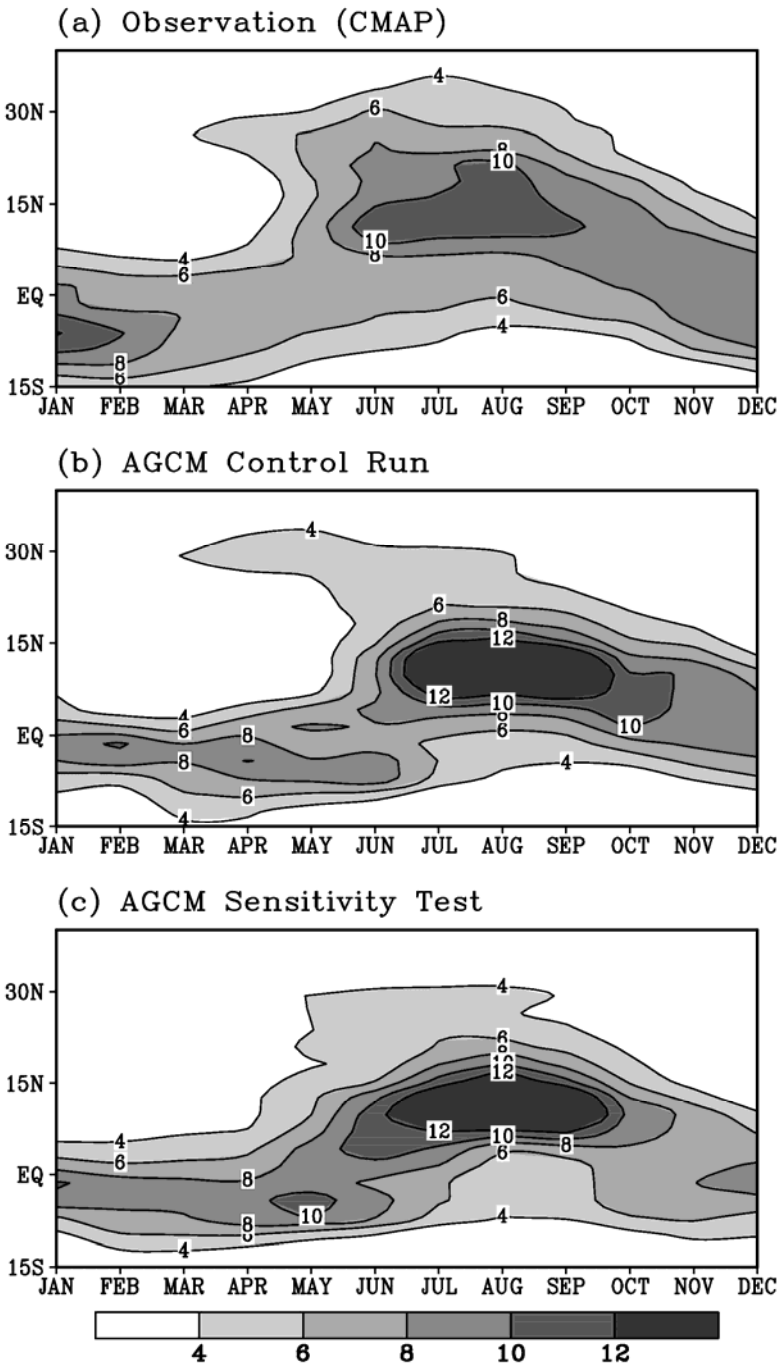
Nat has been promoted twice and now manages the Ecotox Program, a group that presently operates on an annual budget of more than $2.5M and consists of approximately thirty federal researchers, postdoctoral Associates, graduate students, and contractors. He has received competitive research funding from the U.S. Forest Service, the U.S. Fish and Wildlife Service (two grants), the U.S. Army Corps of Engineers, the Oiled Wildlife Care Network at U.C. Davis, the NOAA/NSF ECOHAB Program, and the NIEHS' Superfund Basic Research Program. He is a national leader for NOAA's Coastal Storms Program, a member of the Center's Research Planning Team, and a principal investigator for NOAA's Oceans and Human Health Program. He served last fall as Chief Scientist aboard a NOAA cruise to monitor the ecological impacts of Hurricane Katrina around the Mississippi Delta. More recently he was appointed an Affiliate Associate Professor in the University of Washington's Department of Environmental Health.

Still thirty-something, Nat is looking forward to a couple of decades of innovative and productive ecosystem research with NOAA Fisheries. Human population growth and coastal development are increasingly threatening NOAA's trust resources around the country, and Nat's cutting-edge group is well positioned to meet the future research needs of the agency. With this in mind, he is very grateful to the NRC Research Associateship Programs for providing an opportunity to change his career trajectory. If it hadn't been for the Associateship in 1998, he probably wouldn't be working for NOAA today. *"Opening the award letter from the NRC was literally a life-changing event for me"*, Nat said.

# Annual Cycle of the Monsoon Rainfall over Southeast Asia

Dr. Zhuo Wang, joined the Naval Postgraduate School as a NRC Associate in January 2005 after completing her Ph.D. in Meteorology at the University of Hawaii in 2004. In collaboration with Dr. C.-P. Chang, her NRC Adviser, she is investigating the annual cycle of the monsoon rainfall over Southeast Asia (including Indochina, the Malay Peninsula, and the Maritime Continent). Using the high-resolution Tropical Rainfall Measurement Mission (TRMM) precipitation data and QuikSCAT ocean-surface scatterometer wind data, the scientists have found that wind-terrain interaction plays an important role in shaping the monsoon rainfall.

They have also proposed a mechanism for the asymmetric monsoon transition, in which the maximum convection follows a gradual northeast-to-southwest progression path from Asian summer monsoon to Asian winter monsoon during boreal fall, but the reverse transition during boreal spring is sudden and discontinuous.




**Annual variations of precipitation over 90-130E (units: mm day$^{-1}$) from (a) observational (CMAP) data, (b) atmospheric general circulation model (AGCM) control run and (c) AGCM sensitivity test. The precipitation from observation (a) and AGCM control run (b) both show an asymmetric annual cycle in which the maximum convection marches gradually southeastward in boreal fall but experiences a sudden northward jump in boreal spring; in the sensitivity test (c), the effect of the large thermal inertia of the ocean is excluded, and the spring abrupt jump is much reduced and the season march is more symmetric.**

They suggested that the asymmetric monsoon transition can be understood in terms of the asymmetric sea-level pressure patterns between land and sea, which results from the large ocean thermal memory. This hypothesis has been tested and confirmed by the simulations of an atmospheric general circulation model (AGCM). The first part of their research has been published in *The Journal of Climate*.

In addition to her research on monsoons, Dr. Wang collaborated with Dr. R. Elsberry at NPS to study the multiple African circulations affecting tropical cyclogenesis over the Atlantic. The research involves the combination of aircraft data and satellite data with ECMWF (European Centre for Medium-Range Weather Forecasts) Reanalysis data for use in a state-of-the-art mesoscale model (WRF model) to investigate the dynamics and interaction of the African circulations. They expect that this study will lead to a better understanding and prediction of tropical cyclogenesis.

# NRC Postdocs Lead Sky-Survey Project

Astronomers using the National Science Foundation's Very Large Array (VLA) have overcome longstanding technical hurdles to map the sky to unparalleled sensitivity at long wavelengths. The team of astronomers from the Naval Research Laboratory, the National Radio Astronomy Observatory (NRAO), and the University of Maryland released the unprecedented sky survey data over a nearly two-year period. The VLA Low-frequency Sky Survey (VLSS) Data Release 1, which contained the first half of the survey, occurred in late 2004.

The VLA Low-frequency Sky Survey Data Release 2 offers images of more than 90% of the northern sky visible to the VLA and a searchable database of approximately 67,000 sources. The survey was conducted at a wavelength of 4 meters (74 MHz frequency) making it one of the largest and most sensitive surveys conducted at these wavelengths, and a valuable complement to views of the sky at shorter wavelengths.

*"The initial goal of this project was to exploit recent technical advances in imaging celestial sources at these wavelengths through the disrupting effects of the Earth's ionosphere,"* said Dr. Namir Kassim, NRL NRC Adviser.

A layer of the Earth's atmosphere that is ionized by the Sun's radiation and which extends from about 100 km (60 mi.) to more than 300 km (200 mi.) in altitude, the presence of the ionosphere is useful for long-distance communication, however, from an astronomical standpoint, it has hampered development at the longest wavelengths.

*"Unveiling this new window on the Universe, we expect that the high-quality VLSS images will allow us to study familiar objects in new ways and potentially reveal some rare and entirely new objects,"* said Aaron Cohen, NRL former NRC Associate.

Among the objects the astronomers hope to find in these images are distant radio galaxies possibly containing the first supermassive black holes in the Universe, mysterious "halos" and "relics" produced by enormous collisions of galaxies in clusters, previously-undiscovered superdense, spinning neutron stars known as pulsars, and even "super Jupiters" circling stars beyond the Sun.

