THE NATIONAL ACADEMIES

RESEARCH ASSOCIATESHIP PROGRAMS

NEWSLETTER

Summer 2008

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NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

DOE/NETL/MHFP

The National Research Council (NRC) conducts the National Energy Technology (NETL) Methane Hydrates Fellowship Programs (MHFP) in cooperation with sponsoring federal laboratories, research organizations, and accredited universities.

The National Research Council, through its Associateship Programs office, conducts a national competition to recommend and make awards to M.S., Ph.D., and postdoctoral level candidates.

The objectives of the Programs are (1) to provide postgraduate students and postdoctoral candidates opportunities for career development, largely of their own choice in the Methane Hydrates field that are compatible with the interests of the sponsoring laboratories and universities, and (2) to contribute thereby to the overall efforts of NETL in their support in the development of Methane Hydrate Science.

For postgraduate students, the Programs provide an opportunity for concentrated research or career development in association with selected members of the permanent professional laboratory or university staff, often as a climax to formal career preparation.

Article on pages 7—9

Participating laboratories and universities receive a stimulus to their programs by the presence of bright, highly motivated, recent graduates. New ideas, techniques, and approaches to problems contribute to the overall professional climate of the laboratories. Indirectly, the fellowships also make available to the broader research community the excellent and often unique facilities that exist in federal laboratories and universities.

The Methane Hydrate Fellowship supports highly qualified postgraduate students in the advancement of Methane Hydrate science. In particular; interest is in advanced geological and geophysical projects that will provide improved methods and tools for real time, remote or *in situ* detection, characterization, and appraisal of gas hydrates occurrence and distribution in nature as well as their production potential as an energy resource.

Interest is in projects that provide an improved understanding of the processes that control hydrate stability and their potential role in global climate including formation of Methane Hydrates in permafrost and seafloor settings and the fate of dissociated hydrates through sediments, the water column, and into the atmosphere.

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

The NRC Research Associateship Programs *Newsletter* is published semi-annually (spring and autumn) to highlight research and activities of NRC Associates and Advisers who participate in the programs in our many agencies and laboratories. It is posted on this web page in full-color PDF. In addition, the monochrome version is printed by the National Academy Press (NAP), and bulk orders of 10 or more are available from our office for bulk distribution at agencies/laboratories, scientific meetings, NRC meetings, staff visits, site visits, etc. March 1 and September 1 are the tentative deadlines for submission of articles to the respective spring and autumn issues. However, we accept articles throughout the year-- press releases, profiles, 1 – 2 page articles already written and/or submitted to other publications, images, photos, notices, awards, honors, etc.

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

PROGRAM PROMOTION 2008

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

American Institute for Aeronautics & Astronautics	Jan 7 to Jan 10	Reno, NV
American Meteorological Society (#734)	Jan 20 to Jan 24	New Orleans, LA
Society of Photo-Optical Instrumentation Engineers	Jan 22 to Jan 24	San Jose, CA
Biophysical Society (#427)	Feb 2 to Feb 6	Long Beach, CA
Johns Hopkins Univ/Science & Technology Career Fair	Feb 12	Baltimore, MD
National Society of Black Physicists	Feb 20 to Feb 23	Washington, DC
American Physical Society	Mar 10 to Mar 14	New Orleans, LA
Nat'l Org Professional Adv of Black Chemists & Chem Eng	Mar 16 to Mar 21	Philadelphia, PA
National Society of Black Engineers (#1624)	Mar 20 to Mar 22	Orlando, FL
Experimental Biology	April 4 to April 9	San Diego, CA
American Chemical Society	April 7 to April 9	New Orleans, LA
American Society for Microbiology	June 1 to June 5	Boston, MA
Ecological Society of America	Aug 3 to Aug 8	Milwaukee, WI
American Fisheries Society	Aug 17 to Aug 21	Ottawa, Ontario
American Chemical Society	Aug 18 to Aug 20	Philadelphia, PA
Human Factors and Ergonomics Society	Sept 22 to Sept 26	New York, NY
Geological Society of America	Oct 5 to Oct 8	Houston, TX
SEA Student Technical Conference	Oct 8 to Oct 11	Gaithersburg, MD
Soc for Adv of Chicanos & Native Americans in Science	Oct 9 to Oct 12	Salt Lake City, UT
Hispanic Association of Colleges and Universities	Oct 11 to Oct 13	Denver, CO
Mexican American Engrs & Scientists Symp & Career Fair	Oct 23 to Oct 25	Las Vegas, NV
Florida Education Fund/McKnight Fellows Meeting	TBD	TBD
American Public Health Association	Oct 25 to Oct 29	San Diego, CA
American Indian Science and Engineering Society	Oct 30 to Nov 3	Anaheim, CA
Annual Biomedical Res Conference for Minority Students	Nov 5 to Nov 8	Orlando, FL
Society for Neuroscience	Nov 15 to Nov 19	Washington, DC
Materials Research Society*	Dec 1 to Dec 5	Boston, MA
American Society of Tropical Medicine and Hygiene	Dec 7 to Dec 11	New Orleans. LA
American Society for Cell Biology	Dec 13 to Dec 17	San Francisco, CA
American Geophysical Union	Dec 15 to Dec 19	San Francisco, CA

*Job placement only - no exhibit booth.

PROFILES: NETL Methane Hydrates Fellows

Dr. Monica B. Heintz
NRC/NETL Methane Hydrates Fellow ,
University of California,
Santa Barbara, CA

Solving geological engineering problems and studying microbial communities that oxidize methane in the ocean would seem to most people to be totally different scientific endeavors. But when Dr. Monica Heintz's curiosity about the interface between the biological and mineral worlds steered her from the Colorado Rocky Mountains to the Pacific Ocean, she found that many of the skills she had gained as an undergraduate at the Colorado School of Mines could be applied in modeling how naturally elevated methane concentrations in the ocean change due to currents, dilution, and most importantly, consumption by microbes that rely on methane as a carbon and energy source. Methane is a powerful greenhouse gas, with about 20 times the radiative capacity of carbon dioxide. The oxidation of methane in the water column is one of the least characterized processes of the global carbon cycle, and yet a significant portion of methane released from marine sediments is consumed before it can reach the atmosphere.

