



Department of Biochemistry & Microbiology Newsletter Cook College

The Lipman Log

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Max M. Heggblom and Kathy Maguire, Co-Editors

July, 2003

Greetings from the Chair: Alan D. Antoine

To all of our alumni and friends, this is the Department's premier issue of *The Lipman Log* and is being sent to you with our warmest greetings and best wishes. In the recent years past, the department has added new faculty to our family including our newest member, Dr. Costantino Vetriani (deep-sea microbial ecology), and Dr. Lori White (molecular toxicology of environmental dioxins), Dr. Tamar Barkay (microbial ecology and geochemistry of mercury transformations) and Dr. Max Heggblom (microbial transformations of halo-

genated aromatic hydrocarbons). The faculty number fifteen and continue to earn distinguished awards and honors. Finally, the faculty continue to be promoted. This year, Dr. Max Heggblom was promoted to Professor I and Dr. Tamar Barkay was promoted to Associate Professor.

An External Review of the department was undertaken in the Spring of 2002 and the results were very positive. These include our future plans for recruitment of a department chair and new faculty hires, partially associated with the Genomics and Proteomics

Initiative, and the finalization of the proposed Graduate Program in Microbiology. The department was recognized for its central role as a Cook College core multidisciplinary facility both in undergraduate and graduate education fields. Our staff are great and support us always in these developing areas. While our achievements continue, the challenges get bigger and tougher. Welcome back to our family and the first edition of *The Lipman Log*.

Fenton Seminar in Applied Microbiology: Sir David Hopwood "The *Streptomyces coelicolor* genome sequence: Insights into life in the soil"

The Actinomycetes have held a special place in the Departmental research agenda since Selman Waksman wrote his treatise (MS, 1916), and in 1939 developed his directed antibiotic screening program. This novel approach yielded 14 Actinomycete antibiotics including actinomycin, streptothricin, streptomycin, neomycin and candicidin. Thus it was a special pleasure to welcome Sir David Hopwood, FRS to discuss his life long study of these filamentous bacteria. His team recently sequenced and published the first Streptomyete genome, that of *Streptomyces coelicolor*. Its chromosome is distinctive in being linear, and there is also a large linear plasmid. The chromosome has a central core containing essential

housekeeping genes. The two flanking arms tend to contain genes that code for enzymes that are advantageous a soil microbe such as cellulases. The genes for the synthesis of secondary metabolites (lipids, pigments, siderophores), are in clusters similarly located. The genome picture was that of a microbe well adapted to the soil environment. Furthermore the Actinomycetes will continue to be a treasure trove for further useful metabolites. The seminar was supported through the Linda and Dennis Fenton Fund.



January 16, 2003. Drs. David Hopwood and Boyd Woodruff.

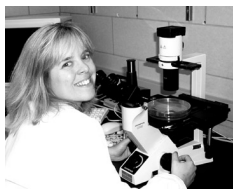
Dr. H. Boyd Woodruff, co-discoverer of actinomycin 1940, and Sir David Hopwood in discussion in the newly renovated Waksman Soil Microbiology Laboratory, the site of discovery of streptomycin by Albert Schatz, Betty Bugie and Selman Waksman

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Faculty Laboratory Profile

The Department of Biochemistry and Microbiology welcomes our two newest members Drs. Lori White and Costantino Vetriani.