The survey has now used nearly 800 hours of VLA observing time. Images from the survey are being made available to other scientists as soon as they are completed. The newly released images and data are available via the NRAO Web site. *"By doing this survey and making the results available, we are bringing low-frequency radio data, previously quite difficult to produce, to all astronomers in a simple and easy manner,"* commented Wendy Lane, NRL former NRC Associate *"We probably will have to wait for years to know the full scientific benefit of this survey,"* she added.

**Left to right: Aaron Cohen and Wendy Lane, NRL former NRC Associates, and Joseph Lazio, NRL NRC Adviser**

Another key use of the survey will be to provide a crucial initial calibration grid for bringing an emerging new generation of powerful long wavelength instruments on-line, including the New Mexico-based Long Wavelength Array (LWA) Project led by the University of New Mexico. In fact it was the breakthrough in ionospheric calibration, demonstrated with the 74 MHz VLA system

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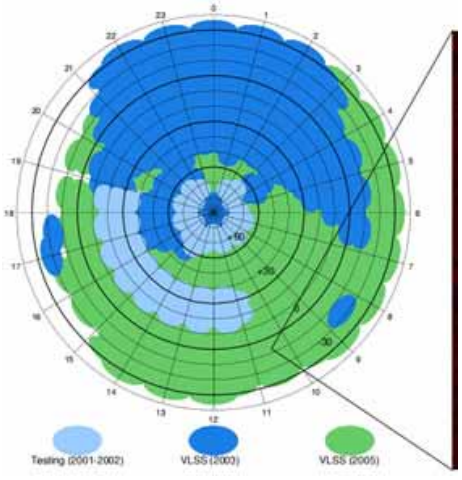
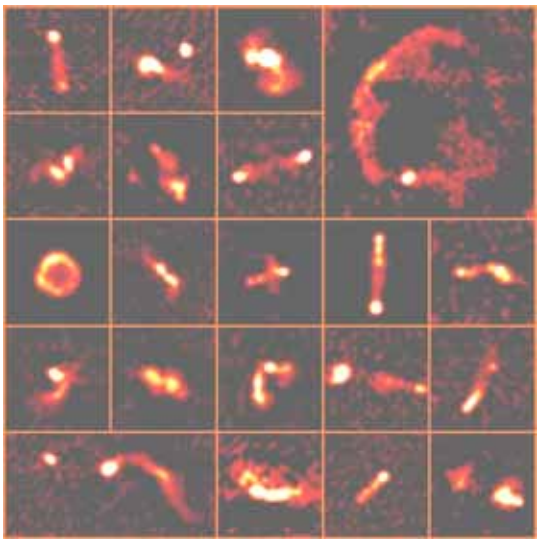



**Left: The sky covered by the VLA Low-frequency Sky Survey. The green ellipses show the region of the sky covered in Data Release 2, the dark blue ellipses show the region covered in Data Release 1, and the light blue ellipses show the region covered in pilot observations. In this display, the North Pole is at the center of the figure and the celestial equator and the projection of the Earth's equator onto the sky is the dark circle labeled 0.**



**Right: A "rogues' gallery" of radio galaxy types seen in the VLSS. White regions indicate radio-bright emitting regions in the galaxies, while deep red/black indicate regions of little or no radio emission. In all cases, the radio galaxies are thought to shine because of jets of highly relativistic material being shot from the environment of a supermassive black hole in the center of the radio galaxy. The diversity of shapes probably reflects the environment of the radio galaxy itself as well as the history of the supermassive black hole and how much material has fallen into it.**

*Sky Survey continued*

through projects like the VLSS, that led to the development of the US-based LWA and Dutch-based Low Frequency Array (LOFAR) projects. Other members in the Southwest Consortium developing the LWA include NRL, the Applied Research Laboratory at the University of Texas (Austin), and the Los Alamos National Laboratory.

In addition to Drs. Kassim, Cohen, and Lane, the VLSS team includes Drs. Rick Perley, James Condon, and William Cotton of NRAO; Dr. Joseph Lazio, NRL NRC Adviser; and Dr. William Erickson of the University of Maryland. NRAO is a facility of the National Science Foundation, operated under cooperative agreement with Associated Universities, Inc.

More information on NRL's involvement with VLSS can be found on the web site: http://lwa.nrl.navy./VLSS.

**Namir Kassim, NRL NRC Adviser standing in one of the dishes of the VLA telescope (New Mexico), holding one of the dipole antennas that Aaron and Wendy used to make the VLSS sky survey . The VLA itself actually has 27 such dishes, and each was equipped with a dipole antenna like the one being held here.**

# Sigma Xi Award

Dr. Amy Szuchmacher Blum, a NRL former NRC Associate in the Center for Bio/Molecular Science and Engineering (2001—2003) received the “2006 Young Investigator Award” from the NRL Edison Chapter of the Sigma Xi Scientific Research Society. This award recognizes scientists for outstanding research within 10 years of their highest earned degree and their ability to communicate their research to the public. Sigma Xi promotes the promise of science and technology and fosters interaction among science, technology, and society; encourages appreciation and support of original work in science and technology; and honors scientific research accomplishments.

Having demonstrated the viability of bottom-up construction of functional nanodevices using programmed self-assembly, Dr. Blum is recognized for "her contribution to the understanding of electron transport in single molecules and their controlled self-assembly on nanoscale." She built the first conductive networks under 50 nanometers by bridging gold nanoparticles with organic molecular wires on protein scaffolds, and has successfully demonstrated that these networks can be used as sensors. This work has the potential to create portable, sensitive, real-time biosensors, with easy-to-interpret electronic readouts. Using biological or organic molecules to fabricate electronic materials is known as molecular electronics. In recent years, molecular electronics has been proposed as a way to develop lightweight, low cost, low-power, high-density nanoelectronic devices. With this technology, it may be possible to build hardware by "growing" circuits and devices in layers that "self-assemble," in much the same way that structures grow in living organisms. Devices for a number of applications could be constructed using techniques based on chemical attractions instead of the complex, high-cost methods now used to etch electronic circuits.

Molecular electronics requires the development of molecules that exhibit reproducible electronic properties. Once such molecules have been developed, significant challenges exist in assembling and interconnecting them to create nanoscale devices and in electronically addressing or measuring responses at the molecular level. Dr. Blum has been addressing these issues by first developing methods to measure the electronic properties at a single molecule level and then assembling them to measure the ensemble properties at the device level.

As the first clear demonstration of hierarchical self-assembly for building nanoscale devices, Dr. Blum's research was featured on the cover of the July 2005 Small, and won the 2005 Small best cover design contest.

Amy began working as a government employee in 2003. She received her B.A. in chemistry from Princeton University in 1994 and a Ph.D. in physical chemistry from the University of Washington in Seattle in 2000. Dr. Blum is a member of the American Chemical Society (ACS) and the Materials Research Society (MRS). She served as chair for the ACS Fall 2005 session, and as chair for the MRS Fall 2005 session.

# Astronomers Weigh 'Recycled' Milli-second Pulsar

A team of U.S. and Australian astronomers is announcing today that they have, for the first time, precisely measured the mass of a millisecond pulsar -- a tiny, dead star spinning hundreds of times every second. This result is of special interest because it gives new insight into the production of millisecond pulsars and may shed light on the laws that govern nuclear matter. The work was presented at the American Astronomical Society meeting in Washington, DC, by Bryan Jacoby, NRL NRC Associate, Aidan W. Hotan of the University of Tasmania in Hobart, Australia; Professor Matthew Bailes of Swinburne University of Technology in Melbourne, Australia; Dr. Stephen M. Ord of the University of Sydney in Sydney, Australia; and Professor Shrinivas R. Kulkarni of the California Institute of Technology in Pasadena, CA.

Pulsars are truly extreme, with significantly more mass than the sun but so compact that they would fit inside the Washington, DC, beltway. These spinning neutron stars are produced when a massive star is destroyed by a supernova explosion at the end of its normal stellar life. As a pulsar spins, it emits beams of radio waves that sweep through space like a lighthouse beacon; astronomers use radio telescopes to observe the apparent blinking of the pulsar and precisely measure the time when its pulses arrive at the earth. A pulsar's spin slows at it ages, but if the pulsar is in a binary system with another star, it can accumulate gas shed by its companion star. This process of accretion, called "recycling," can accelerate the pulsar's spin to hundreds of rotations per second -- faster than a kitchen blender!

Using the 64-meter (210-foot) Parkes radio telescope in Parkes, Australia, the research team made very precise measurements of the pulses from a recently discovered millisecond pulsar called PSR J1909-3744, about 3700 light years away in the constellation Corona Australis. This pulsar spins every 2.9 milliseconds, or 340 times per second; the pulsar and its white dwarf companion star orbit their common center of gravity every 1.5 days. These observations were carried out at a frequency of 1.4 GHz, which provides a good compromise between the brightness of the pulsar and the deleterious effects of the interstellar medium.