Dr. Heintz was recently selected as the first recipient of a new Methane Hydrate Research Associateship awarded by the U. S. Department of Energy in a program directed by the National Energy Technology Laboratory (NETL) through the National Research Council (NRC). In her research, she will concentrate on identifying the microorganisms responsible for methane oxidation in the marine water column and will investigate the ways in which this "biological filter" controls how much of the methane released from the seafloor, either from hydrates or seeps, eventually reaches the atmosphere.

Monica's interest in science started early. ***"I really can't remember a time when I didn't want to be a scientist,"*** she says. ***"In my childhood years, I remember working on science fair-type projects in the garage with grandfather—an electrical engineer. When I went to CSM I was determined to be a physicist, until an introductory earth science course drew me into the geological engineering program. Then, when I made the decision to go on to graduate school I realized I could focus on practically any problem I wanted."***

Dr. Heintz chose to begin by studying microbial communities associated with marine hydrothermal systems under the leadership of U.C. Santa Barbara professors Rachel Haymon and Dave Valentine, soon after a visit to the campus. ***"The people there were terrific, I loved southern California, and two months after starting graduate school I was on a ship, at the Galapagos Spreading Center, collecting samples from plumes of hydrothermal fluid emanating from the mid-ocean ridge with the goal of identifying members of the microbial community that harvest energy from the chemicals in hydrothermal fluids."*** She is currently working toward a Ph.D. in Earth Science as part of Dr. Valentine's biogeochemistry group.

Monica's research under the Methane Hydrate Research Fellowship will ramp up this summer when she participates in a July research cruise in the Santa Barbara and Santa Monica Basins, offshore southern California. The goal of the cruise is to balance the methane budget for the major seep fields in the area. Monica will be collecting samples to screen for methanotropic microbes and will be using radioactively-tagged methane to determine how quickly they oxidize methane in the water column. She will apply results from the work on this cruise to investigate how much of the 40 metric tons per day of methane seeping from the seafloor at the shallower Coal Oil Point seep just off the Santa Barbara coast might be oxidized by bacteria before it escapes into the atmosphere. In this effort, she will be working with Dr. Susan Mau, a post-doctoral researcher in Dr. Valentine's group.

Dr. Laura Lapham
NRC/NETL Methane Hydrates Fellow ,
Florida State University,
Tallahassee, FL

Dr. Lapham has been selected as the third recipient of a Methane Hydrate Graduate Fellowship**.** Dr. Lapham will investigate the factors that control hydrate stability in order to better understand why observed dissolution rates in the field are often much slower than theoretical predictions. Dr. Lapham's work will focus on the influence of in situ methane concentrations in pore fluids adjacent to marine gas hydrates and the influence of kinetic barriers such as entrained oils or microbial coatings on the surface of the hydrate cage. To aid her in her research, Dr. Lapham intends to develop two novel fluid seafloor sampling devices that will allow the measurement of methane concentrations and d13C values adjacent to and at discreet distances away from shallow buried marine gas hydrates. This effort will compare both laboratory and field results with theoretical predictive model results to address and improve our knowledge of gas hydrate stability and dissolution. As a Ph.D. student at the University of North Carolina Chapel Hill, Dr. Lapham was a member of the Gulf of Mexico hydrate research consortium managed by the Center for Marine Resources and Environmental Technology (CMRET) at the University of Mississippi. She and her advisor, Dr. Jeff Chanton, developed a Pore- Fluid Array (PFA) which uses OsmoSampler technology to collect and store pore-fluids at different depths in the sediments over time.

Laura Lapham arrived at Florida State University expecting to study math. ***"I wanted little to do with science,"*** she recounts. An inspirational first year chemistry professor (coupled with the sudden prospect of life as a statistician) diverted her towards the laboratory. For the next 3 years, Laura worked in an Oceanography lab under the direction of Dr. Jeff Chanton. During this time, she conducted research on carbon-dioxide/methane cycling in a Canadian wetland and a local landfill. After graduation and a year working as an organic chemist (***"I learned that spending all day under a hood synthesizing novel compounds just wasn't for me"***) she decided to follow up

on her earlier interest in carbon cycling. This brought her to the University of North Carolina, where she worked with her co-advisors, Dr. Chris Martens and Dr. Chanton, to develop a better understanding of biogeochemical and physical controls on methane and sulfate in cold seep environments.

As part of the Gulf of Mexico hydrate research consortium managed by the Center for Marine Resources and Environmental Technology (CMRET) at the University of Mississippi, Dr. Chanton and Laura have developed a Pore-Fluid Array (PFA) which uses OsmoSampler technology to collect and store pore-fluids at different depths in the sediments over time. The instrument has a detachable OsmoSampler package (developed at Monterey Bay Aquarium Research Institute) that can be collected and replaced by a remotely operated vehicle. The idea behind the PFA is to monitor pore-fluid salt and methane concentrations in order to observe hydrate formation or decomposition events, since hydrates exclude salts during formation. The first PFA was placed at Mississippi Canyon Lease Block 118 in May 2005 and is scheduled to be collected in September 2006, after an extended stay on the seafloor (courtesy of hurricanes Katrina and Rita).

Laura considers herself fortunate to have participated in nine research cruises related to methane hydrate research over the past six years: five different visits to sites in the Gulf of Mexico, three trips to offshore Vancouver Island (Barkley Canyon, Cascadia Margin), and one to the Blake Ridge diapir offshore South Carolina. ***"The main goal of the Gulf of Mexico hydrate consortium is to develop and maintain a long-term hydrate monitoring station on the seafloor,"*** says Laura. ***"My contribution to the project has been to help develop and deploy the PFA and collect gravity cores to determine the spatial variability of microbial processes such as sulfate reduction, anaerobic methane oxidation and methanogenesis; processes that control hydrocarbon distributions in surface sediments."***

Laura received her Ph.D. from the University of North Carolina in 2007, and has gone on to a post-doctoral position at Florida State University. She also has an interest in educational outreach programs that help provide materials and resources to help middle school and high school science teachers strengthen their curricula (such as the Teacher Link Program in Raleigh, NC).

