DEPARTMENT OF BIOCHEMISTRY & MICROBIOLOGY
SCHOOL OF ENVIRONMENTAL & BIOLOGICAL SCIENCES (SEBS)

Lipman Log

APRIL 2007

News from the Chair

Alan Antoine

To all of our friends and alumni, I send you my greetings and best wishes for this Spring 2007. Since the last issue of *The Lipman Log*, the department has recorded a number of new accomplishments and awards. Dr. Elisa Bini received the Cook College & NJAES Pre-Tenure Faculty career Development Award for 2006. Drs. Tamar Barkay, Max Häggblom, Douglas Eveleigh, Lori White and Elisabetta Bini received a Cook College & NJAES Research Infrastructure Award for 2006. Drs. Gerben Zylstra, as Principal Investigator, Tamar Barkay, Elisabetta Bini, Theodore Chase, Max Haggblom were part of a larger group that received a Cook College & NJAES Research Infrastructure Award for 2006. Also, the department is proud to announce the awarding of 10 graduate degrees this past May at commencement. Scholarships were also awarded to graduate students and included the H. Boyd and Jeanette I. Woodruff Graduate Fellowship in Soil and Environmental Microbiology to Ms. Ines Rauschenbach, the Robert S. and Eileen A. Robison Scholarship Award for Excellence in Graduate Studies to Ms. Priya Narasingarao, and a group of 9 individual support awards to selected graduate students from the Karl C. Ivarson Student Assistance fund for students in various microbiology fields.

The department sends its thanks and appreciation to all donors and supporters of our academic and research programs. The Rutgers University Foundation reported that the department received gifts and annual pledges from individual and corporate sponsors totaling $39,431 for fiscal year 2006. This is a major increase from the previous year. We continue to seek support to enhance our departmental missions in microbiology and biochemistry, upgrade our physical spaces and infrastructure, and provide more scholarship support for our students. We hope that you will continue to show your support for the department in the future.

Inside this issue:

Microbiology at Rutgers: ***Cultivating Traditions, Current Strength, and Future Frontiers***

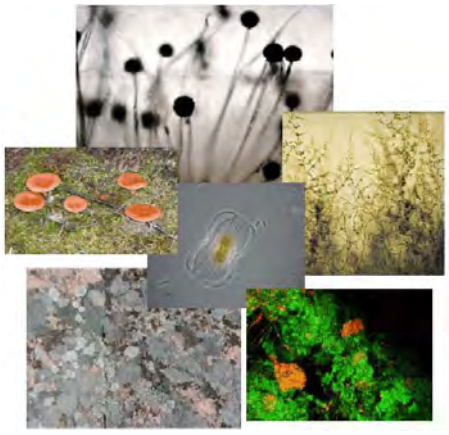
Max Häggblom, Tamar Barkay and Doug Eveleigh (pictured left to right) and with help from Departmental staff and several SEBS microbiologists, including Lee Kerkhof, Joan Bennett and Lily Young, organized the Mini-Symposium "Microbiology at Rutgers University: Cultivating Traditions, Current Strength, and Future Frontiers". The symposium was held at the NJ Museum of Agriculture Jan 25-26. The keynote speaker was Rutgers alumnus Dr. Tom Jeffries (Ph.D. 1975) Director of the Institute for Microbial and Biochemical Technology, USDA Forest Products Laboratory.

(program continued on page 2)

Microbiology at Rutgers University:

Cultivating Traditions, Current Strength, and Future Frontiers

A Mini-Symposium



New Jersey Museum of Agriculture
College Farm Road on the Cook/Douglass Campus

Thursday - Friday, January 25 –26, 2007
New Jersey Museum of Agriculture
College Farm Road on the Cook/Douglass Campus

Biofuels: The Way Forward
Thomas W. Jeffries
USDA Forest Products
Laboratory, Madison, Wisconsin

The field of biomass conversion is attracting increasing attention. In 2006 - President Bush mentioned cellulosic ethanol in his State of the Union Address, and the Department of Energy has instituted several new, large funding programs with both commercial and basic thrusts. Increasing petroleum prices, and greater awareness of global warming have contributed to the current excitement - but the progress we make in the laboratory will be more important than any other element. Scientists have had a vision of producing renewable fuels from cellulosic biomass for almost 200 years. Some of the earliest attempts date back to the 1820's. The first commercial-scale plant for converting wood into ethanol was operated in 1855, and there have been periodic attempts at commercialization ever since. The biotechnology revolution that shook the biomedical industry is now reaching into the production of fine chemicals, feedstocks and precursors, and it will soon become feasible to produce ethanol from cellulose. Traditional strain selection and development have given way to metabolic engineering. We no longer think about optimizing bioreactor conditions - but can begin to see optimization from the inside out: changing the pathways and regulatory matrices of the cells themselves. High throughput gene synthesis, transformation and screening are giving way to systems biology in which computational models will guide our efforts. We can begin to envision not just ways to use the biomass that nature has given us, but to create new forms that better suit our needs. In the end, we must work within nature - but with new techniques we might explore even beyond what nature has known. This talk will offer a historical perspective on biomass conversion combined with examples of how we can apply contemporary tools to go beyond present limitations.