By taking exact measurements of the arrival time of pulses from PSR J1909-3744 at regular intervals for nearly two years, and keeping count of every pulse of radio waves during this time (about 19 billion pulses), the astronomers precisely mapped out the pulsar's position on the sky and the shape of its orbit. They also noticed something unusual: when the pulsar is on the far side of its orbit, behind its white dwarf companion, its pulses arrive at the earth about 14 millionths of a second later than expected based on Newtonian mechanics. This effect, called Shapiro delay, is a consequence of Einstein's general theory of relativity; essentially, the light from the pulsar slows down when traveling through the companion star's gravitational field. When the pulses have to go past the companion on the way to the earth, they arrive late compared to when the companion is behind the pulsar. This is in addition to the much larger Roemer delay (3.8 seconds) arising simply because light from the pulsar has to travel further when it is on the far side of its orbit. Disentangling these two effects is only possible if the orbit is measured in incredible detail. The orbit of PSR J1909-3744 is the most circular known in the universe: the elliptical orbit is over one million kilometers across (about 1.5 times the size of the Moon's orbit around the Earth), but the major axis is larger than the minor axis by only 10 microns, a fraction of the thickness of a human hair.

By precisely measuring the size of the Shapiro delay and how it varies throughout the orbit, the astronomers ascertained the mass of the white dwarf companion and the angle that the pulsar's orbit makes with the sky. Combined with Kepler's laws of motion, this information allowed them to calculate the pulsar's mass: 1.44 times that of the sun.

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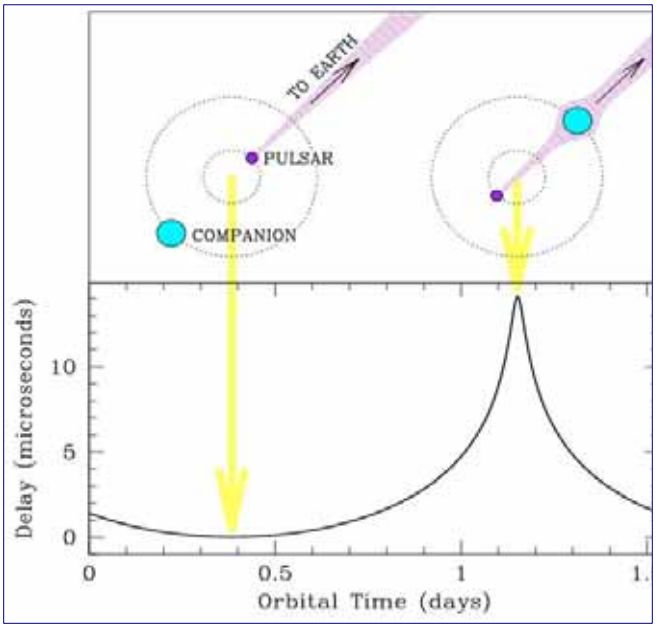


**Shapiro delay in the pulsar PSR J 1909-3744 signal due to the gravitational field of its companion. In the top panel, diagrams show the configuration of the pulsar and its white dwarf companion in their orbits relative to the line of sight to the observer on the Earth at two key points in the orbit: when the pulsar is closest to the Earth (left, the point of minimum Shapiro delay) and when the pulsar is on the far side of its companion as viewed from Earth (right, the point of maximum Shapiro delay). The bottom panel shows the variation in Shapiro delay through one complete orbit of the pulsar-white dwarf system, with yellow arrows highlighting the connection with the corresponding orbital diagrams in the top panel. The size and shape of this delay curve allowed astronomers to precisely calculate the mass of the pulsar. This result, obtained with the 64-meter (210-foot) Parkes radio telescope in Australia, were presented to the American Astronomical Society meeting in Washington, DC on January 12, 2006. Note: diagrams in the top panel are not to scale.**

## NRC Postdoc Directory: http://nrc58.nas.edu/pgasurvey/data/aodir/gen_page.asp

**Astronomers *continued***

The uncertainty in this measurement, 0.02 solar masses, is about 5 times smaller than the uncertainty of the previous best measurement of a millisecond pulsar's mass. This improvement was possible because this particular pulsar is well suited to high-precision pulse arrival time measurements, because its orbit is oriented so that we view it almost exactly from its edge (maximizing the Shapiro delay), and because of the specialized instrumentation developed at the California Institute of Technology and the Swinburne University of Technology for these observations.

Before this result, only the masses of slower-spinning (non-millisecond) pulsars had been measured precisely. Mildly-recycled pulsars, spinning a few tens of times per second and thought to have accreted a relatively small amount of matter from a companion, are between 1.31 and 1.44 times the mass of the sun; reassuringly, none are more massive than PSR J1909-3744 which should have accreted more material from its companion. In only one case has the mass of a completely unrecycled pulsar, spinning once every several seconds, been measured at 1.25 solar masses.

If this mass is typical, we can infer that a millisecond pulsar can be produced with the accretion of less than 0.2 solar masses from its companion. If this is the case, then the pulsar recycling process must be messy: more than half a solar mass must have been lost from the companion as a wind of ejected gas as it evolved from a normal main sequence star to a white dwarf.

Because neutron stars behave, in many respects, like giant atomic nuclei, measuring the physical properties of these exotic objects enhances our understanding of fundamental physics.
This result is exciting because …

*"...we now have a more complete picture of how these exotic objects are formed, and how they relate to other types of neutron stars,"* says Dr. Jacoby.

This research was supported by the NSF and NASA. Basic research in radio astronomy at NRL is supported by the Office of Naval Research. The Parkes telescope is part of the Australia Telescope which is funded by the Commonwealth of Australia for operation as a National Facility managed by CSIRO.

## Naval Research Laboratory
## Call for Abstracts

**The dates and time have been set for the 2007 NRL Postdoctoral Colloquium:**
**4th Wednesday of each month, 10:30 AM**

**All NRL Postdocs are encouraged to participate (including ASEE, NRC, University, etc).**
**If you are interested in presenting, please contact Radoslav Bogoslovov**
**to reserve your day as soon as possible.**
**(202-404-1793, radoslav.bogoslovov@nrl.navy.mil; code: 6126)**
**Postdocs from our non-DC locations should also contact their NRL program coordinators for assistance with travel arrangements.**

**NRL, Building 207, Room 155 (Chemistry Division)**
**45 minute talk followed by Q&A session**
**(on occasion, talks followed by round table discussions)**
**Open to ALL**

## 2007 NRL All-Postdoctoral Colloquium Series

# NRL, Smithsonian Institution, Penn State University, and Ocean Optics Study Properties of HOPE DIAMOND

Since January 2005, scientists from the Naval Research Laboratory (NRL) Chemistry Division have been studying the optical properties of the Hope Diamond, at the invitation of the Smithsonian Institution. In collaboration with Dr. Jeffrey Post, Curator of the National Gem and Mineral Collection at the Smithsonian; Dr. James Butler, NRL NRC Adviser; Dr. Sally Magana, NRL former NRC Associate; Dr. Roy Walters of Ocean Optics; and Dr. Peter Heaney, Penn State University Professor, have conducted spectroscopy tests on the legendary Hope Diamond and other colored diamonds.

The invitation from the Smithsonian presented a rare, hands-on opportunity for James Butler and Sally Magana to study optical defects in natural diamonds with color, and more importantly, the largest known natural blue diamond. Blue diamonds are of particular interest because of their semi-conducting electrical properties as well as the familiar hardness, chemical resistance, thermal, and optical properties. In addition to the Hope Diamond, weighing 45.52 carats, the researchers also studied the Smithsonian's Blue Heart Diamond (30.62 cts) and a suite of 239 colored diamonds, the Aurora Butterfly Collection, on loan to the Smithsonian through July from Alan Bronstein of New York.

While pure diamonds consist of only carbon and are colorless, most natural diamonds contain impurities, usually nitrogen. Color in a natural diamond is definite evidence of an impurity or defect. In the case of the Hope Diamond, the dominant impurity is believed to be boron, whose presence in the lattice can cause the blue color. Dr. Butler, who has been involved in the study and synthesis of diamonds at NRL since the mid-1980s, grows boron-doped and undoped diamonds in the laboratory to research their use as thermal, optical, and electrically semi-conducting materials for such DoD applications as all-electric platforms requiring high-voltage high-current devices, thermal management in electronics, and Micro-electro-mechanical systems (MEMS) for sensors and communications. Since high quality is critical to growing semi-conductor grade diamond materials, learning about the impurities inherent to natural diamonds is an important foundation to understanding the defects observed in synthetic diamonds.

The Hope Diamond was known to have an unusual reddish-orange long-lived phosphorescence – i.e. when illuminated with ultraviolet (UV) light and observed in a darkened room, the Hope diamond would glow for many minutes after the light source was turned off, appearing like a hot coal from a fire. While this phosphorescence had been photographed, it had never been studied scientifically. Such phosphorescence, particularly with an intense red color, is a rare phenomena in natural diamonds.