Dr. Evan Solomon
NRC/NETL Methane Hydrates Fellow , Scripps Inst of Oceanography, LaJolla, CA

Dr. Solomon has also been selected as the second recipient of a Methane Hydrate Graduate Fellowship. We talked to Evan as he was packing to leave on an upcoming methane hydrate research cruise to the Indian Ocean. Most grad students take part in perhaps four such cruises while completing a Masters and Ph.D. in an oceanography-related specialty … this will be Evan's ninth. ***"I'm interested in understanding the dynamics of fluid flow within sediments, particularly as they relate to ocean chemistry,"*** says Evan. ***"I had focused a lot on hydrogeology at UNR, and when a visiting speaker gave a talk about methane hydrates, it seemed to be a very interesting topic, so I sought out Dr. Miriam Kastner at Scripps."*** Evan's seafaring has been the direct result of that decision.

Dr. Solomon's work with Kastner has involved long-term continuous chemical and fluid flux monitoring of two dynamic subsea systems: the Costa Rica subduction zone and the Bush Hill gas hydrate field in the Gulf of Mexico. Off Costa Rica they used continuous water samplers within a borehole observatory to record the chemical and fluid flux. This was the first high-resolution time series data set of chemistry and fluid flow at a subduction zone.

At Bush Hill, as part of a project funded by DOE, Evan helped to develop and deploy a new design of flux meter called the MOSQUITO (Multiple Orifice Sampler and Quantitative Injection Tracer Observer). The device contains a network of osmotic samplers and a tracer injection feature. The tracer is injected at a single point beneath the seafloor and fluid chemistry and tracer concentrations are continuously sampled simultaneously at multiple depths in a three dimensional array relative to the tracer injection point. The data collected over 430 days in 2002-03 have been used to help characterize the complex hydrology around hydrate mounds and their related benthic communities. The results show that methane from active gas vents adjacent to the mounds act to keep the methane hydrate deposit stable.

In an associated experiment, Evan is using methane concentration data from bubble plumes above the active seafloor methane seeps to model the methane flux from the ocean surface to the atmosphere at four sites in the Gulf of Mexico. Ultimately he hopes to combine his results with remote sensing imagery of over 400 active seeps, to extrapolate these flux rates to the entire northern Gulf of Mexico basin. The Gulf of Mexico is one of the few places in the ocean where methane is not oxidized in the water column. If its contribution of methane to the atmosphere can be more accurately quantified the impact of oceanic methane on the atmosphere will come into sharper focus.

Evan is clearly excited about continuing his research beyond the award of his degree. ***"I am hoping to do a post-doc where I can apply some of what I have learned to the study of freshwater lake sediments,"*** said Evan. A post-doc study on methane fluxes and gas hydrate formation and distribution in the Indian Ocean is also on his list.

NETL

The DOE Office of Science manages the DOE National Science Bowl. The Office of Science is the principal supporter of DOE's world-class national laboratory system that will lead the way in innovations including high-end computing, nanotechnology, biotechnology, energy sources, and other material science research.

Photos of the top 16 teams and more information about the DOE National Science Bowl are on http://nationalsciencebowl.energy.gov.

Teams may be interviewed by calling the DOE media contacts listed above.

California student inaugural recipient of DOE Fellowship

The U.S. Department of Energy (DOE) has selected the first recipient of a **National Research Council (NRC) Methane Hydrate Research Fellowship. Dr. Monica Heintz,** a doctoral student at the University of California at Santa Barbara, will receive the inaugural award, which is part of a new program that provides support for graduate and post-graduate scientists in fields related to the study of methane hydrates.

The program is directed by the Office of Fossil Energy's **National Energy Technology Laboratory (NETL)** and helps foster scientific development of one of the world's most promising, but least understood future energy sources.

The U.S. Geological Survey estimates that methane hydrate may contain more organic carbon than all of the world's coal, oil, and natural gas combined, and this immense global storehouse of methane could be an abundant source of energy. One of the greatest challenges, though, is that scientists are unsure of the role gas hydrates play in the global carbon cycle and global climate, and therefore, the potential environmental implications of exploiting methane hydrates.

For her fellowship research, Dr. Heintz will explore processes that moderate the flow of methane through the oceans to the atmosphere - an important consideration in development of hydrates as an energy source and in understanding the potential role hydrates play in global climate change. Her research will concentrate on identifying the microorganisms responsible for methane oxidation in water and will investigate the ways in which this "biological filter" controls the rate and amount that methane released from the seafloor might eventually reach the atmosphere.

Dr. Heintz studies microbial communities associated with marine hydrothermal systems with U.C. Santa Barbara professors Rachel Haymon and Dave Valentine. In December 2005 and January 2006, she was part of a team of 38 scientists who ventured to a deep-sea site north of the Galapagos Islands to conduct research on the global mid-ocean ridge. The expedition was jointly funded by the National Science Foundation and the National Oceanic and Atmospheric Administration's Ocean Exploration Program. Dr. Heintz received her undergraduate degree in geological engineering from the Colorado School of Mines.

Dr. Monica Heintz, NRC Fellow

NETL has a long history of building synergistic relationships with research universities, viewing academic research as a "win-win" situation. The U.S. government benefits by tapping into some of the best minds available for solving national energy problems, universities get support to maintain cutting-edge faculty and laboratories, and students are provided with opportunities that help them along their chosen path of study, ultimately strengthening the national pool of scientists and engineers.

The two-year fellowships awarded under this program are available to students pursuing advanced degrees related to methane hydrate science and feature competitive stipend structures and an annual travel allowance. **The National Research Council (NRC) of The National Academies is responsible for creating and administering the program in association with NETL** and the ongoing interagency research and development effort in methane hydrates.