Thursday, Jan. 25th

4:30 - 4:45 pm ***Welcome***
Robert Goodman,
Executive Dean of the School of Environmental and Biological Sciences

Ken Breslauer, Dean of the Division of Life Sciences

4:45 - 5:00 pm ***A historical perspective of microbiology at Rutgers***

Joan Bennett, Associate Vice President and Dept. of Plant Biology and Pathology

Introduction: **Doug Eveleigh**, Dept. of Biochemistry aMicrobiology

5:00 - 6:00 pm **Keynote presentation: *Biofuels - the way forward***

Tom Jeffries Director, Institute for Microbial and Biochemical Technology, USDA, Forest Service, Forest Products Laboratory, Madison, WI

Introduction: **Robert Goodman**

This talk is cosponsored by the Rutgers University Energy Institute

6:00 - 7:30 pm **Poster session** combined with a wine and cheese reception

Friday, Jan. 26th

8:00 - 8:30 am Morning Coffee

8:30 - 10:00 am **Micro-Macro Organisms Interactions**
Convener**: Lee Kerkhof**, Institute of Marine and Coastal Science

***Plant fungal symbiosis - An example for fair trade*?**
Heike Bucking, Dept. of Biology, Camden

Novel gene regulation systems in human and plant fungal pathogens
Charles Martin, Dept. of Cell Biology and Neuroscience

Destructive microbes inhabiting blueberries and cranberries
Peter Oudemans, Dept. of Plant Biology and Pathology & Marucci Blueberry-Cranberry Research Center

10:00 - 10:30 am Coffee break

10:30 - 12:00 noon **How Microbes Work**
Convener: Tom Montville, Dept. of Food Science

Antibacterial drug discovery: Small-molecule inhibitors of bacterial RNA polymerase
Richard Ebright, Waksman Institute

Extreme expression: Analysis of the genetic and genomic response to copper in Archaea
Elisabetta Bini, Dept. of Biochemistry and Microbiology

Viral activation and recruitment of the programmed cell death machinery in unicellular marine phytoplankton
Kay Bidle, Institute of Marine and Coastal Science

12:00 - 1:30 pm Lunch break combined with **Poster session**

1:30 - 3:00 pm **How Microbes Work for Us**
Convener: Max Häggblom, Dept. of Biochemistry and Microbiology

***Remediation of sediments contaminated by dioxins and PCBs: Is there a role for bioremediation*?**
Donna Fennell, Dept. of Environmental Science

Probiotics as a source of natural antimicrobials: Mode of ac tion and applications
Michael Chikindas, Dept. of Food Science

Geomicrobiology: Why geologists study microbes
Nathan Yee, Dept. of Environmental Sciences and Dept. of Geological Sciences

3:00 - 3:30 pm Coffee break

3:30 - 4:30 pm Group discussion:

Where do we go from here?
A discussion of future academic activities that will enhance collaborations among Rutgers microbiologists
Moderators: Robert Goodman, Executive Dean SEBS and Joachim Messing, Director, Waksman Institute

Faculty - Awards, Grants, Patents and other Activities

OUR FACULTY

Tamar Barkay, Rutgers University Research Infrastructure Award. "Upgrading temperature controlled incubation rooms in Lipman Hall", 2006, $35,000

Elisabetta Bini, received a Cook College/NJAES Intramural Pre-Tenure Faculty Career Development Award of $31,141. The title of her project is "Discriminating Specific Metal-Induced Changes from General Stress Response in the *Sulfolobus transcriptome*."

Doug Eveleigh, professor in the Department was awarded the 2006 Theobald Smith Society—Waksman Award. His talk: *"Guns, Germs, and Rutgers: A life in microbiology at Rutgers - from bench to history"*

Max Häggblom, professor in the Department of Biochemistry and Microbiology, was elected Chair-elect of Division Q (Applied & Environmental Microbiology) of the American Society for Microbiology. His term began July 1, 2006 and he will continue as Chair July 1, 2007– June, 30, 2008.

Max Häggblom is the Principal Investigator on a new grant "Quantifying Enhanced Microbial Dehalogenation Impacting the Fate and Transport of Organohalide Mixtures in Contaminated Sediments" Funded by the Dept of Defence. Co-PIs, are Donna Fennell (Environ Science), Lee Kerkhof (Marine and Costal Sciences), Lisa Totten (Environ Science) and Kevin Sowers (University of Maryland Biotechnology Institute). The overall objectives are develop techniques and amendments that enhance and accelerate microbial dehalogenation of organohalide mixtures in contaminated sediments. Microbial dehalogenation is a key factor in determining the ultimate fate of organohalides in sediments. Techniques are needed to stimulate microbial dehalogenation of organohalide mixtures, including polychlorinated biphenyls (PCBs), chlorinated pesticides, and polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs). Development of *in situ* amendments for enhancing dehalogenation of mixtures, refinement and in situ testing of tools and methods for monitoring the effectiveness of amendment placement and mixing, and development of model frameworks to track contaminant fate and transport during in situ biostimulation are crucial for the successful management of contaminated sediments.

Gerben Zylstra's (Director of the Biotechnology Center for Agriculture and the Environment) proposal (along with 16 cooperating faculty), titled "Cook College DNA Sequencing Facility Upgrade" was accepted. The group received $22,000 to upgrade the current DNA sequencer to the state-of-the-art ABI 3130*xl* instrument. The facility supported the research of 25 faculty in seven departments in 2005.