Working after-hours, when the diamonds were not on display at the Smithsonian Museum of Natural History, over several week-long periods, the researchers took equipment to the Smithsonian vaults, where they looked at the spectroscopic characteristics of the Hope and other diamonds. Using highly sensitive spectroscopy equipment belonging to NRL and Ocean Optics, the researchers were able to study optical absorption, Raman spectroscopy, fluorescence, phosphorescence, and particularly the spectral and temporal properties of the phosphorescence.

**Sally Magana, former NRL NRC Associate, aligns the Blue Heart diamond for an experiment to measure its phosphorescence with a spectrometer. A dual fiber-optic cable provided by Ocean Optics illuminates the stone from a deuterium lamp and receives the spectroscopic information.**

Little information is currently known about phosphorescence of natural diamonds, however it is known that these properties are brought about by UV-activated defects within the diamond. It is also documented that some synthetic diamonds phosphoresce much more than natural diamonds.

Analysis of the data is underway, assisted by NRL summer intern, Derrick Thiel of NOVA Research. The researchers are now examining similarities between the Hope, the Blue Heart, and the blue/grey and other colored diamonds from the Aurora collection. Although they have not yet tied the fluorescent or phosphorescent properties to any specific defect, all of the blue diamonds have phosphoresce bands centered at 500 and 660 nm wavelengths. Depending on the relative intensities and decay times at these two wavelengths, the phosphorescence might appear aqua, pink, orange, or red.

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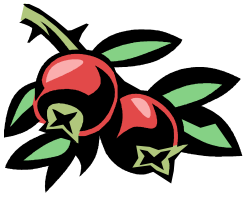
**Naval Research Laboratory (NRL) Public Affairs Office News Release Editor contact:, Janice Schultz/Donna McKinney 202-767-2541; nrl1030@ccs.nrl.navy.mil**

# Cranberry Juice for Immunoassay Enhancement



Brandy J. White,
NRL NRC Associate
Frances S. Ligler,
NRL NRC Adviser
Center for Bio/Molecular Science and Engineering, NRL

Several studies have focused on the ability of the juice of the North American cranberry, *Vaccinium macrocarpon*, to inhibit the adhesion of *Escherichia coli* to cells in the human urinary tract. *E. coli* is responsible for 80-90% of urinary tract infections (UTIs). The juice has also been shown to be effective for the prevention of adhesion of bacteria responsible for ulcers in the stomach and those involved in dental biofilm formation. More recently, cranberry juice has been put to a different use by taking advantage of the same anti-adhesive characteristics.

Immunoassays are routinely used to detect the presence of analytes such as bacteria, viruses, proteins, and even chemical agents. Antibodies are immobilized to a surface in order to capture the target analyte from a sample. Detection can be via one of several methods; in the case of the NRL array sensor, fluorescence is generated through the use of a second fluorescently labeled antibody so that an antibody-antigen-antibody sandwich is generated. When target binds to areas of the sensor surface where no capture antibody is immobilized, signals indicating the presence of targets become difficult to distinguish from background fluorescence. This nonspecific adhesion can result in poor limits of detection and false positive responses. Nonspecific adhesion is usually reduced or eliminated by using blocking agents, which may be added to the samples, to the surfaces, or both.

Commonly used blocking agents include sugars, proteins such as bovine serum albumin, and detergents. Some bacteria are stickier than others, however, and adhere to surfaces even in the presence of blockers. This is true for a nonpathogenic strain of *E. coli* chosen because of safety considerations for routine use in array sensor experiments to provide a "worst case" scenario.

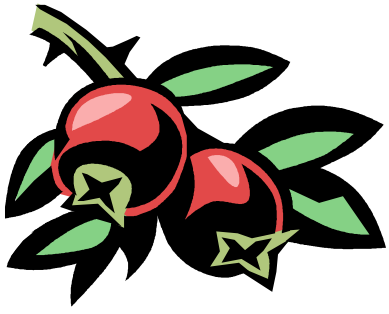
The nonspecific adhesion of this bacteria under standard assay conditions resulted in a background intensity equivalent to 67% of the signal intensity. Addition of Ocean Spray Cranberry and Concord Grape 100% Juice blend (OSCG) to samples at 25% (v/v) reduced the background intensity to 44% of the signal. At 50% OSCG, the background signal was reduced to less than 1% of the signal. In fact, the addition of cranberry juice to assays of other cells (*Salmonella typhimurium* and *Staphylococcus aureus*) where nonspecific binding was problematic also resulted in improvement of the signal-to-background ratios for those measurements.

Cranberries have been documented for treatment of UTIs since the 1700's. Though the reduction in UTI occurrence when the juice or fruit is consumed is well established, the mechanism of action has been widely debated. A variety of mechanisms for the inhibition of bacterial cell adhesion in the human body have been proposed. Cranberry juice has a high concentration of organic acids which may reduce urinary tract pH resulting in an inhospitable environment. The recently described impact on bacterial adhesion in the stomach contradicts this possibility and studies have shown that, at the levels of juice normally consumed, there is a negligible effect on system pH.

Other juices such as grape and apple contain similar amounts of common sugars, but do not prevent UTI. Cranberry juice contains a sugar rarely found in food sources called mannose which may contribute to its anti-adhesive activity. In addition, cranberry juice contains proanthocyanidins (PACs). PACs are polymers of 2 to 50 flavanoid subunits. Though PACs are found in many food items (grapes, chocolate, and tea for example), the PACs in cranberry juice have a specific type of intermolecular bond not found in PACs from other sources. This A-type bond has recently been implicated in the anti-adhesive activity of cranberry juice in the urinary tract.

In the immunoassay, pH was eliminated as the causative factor through controlling the pH of the bacterial cell samples. Sugars such as fructose and glucose were added to samples at concentrations up to an order of magnitude higher than that expected due to juice spiking with no impact on non-specific adhesion. Mannose was added to samples at levels similar to that expected in cranberry juice with no impact on background intensity levels. The impact of spiking samples with other juices such as apple, orange, grape, and white cranberry was also investigated. These juices did not reduce the non-specific adhesion of *E. coli* cells to the surfaces. A surfactant-type action was eliminated as a possibility by advancing contact angle studies.

The active component of the cranberry juice was determined to be slightly hydrophobic and of molecular weight greater than 5,000 by dialysis and HPLC. This information further implicates the PACs in the anti-adhesive activity of cranberry juice. Research into the mechanism of action of the cranberry juice components and the implications of the activity on inert surfaces (as opposed to human cells) is ongoing. This work was published (vol. 78, p 8537, 2006) and featured (vol. 78, p 639, 2006) in *Analytical Chemistry* and has been featured in *Science News* (vol. 169, p 45, 2006) and on the web page of the American Chemical Society (March 6, 2006).



# Nanoscale Organic Light-Emitting Diodes Below 100-nm Diameter

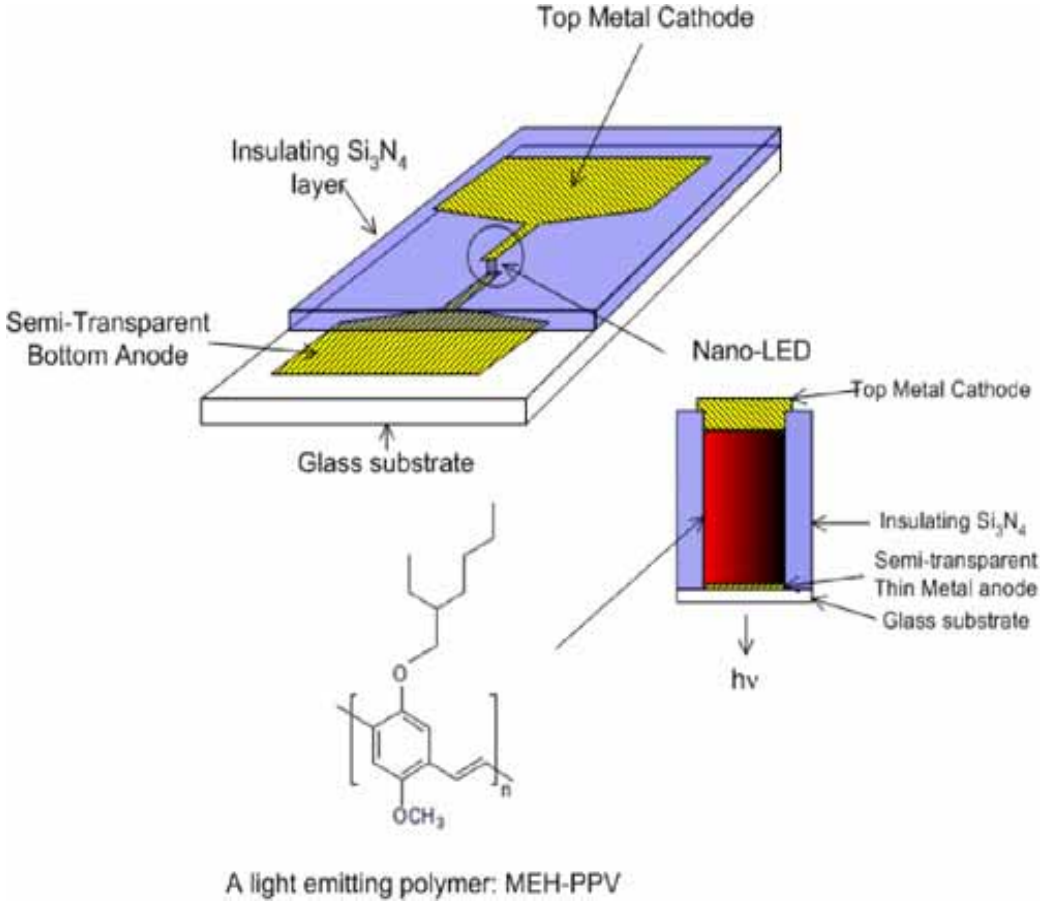
NRL former NRC Associates, Hiromichi Yamamoto, John Wilkinson, Konrad Bussmann, Joseph Christodoulides, and NRC Advisers, James Long and Zakya Kafafi