Announcement advances commitment to future energy scientists

NIAID/ NIH Profile

Dr. Pushpa Pandiyan, NRC Associate

Dr. Pushpa Pandiyan, **NRC Associate**, is a 4th year postdoctoral fellow with Dr. Michael Lenardo in the Laboratory of Immunology, **NIAID/ NIH**. In 2008 she received an American Association of Immunologists-Invitrogen Trainee Achievement Award. Established in 1997, these awards recognize promising trainees in the field of immunology. The award was presented at the AAI Annual Meeting, which was held as part of Experimental Biology 2008, April 5-9 in San Diego, CA. It recognized her presentation entitled "$CD4^+CD25^+Foxp3^+$ regulatory T cells (Tregs) induce cytokine deprivation-mediated apoptosis of effector $CD4^+$ T cells" in which she described a novel mechanism through which Tregs cause apoptosis of CD4 T cells. Accumulating evidence clearly shows that Tregs play a major role in regulating autoimmunity and perhaps also in normal immune responses to infections. However, the mechanism(s) by which these Tregs govern other cells has/have not been resolved. Dr. Pandiyan showed, in *in-vitro* co-culture suppression assays as well as in an *in vivo* model of inflammatory bowel disease (IBD), that Tregs induce the apoptotic death of conventional responding CD4 cells. Her findings resolve some key discrepancies regarding the role of suppressive cytokines or factors produced by Tregs. In addition, the results may contribute to the development of novel strategies to treat patients who lack Tregs and are inflicted with a severe autoimmune disease called IPEX (Immunodysregulation, Polyendocrinopathy, Enteropathy, X-linked) syndrome.

2008 L'Oreal USA Fellowships For Women in Science awarded to five groundbreaking researchers

May 22, 2008, Laurent Attal, President and CEO, L'Oreal USA, and **Dr. Ralph J. Cicerone, President, National Academy of Sciences**, honored the 2008 recipients of the esteemed L'Oreal USA Fellowships For Women in Science in New York City. These women were recognized for conducting innovative and breakthrough research across a range of disciplines, including neuroscience, oceanography, and aerospace engineering. Dr. Shirley Ann Jackson, President of Rensselaer Polytechnic Institute, was also honored with the L'Oreal USA For Women in Science Role Model Award, for raising awareness of the critical role that women play in the sciences.

The prestigious L'Oreal USA Fellowships For Women in Science, now in their 5th year, provide support to postdoctoral women scientists who are undertaking cutting-edge research with practical applications in today's society. By researching current pressing issues as Parkinson's disease and the reduction of fuel consumption, these Fellows represent the next generation of women scientific role models, following in the footsteps of chemist and physicist Marie Curie, and Elizabeth Blackwell, who, in 1849, became the first woman to graduate from medical school. Awardees each receive $40,000 to be used toward independent scientific research. In addition, recognizing that funding is just one of several components necessary to help women build successful careers in the sciences, the L'Oreal USA Fellowships For Women in Science also offer professional development workshops for awardees, and help these Fellows build networks with accomplished women leaders in corporate, academic, governmental and scientific fields.

"***Women scientists are making amazing progress, forging ahead and overcoming obstacles as they dispel the gender stereotype that women are not equipped to excel in the sciences***," said Attal. "***L'Oreal USA is proud to help foster and recognize the success of women scientists at all levels. We believe the world needs science, and science needs women***."

One of the 2008 L'Oreal USA Fellows is a **NRC Fellow at U.S. Department of Energy National Energy Technology Laboratory (NETL), Dr. Laura Lapham - Florida State University, Tallahassee, Florida** - chemical oceanographer, conducting research that may lead to new discoveries around the use of methane hydrates as a potential energy source. Dr. Lapham is working to determine how much methane is entrained as a hydrate, how stable these reservoirs are and how to harvest these deposits for fuel. The primary focus of her research is the development of instrumentation to regularly measure methane that has dissolved in sediments around the hydrates over time, which will allow researchers to better understand the role of hydrates in an abrupt climate change situation.

The Fellows were selected from a competitive pool of candidates by a jury of nine eminent scientists presided over by Dr. Cicerone. These Fellows have earned some of the highest honors in their fields and have been published in respected peer-reviewed journals such as the Journal of Neuroscience; Geochemistry, Geophysics, Geosystems; and the AIAA Journal.

"***The L'Oreal USA Fellowships For Women in Science program is vital for supporting women scientists at the postdoctoral level, and for retaining women in the sciences***," said Dr. Cicerone. "***We must engage the many intelligent young minds in our field. A diverse scientific community produces more cutting-edge research, which is essential to solving some of the world's most complex problems***."

The awards ceremony was preceded by a panel discussion, which included Dr. Jackson; Dr. Elizabeth Blackburn, Morris Herzstein Professor of Biology and Physiology, University of California, San Francisco and 2008 L'OREAL-UNESCO For Women in Science North American Laureate; Helen Greiner, Co-Founder and Chairman, iRobot Corporation; Danica McKellar, accomplished actress, mathematician and author; and Isha Himani Jain, 2008 Siemens Competition in Math, Science and Technology individual award winner. The panel was moderated by Dr. Emily Senay, Assistant Professor, Mount Sinai School of Medicine. The panel focused on dispelling the gender myths that undermine women's potential in the sciences. Panelists discussed how they overcame challenges to achieve successful careers in their fields.

ABOUT THE L'OREAL USA FELLOWSHIPS FOR WOMEN IN SCIENCE

The L'Oreal USA Fellowships For Women in Science program is designed to recognize, reward and advance the role of women in scientific research. Each year, this annual awards program honors five American women at the beginning of their scientific careers. Recipients receive $40,000 each toward independent scientific research.

Launched in 2003 as the U.S. component of the UNESCO-L'OREAL International Fellowships program, the program aims to raise awareness of the contribution of women to the sciences, and to identify exceptional female researchers to serve as role models for young women and girls.

