# The Lipman Log

**October 2008**

Tamar Barkay inside the titanium sphere of the Deep-Submergence Vehicle *Alvin*

Ag Field Day (2008) by Lipman Hall

Students in the Analytical Methods in Microbiology course

## News from the Chair, Max Häggblom

This has been a year of change for the department. I accepted the appointment as Chair of Biochemistry and Microbiology effective January 1, 2008 and am looking forward to serving the faculty, staff and students, and overseeing the next phase of growth for the department. I follow an inspiring group of past chairs. It is good to have many of them around to provide advice.

Professors Theodore Chase, Ronald Poretz and Alan Antoine retired from the faculty in 2007 after many years of service to Rutgers. Ron and Ted have not ventured far and continue their work in the department.

Congratulations to Dr. Lori White, who was promoted to Associate Professor with tenure. You can read more about her research on page 3.

It is good to note that we are seeing an expansion of our faculty. Last summer the Department together with the Department of Plant Biology and Pathology completed a successful faculty search in the field of fungal pathogen population biology. Dr. Ning Zhang will join the faculty in January 2009 with a joint appointment in Plant Biology & Pathology and Biochemistry & Microbiology. We have also launched a search for three tenure track faculty in the areas of microbial physiology, biochemistry and genetics/bioinformatics. These faculty hires will launch a multiyear strategic initiative to enhance the vibrant program in microbiology at Rutgers. We thus expect an interesting year as we continue this development of our programs.

The Microbiology Symposium is now an established annual event (see page 7). Professor Eungbin Kim, who earned his Ph.D. in Environmental Sciences at Rutgers with Dr. Gerben Zylstra, was the keynote speaker in 2008. The next Symposium is scheduled for January 29-30, 2009. We have also launched a new Distinguished Lecture Series in Microbiology, inaugurated last spring by Professor Mirja Salkinoja-Salonen from the University of Helsinki, Finland.

It is my pleasure to announce the appointments of our new Undergraduate Program Directors in Microbiology, Dr. Costantino Vetriani, and Biochemistry, Dr. Lori White. Both curricula are thriving, with the biochemistry major in a steady state of catalysis, while the new microbiology major is still in a phase of exponential growth. The core courses in biochemistry and microbiology taught in our department also serve other life science majors at SEBS and Rutgers and these classes continue to be enrolled to capacity. Our laboratory classes received an additional boost with the faculty appointments of Drs. Diane Davis and Gavin Swiatek as Instructors in Microbiology and Biochemistry, respectively. Diane has, of course, already been coordinating the microbiology laboratories as member of the instructional staff for several years and Gavin has long-time association with the department. Diane and Gavin put together a wonderful display of our curriculum and scholarly activities for Ag Field Day 2008 (see page 10). Additional strength to the teaching laboratories is provided by Lucy Hsu, who joined the department as Principal Laboratory Technician, and Jean Katz, whose appointment as Laboratory Operations Coordinator is now fully in our department.

I wish to thank all the donors and supporters of the Department of Biochemistry and Microbiology. These donations provide special scholarships and travel awards for our students and enhance our departmental mission. Microbiology is featured in the new Rutgers capital campaign, with one of the key goals to obtain core endowment to support sustained research and educational programs in microbiology, specifically in the form of graduate and undergraduate fellowships. We hope that you will continue to show your support for the department in the future.

# DEPARTMENT RETIREMENTS

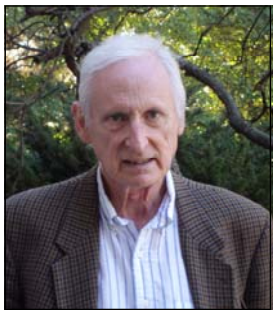
Dr**. Alan Antoine** a long time faculty member (1969-2007) recently retired having served the University and State in myriads of microbial manners. His early studies addressed the finesse of *Neurospora* and *Mycobacterium* regulatory systems, and later addressed more applied aspects of nitrogen metabolism (nitroaromatics) and roles of cyanobacteria. Throughout his career he taught broadly both undergraduates and graduates.

His record as an administrator is unsurpassed. Initially working in the Graduate School (Associate Dean of the Sciences), he subsequently served in a diverse range of university committees. Highlights included Director of the Graduate Program in Microbiology and Molecular Genetics (PI, Merck Foundation grant for Graduate Education, $550,000); Biological Sciences Curriculum Coordinator (Cook); Chair University Student Affairs and Standards, and with this experience led the Department as Chair for two terms.

Alan was a strong supporter New Jersey's microbiology programs serving as Executive Secretary of the New Jersey Academy of Science and received recognition for his service as judge for the Hudson County, Mercer Science and Engineering, North Jersey Science, and the Greater Trenton Fairs. In the Theobald Smith Society, he served as President, Secretary, and as National and Local Councilor. The Society bestowed on him their prestigious Selman Waksman Award in 1997. He was well known for his general microbiological expertise such as oenology, and lectured widely: at the Bell Laboratories, the Rotary, the Elks, Douglass College Social clubs, and Town Public Libraries. His musical talents as a chorister extended though the University Musica Sacra, Oratorio and University Choirs. He and his melodious tones will be missed in Lipman.