Nanophotonic applications will ultimately rely on electrically driven nanoscopic light sources. For example, nanoscale electroluminescent (EL) devices can be expected to play roles in areas as diverse as direct-writing nano-photolithography and schemes for quantum-communication that depend on single-photon emitters. Other potential applications include optical interconnects and chemical and biological sensing. While it is not difficult to excite an isolated nanoscale emitter (such as a quantum dot) by optical means, electroluminescent devices pose challenges in confining either the electrical current and/or the light source itself. We have established one means for meeting these challenges by demonstrating a record-sized nanoscale organic light-emitting diode (NanOLED), in which a light-emitting organic polymer is confined to a lithographically defined pore containing only several hundred polymer molecules. [1]

Inorganic semiconductors (such as gallium arsenide) provide a time-honored approach for EL, but at the nanoscale require architectures that overcome the micron-scale diffusion lengths often exhibited by current carriers and by the light-emitting excitons they form.

A promising alternative builds on the processability of organic materials, such as have been developed for OLED-based devices targeted for flat-panel displays and solid-state lighting. Organic materials can be readily deposited into predefined lithographic nanostructures, such as the 60-nm diameter holes we have defined via conventional electron-beam (e-beam) lithography.

*continued on next page*




**Above: Fig. 1** (a) The architecture of a single NanOLED

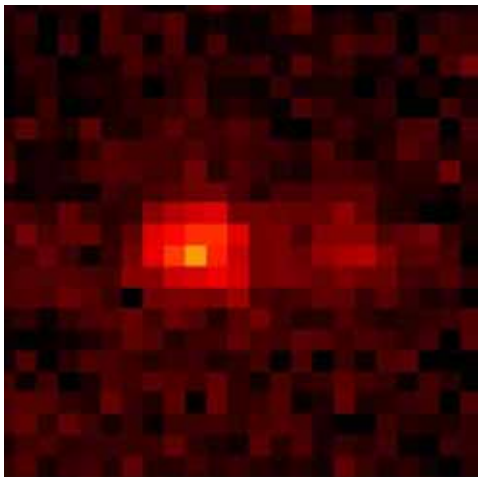


**Fig. 1** (b) EL image of the single NanOLED

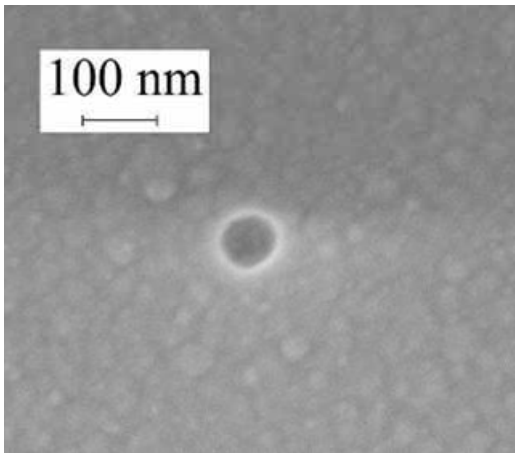



**Fig. 1** (c) SEM image of the nano pore

**Figure 1 (a) The architecture of a single NanOLED, including a monomer unit of the light-emitting polymer, (b) resolution-limited EL image (false-color) from a 60-nm NanoOLED, and (c) a scanning electron microscope image of the defining nano-pore.**

**NanOLEDs *continued***

The architecture the NanOLED developed in this work is sketched in Figure 1a. First, a semi-transparent gold anode was patterned on glass via photolithography. An insulating 100-nm thick film of silicon nitride was then deposited by chemical-vapor deposition. Arrays of nanoscale holes were subsequently etched into the film down to the anode at locations defined by e-beam lithography. The etching of the holes was followed by spinning the light-emitting polymer poly [2-methoxy-5-(2'-ethylhexyloxy)-1,4-phenylene vinylene] (MEH-PPV) over the entire device. Finally, the cathode materials (LiF followed by Al) were evaporated on top of the MEH-PPV film.

Light emission from individual NanOLEDs was recorded through the semi-transparent gold anode by using an optical microscope equipped with a highly sensitive CCD camera and an imaging optical- spectrometer. Figure 1b shows an EL image of one of our smallest devices, in which the polymer was confined to a 60-nm diameter hole, as shown in the scanning electron microscope image of a hole taken prior to spinning the polymer (Figure 1c). The EL spectra (not shown) were found to be entirely consistent with the photoluminescence (PL) spectrum of MEH-PPV, indicating emission from the same singlet excited state. Electrical characteristics were also determined by measuring an array of NanOLEDs (up to 1-μm diameter) fabricated on the same anode. The devices behaved similarly to a large, 2x2 $mm^2$ OLED, in terms of turn-on and operating electric fields.

Taken together, the data show that the nanoscale devices behave quite similarly to a standard single-layer OLED based on MEH-PPV. The ability to fabricate very small (60-nm in diameter) NanOLEDs using e-beam lithography suggests that even smaller devices could be developed down to the lithographic limit. The use of standard nanofabrication techniques, and the well-behaved operating characteristics of the NanOLEDs described here, hold great promise for future photonic and optoelectronic applications.

H.Yamamoto, *et al.*, , Nano Lett. **5**, 2485, (2005).

**Dr. James Long is a Research Physicist in the Chemistry Division at the NRL. His research interests focus on the linear and nonlinear optical properties of nanostructured materials, especially the characteristics of individual nanoscale emitters such as quantum dots, semiconducting nanowires, plasmonic architectures, and NanOLEDs.**

**Dr. Zakya Kafafi is the Head of the Organic Optoelectronics Section at NRL and is an SPIE Fellow. She has organized and chaired numerous international and national meetings, including editing the proceedings of more than 20 SPIE conferences. She introduced the peer review system to the SPIE proceedings and has authored over 30 SPIE manuscripts. She has been chair of the SPIE Trck Program on "Organic Photonics and Electronics" for the last three years.**

***See related article on page 9.***

## How the NRC Research Associateship Programs Work

Federal sponsors are approved for program participation based on their ability to support postgraduate training in any field of science or engineering. The National Research Council recruits on a national and international basis for applicants to these programs. Panels of experts in all disciplines review applicants and participating laboratories authorize awards to the most qualified applicants, based on the availability of funding. The NRC handles all administrative details of the awards and manages stipend, insurance, travel and other details of the awardees tenure.

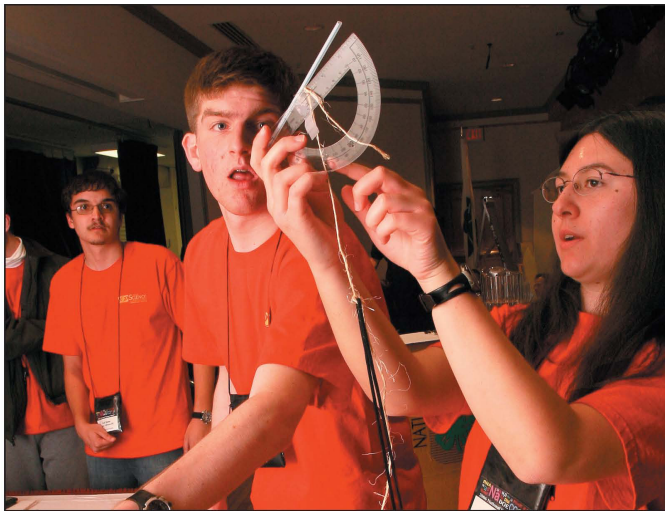
## The NRC's Special Expertise in Science and Engineering Workforce Recruitment

The NRC recruits on behalf of thousands of research opportunities throughout the federal government. The more than 4,000 Advisers selected to serve as mentors in the program comprise an even broader network for outreach. Through these efforts, a large group of highly qualified applicants are generated. The NRC evaluates all applications using a peer review process. Each application receives multiple reviews by scientists and engineers with expertise across the range of sponsored programs. Sponsor labs have input on the quality of applicants and the relevance to their programs. Sponsors also have the final word on authorization of awards. Because the recruitment, review and selection processes are coupled, highly qualified applicants are available to begin work soon after they apply.