Patents: Max Haggblom (Biochemistry & Microbiology), Presenters included Executive Vice President Phillip Furmanski, Associate Vice President Michael Breton, and Director William Adams. This year's event honored 48 Rutgers researchers who had a patent issued in calendar years 2004 and 2005

In Print

Männistö MK, Häggblom MM (2006) Diversity and hydrolytic enzyme activities of psychrotolerant bacteria from Finnish Lapland. Systematic and Applied Microbiology **29:**229-243.

Somsamak P, Richnow HH, Häggblom MM (2006) Carbon isotope fractionation during anaerobic degradation of methyl tert-butyl ether (MTBE) under sulfate-reducing and methanogenic conditions. Appl. Environ. Microbiol. **72:**1157-1163.

Narasingarao P, **Häggblom MM** (2006) *Sedimenticola selenatireducens*, gen. nov., sp. nov., an anaerobic selenate-respiring bacterium isolated from estuarine sediment. Systematic and Applied Microbiology **29:**382-388.

Ravit B, Ehrenfeld JG, **Häggblom MM** (2006) Effects of wetland vegetation on rhizosphere microbial communities: A comparison of disturbed versus undisturbed estuarine sediments. Soil Biol. Biochem. **38:**2359-2371.

Haubert D, **Häggblom MM,** Langel R, Scheu S, Ruess L (2006) Trophic shift of stable isotopes and fatty acids in Collembola on bacterial diets. Soil Biol. Biochem. **38:**2004-2007.

Margesin R, **Häggblom M** (2007) Editorial. Microorganisms in cold environments. FEMS Microbiology Ecology **59:**215-216.

Männistö MK, Tiirola M, **Häggblom MM** (2007) Microbial communities in Arctic fjelds of Finnish Lapland are stable but highly pH dependent. FEMS Microbiology Ecology **59:**452-465.

Zaitsev GM, Uotila JS, **Häggblom MM (**2007) Biodegradation of methyl *tert*-butyl ether by cold-adapted mixed and pure bacterial cultures. Appl. Microbiol. Biotechnol. 74: in press.

Ruess L, Schütz K, Migge S, **Häggblom MM,** Kandeler E, Scheu S (2007) Lipid composition of Collembola and their food resources in deciduous forest stands - implications for feeding strategies. submitted. Soil Biology and Biochemistry, in press.

Narasingarao P, **Häggblom MM** (2007) *Pelobacter seleniigenes* sp. nov., a selenate-respiring bacterium and reclassification of *Malonomonas rubra* as *Pelobacter ruber* comb. nov. Int. J. Syst. Evol. Microbiol., in press.

Ahn Y-B, **Häggblom MM**. Kerkhof LJ (2007) Comparison of anaerobic microbial communities amended with halogenated compounds to enhance dechlorination of 1,2,3,4-tetrachlorodibenzo-*p*-dioxin in estuarine sediments. FEMS Microbiol Ecol., in press.

Martinez, R.J. Y. Wang, M.A. Raimondo, J.M. Coombs, **T. Barkay,** and P.A. Sobecky. 2006. Horizontal gene transfer of PIB-type ATPases among bacteria isolated from radionuclide- and metal contaminated subsurface soils. Appl. Environ. Microbiol. **72**:3111-3118

Ní Chadhain, S., J.K. Schaefer, S. Crane, **G.J. Zylstra**, and **T. Barkay**. 2006. Analysis of mercuric reductase (*merA*) gene diversity in an anaerobic mercury–contaminated sediment enrichment. Environ. Microbiol. **8**:1746-1752

Wiatrowski, H.A., **P.M. Ward,** and **T. Barka**y. 2006. Novel reduction of mercury(II) by mercury-sensitive dissimilatory metal reducing bacteria. Env. Sci. Technol. **40**:6690-6696

Barkay, T, and A.J. Poulain. Mercury (micro) biogeochemistry in polar environments. 2007. FEMS Microbiol. Ecol. **59**:232

Kritee K., J. Blum, M. Johnson, B. Bergquist, and T**. Barkay**. 2007. Mercury stable isotope fractionation during reduction of Hg(II) to Hg(0) by mercury resistant microorganisms. Env. Sci. Technol. **41:**1889-1895

Chatziefthimiou, A.D., Crespo-Medina, M., Wang, Y., Vetriani, C., and **Barkay, T.** The isolation and initial characterization of mercury resistant chemolithotrophic and thermophilic bacteria from mercury rich geothermal springs. *Extremophiles*, in press.

Hügler, M., Huber, H., Molyneaux, S.J., **Vetriani, C.,** and Sievert, S.M. (2007) Autotrophic CO_2 fixation via the reductive tricarboxylic acid cycle in different lineages within the phylum *Aquificae*: Evidence for two ways of citrate cleavage. *Environmental Microbiology* **9**:81-92.

Reed, A.J., Lutz, R.A., and **Vetriani, C.** (2006). Vertical Distribution and Diversity of Bacteria and Archaea in Sulfide and Methane-Rich Cold Seep Sediments Located at the Base of the Florida Escarpment. *Extremophiles* **10:**199-211.

Voordeckers, J.W., Starovoytov, V., and **Vetriani, C.** (2005). *Caminibacter mediatlanticus* sp. nov., a thermophilic, chemolithoautotrophic, nitrate ammonifying bacterium isolated from a deep-sea hydrothermal vent on the Mid-Atlantic Ridge. *Intl. J. Syst. Evol. Microbiol*. **55**:773-779.