The focus of my laboratory is to investigate the molecular mechanisms of xenobiotic exposure and to link these molecular changes to xenobiotic-induced pathologies. The polycyclic aromatic hydrocarbon (PAH) 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is a byproduct of industrial combustion processes. Exposure results in a variety of pathologies in humans, including alterations in the immune and neurological systems, liver dysfunction, and increases in bladder and skin cancer. It is believed that these pathologies are mediated by TCDD binding to the AhR (aryl hydrocarbon receptor) which heterodimerizes with Arnt to function as a transcription factor and alter gene expression. Although this pathway has been well characterized, it is unclear how TCDD activation of the AhR pathway results in the pathological effects of exposure. Using skin as a model system, we aim to identify the molecular pathways that are involved in mediating PAH-induced pathologies, and to better understand the role these chemicals play in skin carcinogenesis. One area of interest is to identify biologically relevant targets of the AhR/Arnt pathway. To this end, we have shown that exposure to TCDD results in an increase in expression and activity of matrix metalloproteinases in normal human keratinocytes. These enzymes mediate the degradation of the extracellular matrix and basement membrane proteins during processes of tissue remodeling and cell migration, and inappropriate expression of these enzymes is associated with tumor metastasis. Another project is aimed at understanding the regulation of an AhR responsive gene, cytochrome p-450 1B1 (CYP1B1). CYP1B1 is a monooxygenase that metabolizes xenobiotic compounds and endogenous steroids to

carcinogenic compounds. We have recently found that expression of this gene is influenced by cell-cell interactions in murine keratinocytes. By utilizing both human and mouse model systems, we aim to gain a better understanding of the molecular mechanisms that are important for PAH-induced carcinogenesis in skin. **



Research in my laboratory is focused on: i) the diversity, ecology and evolutionary relationships of deep-sea prokaryotes, with an emphasis on deep-sea hydrothermal vents and cold seeps, and ii) the microbial adaptations to extreme environmental conditions (e.g., thermophily, psychrophily). More specifically, we work on the isolation and characterization of novel organisms from deep-sea environments, with an emphasis on thermophilic Archaea and Bacteria, and we look at community dynamics along chemical and physical gradients at deep-sea vents and cold seeps. Our experimental strategies include standard approaches in marine microbiology, such as enrichment cultures/isolations, and molecular ecological approaches, such as PCR, library construction and screening, sequencing, DGGE, and FISH. Furthermore, in collaboration with biochemists, we use genetic engineering and biochemical approaches, combined with comparative protein structure modeling, to study the evolutionary adaptive features that allow microorganisms to thrive in the extreme environmental conditions found in the deep-sea (e.g., extremely high temperature found at deep-sea vents). We believe that the integration of multiple approaches is critical to understand the ecology and evolution of deep-sea microorganisms.

FACULTY NEWS

FACULTY HONORS AND AWARDS

Alan Antoine is the recipient of the 2002-2003 Academic Professional Excellence Award for Outstanding Undergraduate Advisor. This award is presented to a faculty or administrative staff member who has made an exceptionally conscientious effort in advising Cook College undergraduates and/or student organizations for a period of at least 5 years.

Douglas E. Eveleigh was invested as the D. and L. Eveleigh and D. and L. Fenton Chair in Applied Microbiology.

Max M. Hågblom received the Cook College NJAES Award for Sustained Research Excellence.

Peter Kahn was awarded the Warren I. Sussman Award for Excellence in Teaching.

Books and Publications:

Hågblom MM, Bossert ID (Editors) (2003). Dehalogenation: Microbial Processes and Environmental Applications, Kluwer Academic Publishers, Boston.

Benyehuda, G., J. Coombs, P.M. Ward, D. Balkwill, and **T. Barkay**. 2003. Metal resistance among aerobic chemorganotrophic bacterial isolates from the deep terrestrial subsurface. *Can. J. microbial.* 49:151-156.

Barkay, T., S. Miller, and A.O. Summers. 2003. Bacterial mercury resistance from atoms to ecosystems. *FEMS Microbiol. Rev.* 27:355-384.

Research Projects:

Arctic Microbiology
The Arctic Microbiology research program (Principal Investigator: Max Hågblom) funded by The Finnish Technology Agency Tekes is coordinated under the framework of the "Arctic Microbiology Research Consortium ARMI", a collaborative effort between the Rovaniemi Economic Development Agency, The Finnish Forest Research Institute, Rutgers University and the University of Helsinki. The overall goal of the research project is to explore and prospect the microbial diversity of arctic soils and sediments, with the potential for discovery of new microorganisms, biochemical pathways, genes and enzymes for applications in bioremediation, biotransformations and biocatalysis.
For more information, see:
<http://www.rovaniemi.fi/armi>