## Outcomes of NRC Research Associateship Programs

The presence of a postdoctoral or visiting scientist adds value to the federal research enterprise by imparting new ideas and skills. At the same time, the awardee benefits by exposure to top-notch federal scientists and the availability of often unique equipment, facilities and data. Statistics maintained by the NRC show that over 40% of National Research Council Associates continue on as federal scientists and engineers either as regular employees or as contractors. Even for those NRC Associates who do not remain with the laboratory in some official capacity new linkages have been established. These often result in long-term collaborations and successful competition for federal research dollars by former Associates at universities or in private enterprise.

# NRL participates in DOE Science Bowl



**In the photo above, Pennsylvania's State College Area High School team members consult on a question during the science bowl. The team won first place in this year's competition. On the right, Thomas Jefferson High School for Science & Technology (TJHSST) students from Alexandria earn first place in the Fermi Division Interactive Science Discovery activity. (photos courtesy of DOE)**

At the end of April, NRL researchers served as volunteers for the Department of Energy's National Science Bowl. Sixty-five teams made up of more than 300 students from 40 states, the District of Columbia, and the U.S. Virgin Islands competed in this annual tournament. Earlier this spring in regional efforts, more than 12,000 students from 1,800 schools across the country participated in 65 regional Science Bowls to earn the right to compete in the national finals.

During the bowl, students were given between 5 and 20 seconds to answer very difficult questions, but often they would "buzz" in with the answer before the moderator had even finished reading the question, said Ian Downard, of NRL's Networks and Communications Systems Branch. Downard served as the timekeeper during the national bowl, enforcing the time limits for answers, as well as the 20-minute game clock. He noted that the timekeeper has to be very focused on the clock *"so as not to get distracted by trying to answer the questions silently in your own head."*

Other volunteers filled roles for scorekeeper, moderator, science judge (who monitors correctness of answers), and rules' judge.

Although a number of volunteers came from NRL and DOE, others came from all over the country to participate. After two days of competition, the State College Area High School from State College, Pennsylvania, won the championship. Other activities at the national level included a hydrogen fuel cell model car challenge and science discovery activities.

Kudos to the participating teams and thanks to the NRL volunteers who gave their time to help make these events successful. Participants in Maryland and District of Columbia regional competitions included Dr. George Carruthers, NRC Adviser, Space Science; Dr. Leah Chock, NRL NRC Associate, Plasma Physics; Dr. Melissa Hornstein, NRL NRC Associate, Plasma Physics; Dr. Bill Kennedy, NRL NRC Associate, Information Technology; Dr. Matt Laskoski, former NRL NRC Associate, Chemistry; and Dr. Holly Ricks-Laskoski, former NRL NRC Associate, Chemistry.

## NRL ALL-POSTDOC POSTER SESSIONS

The NRL Edison Chapter of Sigma Xi and the NRC sponsor the NRL semi-annual Autumn Postdoc Networking and Poster Session; the NRL WISE chapter and the NRC sponsor each Spring session. These semi-annual networking and poster sessions (including refreshments) provide the opportunity for all postdocs 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. 20 presenters participated in the Autumn 2006 session, with 80-90 attendees.

Greg Collins, NRL Adviser, receives an award from CAPT Gahagan (left) and John Montgomery, Director or Research, (far right) for the winning article from the Materials Science and Component Technology Directorate.

## ...looking back to 2005

# Review Authors accept awards

*Jonna Atkinson*
*Technical Information Services Branch, Code 3430*

At a ceremony on May 23, 2005, in the Management Information Center, several NRL scientists and engineers received recognition for writing excellent articles in the *2005 NRL Review*. This awards ceremony was established in 1990 by the senior science editor and the *NRL Review* coordinator to recognize scientists and engineers who fulfilled the following criteria in writing for the *NRL Review*: (a) relevance of the work to the Navy and DoD; (b) readability to the college-graduate level; (c) clear, concise content; and (d) the use of graphics that are interesting, informative, and eye-catching. The winning featured research article is selected jointly by NRL's Director of Research and Commanding Officer. One winning short article from each directorate is selected by that directorate's Associate Director of Research.

This year, the award for the best featured research article was presented to Dr. Alan Bracker, NRL NRC Adviser; and to Drs. Daniel Gammon, Eric Stinaff, Morgan Ware, Joseph Tischler, Andrew Shabaev, and Alexander Efros, all NRL former NRC Associates, (Electronics Science and Technology Division) for their article, "Using Light to Prepare and Probe an Electron Spin in a Quantum Dot."

Individual directorate awards were presented, including an award to the Materials Science and Component Technology Directorate—Dr. Greg Collins, NRL NRC Adviser, (Chemistry Division); Dr. Jeremy Ramsey (GeoCenters, Inc.); Dr. Braden Giordano (ASEE Postdoc); and Dr. M. Chatrathi (Arizona State University Postdoc), for their article, "Lab-on-a-Chip Analysis of Explosives".

Before Dr. Montgomery presented the awards, he remarked that NRL's annual *Review* is a professional publication used for reporting NRL's accomplishments as well as for recruiting prospective scientists and engineers to the Lab. In closing, CAPT Gahagan commented that we must continuously spread the word that NRL is a world-class institution performing leading-edge technology. He thanked everyone for participating in the *NRL Review*.

Receiving awards from CAPT Daniel Gahagan, left, are (left to right): Alan Bracker, NRL NRC Adviser; Joseph Tischler and Alexander Efros, both NRL former NRC Associates. Dr. John Montgomery, Director of Research at NRL, is on the far right. Not present for the photo were Daniel Gammon, Eric Stinaff, Morgan Ware, and Andrew Shabaev, all NRL former NRC Associates .

# 1st Annual NRC/ASEE Postdoctoral Publication Awards

Last year, on March 17, 2006, the first Annual NRC/ASEE Postdoctoral Research Publication Awards were a part of the Annual Research Publication Awards Dinner (ARPAD) program. These awards not only honor NRC postdoctoral associates for superior scientific accomplishments in the field of naval research, but also seek to promote continued excellence in research and in its documentation. There were 188 NRC and ASEE postdoctoral associates on board during 2005. Thirty-three papers generated by these postdocs were nominated for this award and five were selected for recognition. They represent 19 authors. NRC Awardees: Dr. Arnold Stux, Dr. Harry Uyeda, Dr. Nicolas Valdivia, and Dr. Igor Zutic.

**Arnold Stux, former NRL NRC Associate**

**Harry Uyeda, former NRL NRC Associate**

Simultaneously, NRL hosted the *ARPAD*. Now in its 38th year, ARPAD recognizes the authors of the best NRL scientific publications of 2005. The ceremony, held at the Bolling Air Force Base Officers' Club, honors individuals for outstanding scientific accomplishments in the field of naval research, while promoting continued excellence in research productivity and documentation. This year, 37 papers were selected for recognition from among 360 papers considered, representing 152 authors.

NRL Edison Patent Award winners were also recognized for significant contributions to science and engineering, as demonstrated by the patent process. Recognized patents are perceived to have the greatest potential benefits to the country. Three patents were recognized from among 55 nominations, representing 8 inventors and 3 patent attorneys.

Distinguished ARPAD guests this year included RADM William E. Landay III, Chief of Naval Research; CAPT Dennis Sorensen, Assistant Chief of Naval Research; Dr. Starnes Walker, Technical Director/Chief Scientist (ONR) and wife Patricia; Ms. Charlotte Watson, Director, ASEE Fellowship Programs, and guest Dr. Steve Kargauer; Dr. Eric Basques, Program Administrator with the Research Associateship Programs at the NRC, and wife Arlene.

**Nicolas Valdivia, former NRL NRC Associate**

Following the reception and dinner, Dr. John Montgomery, NRL Director of Research, gave the annual ARPAD remarks. NRL Commanding Officer, CAPT Daniel Gahagan, presented the awards as Dr. Montgomery called the recipients to the stage.

ARPAD was established in 1968 by then NRL Director of Research, Dr. Alan Berman, to recognize the authors of the best NRL publications of the preceding calendar year. In 1982, the annual awards program was renamed in honor of its founder to the Alan Berman Research Publication Awards Ceremony. Since 1991, the awards ceremony has also included recognition for outstanding patents granted to NRL NRC postdocs and now is officially called the Alan Berman Annual Research Publication and Edison (Patent) Awards.

**Igor Zutic, former NRL NRC Associate**

The 39th Annual Berman Research Publication and Edison Patent Awards, and the second Annual NRC/ASEE Postdoctoral Research Publication Awards held in March 2007 will be featured in our next issue.

# 38th Annual Berman Research Publication and Edison Patent Awards

# Remote Triage Research Team

Dr. Caroline A. Rickards, USAISR NRC Associate, joined the Remote Triage Research Team at the United States Army Institute of Surgical Research (USAISR) in San Antonio, Texas following completion of her Ph.D. at RMIT University in Melbourne, Australia in 2005. Caroline is working with Dr. Victor Convertino, NRC Adviser, and the Remote Triage Research Team to identify physiological markers that provide the best early prediction of injury severity and combat casualty outcomes. One of the ultimate goals of this research team is to formulate a decision-assist algorithm in order to predict the requirement for life saving interventions in trauma patients in both the military and civilian settings.