Conferences - Seminars -Symposia

Barkay, T., and C. Vetriani. Microbe-mercury interactions in geothermal environments: insights into the evolution and origin of microbial mercury detoxification. Gordon Research Conference on Environmental Bioinorganic Chemistry, Andover, NH, June 18–23, 2006 – invited.

Wiatrowski, H., and **T. Barkay.** Reduction of Hg(II) to Hg(0) by dissimilatory metal reducing bacteria. 8th International Conference on Mercury as a Global Pollutant. Madison, WI, Aug. 11–Aug 16, 2006.

Kritee, K., J. Blum, M. Johnson, B. Berquist, and **T. Barkay.** The measurement of microbial mercury stable isotope fractionation and its potential utility for distinguishing between Hg sources. 8th International Conference on Mercury as a Global Pollutant. Madison, WI, Aug. 11–Aug 16, 2006.

Yu, R., C. DiPasquale, and **T. Barkay**. Molecular characterization of microorganisms in a methylmercury producing Adirondack Wetlands. 8th International Conference on Mercury as a Global Pollutant. Madison, WI, Aug. 11–Aug 16, 2006.

Crane, S., J. Dighton, and **T. Barkay**. Interactions between mercury and ectomycorrhizal fungi. 8th International Conference on Mercury as a Global Pollutant. Madison, WI, Aug. 11–Aug 16, 2006.

Barkay, T. J. Coombs, and A. Chaziefthimiou. Horizontal gene transfer in microbial communities: Genetic plasticity for coping with environmental change. 4th Okazaki Biology Conference on "Terra Microbiology II", Okazaki, Japan, Sept. 10–15, 2006 – invited.

Øregaard, G., J.R. de Lipthay, **T. Barkay,** and S.J. Sørensen. High diversity of bacterial mercuric reductase gen from surface and sub-surface soil. 11th International Symposium on Microbial Ecology. Viena, Austria, Aug. 20–25, 2006

Max Häggblom with Rosa Margesin (University of Innsbruck) served as Editor for a special thematic issue on "Microorganisms in Cold Environments" published in FEMS Microbiology Ecology February 2007. The thematic issue covers research on ecology and microbial diversity in arctic, antarctic and alpine ecosystems; biogeochemistry and nutrient cycling; impact of climate change on microbial communities; low temperature biodegradation and bioremediation; physiological and genetic aspects of psychrophilic microorganisms; as well as astrobiology. These topics were presented at the "International Conference on Alpine and Polar Microbiology", which was a continuation to the Artic Microbiology conference organized in Rovaniemi, Finland in 2004.

Max Häggblom gave a talk at the 2006 NEMPET (Northeast Microbiologists: Physiology, Ecology, Taxonomy) meeting on "Anaerobic Dehalogenation: Sponging up Superfund Sites". The NEMPET meeting was also attended by recent Cook graduate (Microbiology & Biochemistry) Renee Schnaidt who presented a poster on her research on microbial transformation of brominated flame retardants.

In July **Max Häggblom** served as Discussion Leader at the 2006 Gordon Research Conference on Environmental Sciences: Water, chairing a session on Microbial Degradation of Organic Contaminants. In August 2006 he was an invited speaker at the Society for General Microbiology, Irish Branch Symposium, held in Dublin.

Max Häggblom spent the second week in January 2007 teaching the graduate course "Biodegradation and Bioremeidation" at the University of Jyväskylä. This course is part of the Graduate Program in Biological and Environmental Sciences. MH is a Docent (Adjunct Faculty) at University of Jyväskylä and teaches this course regularly every 2-3 years.

In Aug. of 2006 **the Barkay lab** participated in the 8th International Conference on Mercury as a Global Pollutant that was convened in Madison, WI, from Aug. 11th through the 16th. We presented 5 posters at that meeting and Tamar organized and convened a combined oral/poster session on "Mercury (micro) biogeochemistry" where the latest studies on the microbiology of mercury cycling was presented. Two of our students, Kritee and Melitza Crespo-Medina were the recipients of outstanding student posters award. Considering that there were hundreds of student posters at the meeting and that only 4 awards were given this is an awesome achievement.

Melitza participated in a deep sea cruise to the East Pacific Rise in Jan. of 2007. It was her first such cruise during which she had a chance to join an Alvin dive for the purpose of collecting microbiological samples from hydrothermal vents (***see images on pg 14)***

Continued: page on 15

Our Undergrads

The David H. Strumeyer Award (physically a Merck Index) was awarded to the four top graduating students in the Biochemistry major, **Kevin George, Anthony DeCicco, Giang Nguyen and Daniel Kagan**, all of whom graduated with highest honors (overall GPA above 3.85). This award is named for the late David H. Strumeyer, Professor of Biochemistry in this Department, who administered the award during his lifetime (when it was called the Selman H. Waksman award). It is given under that name to equally high-GPA students in other majors doing research with department faculty.