Poretz Family

Dr. **Ronald Poretz** (pictured at left) retired from the Department in January 2008. He joined the Dept. of Biochemistry of Rutgers College in 1973 after serving three years as an assistant professor of Biochemistry at the University of Kansas Medical School. He was transferred to the Cook College (SEBS) Department in 1993. While at Rutgers he served as Chairperson of the Busch Campus Department and Director of the Joint Graduate Program in Biochemistry as well as a member in the graduate programs in Toxicology and Microbiology. He taught classes in both the undergraduate and graduate curricula and trained numerous undergraduate, graduate and post-doctoral students. His research in glycobiology, cancer therapy, and neurotoxicology resulted in over 50 peer review publications and book chapters, as well as three inventions protected by US and foreign patents. Dr. Poretz's research was supported by numerous grants and contracts from NIH, NSF, March of Dines, and industrial sponsors. He presently continues his research activities in the Department in Lipman Hall.



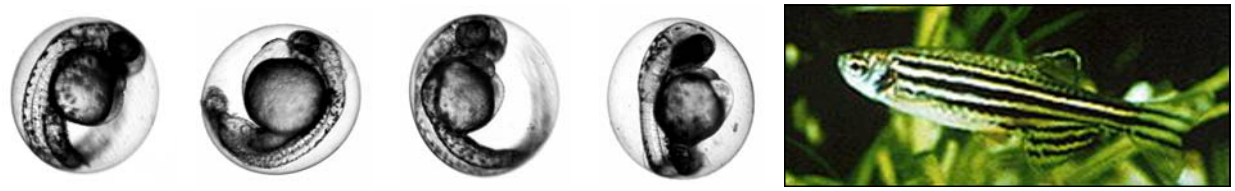
Dr. **Theodore Chase, Jr.** retired from the university after 38 years on the faculty, which he joined in 1969. Prof. Chase earned his bachelor's degree at Harvard and his doctorate at the University of California at Berkeley. A biochemist specializing in enzymology, much of his research career was devoted to microbial enzymes. He sometimes describes his research work as practicing microbiology without a license, making him a central figure in the department. He led the Department as Chair from 1990 to 1999. He is especially known for his commitment to teaching, having taught both graduate and major undergraduate courses. Among the former has been Proteins and Enzymes, which is given to upper level undergraduates and graduate students. For decades he taught Experimental Biochemistry, our one-year laboratory course taken by majors in Biochemistry and Biotechnology. His attention to detail and insistence on rigor have made these courses noteworthy, with students expressing gratitude and satisfaction with the level of preparation he had provided. They often express that gratitude after the courses are completed when they are out in the world. For many years he served as Undergraduate Program Director for the Biochemistry major, and in that capacity he is legendary for the care he took – and continues to take – in helping students configure their academic programs. In fact, many students not in the Biochemistry major have come to him and received the same detailed level of sound advice. Although formally retired, he continues research and student advising as well as some teaching. In between he travels, often to study Byzantine art.

**Emilia Rus** retired as Principal Laboratory Technician on June 30, 2007. She had been technician for the Experimental Biochemistry lab since 1993. Emilia held an undergraduate degree in food technology in her native Romania, and was technical director for a brewery in her native Iasi, Romania. (This experience made her a top judge of beer produced in our Applied Microbiology course.) After she came to the U.S. with her husband and son, she worked as a laboratory technician at New Jersey Institute of Technology for six years, and earned a master's degree in Environmental Science. She came to us with little experience in biochemistry and no expectation of teaching, but soon became expert in the many procedures of Experimental Biochemistry, absolutely dependable in preparation of the many materials and instruments used in the course, and helpful to a generation of students in demonstrating how to do procedures correctly. By the end of her service she was doing more of the hands-on instruction than either the teaching assistants or the instructor. In addition to her teaching duties she had many departmental responsibilities in maintenance of equipment and instrumentation. She will be a hard act to follow. She is missed by her many friends and colleagues.

# OUR FACULTY

## Lori White: Molecular mechanisms of xenobiotic-induced pathologies

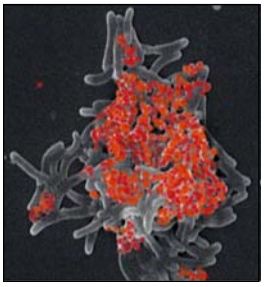
The focus of my laboratory is on how environmental contaminants alter cellular interactions and matrix metabolism. To study these processes, we use two distinct experimental models, human cell culture and the zebrafish (*Danio rerio*). Using human cell culture models, we have shown that the environmental contaminant 2,3,7,8-tetracholodibenzo-*p*-dioxin (TCDD) alters the expression and activity of enzymes involved in matrix metabolism, the matrix metalloproteinases (MMPs) in two cell types in skin, normal human keratinocytes and human melanoma cells. Currently we have several projects utilizing the zebrafish model to study the effects of environmental contaminants on embryonic development. One is a collaborative effort between my laboratory and the laboratory of Dr. Häggblom in our department. This project is focused on the effect of microbial transformation on the fate and toxicity of brominated flame retardants. Our preliminary findings in this area demonstrate that microbial transformation of flame retardants results in compounds with significantly different toxicological abilities, and suggests that microbial transformation in the environment my play an important role in the toxicity of these compounds and TBBPA (tetrabromobisphenol A). PBDEs are not chemically fixed to the product, and these compounds have been detected in the environment, in wildlife, and in human tissues, raising concern of human health impact.