Since the L'OREAL-UNESCO For Women in Science international program's inception in 1998, 52 Laureates and 120 International Fellows have been recognized from around the world. National Fellowship programs have also been established in 35 countries and have awarded fellowship grants to more than 340 young women researchers.

Winners addressing critical issues including Parkinson's Disease and global climate change

Dr. Laura Lapham, NRC NETL/MHFP Fellow

Unique Tools Sample Sediment Pore Water near Seafloor Hydrate Mounds in the Gulf of Mexico

Laura Lapham[1*], Jeff Chanton[2], Chris Martens[1], Howard Mendlovitz[1], Paul Higley[3], Carol Lutken[4], Bob Woolsey[4]

The DOE-sponsored Gulf of Mexico Gas Hydrate Research Consortium has established a seafloor monitoring station at 1 kilometer (km) water depth at Mississippi Canyon Block 118 (MC 118). The station is designed to quantify temporal variations in gas hydrate and free gas reservoirs and thus assess hydrate stability. While stability fields of gas hydrates are generally defined by pressure and temperature, in this article we address a third parameter that is seldom investigated: the concentration of dissolved methane in fluids bathing the hydrate. Questions infrequently asked are "Is the concentration of dissolved methane in the pore waters surrounding the hydrate sufficient to indicate thermodynamic stability? Are the hydrates at equilibrium with methane in the pore fluids bathing them, or are they shedding methane to surrounding sediments at high rates?" These questions were sparked by observations of exposed hydrates outcropping on the seafloor at MC-118 (e.g., the now famous "dragon's head" gas hydrate spar illustrated in Figure 1). We were also intrigued by the results of a yearlong, time-lapse photography series of a hydrate mound carried out by Ian MacDonald of Texas A&M University. The series of photographs recorded fish coming and going and nearby microbial mats changing color, however, the morphology, size and shape of the exposed hydrate mound remained unaltered.

In order to determine the influence of methane concentration in nearby fluids on hydrate stability, we need to be able to measure the pore-water dissolved methane concentration in the fluids bathing a gas hydrate deposit. Sampling such fluids is no small feat, as at 1 km water depth, any gas in the pore fluids will expand 100-fold during ascent to the surface (or, if held at a constant volume, the fluid pressure in the sample container will increase 100 fold). To measure *in situ* dissolved methane concentrations, we required something different from the pressured core sampler developed by Dickens and others, a device that yields the sum of dissolved and gas bubble methane in addition to that derived from decomposing gas hydrates. The need for *in situ* dissolved methane concentration data led us to develop a pressurized, *in situ* pore-water sampler.

We first adapted an older pore water suction sampling device originally intended for collection of non-pressurized samples of dissolved ions, in order to measure dissolved gases. The original device had a 50 centimeter (cm) long sampling tip with 10 ports configured at differing distances along its length. We replaced the sample chambers with reinforced stainless steel cylinders and configured high pressure valves on either side of the chambers (Figure 2). Initial tests of the device were quite successful. Pre-adaptation, dissolved gas pore water profiles measured by the device were low and spiky, demonstrating significant dissolved gas losses during sampler ascent (Figure 3), while post-adaptation profiles were smooth and concave upward, reaching concentrations as great as 15 milli-moles/L (mM). However, the device was too heavy and cumbersome for submersible use and emplacement using remotely operated vehicles (ROVs) was out of the question.

We further modified the device by decoupling the sampling reservoirs from the harpoon style sampler, which resulted in a sleek, light-weight and highly mobile sampling device (Figure 4a and 4b). The reconfiguration resulted in less weight being put on the submersible and ROV robot arms, improved the seal in the sediments, enabled the device to be used by smaller ROVs and permitted more precise positioning in unique environments (e.g., the mussel bed in Figure 4b).

As we explored the seafloor surrounding the gas hydrates found in outcrops at other hydrate locations (e.g., Northern Cascadia Margin), we became increasingly interested in the drape of sediments overlying the hydrate deposits. Was this drape gas charged? We hypothesized that it should be saturated with methane if the hydrates were at equilibrium with respect to dissolved pore water methane concentration. This led to a third adaptation to our pore-water probe design: a series of interchangeable sampling heads to achieve maximum flexibility. This redesign included a feature that permitted the probe depth to be adjusted to obtain horizontal gradients extending away from a hydrate deposit in addition to vertical gradients above a deposit (Figure 5). With the new device, we were able to sample pore water within 3 cm of the hydrate surface, where we expected to observe dissolved methane concentrations approaching the saturation value of approximately 70 mM.

The results, however, proved quite contrary to our hypothesis. Despite the capability of the device to capture and retain dissolved gases at pressures of up to 100 atmospheres, we never observed dissolved methane concentrations above 15 mM, and generally concentrations were far lower. The below-saturation methane concentrations in pore-water surrounding hydrate deposits and their apparent temporal stability indicate that other factors may be playing an important role in maintaining hydrate equilibrium (e.g., the presence of a protective mi-

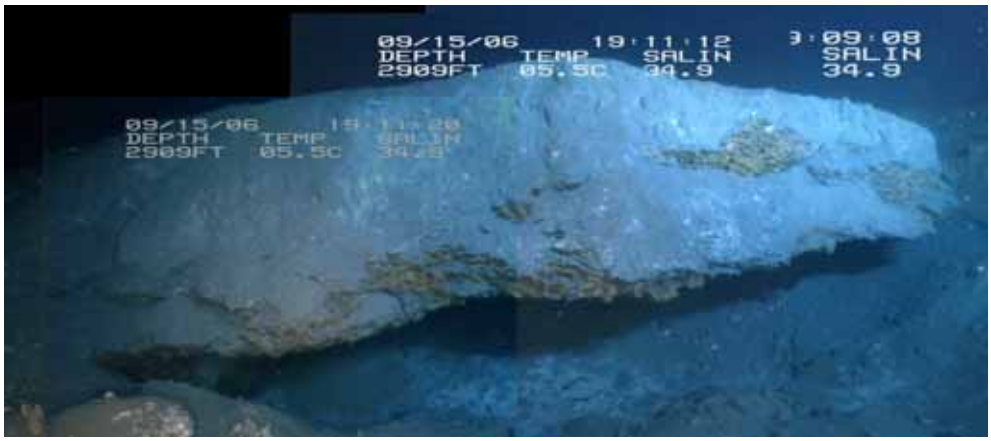


Figure 1: Composite photo of large hydrate outcrop, located near core 25 on Figure 3a, with sediment drape and ice worms (photo courtesy of Paul Mitchell, University of Mississippi).