(Dan Kagan & Tim Casey)

Undergraduate **Kevin George** graduated with Highest Honors as a G. H. Cook Honors student in Biochemistry, working with faculty member **Max Häggblom** (Biochemistry and Microbiology). Kevin will continue with graduate studies in Environmental Toxicology at Cornell University. Other graduating G.H. Cook Scholars working in the Haggblom lab include **Renee Schnaidt**, **Brandon Saks**, and **Barbara Spokas**. Brandon Saks recently made a research visit to Rovinj, Croatia, funded through the Rutgers Undergraduate Research Fellowship Program, to collect sponge samples for a study on anaerobic dehalogenating bacteria associated with marine sponges.

Elisabetta Bini's undergraduate student, **Katie Voskoboynik**, was selected to participate in the 2006 ASM Undergraduate Research Fellowship (URF) Program, sponsored by ASM. She will receive a $4,000 stipend to work in the Bini lab over the summer, and $1,000 to present her work at the 2007 ASM General Meeting.

Renee Schnaidt and **Frank Zadlock** were the first graduates of the new Microbiology Major at Cook College. Renee who also had a double major in Biochemistry was the recipient of the Microbiology Curriculum award. Renee is now a research scientist at Bayer Heathcare in Tarrytown, NY

The Microbiology curriculum has grown and will be graduating 14 students in the spring 2007.

(pictured Renee and Dr. Häggblom)

Master's & Ph.D. Theses

Our Graduate Students

Master of Science degrees:

Aspassia D. Chatziefthimiou - Thesis Advisors: Dr. Tamar Barkay and Dr. Costantino Vetriani

Microbe-metal Interactions in Geothermal Hot Springs. Isolation and Characterizaton of Thermophilic, Mercury Resistant, Thiosulfate-Oxidizing Bacteria from Mount Amiata, Italy.

The evolutionary origin of the wide spread bacterial mercury (Hg) resistance (*mer*) operon, is presently unknown. It is hypothesized that this operon has evolved in geothermal environments as they are rich in Hg, in the form of its ore cinnabar and where chemolithotrophic iron and sulfur-oxidizing bacteria may release mineral bound metals. To test this hypothesis thiosulfate oxidizing bacteria from hot springs in Mount Amiata, Italy, were investigated. Mount Amiata is known for its geological mercury mineral deposits of cinnabar.

Twelve pure cultures were isolated from enrichments that were carried out at 55^{O}C. Six strains were enriched in acetate (10mM) and $HgCl_2$ (10μM), 4 in acetate without Hg and 2 in a medium with Hg and without acetate. Further tests revealed that all strains were resistant to Hg and did not grow at temperatures below 45^{O}C. The optimum growth temperature for 7 strains was 60^{O}C and 55^{O}C for 3 other strains. Only one isolate was found to be an obligate chemolithotroph, failing to grow on thiosulfate medium containing acetate or on LB.

Phylogenetic analysis revealed that all isolates belonged to Low percent mol G+C Gram positive bacteria, most likely related to *Brevibacillus, Geobacillus*, and *Anoxibacillus*. Three or possibly six isolates reduced Hg^{2+} to Hg^{O}. Attempts to amplify *mer*A genes from genomic DNA of all strains were unsuccessful, with the exception of one facultative chemolithoautotrophic strain. Phylogenetic analysis revealed that the MerA protein of this strain was most similar to MerA of *Geobacillus kaustophilus*, a Low percent mol G+C Gram positive isolate from the Mariana Trench. Because the employed PCR primer sets were designed to target all characterized *mer*A genes from Gram positive bacteria, *mer*A in the Hg resistant Mount Amiata isolates must be more divergent than is presently known.

Results of this study suggest that mercury resistant thermophilic bacteria are both present in and culturable from the sulfidic hot springs samples, and provide data that, with further study, could be used to evaluate the linkage of *mer* ancestry to geothermal environments. Further characterization of *mer* genes in the described culture collection is needed to elucidate the mechanisms of mercury resistance and their evolution in this unique environment.

Doctor of Philosophy:

Daniel Gustavo Gonzalez Guardiola defended his Ph.D. Thesis **Studies on Recombinant Fluorescent Macromolecules: Expression, Cultivation and Purification; with Applications Towards the Isolation of nucleic acids.** Dissertation Director: Theodore Chase, Jr.

These studies focus on fluorescent proteins and culminate with the production of a synthetic gene for expressing a fluorescent protein. Initial studies led to the publication of technical notes (see appendix) describing the quantitation of green-fluorescent protein (GFP) both in whole bacteria and in solution. These led to studies with large-scale expression, cultivation, and purification of recombinant GFP showcasing various techniques including large—scale fermentation and chromatography, culminating in a paper in Methods in Enzyniology, Bioluminescence and Chemiluminescence, Part C. 305:212-23, 2000. These large- scale techniques were needed to overcome poor expression and inefficient purification methods in order to produce enough protein for study. Another study, with a mutant variant of GFP called enhanced green-fluorescent protein or eGFP, was used to explore mutagenesis of the GFP gene as well as new and more efficient approaches to expression and purification such as the application of non-lytic methods of extracting macromolecules. Yet another study applies this experience with the non-lytic method of extraction to isolate plasmid DNA. Finally, a synthetic gene was generated to express a protein based solely on its known primary structure. This protein, a red-fluorescent protein (RFP), described originally from a non-bioluminescent organism, became a platform for exploring techniques in synthetic gene design and creation. it also allowed for pursuing different methods of expressing and purifying fluorescent proteins in a recombinant system. These methods include an aggressive method of osmotic shock to produce an extract that is relatively free of endogenous proteins, as well as a technique for batch precipitation of protein based on the the histidine tag which allowed for very specific precipitation of recombinant protein.