# GRANTS AND PROJECTS

**Tamar Barkay** received funding for a one year pilot project from DuPont to study factors controlling methylmercury production in the South River, VA: Substrate bioavailabilty and potentials for methylation and demethylation. Elevated Hg concentrations in some sites within the South River, VA, ecosystem have persisted even though over 50 years have passed since effluents from the DuPont plant in Waynesboro were ceased. Thus, Hg and MeHg in river surface water remain above background and in some cases fish tissue concentrations of Hg and MeHg are elevated. The only possible explanation for the persistence of Hg contamination in the South River rests in the biogeochemistry of Hg in the South River ecosystem, which drives the release and methylation of previously deposited Hg, increasing Hg bioavailability to the rivarine food chain. This hypothesis is tested in a one-year pilot study that examines two factors that may control MeHg production in the South River ecosystem. These are (i) the bioavailability of Hg to microorganisms as revealed by the use of a luminescence bioseonsor and other methods, and (ii) the potential rates of methylation and demethylation, the two processes that directly control MeHg production in a given environment.

The Department of Energy, Environmental Research Science Program, is funding a three year project in **Tamar Barkay**'s laboratory on Reduction of mercury in saturated subsurface sediments and its potential to mobilize mercury in its elemental form. Mercury is a component of mixed wastes that have contaminated vast areas of the deep subsurface as a result of nuclear weapons and energy production. While this mercury is mostly bound to soil constituents, episodes of mercury mobilization into groundwater have resulted in contaminated potable water and public health concerns. The project will test how microbial and chemical reduction of Hg(II) to Hg(0) in saturated subsurface sediments contributes to the mobilization of mercury as Hg(0) in saturated sediments from various Department of Energy sites.



The Department of Energy Joint Genome Institute Community Sequencing Program selected a proposal by **Elisabetta Bini** and **Max Häggblom** for sequencing the genome of *Selenospirillum indicus*, a new selenium oxyanion-respiring bacterium isolated by members of the Häggblom lab. Updates regarding the progress of the sequencing project are posted at: http://www.jgi.doe.gov/sequencing/why/CSP2008/sindicus.html

**Lori White** has received a UMDNJ-Robert Wood Johnson grant A Development of a Zebrafish *(Danio rerio)* Model as a Acreen for Compounds Altering Gluclose Metabolism.

**Lori White** (PI) and **Max Häggblom** received a NJAES Competitive Hatch Award grant to study the effect of brominated flame retardants on matrix metabolism in the developing zebrafish (*Danio rerio*). The goal of the studies outlined in this proposal is to investigate the effect of exposure to brominated flame retardants (BFRs) on ecological and human health using the zebafish (*Danio rerio*) model. Our studies focus on PBDEs (polybrominated diphenyl ethers)

# GRANTS AND PROJECTS (continued)

The New Jersey Department of Environmental Protection Spill Research Fund is funding a two-year project in **Max Häggblom's** laboratory on Developing Tools for Monitored Natural Attenuation of Methyl tert-Butyl Ether. Methyl tert-butyl ether (MTBE) was the most common fuel oxygenate throughout the 1990s and has become a widespread and persistent pollutant of water resources near urban areas around the world. There is an increasing interest in the development of effective technologies to remediate MTBE-contaminated sites, for instance pump-and-treat techniques, biostimulation, and bioaugmentation. The fate of MTBE in the environment is mainly dependent upon natural remediation processes. The aim of this project is to identify the organisms that mediate anaerobic MTBE-degradation in anaerobic laboratory cultures in order to develop molecular tools for monitoring natural or enhanced attenuation of MTBE. Specifically, we will be using complementary molecular tools to identify microorganisms present in anaerobic MTBE-degrading laboratory cultures and stable isotope probing (SIP), with 13C-labeled MTBE to identify microorganisms responsible for anaerobic MTBE-degradation. We have demonstrated that addition of a low concentration of the naturally occurring methoxylated compounds may be a useful way of enhancing and possibly stimulating anaerobic MTBE degradation in situ. Future studies will investigate the use of the O-methylated aromatic compounds presented here to stimulate or enhance MTBE degradation in situ in polluted environments. Identification of the microorganisms mediating anaerobic MTBE degradation will form the foundation for developing a "toolbox" for site assessment and bioremediation. The project is funding the Ph.D. thesis work of Laura Youngster.


**Costantino Vetriani** and Sara Borin (Fulbright Scholar in Costa's lab in 2007) participated in an oceanographic expedition aboard the R/V *Atlantis/Alvin*, from December 28, 2007 to January 20, 2008. Sara and Costa dove in the Deep-Submergence Vehicle *Alvin* on the East Pacific Rise (depth 2500 m) and deployed and recovered experimental microbial colonizers to study early colonization at the newly formed deep-sea vents.

**Gerben Zylstra** (Biotechnology Center for Agriculture and the Environment) received a Fogarty International Research Collaboration Award. This grant is offered through the Global Institute for Bio-Exploration (GIBEX) and will supplement the existing International Cooperative Biodiversity Groups program in Central Asia. Most of the funding will be spent in Kyrgyzstan on microbiological bioprospecting, which will further advance GIBEX mission. Zylstra has also received an award from the National Institutes of Health for the first year of a collaborative research project with Kyrgyz-Turkish Manas University in Kyrgyzstan. The project will explore molecular insights into toxicant degradation by microbial communities activities.

**Max Häggblom** is leading a new project studying the microbial communities active in Arctic tundra soils. The

4-year study is funded by the Academy of Finland (Impact of climate fluctuations on microbial communities responsible for carbon and nitrogen cycling in Arctic soils) and is a collaboration between the Finnish Forest Research Institute, the University of Jyväskylä and Rutgers University. Additional funding is provided by the National Science Foundation for a related study (Microbial subzero activity and its impact on biogeochemical processes in frozen tundra and permafrost) in collaboration with Dr. Lee Kerkhof (Rutgers, Institute of Marine and Coastal Sciences) and Dr. Nikolai Panikov (Dartmouth College).