Dr. Tamar Barkay had two projects funded: The National Science Foundation/Biocomplexity Program will support a project on "Atmospheric deposition, transport, transformations and bioavailability of mercury across a northern forest landscape". This study, to be performed in the Adirondacks, is a 5 years collaboration with scientists from Syracuse University, Clarkson University, and UMass Lowell, and The Department of Energy/NABIR Program will support a study on importance of mobile genetic elements and conjugal gene transfer for subsurface community adaptation to biotransformation of metals. This is a three years study carried out in collaboration with scientists from the University of Copenhagen and University of Colorado.

Peter Kahn gave a talk at the Mid-Atlantic Regional Meeting of the American Chemical Society and recently at the Univ. of Toronto titled "On the Role of Buried Charge in Protein Stability."

Posters and Invited Seminars by Faculty & Students

Several students and postdocs from the Department presented their research at the ASM 103rd General Meeting

RL Kaletsky, AD Chatziefthimiou, M. A. Fleming, and T. Barkay: Isolation and Initial Characterization of novel organomercurial lyases

JM Coombs, T Barkay: Lateral transfer of metal homeostasis genes: a comparison between surface bacteria and isolates from deep terrestrial subsurface.

A Uzelac, DE Eveleigh, JK McCarthy: Virtual site-directed mutagenesis of an evolved glucan glucohydrolase from *Thermotoga neapolitana* to access structure-function relationships of the enhanced enzyme.

J Kist, DE Eveleigh, M M Haggblom: A Century of Microbiology at Rutgers (1901-2001) - growing from the ground up.

DE Fennell, I Nijenhuis, SF Wison, SH Zinder and MM Haggblom: Dehalogenation of halogenated aromatic compounds by *Dehalococcoides ethenogens* strain 195 in pure and mixed cultures

JW Voordeckers, MM Haggblom CL Van Dover, C Vetriani -Phylogenetic and functional analysis of microbial communities associated with active black smokers at Mid-Atlantic, Ridge hydrothermal vents.

AJ Reed, RA Lutz, CI Van Dover, and C Vetriani: Diversity community structure and vertical zonation of sedimentary bacteria and archaea from the base of the Florida Escarpment, Gulf of Mexico.

MI Cruz, R Jacobi and GJ Zylstra: Genetic analysis of phenylalanine and tyrosine catabolism by *Burkholderia cepacia* DB01.

CA Kachel, RJ Giannone, RE Parales, GR Johnson, JC Spain and GJ Zylstra: Nucleotide sequence analysis of the *Burkholderia* sp. strain DNT large catabolic plasmid for dinitrotoluene degradation.

HK Chang and GJ Zylstra: Directed evolution of *Comamonas testosteroni* GZ39 m-hydroxybenzoate hydroxylase for the synthesis of 4-substituted catechols.

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The following students were awarded their doctoral degrees:

Gazala Khan-Kotchia, PhD 2003. Microbiology and Molecular Genetics. Molecular characterization and homology modeling of the three-dimensional structure of *Thermotoga neapolitana* N-acetylglucosaminidase. **Advisor: D. Eveleigh**

Lynda L. Perry, PhD 2003. Molecular and Biochemical analyses of p-Nitrophenol Degradation by *Arthrobacter* sp. Strain JS443. **Advisor Gerben J. Zylstra**

Ray Sullivan, PhD 2003. Microbiology and Molecular Genetics. Purification and characterization of highly thermostable family 1 β -glycosidase from a newly isolated *Fervidobacterium* sp. From Yellowstone National Park. **Advisor: D. Eveleigh**

James (Flip) McCarthy, PhD 2002. Microbiology and Molecular Genetics. Directed evolution of 1,4 β -D-glucan glucohydrolase from *Thermotoga neapolitana*: tracking improvements in catalytic efficiency by thermostable coupled enzyme assay derived from *Thermotoga maritima*. **Advisor, Douglas Eveleigh**

