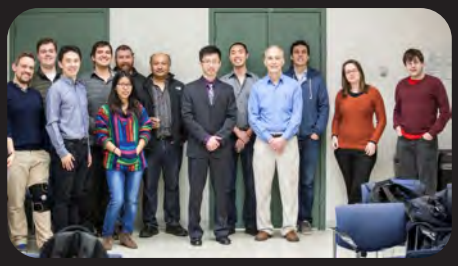
# The Lipman Log

**2016**

J. Boyd & Zuelay Rosario-Cruz

Kennida Polanco Espinal



## News from the Chair, Max Häggblom

Greetings from Lipman Hall! This issue of the Lipman Log includes highlights from the 2015-2016 academic year. We hope that you will enjoy reading about the activities and accomplishments of our students, faculty and staff. It is always a delight to follow the achievements of our undergraduate and graduate students, who are engaged in diverse exciting research projects with our faculty members. In this issue you can read more on the latest Ph.D. and M.S. theses, the awards our students have received and about their other activities.

It is our distinct pleasure to congratulate Dr. **Yana Bromberg** on her promotion to Associate Professor with tenure. She has established herself as a leader in bioinformatics and computational biology. Read about her exciting research program in elucidating biological functions on page 3. Her long-term goal is to understand how biological functionality is encoded in genomic data, whether by a single gene, a genome, or a metagenome. Her research is focused on interrogating biological data through an informatics lens. In particular, she comes up with novel approaches for elucidating the details of biological function hidden in genomic and metagenomic sequences. Dr. Bromberg received the Board of Trustees Research Fellowship for Scholarly Excellence for 2016 as one of Rutgers University's distinguished young faculty members. Furthermore, she was recently awarded a National Science Foundation Career Grant "Molecular functional diversity of microbes and microbiomes" and a National Institute of General Medical Sciences grant "AVA, Dx: Analysis of Variation for Association with Disease".

Rutgers has recently adopted a new set of titles for Non-Tenure Track Teaching faculty. Non-tenure track faculty fill critical roles in the teaching, research, and engagement missions of the School of Environmental and Biological Sciences. NTT faculty are essential to meeting the programmatic needs within our department and complement the efforts of the tenured and tenure-track faculty. Thus, it our pleasure to congratulate Dr. **Diane Davis** on her promotion to Associate Teaching Professor. Diane has over the last 20 years made significant positive contributions to the department, to SEBS, and to Rutgers University through her excellence in teaching and teaching scholarship, as well as service and outreach to Rutgers and the broader community. She has been a driving force and initiator of the expansion of microbiology education at SEBS (see page 4). Dr. Davis is a "mover-and-shaker" of microbiology by constantly seeking to generate new opportunities for our students, maintaining high standards of instruction, and nurturing students and faculty. We are further delighted by the promotions of Dr. **Ines Rauschenbach** and Dr. **Kyle Murphy** to the rank of Assistant Teaching Professor. Ines and Kyle are inspiring and dedicated instructors and this recognition is well deserved.

Additional faculty accomplishments to note include the naming of Associate Professor **Ning Zhang** as a Chancellor Scholar and the election of Distinguished Professor **Tamar Barkay** as a Fellow of the American Association for the Advancement of Science.

Our annual **Microbiology Symposium** (page 2) continues to bring faculty and students from across Rutgers together to hear about the most recent advances in microbiology research. The symposium includes a keynote speaker (one of our alumni), short talks by current faculty and poster presentations by our graduate and undergraduate students and postdocs.

Rutgers Day-AgField Day continues to be a wonderful opportunity to reach out to our alumni, friends and community. Our program theme is "Boisterous Biochemistry and Marvelous Microbiology" and our undergraduate and graduate students coached budding scientists in the wonders of biochemistry and microbiology, including the "Cheese or Feet?" activity: Can you really distinguish between the aroma of a gourmet cheese and a dirty sock?

Finally, I wish to thank all our donors!! Your contributions provide important student scholarships, awards and travel fellowships and support our Fermentation Club seminar series. The Cuskey and Eveleigh Graduate Student Travel Awards that we established two years ago continue to provide much needed support for our students to travel to national and international conferences to present their work, network, and learn. We hope that you will continue to show your support for the department and our scholarly programs in the future. Our next "grand target" is the Douglas E. Eveleigh Endowed Graduate Fellowship to support incoming students in the Microbial Biology Graduate Program. Please see the back page on how you can contribute.