The focus of the research project is to examine the role of different bacterial groups in carbon and nitrogen cycling in Arctic soil environments in northern Finland and assess the selection mechanisms promoting the dominance of key species in changing temperature regimes. Climate fluctuations in the Arctic are expected have a major impact on the microbial community that is active at different temperatures and this will greatly affect carbon and nitrogen turnover in Arctic soil environments. Field and laboratory experiments are combined to elucidate the metabolic fingerprints of the dominant bacterial species and identify the key organisms involved in carbon and nitrogen cycling. The research is advancing our knowledge of the relationship between microbial community composition and activity and environmental conditions in Arctic soil environments. This study will also have broader impact by providing a basis for predicting the effect of long-term temperature changes and global warming on microbial activity in Arctic soils.

In September Max Häggblom and Lee Kerkhof visited Finland for a one-week field experiment in northern Lapland. This field experiment tested the use of stable isotope probing (SIP) for "metabolic fingerprinting" of the microbiota active in carbon and nitrogen cycling in Arctic tundra soils. The goal is to elucidate the niche partitioning and metabolic fingerprints of the dominant bacterial species.

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**Caren M. Villano - The Inhibitor Of DNA: Binding Proteins In Cellular Proliferation And Differentiation: Regulation By The Retinoic Acid Signaling Pathway**. Joint Graduate Program in Toxicology, Dissertation Director: Lori A. White.

The Id (Inhibitor of differentiation or DNA binding) helix-loop-helix proteins mediate cellular differentiation and proliferation in a variety of cell types through regulation of gene expression. The goal of the thesis was to determine the effect of the retinoic acid signaling pathway on Id expression using cell culture and whole animal models. Retinoids, vitamin A analogues, are powerful regulators of cell growth and differentiation and are widely used in the prevention and treatment of a variety of cancers in humans. Exposure of normal human keratinocytes to all-trans retinoic acid (RA) results in increased expression of Id1 and Id3, which is mediated by increased transcription involving cis- acting elements in the distal portion of the promoter. To examine the effect of the Id proteins in development, we used the zebrafish (*Danio rerio*) model. Morpholino knockdown of Id1 in the developing zebrafish embryo results in pericardial, yolk sac and/or brain edema, as well as an undulating notochord. Loss of Id1 in early zebrafish embryogenesis results in defects in larval development, such as decreased body size, lack of swim bladder inflation, and craniofacial defects. We conclude that Id1 is critical for early and late zebrafish development. Our findings also demonstrate that RA exposure decreases expression of Id1 specifically in the heart, and RA deficiency results in increased Id1 expression. Id1 knockdown results in increased expression of the cardiac-specific transcription factors gata5 and nkx2.5 which are also targets of the RA signaling pathway. To further examine the role of Id1 in differentiation and proliferation, we examined Id expression during caudal fin regeneration. Id1 expression is induced in the blastema during caudal fin regeneration, and exposure to RA during regeneration decreases Id1 expression. Taken together, the data demonstrate that Id1 is a target for RA signaling in both human skin cells and in zebrafish and suggest that Id1 may be an important intermediate in the RA signaling pathway, by altering expression of genes involved in proliferation and differentiation.

**Kritee - Mass Dependent Stable Isotope Fractionation of Mercury During Microbial Transformations.** Graduate Program in Microbiology and Molecular Genetics, Dissertation Director: Tamar Barkay.

Mercury (Hg) is often cited in fish consumption advisories across the world due to the extreme neurotoxicity of its methylated forms. Given the complex biogeochemical cycling of Hg, a differentiation between local vs. global and natural vs. anthropogenic sources of Hg(0) and determination of transformations that are dominant in a given ecosystem is critical. Mercury has seven stable isotopes and Hg isotope ratios can become a novel biogeochemical tool to track sources and transformations of Hg in the environment. However, development of a stable isotope based tool requires the determination of the extent of fractionation during individual biotic and abiotic transformations that can occur in the environment. The extent of fractionation of Hg isotopes during two biological transformations was reported: 1) degradation of monomethyl-Hg (MMHg) via the mercury resistance (mer) pathway and 2) Hg(II) reduction by four Hg(II) reducing strains, including three Hg(II) resistant strains and a Hg(II) sensitive strain. Using a multi-collector inductively coupled plasma mass spectrometer, it was found that MMHg and Hg(II) that remained in the reactors became progressively enriched in heavier isotopes with time and underwent mass dependent Rayleigh-type fractionation with average fractionation factors of 1.0004 and 1.0016, respectively. Mass independent fractionation was not observed and based on the nature of microbe-Hg interactions, the nuclear spin dependent MIF is unlikely to occur during biological processes. A clear effect of Hg(II) bioavailability on the extent of fractionation of Hg was observed. A multi-step framework for understanding the extent of fractionation seen during the mer mediated MMHg degradation and Hg(II) reduction experiments was proposed, and based on the biochemistry and kinetics of the steps involved in the two pathways, the steps in the process that could contribute to the observed extent of fractionation are suggested in the thesis. This framework can guide future experiments on Hg isotope fractionation during other transformations in its biogeochemical cycle, and ultimately facilitate a more rigorous development of a Hg isotope based geochemical tool.