Doctor of Philosophy:

Priya Narasingarao defended her Ph.D. Thesis **Anaerobic Bacterial Respiration of Selenium Oxyanions** in July 2006 (Graduate Program in Environmental Science).

Selenium is a naturally occurring element in the earth's crust that becomes very toxic when its mobile oxyions (such as selenate and selenite) gain entry into water systems due to oxidation-reduction reactions. Microorganisms have the capability to use selenate as a terminal electron acceptor by reducing it to selenite and elemental selenium by the process known as dissimilatory selenate reduction (DSeR). The overall objective of this study was to gain an in-depth understanding of anaerobic biotransformation of selenium in the environment (with emphasis on respiration of selenium oxyanions) and elucidate the microorganisms catalyzing this process. Here we demonstrate the enrichment and isolation of selenate reducing bacteria from a wide range of sediments. Novel anaerobic dissimilatory selenate reducing bacterial strains were isolated from these selenate-reducing enrichments. All these strains are phylogenetically distinct belonging to various phyla in the bacterial domain. Based on 16S rRNA gene sequence analysis, strain AK4OH1 is classified as a new genus *Sedimenticola selenatireducens* belonging to the *Gammaproteobacteria, s*train S5 as a new genus *Selenospirillum indicus, and* strain KM as new species *Pelobacter selenogenes.* All these strains are anaerobic gram-negative selenate respiring microorganism which are phylogenetically and physiologically highly distinct. Apart from selenate reduction, these strains also respire nitrate. Strain S5 and Strain KM possess the unique ability to reduce selenate completely to elemental selenium which was confirmed using XANES analysis of the elemental selenium precipitate. We have thus shown that there exists tremendous phylogenetic diversity of these selenate respiring bacteria but it is still unknown as to why these diverse bacteria possess this conserved metabolic function. Further analysis of the biochemistry of the selenate reductase genes in other isolates will shed some light on the diversity of these bacteria in their natural environment.

Priya is currently a Post-Doctoral Associate at the Scripps Institute of Oceanography, Univ of Cal. San Diego working with Dr. Eric Allen working on community genomics of hypersaline lakes and deep surface coal-beds.

Frank Ritacco defended his Ph.D Thesis **The phaeochromycins from Streptomyces strain LL-P018: from taxonomy to novelties of biosynthesis** in March 2007 (School of Environmental and Biological Sciences) (left to right, Frank, Max and Peter)

The phaeochromycins are a newly discovered family of aromatic polyketides produced by *Streptomyces* strain LL-P018, which are of medical interest for their inhibitory activity against MK-2, a kinase involved in the inflammatory response. Because the phaeochromycins show promise as potential anti-inflammatory therapeutic agents, further knowledge of their biosynthesis and the taxonomy of the producing organism was sought. Using a combination of traditional and molecular techniques (morphology, physiology, 16S ribosomal RNA (16SrRNA) sequence, and ribosomal polymerase β-subunit (*rpoB*) gene sequence analysis), strain LL-P018 was identified as *Streptomyces phaeochromogenes*. Additionally, a new taxonomic method was developed which integrates genetic fingerprints and metabolite profiles in a single comparison. This novel approach was used to assess strain variation between strain LL-P018 and closely related organisms, and also clarified the relationship *S. phaeochromogenes* and *Streptomyces ederensis*. Genomic analysis of strain LL-P018 revealed the presence of a type II polyketide synthase gene cluster and gene disruption experiments determined this pathway to be responsible for both phaeochromycin and alnumycin biosynthesis. Alnumycin is an aromatic polyketide which has structural similarities to the phaeochromycins. The genetic analysis suggests that the phaeochromycins may be intermediates or shunt products in alnumycin biosynthesis.

About our Alumni

by Kathy Maguire

Received an email message from **Nick Landau (Ph.D. 2000)** a student in the Bartha Lab who then went on to law school. He is now an environmental and patent attorney with the U.S. Army Corps of Engineers. Nick said, "*I am always curious as to what the Lipmaniacs are up to*!" nick_landau@earthlink.net.

ED LASHEN: one of Dr. Starkey's students, who reviews his career after graduating from Biochemistry and Microbiology. This was received by David Pramer, who commented (and which gives a lead to Dr. Lashen's career activities):

My thesis advisor was Dr. Starkey. I think I was his next to last student, my thesis being "Microbial Dissimilation of *Thiourea*" (1964).

My entire post doctoral career of 28 years was at Rohm and Haas Co. Initially, I worked on biodegradation projects. We made several non- ionic surfactants for industry and these were considered recalcitrant; and therefore a "no- no" for secondary sewage disposal plants. If you remember, at that time there was a big push to produce biodegradable anionic surfactants because of the hugh foam in sewage disposal plants. The anionics are typical detergents used by consumers in laundry, etc., but non-ionics were primarily used in industry and in some consumer products, like *Woolite*. The dominant non-ionic surfactant that R&H made was based on a para-tertiary octylphenol.