**Editors: Max M. Häggblom, Jeffrey M. Boyd, Doug E. Eveleigh and Kathy Maguire**
Department of Biochemistry and Microbiology · School of Environmental and Biological Sciences
Rutgers, The State University of New Jersey · Lipman Hall · 76 Lipman Drive · New Brunswick, NJ 08901-8525
Tel: 848-932-9763 | Fax: 848-932-8965 | Website: dbm.rutgers.edu | Facebook : https://www.facebook.com/RutgersDBM

# Microbiology at Rutgers University: 2016 Symposium

## *Cultivating Traditions, Current Strength, and New Frontiers*



**Thursday, February 25, 2016**

Welcome: **Robert Goodman**, Executive Dean of the School of Environmental and Biological Sciences
History: **Magda Gagliardi** (a veteran of the Lechevaliers' laboratory) "Recalling the humor and sensitivities of a truly renaissance couple, Midge and Hubert Lechevalier":

Keynote presentation: **Daniel L. Distel,** PhD, Director Ocean Genome Legacy Center of New England Biolabs at Marine Science Center, Northeastern University. Dr. Distel is a 1979 Cook College graduate, with a B.S. in Biology.
**"How to eat a tree: Lessons from a Bacteria-Bivalve Symbiosis"**

**Friday, February 26, 2016**:

**Session I: Metals: you can't do with them; you can't do without them** - Convener: Eric Klein (Biology, Camden)
9:00 Gloria Marcela Rodriguez (Public Health Research Institute Center and New Jersey Medical School, Newark) "How *Mycobacterium tuberculosis* handles the iron problem"
9:30 Kim Thamatrakoln (Marine and Costal Sciences, SEBS): "Molecular underpinnings of diatom silicification: Implications for silicon biogeochemistry in the ocean"
10:00 Jeff Boyd (Biochemistry and Microbiology, SEBS): "Reexamining the mechanisms of copper detoxification in *Staphylococcus aureus*"

10:30-11:00 Break (Coffee/Tea)

**Session II: Pathogens: Learning how to win a fight** - Convener: Yana Bromberg (Biochemistry and Microbiology, SEBS)
11:00 Marila Laura Gennaro (Public Health Research Institute Center, Newark): "An old/new mechanism of surface stress response in *Mycobacterium tuberculosis* "
11:30 Stephen Burley (Chemistry and Chemical Biology, SAS): "Structural biology of Carbapenem resistance"
12:00 Huizhou Fan (Robert Wood Johnson Medical School): "GrgA: A key regulator of *Chlamydia* physiology and potential antichlamydial target"

12:30 – 2:00 pm Lunch and Poster Session

**Session III: Microbes sensing and interacting with their environments** - Convener: Tamar Barkay (Biochemistry and Microbiology, SEBS)
2:00 Kwangwon Lee (Biology, Camden): "Natural variations and fitness of the circadian rhythms in *Neurospora*"
2:30 Donna Fennell (Environmental Sciences, SEBS: "Microbes meet the atmosphere"
3:00 Lee Kerkhof (Marine and Costal Sciences, SEBS): "Sampling the lung microbiome"

3:30-4:30 pm Poster Session

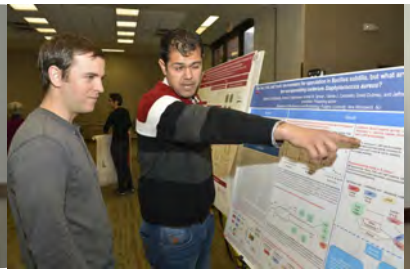
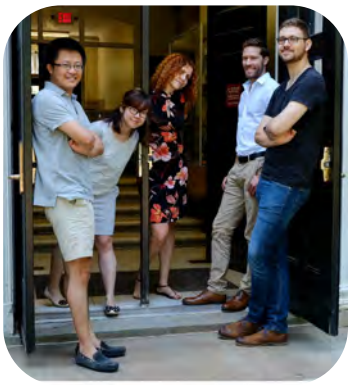
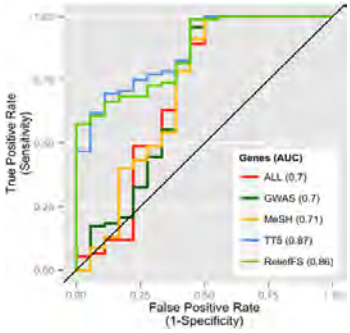