**Kyle Murphy - Regulation of Matrix Metalloproteinase Expression and Activity by the Aryl Hydrocarbon Receptor in A2058 Human Melanoma Cells**. Joint Graduate Program of Biochemistry RU/UMDNJ, Dissertation Director: Lori A. White.

Malignant melanoma has a high incidence of mortality due to its resistance to chemotherapy and tendency to metastasize, and in the past 60 years has seen an increase in industrialized nations. We propose that activation of the aryl hydrocarbon receptor (AhR) by environmental chemicals contributes to melanoma invasion through enhancing expression and activity of the matrix metalloproteinases (MMPs). Further, AhR interactions with other signaling pathways may be critical for AhR-induced MMP expression in these cells. The AhR, originally identified as the receptor for the polycyclic aromatic hydrocarbon (PAH) family of environmental contaminants, is activated by endogenous and exogenous compounds, including flavonoids, UV photoproducts of tryptophan, as well as some synthetic retinoids. TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin)-activation of the AhR results in increased expression and activity of MMPs-1, -2 and -9, a family of zinc- and calcium-dependent proteinases that degrade extracellular matrix (ECM) substrates involved in melanoma progression and metastasis. Maximal TCDD-induced MMP-1 activation in A2058 melanoma cells required 3 cis-acting response elements in the distal portion of the MMP-1 promoter, the NFkB, CCAAT and MITF sites. These elements are downstream targets of the Ras/Raf signaling pathway, and our data also show that Ras/Raf activation is critical for AhR-induced MMP-1, -2 and -9 expression. AhR-Ras/Raf interactions result in deregulation of ECM metabolism, through alterations in expression of MMPs and their endogenous inhibitors, TIMP-1/-2 (tissue inhibitor of metalloproteinases). Crosstalk between Ras/Raf signaling and the AhR pathway was demonstrated, and at loss of AhR resulted in a reduction in Ras/Raf-mediated phosphorylation of ERK. Crosstalk is also demonstrated by a reduction of AhR expression and activity observed following Ras/Raf inhibition. Interestingly, 60% of all melanomas contain an activating mutation, $^{V600E}$BRAF, in the Ras/Raf pathway, suggesting that melanomas may be more sensitive to AhR-activation. These data demonstrate that AhR-activated expression of MMPs in A2058 melanoma cells requires Ras/Raf signaling and that these pathways are directly involved in the regulation of enzymes vital to melanoma progression. (Kyle is moving to the Cancer Institute of New Jersey to do research with Dr. Lorna Rodriguiez-Rodriguez.)

**Allen Watkins Smith - Phylogenetics and Homology Modeling**. Joint Program (Rutgers/UMDNJ) in the Molecular Biosciences, Microbiology and Molecular Genetics, Dissertation Director: Dr. Peter Kahn.

Phylogenetics uses nucleotide and/or amino acid sequences to construct evolutionary trees and reconstruct the sequences (or other characteristics) of ancestral organisms. Proteins function almost entirely in their folded form, but phylogenetic work typically does not directly consider the structures into which protein sequences fold. Homology modeling uses a known protein structure to model the structure of a similar sequence, with the similarity arising from an evolutionary relationship - thus "homology". However, homology modeling typically does not explicitly use evolutionary data, even though the modeled proteins are part of evolved biological systems. Combining these fields is likely to be fruitful: since proteins are the product of organismal evolution, an examination of evolution is needed to understand them; since proteins are a vital component of all known organisms, an examination of protein evolution is needed to understand organismal evolution. Protein structure is more conserved than protein sequence, especially for vital proteins. Therefore, the structure of a putative ancestral protein is likely to be close enough to modern-day structures to be modeled, especially if done in short evolutionary stages with each step having few sequence differences. It should therefore be possible to go down a tree, homology modeling the structure of a protein at each stage, then go back up again to a modern-day sequence to derive a structure for said sequence (usable as a test if already experimentally known). Ways in which structural data can assist in phylogenetics, such as whether predicted ancestral sequences are structurally realistic, have been found. Some interesting phylogenetic findings have been made and a supertree construction technique explored.

# The Second Annual Mini-Symposium on Microbiology at Rutgers University: Cultivating Traditions, Current Strength, and Future Frontiers

**Thursday, February 7th**

5:00 - 5:15 pm ***Welcome*** **Robert Goodman**
Executive Dean of the School of Environmental and Biological Sciences

5:15 - 5:30 pm ***Pioneers of Microbiology at Rutgers - Over 200 Years of Research in the Life Sciences?***
**Chuck Martin**, Dept. of Cell Biology and Neuroscience

5:30 - 6:30 pm **Keynote presentation:** ***A ten-year story on aromatic hydrocarbon degradation by*** **Rhodococcus** ***sp. strain DK17***
**Eungbin Kim**, Associate Dean of Policy Administration, University College and Department of Biology, Institute of Life Science and Biotechnology, Yonsei University, Seoul, Korea
Introduction: **Gerben Zylstra**, Biotechnology Center for Agriculture and the Environment & Dept. of Biochemistry and Microbiology

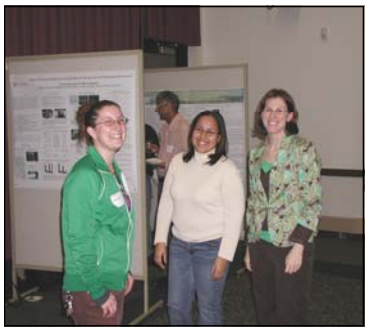
6:30 - 8:00 pm **Poster Session** Combined with a **Wine and Cheese Reception**