Hudan Safarpour, PhD 2001. Capillary electrophoresis of the imidazolinone herbicide imazomox and its metabolites in environmental matrices. **Advisor: S. Katz**

Bongkeun Song, PhD 2000. Environmental Science. Diversity of bacteria capable of degrading halobenzoates under denitrifying condition. **Advisor: M. Haggblom**

Dinesh Yernool, PhD 1999. Microbiology and Molecular Genetics. Molecular and functional analysis of a hemicellulase gene cluster from *Thermotoga neapolitana*, A Marine Hyperthermophile. **Advisor: D. Eveleigh**

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The following students were awarded their master degrees:

Jedd Hilligrass, MS 2003. Environmental Science. Determination Of New Jersey-Specific Soil Contaminant Bioaccumulation Factors For Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyls, And Heavy Metals Using The Earthworm, *Lumbricus Terrestris* L. **Advisor: Keith Cooper**

Deborah A. Boni, MS 2001. An evaluation of *in vitro* release rates and kill effectiveness of four terconazole product dosage forms against *Candida albicans*, the primary causative agent of vulvovaginal candidiasis. **Advisor: Stan Katz**

Jayeeta Dutta, MS 2000. Microbiology and Molecular Genetics. Isolation and characterization of polycyclic aromatic hydrocarbon degrading bacteria from the rhizosphere of salt marsh plants. **Advisor: M. Haggblom.**

Scholarships

Jane Pavlik is the 2003 holder of the *Hamo Hachnasarjian Scholarship* for \$1000.

Ruyang Han and **James Voordecker** are the recipients of the H. Boyd Woodruff Microbiology Fellowship at Cook College

Priya Narasingarao and **Piyapawn Som-samak** were awarded the NJ Water Resources Institute Fellowships.

Jeffra Schaeffer was awarded the *NY Farmers Scholarship* for \$1000.

James Voordecker is the 2004 holder of the *Hamo Hachnasarjian Scholarship* for \$1000.

Visiting Scientists at the Department

The Department had several visitors during the fall and spring. **Sehanat Prasongsuk**, a visiting graduate student from Bangkok, Thailand, who is studying the black yeast, *Aureobasidium pullulans*. Sehanat is both characterizing isolates of this yeast, and also considering approaches to optimize their production of its gum, pullulan. His program include a second stint (August through to February) with Dr. Eveleigh. Sehanat is studying under the direction of Professor Hunsu Punnapayak, Chulalongkorn University, the oldest Thai university and named by King Vajiravudh after his father. If you have isolates of black yeasts, Sehanat will be pleased to hear of them.

Dr. Liliane Ruess from the Institute of Zoology, Technical University of Darmstadt, Germany visit Dr. Högblom's laboratory in January-February, 2003. Dr. Ruess is investigating cellular lipid and ¹⁵N-flux in soil food webs. At Rutgers she analyzed the fatty acid patterns of neutral lipid and phospholipid fatty acids of different members of an experimental food web. Her study is providing insight into the lipid metabolism of springtails, the changes due to variations in dietary nutrient supply, and the use of fatty acids as biomarkers in food web analysis.

Spring 2003 NJAES Distinguished Lecture Series:

Jan. 29: Kent Kirshenbaum, Department of Chemistry -New York University
"Hacking Codes: Rewriting the Genetic Code, Developing New Folding Codes"

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Feb. 12: David E. Ellis DuPont Engineering -CRG
"Bioaugmentation of contaminated aquifers for biodegradation of chlorinated ethenes and molecular techniques for tracking Dehalococcoides ethenogenes".

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Feb. 19: Jeanne Poindexter, Biological Sciences - Barnard College, Columbia University
"ssRNA Bacteriophage Infections: Gentle viruses, tolerant hosts."