Photo credit: Peter Anderson

# Yana Bromberg - Bioinformatics of Molecular Function

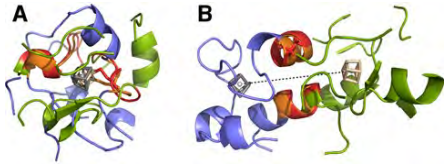


The past year has been very productive for the Bromberg lab. In early 2015, Yana secured funding (Informatics Research Starter Grant, $100,000, 1/2015-12/2015) from the PhRMA foundation to develop new computational methods for improving our understanding of complex human diseases. She used the funds to purchase necessary equipment and to recruit a new graduate student, Yanran Wang, to the lab. In the next months, Yanran had collected the encouraging preliminary data that Yana leveraged to secure funding (R01 grant $1,475,896 total, 2015-2020) from the National Institutes for General Medical Sciences (NIGMS) to continue the project and to develop AVA, Dx (Analysis of Variation for Association with Disease), a novel computational method that uses predictions of functional effects of genome variants in disorder-specific genes to predict individual disease susceptibility. The project has already resulted in three publications and a number of invited talks, including two keynotes (Joint Genome Informatics Workshop and International Conference on Bioinformatics 2015 conference in Tokyo, Japan and the MidSouth Computational Biology and Bioinformatics Society annual conference in Little Rock, AR). Currently, the AVA,Dx work is carried out by Yanran and Max Miller, another Ph.D. student in the Bromberg Lab. Yana is currently working on recruiting two postdocs to the project.




Computational identification of CD genes.

Incidentally, Max was recruited to the lab through Yana's appointment as a fellow in the Institute for Advanced Study in the Technical University of Munich (TUM-IAS Hans Fischer Fellowship for Outstanding Early Career Scientists, €170,000, 2014-2017). This work, carried out by two Ph.D. students in the lab – Yannick Mahlich and Chengsheng Zhu, aims to develop new computational algorithms for the exploration of the microbial world and has recently produced a number of publications. More importantly, however, it helped Yana receive a prestigious Faculty Early Career Development Program (CAREER, 2016-2021) award from the NSF. The project, "Molecular functional diversity of microbes and microbiomes," is being supported by $1,091,177 in NSF funding. This work goes further to help us to better understand emergent biological functionality of microbes and microbiomes. Additionally, under the auspices of the CAREER award, Yana will develop new hands-on classes in bioinformatics to be taught at Rutgers and internationally, as well as in a high school and in a community lab space. An additional Ph.D. student was recently recruited to the project from the newly formed Rutgers graduate program for Quantitative Biology. Yana is also looking for another postdoc to accelerate the pace of discovery.

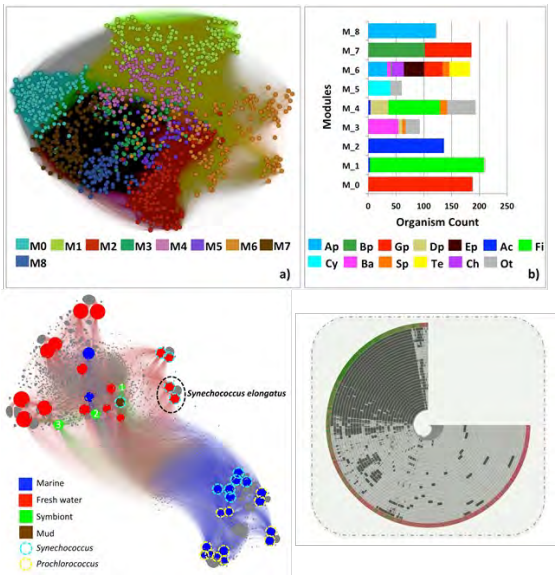



Recognizing functional similarity in structural alignments.

Overall, under Yana's leadership, since 2015 the members of the Bromberg lab have given 23 invited presentations and published eight papers. Starting this year, Yana is also the newest (and youngest) member of the Board of Directors of the International Society for Computational Biology (ISCB) and a chair of numerous scientific meetings. Yana was recently awarded the Rutgers Board of Trustees Research Fellowship for Scholarly Excellence (2016) and the Theobald Smith Society Young Investigator Award (2016). For her contributions to science and teaching and service accomplishments, Yana was also promoted to the rank of Associate Professor with tenure this year.