Figure 2: The first pore-water probe with high pressure stainless steel sample chambers and on/off valves. The 50-cm probe tip is visible below the lab cart. Inserting the probe into the sediment required the entire device to be manipulated on the seafloor.

crobial slime coating). Incorporating what we had learned from the development of the previously described pore-water samplers and adapting instruments developed by Jannasch, Kastner, and others, we developed an instrument for the determination of temporally variable *in situ* methane concentrations at the MC 118 seafloor monitoring station. The Pore-Fluid Array (PFA) is designed to obtain a continuous temporal record of *in situ* gas and ion concentrations and isotopes in pore-fluids near hydrate deposits (Figure 6). The device is a weighted, gravity emplaced seafloor sediment probe that contains filtered probe ports along the shaft that are interfaced to a pore-fluid sampling instrument package *via* small diameter tubing and a low dead-volume connector. An important feature of the PFA is that the pumps and sample collection package can be periodically replaced by an ROV without removing the probe shaft from the sediments, thus minimizing disruption of sample collection between visits.

The current PFA instrument package is comprised of four OsmoSamplers (developed by Hans Jannasch at Monterey Bay Aquarium Research Institute) and a high pressure valve. The OsmoSamplers use osmotic pumps to pull pore-fluids into lengthy, small diameter, gas-tight, copper tubing coils. The OsmoSamplers are ideal for deep-sea deployments because they require no power, have no moving parts, and require little maintenance. In order to obtain an *in situ* sample, the sample coils are plumbed into a high-pressure valve that, when closed on the seafloor, prevents samples from degassing upon ascent through the water column. Preliminary results from the PFA reveal elevated methane concentrations within 1.2 meters below the seafloor as compared to overlying seawater (Figure 7). The results also show a sudden, sharp increase in recorded methane concentration in the overlying water column that coincided with a magnitude 6.0 earthquake concentrated 260 miles southwest of Tampa, Florida, on September 10, 2006, during the final days of a deployment.

The development of seafloor probes and the PFA for measurements of *in situ* dissolved methane and other gas concentrations in the deep sea environment will help us develop a better understanding of the factors controlling hydrate stability. These instruments also can help to lay the foundation for a continuous seafloor hydrate monitoring station where changes in these geochemical parameters can be observed in concert with variations in dynamic geophysical processes such as salt diapir tectonics.

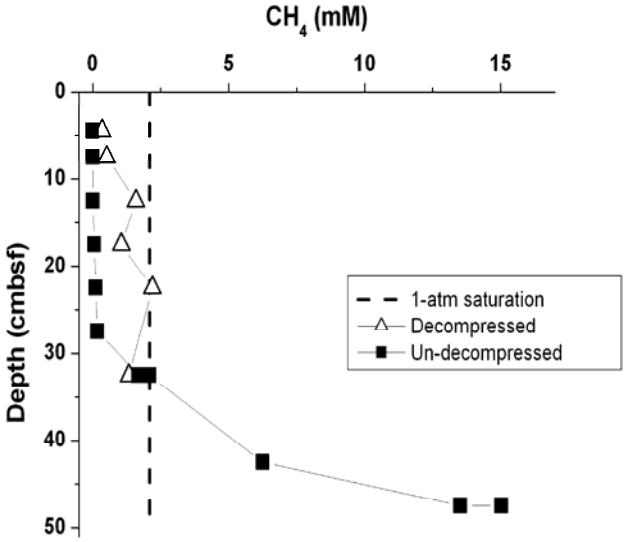
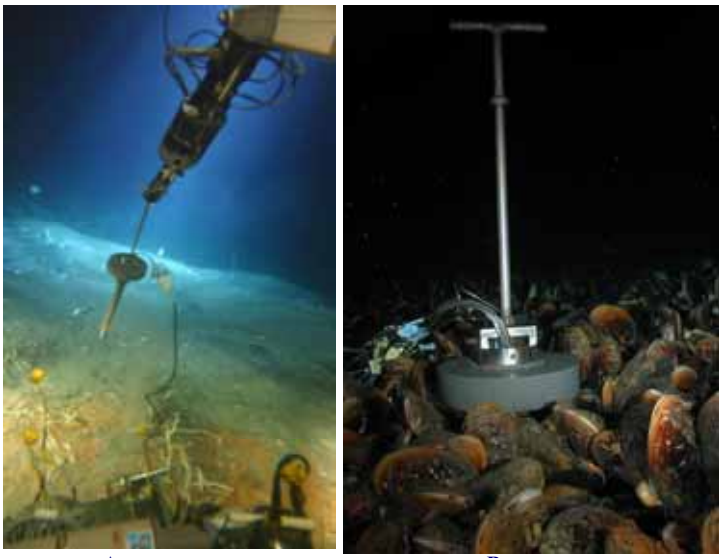


Figure 3: Methane concentrations at 1-atm saturation (dotted line), are compared to data from the original pre-adaptation instrument (where samples were allowed to decompress) and from the adapted instrument outfitted with high-pressure sample chambers and valves (un-decompressed samples). Adapted from Lapham, 2007 dissertation.



A **B**

Figure 4: A second generation adaptation showing the decoupled probe tip (A) being manipulated by a submersible robot arm and inserted into sediments beneath a mussel bed.

Figure 5: The third generation of the pore fluid sampler involved a probe tip adaptation that permitted the measurement of horizontal pore fluid gradients. Here, the device is deployed within 15 cm of sediment overlying exposed hydrate.