*Eungbin Kim*

**Friday, February 8th**

9:00 - 10:30 am **Regulating Life and Death**
Convener: Richard Ebright, Waksman Institute of Microbiology

***Post-translatonally modified microcins***
**Konstantin Severinov**, Waksman Institute of Microbiology
***New insights into the targets of ribosome inactivating proteins and trichothecene mycotoxins***
**Nilgun Tumer**, Dept. of Plant Biology and Pathology & Biotechnology Center for Agriculture and the Environment
***Regulation of transcription by the bacteriophage lambda Q antiterminator protein***
**Bryce Nickels**, Waksman Institute of Microbiology


*Poster presenters K. Parisi, N. Lopez, J. McCormick*

10:30 - 11:00 am Coffee break

11:00 am - 12:30 pm **Microbes Make the World Go Round: From the Abyss to the Mountain Tops**
Convener: Donna Fennell, Dept. of Environmental Science

***Microbial studies of post eruptive deep-sea hydrothermal vents***
**Costantino Vetriani**, Dept. of Biochemistry and Microbiology & Institute of Marine and Coastal Science
***Between a soft metal and a hot place: Mercury-microbe interactions in geothermal springs***
**Tamar Barkay**, Dept. of Biochemistry and Microbiology
***Assessing active microbes using nucleic acid based methods***
**Lee Kerkhof**, Institute of Marine and Coastal Sciences


*J. Messing and D. Pramer in discussion*

12:30 - 2:00 pm Lunch break combined with **Poster session**

2:00 - 4:00 pm **Microbial Metabolism: From Genomes to Ecosystems**
Convener: Elisabetta Bini, Dept. of Biochemistry and Microbiology

***Use of microbial genomic resources to uncover variations in metabolic pathways***
**Tom Leustek**, Dept. of Plant Biology and Pathology & Biotechnology Center for Agriculture and the Environment
***Aspergillus genomics and the search for the holy grail***
**Joan Bennett**, Dept. of Plant Biology and Pathology
***Electrons, Life, and the Evolution of Earth's Oxygen Cycle***
**Paul Falkowski**, Institute of Marine and Coastal Science & Dept. of Geological Sciences
***Presidential Microbiology: "The George Washington Experiment"***
**Doug Eveleigh**, Dept. of Dept. of Biochemistry and Microbiology

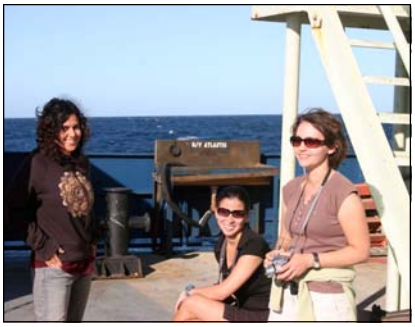

*C. Martin, T. Barkay and D. Eveleigh*

4:00 - 5:00 pm **Poster Session** combined with Coffee Break

**Please join us on January 29, and 30, 2009 for our Microbiology at Rutgers Mini-Symposium**
**check our website (in November) for further details**

# OUR DEPARTMENT

**Costantino Vetriani** led as chief scientist an oceanographic expedition aboard the R/V *Atlantis/Alvin* in the Guaymas Basin, Gulf of California, in October 2007.



Tamar Barkay, **Melitza Crespo-Medina**, **Ileana Perez** and **Abigail Porter** (pictured) also participated in the expedition. All participants dove in the Deep-Submergence Vehicle *Alvin* to explore and sample the Guaymas Basin vents at a depth of 2000 m. Tamar and Abbie went down in Alvin for the first time, diving with the Alvin to a depth of 2000 meters to the hydrothermal vents in Guaymas Basin! (*See Tamar pictured on cover*).

In June, **Tamar Barkay** Tamar spent a week working researching the degradation of methylmercury by bacteria in the northern Adriatic Sea visiting the Marine lab in Piran, Slovenia. She then traveled to Montana where she studied mercury methylation by microbial mats and sediment in Yellowstone National Park.

**Doug Eveleigh** recently spoke at the second Nantucket Biodiversity Initiative Conference, Nantucket, MA. Dr. Eveleigh added to the broad breadth of topics that included spiders, seals, box turtles and wildflowers of the sandplains, with discussion of "Wee Beasties and Teeny Plants," the role of microbes in fishery development. The NBI is a partnership of environmental organizations, including the Maria Mitchell Association, the Linda Loring Nature Foundation, the Massachusetts Audubon Society, the Nantucket Conservation Foundation, and the Nantucket Land Council.

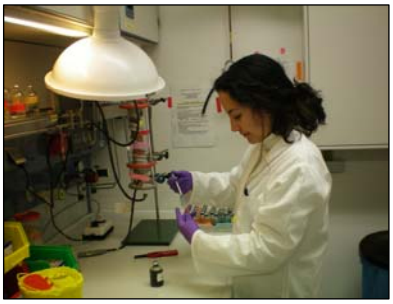
**Zac Freedman** (Barkay Lab, Graduate program in Ecology and Evolution) presented his poster, "Is the Mercury System of *Thermus thermophilus* HB 27 an Ancestor to the Broadly Distributed Mercury System Among the Bacteria?" at the American Society for Microbiology conference that took place from May 21–25 in Toronto. Freedman's poster earned him the Karl C. Ivarson award from the Department of Microbiology and Biochemistry to attend the conference.