**NIGMS.** Every person is genetically predisposed to a number of disorders that could significantly affect their span or quality of life. One in four adults in the United States is diagnosable with a mental illness in any given year. Autoimmune disorders and chronic obstructive pulmonary disease affect one in ten people, each. Despite all research efforts, however, genetic causes of these and other complex diseases remain elusive. We propose to develop AVA,Dx (Analysis of Variation for Association with Disease), a novel computational method that leverages predictions of functional effects of genome variants in disorder-specific genes to predict individual disease susceptibility. We will demonstrate proof of concept functionality of our method using the genetic and clinical data from Tourette disorder, Crohn's disease, and chronic obstructive pulmonary disease patients and their families. AVA,Dx will motivate new experimentally testable hypothesis regarding the biological mechanisms of various diseases and provide a means for earlier prognosis, more accurate diagnosis and the development of better treatments.

**NSF.** Microbes dominate life on Earth and evolutionary pressure exerted on microbial communities by environmental stressors such as climate change and pollution have global impact. Understanding the environment-specific microbial molecular functions is, therefore, a critical challenge. Under the auspices of this project, the Bromberg lab will computationally analyze existing microbial genomic data using a new metric of whole organism molecular function similarity. Such a function-based approach will offer a powerful new way of annotating the world's microbial functional diversity, allowing selection of environmentally optimized functionality. Applied to the influx of new "-omic" data, that approach will offer a wealth of functional data to guide further experimental research. The tools will be publicly accessible, providing a cheap, efficient and accurate way to extract previously inaccessible meaning from the existing and newly sequenced microbial genomic data.




Function-based classification for an understanding of the microbial world.

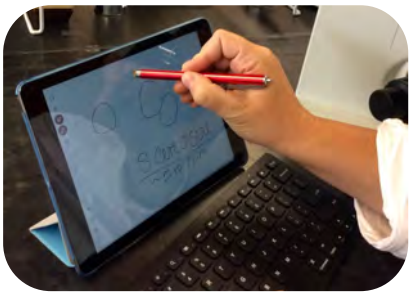
# 20 Years of Undergraduate Teaching in Microbiology: Building and Growing

The department of Biochemistry and Microbiology has a rich history that includes breadth and depth in undergraduate teaching. Over the past 20 years undergraduate teaching in the discipline of microbiology at Rutgers has grown by many metrics, building on this strong foundation. Enrollment in ***General Microbiology*** has doubled over the past 10 years. Currently 21 sections of *General Microbiology Lab* are taught annually during the fall, spring and summer sessions. *General Microbiology* is team-taught; Tamar Barkay, Costa Vetriani and Diane Davis share the lecturing, while Ines Rauschenbach coordinates the labs.

Microbiology became an undergraduate major in 2005. With a new major came new courses for majors building on *General Microbiology*, ***Applied Microbiology***, currently team-taught by Max Häggblom lecturing and Ines Rauschenbach coordinating the lab, and ***Microbial Ecology and Diversity*** lab and lecture courses (formerly *Microbial Ecology*, a single course with lab and lecture components). Tamar Barkay teaches both Microbial *Ecology and Diversity* courses. This summer graduate student Ashley Grosche, working with Tamar is wholly updating *Microbial Ecology and Diversity Lab*. New courses that have been developed for the microbiology major include the following: ***Analytical Methods in Microbiology*** an upper level lab-intensive course developed and taught by Max Häggblom; ***Microbial Genomics*** currently taught by Gerben Zylstra; ***Microbial Ph***ysiology, an intensive course integrating biochemistry and genetics to enhance the understanding of the microbial cell taught by Jeff Boyd, ***Seminar in Microbiology*** lead by Costa Vetriani, where students discuss current issues in microbiology and by doing so develop effective written and oral communication skills, and critical and analytical thinking, and ***Ethics and Issues in Microbiology*** lead by Diane Davis, focusing on ethical conduct and scientific integrity in the profession and practice of microbiology.