Hemorrhage is a major cause of death in civilian trauma, and the primary cause of death on the battlefield. As such, the USAISR Remote Triage Team is particularly interested in assessing techniques/ methodologies for predicting hemorrhage severity and also testing devices that may reduce the magnitude of traumatic hemorrhage and hence improve the rate of survival from these injuries. One such device is the impedance threshold device (ITD). The ITD was recently developed for the treatment of a number of different clinical conditions associated with significant life-threatening reductions in blood pressure (hypotension). When patients breathe through the ITD it decreases the pressure in the thorax, which draws blood back into the heart from the periphery.

This causes an immediate increase in the volume of blood ejected from the heart with each beat (stroke volume) and elevates arterial blood pressure. Caroline is involved in studies testing the efficacy of the ITD in preventing cardiovascular collapse in conscious, humans exposed to lower body negative pressure (LBNP), a model of acute hypovolemic hypotension (simulating hemorrhage). Caroline is particularly interested in the effect of the ITD on cerebral blood flow regulation during the hypotensive challenge of LBNP, and the relationship between subjective symptoms of orthostatic intolerance and reductions in cerebral perfusion. The manuscript from this project is currently in review for publication, and Caroline will be presenting her findings at the Experimental Biology meeting in Washington D.C. in April/May this year.


**Caroline Rickards, USAISR NRC Associate working with Mr. Gary Muniz, Head Technician**

Caroline also completed a preliminary study assessing the effect of ITD breathing on cerebral blood flow responses with orthostatic hypotension during a visit to Kennedy Space Center in Florida in June/July 2005 - just two weeks following her arrival in the United States! Caroline conducted the research project on behalf of the US Army as part of the six-week intensive NASA Spaceflight and Life Sciences Training Program (SLSTP), together with four undergraduate students from US and Canadian universities. Caroline presented the findings from this study at the Aerospace Medical Association's Scientific Meeting in Orlando, Florida, May 2006, and she has also submitted two manuscripts for publication in peer reviewed journals.

Caroline intends on renewing her NRC Associateship for a third year at USAISR in order to continue investigations into understanding the relationship between hypovolemic hypotension and cerebral blood flow regulation, and the effect of ITD breathing on cardiovascular dynamics under orthostatic stress.

*"We should share in the pride that Dr. Rickards received the 2007 tum Suden & Hillebrandt Award from the American Physiological Society for her research abstract that describes that maintaining high cerebral blood flow oscillations independent of average cerebral blood flow is associated with eliminating symptoms (i.e., maintaining good mental status) during central blood volume reduction in humans. Congratulations to all for supporting the NRC Postdoctoral Program. This award truly reflects well on the NRC and USAISR."*

Victor Convertino,
NRC Adviser

# Multivalent Vaccine Research

Dr. Les Dupuy joined the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Virology Division at Ft. Detrick, Maryland, in May 2003 as an NRC Associate. He completed his doctoral degree in the Department of Biochemistry and Molecular Biology at the University of South Alabama, and was a postdoctoral trainee at the Center for AIDS Research at the University of Alabama at Birmingham prior to assuming his current position at USAMRIID.

The mission of USAMRIID is to conduct basic and applied research on biological threats resulting in medical solutions to protect the war fighter. Les is working in the laboratory of Dr. Connie Schmaljohn, NRC Adviser and former NRC Associate, whose studies focus on the development of DNA vaccines for various biological threat agents. The goal of his project is to investigate methods for developing a multivalent DNA vaccine that offers simultaneous protection against the alpha viruses Venezuelan (VEEV), eastern (EEEV), and western (WEEV) equine encephalitis viruses. One of the inherent advantages of a DNA-based vaccine approach is the ability to combine multiple individual plasmid constructs and administer them together as a single vaccine. Les Dupuy's research has demonstrated that the immunogenicity and protective efficacy of individual DNA vaccines expressing the envelope glycoproteins of VEEV, EEEV, and WEEV are not significantly altered when they are delivered in combination. Along with previous results from the Schmaljohn laboratory, this result demonstrates the potential for developing multi-agent DNA vaccines against multiple biological threat agents by using this "cocktail" approach.

**Connie Schmaljohn, USAMRIID NRC Adviser and Les Dupuy, USAMRIID former NRC Associate**

Protein modification by directed molecular evolution, which encompasses *in vitro* multigene recombination coupled with effective screening methods, represents another strategy for developing multivalent antigens capable of eliciting protective immune responses against multiple pathogens. In collaboration with the Redwood City, California-based Maxygen, Inc., libraries of novel envelope glycoprotein chimeras were produced following *in vitro* recombination of the parent VEEV, EEEV, and WEEV envelope glycoprotein genes. Les screened several hundred of these chimeras and identified certain clones that possess improved immunogenicity, cross-reactivity, and protective efficacy as compared to the wild type parental antigens. The results from this fruitful collaboration illustrate that directed molecular evolution represents a powerful method for creating novel proteins with improved function.

One final facet of Dr. Dupuy's work at USAMRIID involves the evaluation of several different methods for the delivery of DNA vaccines designed to protect against biological threat agents. Among the methods being tested are particle bombardment (gene gun), skin dermabrasion, transcutaneous chemical, microneedle injection, liquid jet injection, and cationic lipid-mediated delivery. The goal is to determine the most efficacious delivery method for a given antigen that also provides the highest level of ease-of-use.

Dupuy's findings have been presented at DNA Vaccines 2004; The Gene Vaccine Conference in Monte Carlo, Monaco; at the XIII International Congress of Virology in San Francisco, California; and at the 2005 Scientific Conference on Chemical and Biological Defense Research in Timonium, Maryland. His results are also currently being submitted for publication in peer-reviewed journals. Following his tenure as an NRC Research Associate, Dr. Dupuy will continue his work at USAMRIID as a principal investigator.

**ADVISERS: Update your own contact information on http://nrc58.nas.edu/pgasurvey/data/adviser/login.asp**

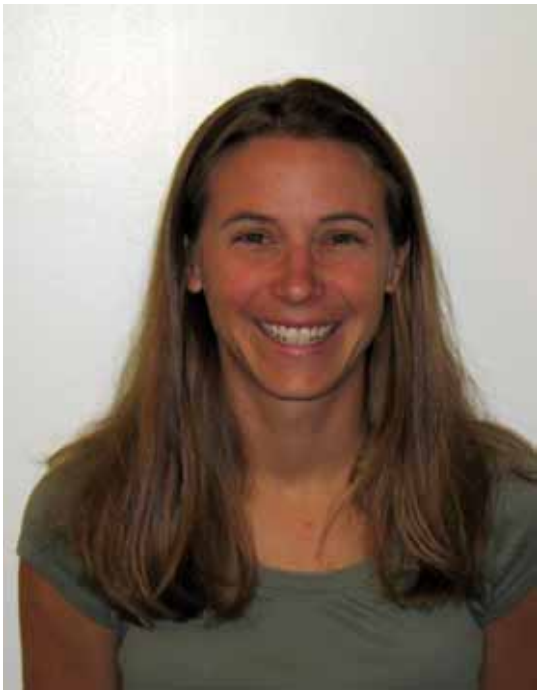
# USARIEM

Dr. Juli Jones is a NRC Research Associate in the Thermal and Mountain Medicine Division at the United States Army Research Institute of Environmental Medicine (USARIEM), Natick, MA. Jones and Dr. Allen Cymerman, NRC Adviser, are testing the hypothesis that systemic administration of Erythropoietin (EPO) will decrease cognitive performance decrements and Acute Mountain Sickness (AMS) symptomology when soldiers are exposed to high altitude.

Rapid deployment of unacclimatized troops to high mountainous terrains causes debilitating effects on force health and fighting capabilities. Substantial impairments in psychomotor performance, mental skills, reaction time, vigilance, memory, and logical reasoning are apparent immediately upon rapid ascent to altitudes above 2,500 m. In addition to cognitive deficits, most humans ascending to elevations above 2,500 m will experience some degree of AMS. AMS is a syndrome that is characterized by headache, anorexia, nausea, vomiting, insomnia, lassitude, and malaise.

Although AMS and cognitive impairments may be caused by different mechanisms, including alteration of normal cerebral tissue fluid distribution and increases in various neurotransmitters in the extracellular fluid, EPO may globally protect against both. Studies suggest that EPO is an endogenous mediator of ischemic preconditioning and is potently neuroprotective against various stimuli including cerebral ischemia, mechanical trauma, excitotoxins, and neuroinflammation.

The objective of the proposed study is to prevent cognitive performance impairments and alleviate AMS symptoms with acute EPO administration. In the present study Jones's goal is to deliver EPO in a manner that provides neuroprotection without raising hemoglobin or hematocrit.