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Feb. 26: Thomas Silhavy, Molecular Biology, Princeton University
"Coping with External Stress"

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Mar. 5: Daniel Van der Lelie, Biology Department, Brookhaven National Lab
"Analysis of microbial community composition and functional: classical methods and new potential approaches under development"

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March 12: Dittmar Hahn, Department of Chemical Engineering, New Jersey Institute of Technology (NJIT) and Department of Biological Sciences, Rutgers University
"Interactions among purple sulfur and sulfate-reducing bacteria in the chemocline of meromictic Lake Cadagno, Switzerland"

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Mar. 26: Allen E. Silverstone
Dept. of Microbiology & Immunology, SUNY Upstate Medical Center
Cell and molecular mechanisms by which dioxins and estrogens affect immune cell development and function

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Apr. 2: Mary Lowe, Physics Department, Loyola College in Maryland
"Multiplexed Identification and Quantification of Environmental DNAs on Bead Surfaces using Flow Cytometry"

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Apr. 9: Brad Hillman, Plant Pathology - Rutgers University
"Viruses and transposons of Cryphonectria parasitica: Tools for biological control and study of an important plant pathogenic fungus"

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Apr. 16: Ilya Muchnik, Computer Science, Rutgers University
Quasi-convex Combinatorial Clustering in Exploratory Data Analysis and Bioinformatics

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Apr. 23: Jim White, Plant Pathology, Rutgers University
"Clavicipitalean Endophytes and Epibionts: An Examination of Life Cycle Variations and Ecological Impacts."

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Apr. 30: Peter Oudemans, Plant Pathology, Rutgers University
Investigating plant disease and crop stress through satellite remote sensing and GIS



Dolph Klein (Ph.D 61), kledolph@acpub.duke.edu

Duke (1974 to present). I am proud to have been associated with Robert L. Starkey, Head of Soil Microbiology, and David Pramer, my mentor. Being at Rutgers University was an experience that I will always cherish.

Frank Ritacco (MS 196) ritaccf@wyeth.com

I am a research microbiologist at Wyeth Pharmaceuticals, Natural Products Microbiology, Pearl River, NY. I work mostly in the isolation, fermentation, and taxonomy of *Streptomyces* and other actinomycetes. I spent four undergraduate years at Cook College, followed by a great couple of years working towards my M.S. with Dr. Mac in Lipman Hall, ~1993-1996. I remember fishing on Mac's boat, Friday Fermentation seminars, and drinking a lot of beer. (There were always a few cases in the cold room, and sometimes a keg or two.) I was a T.A. for Dr. Eveleigh's General Microbiology and Dr. Mac's Applied Microbiology classes. The grad students all worked hard and knew how to have a good time with no money and a thesis project hanging over their heads. We had a great family in Lipman Hall, and those were great times.

Alumni Connection

Please pay us a visit and share your thoughts:

<http://www.cook.rutgers.edu/~dbm/aboutus.html>

Cook College

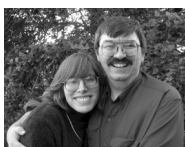
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What's Shaking?

The Department welcomes a new staff member, Jessie Maguire. Jessie is support staff for the Biochemists and financial assistance for the Department.



Wedding bells are ringing for John Hunter and Jonna Coombs, the wedding date is August 9th, 2003, and it will be held in Danforth, Maine

Good things come in threes - Lori White and Kevin Tritz, Jeffra Schaeffer and Joseph Ferris are engaged, too!

Eileen Glick, Peter Anderson and Arleen Nebel are celebrating 15 years with the Department

As of July 1, 2003, Stan Katz will be celebrating 45 years in the Department...

Two undergraduate students who have been with us for a long time have graduated in May. Rachel Kaletsky will join graduate school at UPenn in September and CJ Asakiowicz is heading off to law school. Jane Yagi will be leaving at the end of July in preparation for graduate school at Cornell in the Fall...

As always, the Applied Micro class fermentation products were excellent. We were fortunate enough to have an expert panel of judges to evaluate the beer including Emelia Rus, Jane Pavlik, Mike Fleming and Gavin Swiatek. The coveted golden *Petri Dish & Inoculating Loop* were awarded to the top brew in each section. Shown below are the gold, silver and bronze awards and the happy winners from Section 1. **Congratulations to the class and many thanks to our Judges!...**