I came into the lab then to help decide, based on lab tests, whether R&H was to give up on these products. The results they were getting then looked bleak. Lab tests were based on simulated secondary sewage units using sludge taken from a local sewage treatment plants serving residential neighborhoods. I discovered that a large cluster of manufacturing companies in Philadelphia were using our nonionic products and that their wastes were actually entering into the NE Philadelphia sewage treatment plant. Using sludge from this plant showed almost instant biodegradation of these non-ionics in our lab tests; certainly a concept of adaptation that you taught me, but was not known in this industry. Field tests agreed with the lab tests and my results were widely published in trade journals. This was a fun time.

I then moved on to another lab where I began evaluations of chemicals made by our synthesis chemists for use as microbicides in industry: as algaecides, bactericides, and fungicides in cooling towers, preservatives in water based paints, cosmetics, shampoos, paint film, wood, water based metal working fluids, and many more. This project required an ability to predict efficacy before safely recommending commercialization. Current lab screening tests, which were similar to that used to find antibiotics, were inadequate. We needed tests to simulate use conditions. Preservative tests were straight forward; add biocide to the specific product, inoculate with mixed microrganisms from spoiled products, and incubate and evaluate over time. Other tests required bench scale simulations of use, like the simulated sewage treatment units mentioned above. We constructed lab cooling towers with the important variables that would affect microbicides, painted popsicle sticks and then inoculated them with the fungi that produce black staining, etc. Field tests were done with the best candidate biocides and we went on to develop multi-million dollar (annually), broad spectrum products for water treatment and preservative applications and a fungicide product for paint film and wood. These products are isothiazolones. Check your shampoo ingredient list and most likely you will see the last, or almost last, ingredient is methyl and chloromethyl isothiazolone. The paint film fungicide is an octyl-isothizolone. These biocides, especially the former, is very effective in water environments as an algaecide, bactericide and fungicide at levels of 10 ppm a.i. Basically, they are behaving more as static agents, but cidally in preservation applications where contamination is usually only during manufacturing.

(continued on next page)

I ALSO WORKED WITH biocides USED in oil field secondary oil recovery, where water is pumped down hole to retrieve oil. In lab test units to simulate metal surface exposed to water with special surface sampling ports, we found biofilm, obviously, to be the most important factor in fouling control on these surfaces. The biofilm that develops easily in the field and in the lab units provides a buffer against biocides; and below the biofilm where the anaerobe sulfide producers, much like the foam with surfactants, was a real obvious objection. These biofilms were predominately pseudomonads and desulfovibrio and very difficult to control. The H2S also inactivates many biocides. Much of this work was done with our support at the U.of Calgary, Canada. This was especially nice, since I was "forced" to visit periodically to supervise the work and review the data and, since I was a skier, spent the weekend sking, in great sky country. I went up on Thursdays, then off to ski on Fri-Sun and returned on Mondays; the things I had to endure for my company. Oh well!

During product development and sales I helped the sales departments internationally at customer meetings and by making technical presentations.

I also spent some time in Brazil and Singapore helping local R&H technical people to set up customer supports laboratories. In fact, I was in Brazil at the time when I heard that R&H was offering retirement packages for all eligible North American employees. When I got home I found out that I qualified. I was planning to retire at 60, but this offer was a better deal at my then age of 58. I grabbed it! It was time for doing other things and I was developing interest in furniture making, but no time to do it. Also, on my long flights to Europe, Asia and South America I developed interest in reading fiction, after many years of reading mostly technical literature and internal reports. I look back with no regrets. I could have played more the political role at my company seeking greater managerial advancement, beyond a Lab Head, but I did the best I could with what I have, what I am and what I wanted.

I hope I didn't put you to sleep with such a discourse; much longer than I intended and surprisingly in more detail than I thought I would remember.

Best Regards, Ed
Edward Lashen - eml24@comcast.net

Richard Monaghan (Ph. D. 1975) recently received the Charles Thom Award at the Society of Industrial Microbiology annual meeting in Baltimore for outstanding contributions in industrial microbiology. Dick's thesis addressed his discovery of the enzyme chitosanase, since found to occur widely in plants as a component of their defense mechanism towards potential pathogens. On graduating, he was directly hired by Merck and over his career span of 31 years was co-inventor of over 50 patents applications. His contributions led to the discovery or development the first serum cholesterol lowering statin (mevinolin) on which Mevacor and Zocor were based, the pneumocandins antagonists of Candida one being a precursor to Cancidas , and the antiparasitic and insecticidal avermectins including Ivomec . The breadth of his drug discovery studies with his Merck Sharp Dohme Research Laboratory (MSDRL) colleagues is amazing including microbial products active in Alzheimer's disease, bipolar disorder, blood pressure regulation, cancer, eating disorders, glaucoma, leukemia, prostate disease and transplant rejection. He had previously won the Inventor of the year Award of the Intellectual Property Owners Inc., Washington DC, and the Thomas Alva Edison Patent Award from the R & D Development Council of NJ. Dick and his wife Joan with their three children and spouses all shared the day at this prestigious award ceremony.

Lucille's Retirement Party

Lucille Pasquale retired from the Department of Biochemistry and Microbiology on December 31, 2005, and from her position as a full-time Laboratory Assistant. A retirement luncheon was held in her honor on December 5th, 2005. Fun was had by all, with over 30 people attending, including her son Jon, whom documented the party by videotaping the days events!