A B

Figure 6: The pore-fluid array (PFA): A) preparation for deployment at MC 118 and B) The PFA suspended off the back of the ship (1 = sampler box, 2 = low dead-volume connector, 3=cement weight, and 4 = probe tip which extends 10 meters).

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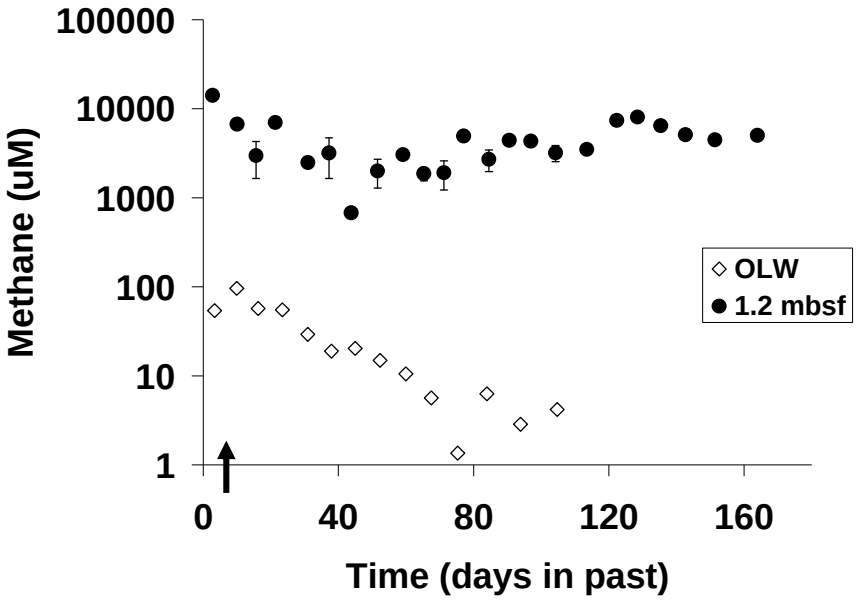

Figure 7: Methane concentrations over time for overlying water (OLW) and 1.2 meters below seafloor (mbsf). Arrow signifies the timing of a 6.0 earthquake. Figure adapted from Lapham, unpublished data.

NEW FEATURE

Advisers,

You may now update your *own* contact Information!

http://nrc58.nas.edu/pgasurvey/data/adviser/login.asp

NEW FEATURE

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Ben-Gurion University researchers develop new gesture interface device to maintain sterility during medical procedures

Tests during two (In Vivo) Surgeries at a Washington D.C. Hospital Reported in the June issue of Journal of the American Medical Informatics Association

Researchers at Ben-Gurion University of the Negev (BGU) have developed a new hand gesture recognition system, tested at a Washington, D.C. hospital, that enables doctors to manipulate digital images during medical procedures by motioning instead of touching a screen, keyboard or mouse which compromises sterility and could spread infection, according to a just released article.

The June article, "A Gesture-based Tool for Sterile Browsing of Radiology Images" in the *Journal of the American Medical Informatics Association* (2008;15:321-323, DOI 10.1197/jamia.M24), reports on what the authors believe is the first time a hand gesture recognition system (Gestix) was successfully implemented in an actual "in vivo" neurosurgical brain biopsy. It was tested at the Washington Hospital Center in Washington, D.C.

According to **lead researcher Juan P. Wachs**, a recent Ph.D. recipient from the Department of Industrial Engineering and Management at BGU, and currently a NRC Associate at the Naval Postgraduate School in Monterey, California, "***A sterile human-machine interface is of supreme importance because it is the means by which the surgeon controls medical information, avoiding patient contamination, the operating room (OR) and the other surgeons***. ***This could replace touch screens now used in many hospital operating rooms which must be sealed to prevent accumulation or spreading of contaminants and requires smooth surfaces that must be thoroughly cleaned after each procedure – but sometimes aren't. With infection rates at U.S. hospitals now at unacceptably high rates, our system offers a possible alternative***."

Helman Stern, a principal investigator on the project and a professor in the Department of Industrial Engineering and Management, explains how Gestix functions in two stages: "***[There is] an initial calibration stage where the machine recognizes the surgeons' hand gestures, and a second stage where surgeons must learn and implement eight navigation gestures, rapidly moving the hand away from a 'neutral area' and back again. Gestix users even have the option of zooming in and out by moving the hand clockwise or counterclockwise.***"

To avoid sending unintended signals, users may enter a "sleep" mode by dropping the hand. The gestures for sterile gesture interface are captured by a Canon VC-C4 camera, positioned above a large flat screen monitor, using an Intel Pentium and a Matrox Standard II video-capturing device.

The project lasted for two years; in the first year Juan Wachs spent a year working at IMI (Washington D.C.) as an informatics fellow on the development of the system. During the second year, there was a contract which ended between BGU and WHC (Washington Hospital Center) where Wachs continued working at BGU with Professors Helman Stern and Yael Edan, the project's principle investigators.

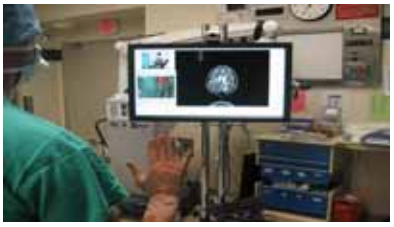
At BGU, several M.Sc theses, supervised by Prof. Helman Stern and Yael Edan, have used hand gesture recognition as part of an interface to evaluate different aspects of interface design on performance in a variety of telerobotic and teleoperated systems. Ongoing research is aiming at expanding this work to include additional control modes (e.g., voice) so as to create a multimodal telerobotic control system.

In addition, Dr. Tal Oron and her students are currently using the gesture system to evaluate human performance measures. Further research, based on video motion capture, is being conducted by Prof. Helman Stern and Dr. Tal Oren of the Dept. of Industrial Engineering and Management and Dr. Amir Shapiro of the Dept. of Mechanical Engineering. This system, combined with a tactile body display, is intended to help the vision impaired sense their surroundings.