**Julie Jones, USARIEM NRAC Associate**

**Miyo Yokota, USARIEM NRAC Associate**

Dr. Miyo Yokota is a NRC Research Associate in the Biophysics and Biomedical Modeling Division at the United States Army Research Institute of Environmental Medicine (USARIEM), Natick, MA. Miyo and Dr. Larry Berglund, NRC Adviser, recently developed ICDA (Initial Capability Decision Aid), a heat stress prediction model for monitoring the real-time physiological status of soldiers in the battlefield. ICDA estimates metabolic rates from heart rate and ambient temperature using non-invasive sensors and predicts longitudinal physiological parameters including core temperature, sweat rate, and skin temperature.

The model provides physiological and health status of soldiers performing different tasks over hours or days. Forecasting real-time and future probabilities of soldiers' health status and notifying medical indications to medics, are both growing needs to save soldiers' lives according to recent reports from wars in Iraq and Afghanistan. ICDA has been applied to meet such demands for the Warfighter Physiological Status Monitoring program.

Another challenge for thermoregulatory mathematical models is to characterize the individual variability of soldiers and implement this variability into these biomedical models, thus improving the accuracy of predictions as opposed to the traditional thermoregulatory models described as "one model fits all." Using her educational background in biological anthropology, Miyo's research will focus on the examination and application of individual anthropometry and physiology of soldiers using multivariate analyses and Monte Carlo methods to improve the existing USARIEM thermoregulatory prediction models.

The NRC staff attend approximately 32 professional meetings each year to disseminate information about the NRC Associateship Programs. With the goal of increasing diversity of applicants to our program, we have added more meetings that target unrepresented minorities.

| NRC EXHIBITS AT SCIENTIFIC MEETINGS | LOCATION | | 2007 |
|---|---|---|---|
| **MMM Intermag Conference** | **Baltimore** | **MD** | **01/07/07-01/11/07** |
| **American Institute of Aeronautics & Astronautics** | **Reno** | **NV** | **01/08/07-01/11/07** |
| **American Meteorological Society** | **San Antonio** | **TX** | **01/14/07-01/18/07** |
| **Society of Photo-Optical & Instrumentation Engineers** | **San Jose** | **CA** | **01/23/07-01/25/07** |
| **Johns Hopkins Univ/Science & Technol Career Fair** | **Baltimore** | **MD** | **02/08/07-02/08/07** |
| **National Society of Black Physicists** | **Boston** | **MA** | **02/21/07-02/24/07** |
| **Biophysical Society** | **Baltimore** | **MD** | **03/04/07-03/06/07** |
| **American Physical Society** | **Denver** | **CO** | **03/05/07-03/07/07** |
| **American Chemical Society (Spring)** | **Chicago** | **IL** | **03/26/07-03/28/07** |
| **National Society of Black Engineers** | **Columbus** | **OH** | **03/29/07-04/01/07** |
| **American Association of Petroleum Geologists** | **Long Beach** | **CA** | **04/01/07-04/04/07** |
| **Nat'l Org of Black Chemists & Chemical Engineers** | **Orlando** | **FL** | **04/01/07-04/07/07** |
| **Experimental Biology (combined with ASBMB)** | **Washington** | **DC** | **04/28/07-05/02/07** |
| **Conference on Lasers & Electro-Optics** | **Baltimore** | **MD** | **05/08/07-05/10/07** |
| **American Society for Microbiology** | **Toronto** | **ON** | **05/21/07-05/23/07** |
| **Ecological Society of America** | **San Jose** | **CA** | **08/05/07-08/10/07** |
| **American Chemical Society (Fall)** | **Boston** | **MA** | **08/20/07-08/22/07** |
| **American Fisheries Society** | **San Francisco** | **CA** | **09/02/07-09/06/07** |
| **Science & Engr Alliance-Student Technical Conference** | **Washington** | **DC** | **10/01/07-10/01/07** |
| **Human Factors and Ergonomics Society** | **Baltimore** | **MD** | **10/01/07-10/05/07** |
| **Soc for the Advncmnt of Chicanos & Native Am in Science** | **Kansas City** | **MO** | **10/11/07-10/14/07** |
| **Hispanic Association of Colleges & Universities** | **Chicago** | **IL** | **10/20/07-10/23/07** |
| **Mexican American Engineers & Scientists** | **Albuquerque** | **NM** | **10/25/07-10/27/07** |
| **Geological Society of America** | **Denver** | **CO** | **10/28/07-10/31/07** |
| **Florida Education Fund, McKnight Fellows Meeting** | **Tampa** | **FL** | **11/01/07-11/01/07** |
| **American Indian Science & Engineering Society** | **Phoenix** | **AZ** | **11/01/07-11/03/07** |
| **Society for Neuroscience** | **San Diego** | **CA** | **11/03/07-11/07/07** |
| **American Public Health Association** | **Washington** | **DC** | **11/03/07-11/07/07** |
| **American Society for Tropical Med & Hygiene** | **Philadelphia** | **PA** | **11/04/07-11/08/07** |
| **Annual Biomedical Research Conference for Minority Students** | **Austin** | **TX** | **11/07/07-11/10/07** |
| **Society for Environmental Toxicology & Chemistry** | **Milwaukee** | **WI** | **11/11/07-11/15/07** |
| **Materials Research Society** | **Boston** | **MA** | **11/26/07-11/30/07** |
| **American Society for Cell Biology** | **Washington** | **DC** | **12/01/07-12/05/07** |
| **American Geophysical Union** | **San Francisco** | **CA** | **12/10/07-12/14/07** |

Advisers' Note: If you are interested in promoting a specific research opportunity at any of these meetings, please contact Jane Dell'Amore at least one month prior to the meeting date to request flyers for your opportunity to be distributed at the meeting. Another effective means of finding prospective applicants for a specific research opportunity is to place an announcement on a professional society web site; this is relatively inexpensive compared to the cost of display advertisements in printed publications. If you will be attending a meeting not on our list, you can request a supply of flyers for your own use. **Jane Dell'Amore can be reached at (202) 334-2768 or jdellamo@nas.edu**

# 2007 PARTICIPATING PROGRAMS



2007 PARTICIPATING PROGRAMS

# 2007 SCHEDULE

## February Review

| | |
|---|---|
| February 1 | application deadline |
| February 12 | rosters to agencies |
| February 26 | LCR forms due from agencies |
| March 8/9 | panels review / board meeting |

## May Review

| | |
|---|---|
| April | manuscripts arrive from agencies |
| April 23 | LPR Meeting |
| May 1 | application deadline |
| May 14 | rosters to agencies |
| May 25 | LCR forms due |
| June 21/22 | panels / board mtg |

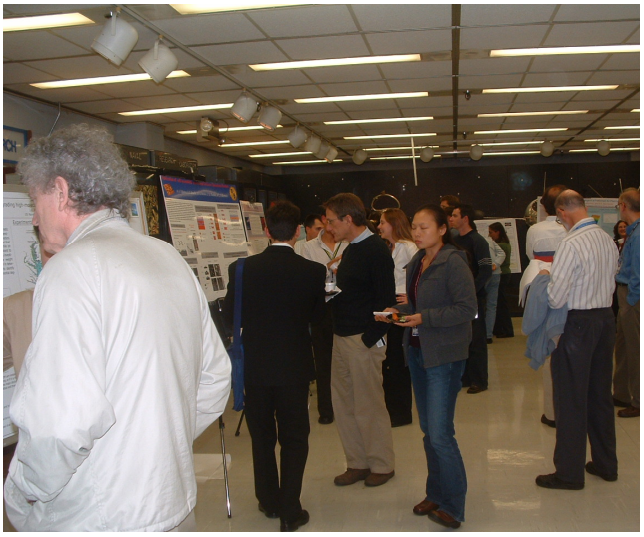
## August Review

| | |
|---|---|
| August 1 | application deadline |
| August 10 | rosters to agencies |
| August 24 | LCR forms due from agencies |
| October 6 | panels review / board meeting |

## November Review

| | |
|---|---|
| November 1 | application deadline |
| November 9 | rosters to agencies |
| November 26 | LCR forms due from agencies |
| January 7, 2008 | panels review/board meeting |

Resident Research Associateship Programs
The Keck Center, 500 Fifth Street NW, #568
Washington, DC 20001



## NRL All-Postdoc Poster Session—Spring 2007

18 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 at a poster session on May 16th sponsored by NRC and the NRL Women In Science and Engineering Network (WISE). The associates represented seven NRL Divisions (Optical Sciences, Chemistry, Materials Science and Technology, Electronics Science and Technology, Center for Biomolecular Sciences and Engineering, Remote Sensing, and Space Science) from three of the five NRL directorates and presented a broad range of topics from obital decay of a binary neutron star system to undersea aerobic environment fuel cells. The event was well attended with approximately 80 people viewing and discussing the posters including Dr. Basques, NRC Program Administrator, and Captain Gahagan, Commanding Officer of NRL.

Spring sessions are sponsored by NRL-WISE; Autumn sessions are sponsored by Sigma Xi.