Congratulations to **Jessica McCormick**, a fourth year graduate student in the Microbiology and Molecular Genetics Program, working in the laboratories of Dr. Max Häggblom and Dr. Lori White. She received the following awards in the spring of 2008: Robison Award for Graduate studies from the Department of Biochemistry and Microbiology, a travel award from the American Society for Microbiology, the Graduate Scholarship from the Theobald Smith Society and a Koft-Umbreit fellowship from the Microbiology and Molecular Genetics Program. Also, in 2007, Jessica was awarded a fellowship from the Hudson River Foundation.

A. Antoine and J. McCormick

**Melitza Crespo-Medina** (Vetriani Lab) was awarded the prestigious Ocean Sciences Award of Recognition for her presentation at the 2008 Ocean Sciences Meeting in Orlando, FL.

**Isabel Gray** (Häggblom Lab, Graduate program in Environmental Science) spent 3 months in the fall of 2007 at the Helmholtz-Centre for Environmental Research - UFZ in Leipzig, Germany working on stable carbon isotope fractionation during reductive debromination. Her research visit was supported by a European Union Marie Curie Host Fellowship for Early Stage Training in Assessment of in situ Transformation of Xenobiotic Organic Material.

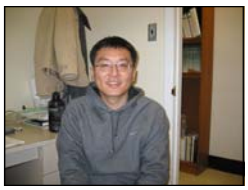


**Kathy Maguire** received the 2008 School or Environmental and Biological Sciences Staff Recognition Award. Kathy was recognized for her superior sustained service to the mission of our department and to Rutgers. She has spearheaded the department newsletter, *The Lipman Log*, and has designed and maintains our department web pages. Kathy has of course also been instrumental in the organization of several of our major departmental meetings and symposia over the last decade.

A full-page photo of **Max Häggblom**'s desk (not that it can be seen under all the piles of paper) was featured in the May/June 2008 issue of the magazine *Seed.*

Visiting student – **Annette Møller** is visiting the Barkay lab for a period of approximately eight months. Annette is a graduate student at the University of Copenhagen. Her Ph.D. thesis research addresses the interactions of microbes from northern Greenland with mercury.

Dr. **Duong Minh Vien** from Can Tho University, Department of Soil Sciences and Land Management, Vietnam joined the department in August, 2008 as a Visiting Scientist for one year in Dr. Häggblom's laboratory. Dr. Vien is funded by an educational exchange in science and technology fellowship from the Vietnam Education Foundation. His work will focus on microbial degradation and dehalogenation of polychlorinated dibenzo-*p*-dioxins.



Dr. **Chu Ching Lin** joined the Barkay lab in early September. He earned his B.S. (1998) and M.S. (2000) degrees in Environmental Engineering in Taiwan and Ph.D. (2007) in Civil Engineering from UCLA. He is interested in the biogeochemical cycling of mercury, particularly focusing on the reduction and methylation of mercury by microorganisms in anoxic environments.

Welcome **Yun Lucy Hsu** (Principal Laboratory Technician) to the Department.

Dr. **Suman Rawat** joined the department in July 2008 as the Laboratory Manager in Dr. Häggblom's lab. She earned her Ph.D. in Biotechnology, National Chemical Laboratory, University of Pune, India, and has had previous research appointments at University of British Columbia, Dartmouth College and UMDNJ.

Dr. **Sung-Keun Rhee** (Chungbuk National University, South Korea) is spending a sabbatical at Rutgers starting September 2008 working with Drs. Lee Kerkhof (IMCS) and Max Häggblom exploring and characterizing Archaea in different environments.

## *What's Shaking!*

Baby Alexander Jiading Lu was born on 4:53 pm Thursday, 01/24/2008. He was doing fine with 20.5 inches in length, 8 lb and 8 oz in weight. Both mommy and daddy were tired in coping with this cute little angel, but we are deeply enjoying the happiness that our son had brought and will give to us in the whole life time! BTW, it is really not an easy job of being mommy & daddy… Best regards, **Hui** & Zhidong

Email from **Dr. André Oliveira de Souza Lima** (former visiting scientist in the Eveleigh lab) (lima@univali.br) - *…Also, I would like to thank you for the Lipman newsletter that sometimes I receive… Last year I was looking at the electronic version of Lipman newsletter and I found out that Joe Cagno has a kid too… maybe we are getting old….I mean Me and Joe, not you!!*

Congratulations to Andre and Angela on the birth of their new daughter Melissa, born on February 9, 2008.

Congratulations to **Eileen and Michael Glick** their daughter and son-in-law Jennifer and Josh Barons. Their first grandchild Nathaniel Rhys Barons was born on May 6, 2008 weighing in at 8 lbs. 7oz. and 19 ½" long.

More good news for the **Glick Family** wedding bells for Eileen's son David who was married on August 23 to Leslie Weiner.

**Lisa Domico (**Ph.D. student, Cooper Lab) welcomed a baby girl Zoe Elizabeth on November 7, 2007.

The Barkay lab has experienced changes in personnel this year. Postdoctoral fellow **Heather Wiatrowski** left the lab at the end of June to take a faculty position at Clark University in Massachusetts and **Kritee** graduated in May and has moved on to Princeton University as a postdoctoral fellow in the Department of Geosciences working with Prof. Daniel Sigman at on the extent of fractionation of nitrogen stable isotopes during microbial processes

Graduate student **Riqing Yu** has recently become the father of a baby girl named Sisi.

**Priya Narasingarao** (former Ph.D. 2006, Häggblom Lab) [npriyarao@gmail.com] and her husband welcomed daughter Sarngini Sudarsan, born August 27, 19 inches tall, 7 lbs 5 ozs at birth.