Dr. Juan Wachs, NRC Associate

Using Gestix in the OR

(above) Browse function
(below) Rotation function



Operating Room Beta Test - Neurosurgery **http://www.nps.edu/academics/GSOIS/CS/eventDetail_020.htm**

NRLers honored at 40th Annual ARPAD and Edison Patent Awards and Third Annual NRC/ASEE Postdoctoral Publication Awards ceremony

On Friday, March 28, NRL hosted its Annual Research Publication Awards Dinner (ARPAD) at the Bolling Air Force Base Officers' Club. Now in its 40th year, ARPAD recognized the authors of the best NRL scientific publications of 2007.

ARPAD was established in 1968 to recognize the authors of the best NRL publications each year. These awards not only honor individuals for superior scientific accomplishments in the field of naval research, but also seek to promote continued excellence in research and in its documentation.

In 1982, the name of this award was changed to the Alan Berman Research Publication Awards in honor of its founder. Of the 224 papers considered for the 2007 awards, 35 were selected for recognition. They represent 161 authors. The names of the authors with the titles and abstracts of their publications are listed under their respective research divisions.

NRL also recognizes patents as part of its annual publication awards program. The NRL Edison (Patent) Awards were established in January 1991 to recognize NRL employees for outstanding patents issued to NRL by the U.S. Patent and Trademark Office during the preceding calendar year. The awards recognize significant NRL contributions to science and engineering, as demonstrated by the patent process, that are perceived to have the greatest potential benefit to the country. Of the 62 patents considered for 2007, three were selected, representing nine inventors and three patent attorneys. (They are listed under the NRL Edison (Patent) Awards.)

The third Annual NRC/ASEE Postdoctoral Research Publication Awards were also a part of the ARPAD program. These awards honor our postdoctoral associates for superior scientific accomplishments in the field of naval research, and seek to promote continued excellence in research and in its documentation. There were 165 NRC and ASEE postdoctoral associates on board during 2007. Two hundred thirty-nine papers generated by these postdocs were nominated for this award and five were selected for recognition. They represent 16 authors.

Dr. Sophia Economou NRC/NRL Postdoctoral Associate

Dr. Cara Rakowski, NRC/NRL Postdoctoral Associate

Distinguished ARPAD guests this year included Dr. Joseph Lawrence, Director of Transition, Office of Naval Research, and his wife Mary; Dr. Lawrence Schuette, Director of Innovation, Office of Naval Research, and his wife Jennifer; Dr. Patricia Gruber, Director of Research, Office of Naval Research; Dr. William Rees, Deputy Under Secretary of Defense, Laboratories and Basic Sciences, and his wife Phyllis; Mr. Rick Kempenski and Mr. Artis Hicks, Program Directors, ASEE Fellowship Programs; and **Dr. Ray Gamble**, **Director, National Research Council (NRC) Research Associateship Programs**.

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.

2008 Postdoc Conference/Career Fair
October 16, 2008
NIH campus
www.postdocconference.org

2008 SCHEDULE

February Review

Submission deadline - February 1
Transcripts and Reference Reports deadline - February 15.
The Board meets on March 21.
Agencies will be notified within two weeks.

August Review

Submission deadline - August 1.
Transcripts and Reference Reports deadline - August 15.
The Board meets on September 26.
Agencies will be notified within two weeks.

May Review

Submission deadline - May 1
Transcripts and Reference Reports deadline - May 15.
The Board meets on June 27.
Agencies will be notified within two weeks.

November Review

Submission deadline - November 1.
Transcripts and Reference Reports deadline - November 15.
The Board meets on January 9, 2009.
Agencies will be notified within two weeks.

Individual Variability for Thermal Mathematical Modeling

Human thermal regulatory mathematical models have been increasingly utilized for examining and anticipating physiological responses of deployed Soldiers and workers under various stressful situations. The benefits of using these computer models include assessment of thermal strains at the work place without the risk, cost, and time of related human experiments. The Biophysics and Biomedical Modeling Division (BBMD) of US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, plays active roles in developing and using human physiological simulation models for thermal and safety assessment, mission planning and the product development (e.g., clothing, cooling devices). In the past, traditional thermal regulatory models predicted the response of the average person, but people are different in body size and shape, and their physiological responses can also be different. Thus recent challenges and demands have included characterizing individual variability and its implementation into the models.

Dr. Miyo Yokota, NRC senior Associate

Since 2006, **Dr. Miyo Yokota, senior NRC Associate**, with her advisor Dr. Larry Berglund of BBMD, USARIEM, has been characterizing individual variability and customizing thermo-physiological models for various working situations to improve their accuracy and applicability. Using the multivariate thermal modeling and parameter constrained randomization approaches to detect anthropometric variability from the latest USARIEM body composition data, Dr. Yokota was able to demonstrate the probable response variability for a specific situation in the US Army and related populations. This type of approach is useful to identify who are/not susceptible to thermal stress in certain environmental and operational conditions, ultimately, assisting the reduction and prevention of thermal related injuries, illness and performance decrement.

Dr. Yokota's research has been further applied to various projects in collaboration with other governmental institutions through her BBMD colleagues. Custom modeling for occupants of disabled U.S Navy submarines and the Probability of Decision Survival Aid model for U.S. Coast Guards are examples of predicting individual variability of survival rates in thermally stressful conditions.

FHWA HRDI PROJECT PRESENTATION
Wednesday, August 20, 2008, Building/Room F-208
12:00 - 12:20PM Brown Bag Lunch (BYOL)
12:20 - 12:40PM Ralf Arndt (NRC Associate)
"Time - Resolved Microwave Thermoreflectometry for Corrosion Detection in Concrete-- an Advanced NDE Research at TFHRC"
12:40-1:00PM Jim Sherwood
"Validation and Calibration of the Mechanistic-Empirical Pavement Design Guide (MEPDG) by the Accelerated Load Facility (ALF) Data Base"