Lucille began her career at Rutgers University in September 1965 as a part-time lab assistant, and as the department expanded in teaching and research activities, she became a full-time employee in September 1973. Over the years, she accepted extra shared teaching cleanup responsibilities in Foran Hall and Food Science as teaching developed at those locations. During this forty-year period of employment, Lucille has been committed to and responsible for her job as caretaker of the departmental laboratory washroom facility, and all of its equipment. Her performance has always been constant, efficient, accurate and always on time, and she always exhibited a steadfast attitude and pleasant demeanor on the job at all times. Lucille has been a major support staff member that regularly assisted in the maintenance of multiple teaching and research programs. Lucille is sorely missed as a person, and as a working colleague to all personnel in the Department. She has always been a devoted employee and friend.

Alan D. Antoine, Chairman
Department of Biochemistry and Microbiology

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Lucille: It is with great pleasure that we recognize your 40 years of service to Rutgers University. Throughout this period, your devotion to the University efforts on teaching and research has been consistently commented on by faculty, post-doctoral workers, graduate students and indeed the whole staff in the Department of Biochemistry and Microbiology. We all recognize your efforts in teaching us how to operate the autoclaves and indeed in keeping them operational, besides the other instrumentation in your bailiwick. At times such as these, it really comes to focus as to how you have been a lynch-pin in keeping the department's teaching and research facilities operational.

What changes you have seen. We note that forty years ago that you began at a salary level of $1.50 per hour. How things have changed. We also note that the Departmental Nobel Prize winner, Professor Selman Waksman, when distributing patent monies from the discovery of streptomycin, insisted that all members of the department, faculty, students and staff, should be part of the recognition. Today our gratitude is expressed to you from the whole Department in like manner.

We have arranged to keep the campus bus running even though you have retired. Thus come visit often and enjoy your retirement.

Douglas E. Eveleigh

Lucille and son Jon

David Pramer with Lucille

Lucille and the *Lipman Hall Gang*
In front of the "Pasquale Bus Stop"

Whats Shaking

Star frog catcher **Brigid, Jessie Maguire's** daughter, was featured in the New York Times during the annual mating run of the frogs and salamanders. She was helped by David Moskowitz, a graduate student in the Ecology Program! (Brigid in blue coat)

Sampras Grace Takacs born October 18, 2006 to Margy Wintermeyer -Takacs (Ph.D 2005, Cooper Lab) Weighing in at 7lbs 3oz!

Joe Cagno's (Ph.D 2003 in Katz Lab) daughter Olivia Rosalie Cagno was born December 22, 2006, 6 lbs, 14.7 oz, 20 3/4 inches. Jen Rakeman (lab technician in Dr. MacMillian's lab; Cook undergrad) and Olivia are doing very well.

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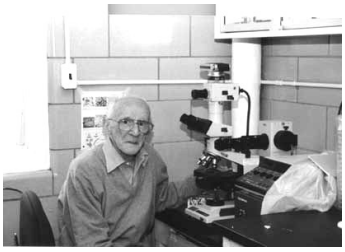
From pg. 7 Melitza participated in a deep sea cruise to the East Pacific Rise in Jan. of 2007. It was her first such cruise during which she had a chance to join an Alvin dive for the purpose of collecting microbiological samples from hydrothermal vents.



Norberto Palleroni, visiting scientist in Max Häggblom's lab, was recently honored by having a new genus of bacterial species named after him. The new genus, *Palleronia*, includes the species *Palleronia marisminoris*, a moderate halophilic species isolated from the Mediterranean coast of Spain. The dedication recognizes Palleroni's extensive contributions to microbiology, including the introduction of molecular approaches to the taxonomy of bacteria, a new system of classification of *Pseudomonas* species, and the design of original isolation methods for members of various microbial groups. In addition to the new genus, three species have previously been named in Palleroni's honor: *Hydrogenophaga palleronii* (an autotrophic hydrogen bacterium capable of fixing carbon dioxide using the energy of hydrogen oxidation and originally named *Pseudomonas palleronii*); *Actinoplanes palleronii* (a rare actinomycete that has motile spores); and *Pseudomonas palleroniana* (a heterotrophic bacterium isolated from rice).

Continued from page 7: Conferences, Seminar, Symposia

Costa Vetriani:

"MIP: Physiology and Molecular Ecology of Thermophilic Nitrate-Reducing Microorganisms at Deep-Sea Hydrothermal Vents". Microbial Observatories/Microbial Interaction and Processes Principal Investigators' Meeting and Workshop, Washington, DC, March 1-3, 2007.

"Microbiology of Deep-Sea Vents: A View of Ancient Microbial Processes". Theobald Smith Society, New Jersey Branch of the American Society for Microbiology, Rutgers University, Piscataway, N.J. December 7, 2006.

"Microbial Diversity of Deep-Sea Reducing Environments: Hydrothermal Vents and Cold Seeps". Columbia Earth Microbiology Initiative, Workshop on Subsurface Microbiology, Lamont-Doherty Earth Observatory, Palisades, NY, November 15, 2006.

"Introduction to the IMAX Movie Volcanoes of the Deep-Sea", for the Sixth Grade MARE Workshop. Jacques Cousteau Coastal Education Center, Tuckerton, NJ. July 30, 2006.

"Volcanoes and Bacteria at the bottom of the ocean". Department of Biology, University of Rome III, Rome, Italy. September 26, 2005.

We are updating our contact list - please email me any changes in address and email to: maguire@aesop.rutgers.edu

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