Congratulations to **Allen Watkins Smith** (Ph.D. 2008 -Kahn lab) married Liora Engel on the 20th of February. The wedding reception was held in Lipman Hall.

# AG FIELD DAY ON THE G. H. COOK CAMPUS 2008

Last April the Department joined in the annual celebration of Ag Field Day pitching a pair of tents on the front lawn and offering activities for all ages. In one tent the **undergraduate club for biochemistry and microbiology majors** introduced visitors to the biochemistry of photosynthesis through illustrative posters and a display of basil seeds that had been grown to different stages of germination. Youngsters could paint a flower pot and plant a basil seed in their painted pot. The club also offered T-shirts for sale with the slogan "*I survived the wrath of Kahn"*. Referring, of course, to their perhaps not so easy time with Biochem 403! In our second tent passersby were introduced to the important roles microorganisms play in their lives each day; with examples from the well-known role of antibiotics in medicine, yeast in the production beer, wine and bread products – including the pretzels to go with the beer -, cheese, pickles etc. and to the less commonly known role of microorganisms in the production of high fructose corn syrup, vitamins, citric acid and many other microbial products in the food we eat each day. Posters and examples illustrated the cultivation of microorganism in the lab. With the help of Microbiology majors **Allison Isola** and **Kim Cruz**, **Diane Davis** brought along a microscope and a hay infusion providing samples alive with a multitude of organisms for viewing through the microscope, a perennial favorite particularly for the young visitors. The boys in the picture below began with the hay infusion and started making slides from soil, grass and anything they could get their hands on. **Gavin Swiatek** introduced the concept that DNA is everywhere by helping interested participants isolate and visualize DNA from peas. In just a few minutes the peas were blended, alcohol added and the milky strands of DNA were clearly visible to the amazement of many who had never seen DNA before. **Doug Eveleigh** and **Max Häggblom** joined in the fun and camaraderie. Traffic through our tents was brisk; the day flew by!

**"Selman Waksman and the Discovery of the Rutgers antibiotics - Out of the Earth shall come thy Salvation"**, a new permanent exhibition at the Library of Science and Medicine opened August 15th, 2007.

The opening of this exhibition at the Library of Science and Medicine (LSM) on the discovery of the Rutgers antibiotics by Selman Waksman's research group was marked by a luncheon and coordinated with a celebration honoring **Boyd Woodruff**, the co-discoverer of the first Rutgers antibiotic, actinomycin on the occasion of his 90th birthday. Guests included Jeannette Woodruff, President Richard McCormick and his wife, Joan, Executive Dean Robert Goodman, Associate Vice President for the Promotion of Women in Science, Engineering, and Mathematics, Joan Bennett, antibiotic statesmen, librarians and microbiologists. Senator Robert Dole, a beneficiary of the Rutgers antibiotics in World War II injury, sent a letter of congratulations to Dr. Woodruff. The Exhibition now at the Conference Room, LSM, was designed by Mei Ling Lo, Kristi Conover and Michele Tokar. The Rutgers antibiotics revolutionized world health.

Left to right: H. Masuda, I. Rauschenbach, R. Han, Boyd & Jeanette Woodruff, J. Voordeckers and J. Kist (All Woodruff Microbiology Fellows) at the Theobald Smith Society Meeting in May 2008.

## Re-Enactment of General George Washington's & Tom Paine's Experiment Proving that Will-O'-the-Wisp is a Flammable Gas

### November 5th, 1783 - November 5th, 2008

**It's a Gas: A Classic Early-American Scientific Experiment Is Re-created**

A re-enactment of the famous experiment by General George Washington and Thomas Paine of their discovery of the nature of the fiery Will-O'-the-Wisp marshes and rivers. Could the fiery Will-O'-the-Wisp of marshes be due to bituminous matter or a gas?

GENERAL GEORGE WASHINGTON & THOMAS PAINE FLAMMABLE GAS, 1783

More than two centuries ago, many wondered about the nature of the so-called "Will-O'-the-Wisp"—flickering lights sometimes seen at night or twilight in bogs and marshland. General George Washington, his officers and Thomas Paine, in a moment of respite after the end of the American Revolutionary War, decided to investigate. The officers wondered if the will-o'-the-wisp was due to bituminous matter perhaps turpentine created by decaying vegetation, while Paine and Washington supported that the flame was caused by a gas. They all took a scow onto the Millstone River and, while holding blazing torches above the river surface, probed the river mud with poles. Bubbles rose and there was a flash above the river. This proved that the will-o'-the-wisp was caused by a flammable gas, now known to be methane.

George Washington (1783) at Rockingham William Dunlap, NJ artist

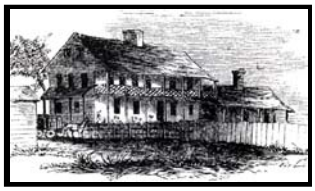
Thomas Paine (1792) copy Auguste Millière (1802)

PRINCETON 1783 The Nation's Capital

**The mysterious Will-O'-the-Wisp flame lured travelers into marshes.**

**Was the flame due to Bituminous Matter or a Gas?**

On the 225th anniversary of Washington and Paine's experiment, costumed actors will take to the Millstone River by boat and re-create this famous scene. All are invited at twilight to watch the re-enactment, which can be viewed from Rt. 518 where it crosses over the Millstone River.



Washington stayed at Rockingham

**Thanks to individuals and organizations who provided financial support to the Department over the year.**

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