New courses have recently been added introducing microbiology to non-scientists and meeting the needs of non-majors needing training in microbiology. ***Introduction to Microbiology*** developed by Diane Davis, is a course for non-microbiology science majors that presents the basic principles of microbiology and examines the microbes that inhabit our planet and their effect on the biosphere. *Introduction to Microbiology* will be offered for the first time in spring 2017 and taught by Ines Rauschenbach. ***Living in the Microbial World***, developed and taught by Diane Davis, is an introductory course for the non-science student that aims to connect microbiology topics and concepts to the challenges of the 21st century. A successful summer study abroad course, ***The Microbiology and Culture of Cheese and Wine*** developed and taught by Max Häggblom on site in southern Burgundy, combines applied microbiology with socioeconomic and cultural history. This course has been reimagined by Diane Davis to showcase New Jersey as the new course ***Microbiology of Agricultural Products in New Jersey***. This three week summer course features trips to local cottage industries producing microbial products including wine, beer, cheese, bread and sausage. Both courses are in-depth studies of microbial fermentations for science majors.

In order for our microbiology teaching labs and teaching practices in be in line with 21st century technology and pedagogy several initiatives have been implemented. Over the past 10 years computers have been added to the teaching lab and continually updated. Currently there are 12 computers servicing students. A new emphasis has been placed on the safety of our students and staff working in the laboratory and, equally important, on biosafety education. Students leave our lab courses knowing the importance of safety and biosafety in ALL labs and have experience in implementing best lab practices as they continue on in future endeavors. Students in our *General* and *Applied Microbiology* laboratories as well as Microbial *Ecology and Diversity Laboratory* are now keeping electronic laboratory notebooks, taking quizzes, recording and sharing data, taking photographs, and making drawings, tables etc., on iPads. Currently we are using the LabArchives, a cloud-based platform to enable researchers to store, organize, and publish their research data, for maintaining laboratory notebooks. LabArchives is used by The National Institutes of Health and many major universities; we are the only department at Rutgers using LabArchives electronic notebooks in a teaching lab. With LabArchives students can access their notebooks and lab manuals from their own personal devices. The iPads remain in the lab, being used by a new group of students in each laboratory section. Survey data indicate that although there is an initial learning curve, over 75% of the class are enjoying the experience by the end of the course and recognized that the use of electronic notebooks in class was an opportunity preparing them for their future in science. The use of LabArchives facilitates also the grading of student lab work and the ability to supply feedback to the students. This computer initiative, begun by Diane Davis in 2005 continues to flourish through the hard work of she and Ines Rauschenbach. Over the years computer funding has been secured through grants from Rutgers Instructional Computing totalling more than $43,000.



Since 2005 websites, designed specifically for both *General and Applied Microbiology* laboratories by Diane Davis, have served as a resource for both undergraduate students taking the courses and the teaching assistants assigned to teach the lab sections. The course websites provide a myriad of diverse supplemental information, including PowerPoint presentations, rubrics, and "how to" presentations covering many topics including pipettor use, laboratory safety, and even a video describing how to sign up for LabArchives. The websites are now

Although microbiology labs must necessarily emphasize individual work in learning techniques; the value of team work is also highlighted with a student project involving in-class presentation of experimental results in poster format. Students apply scientific method from hypothesis to conclusion. Each team designs, performs and evaluates an experiment to test a team-proposed hypothesis and then prepares a poster on their findings and presents it to the class. This team project, originally developed by Diane Davis, has been recently very successfully updated by Ines Rauschenbach.

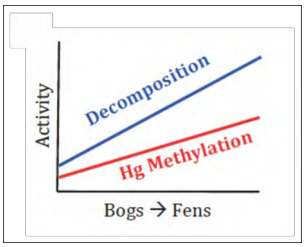
In the fall of 2015, Diane Davis introduced undergraduate learning assistants (LAs) as a part of our instructional team. The LA program at Rutgers is an innovative new program that engages undergraduates in classroom teaching and learning while helping them develop their teaching, leadership, and interpersonal skills. LAs must complete a 3-credit pedagogy course; attend weekly staff meetings with faculty as well as assist in classroom learning in a variety of ways including facilitating discussions and workshops during lectures, team teaching recitation or laboratory sections with a graduate teaching assistant, or independently leading supplemental study groups. Our learning assistants promote learning is several ways, facilitating discussions and workshops during lectures, and leading voluntary study groups. This is a great opportunity for our highest achieving microbiology majors. Currently LAs are leading study groups in *General Microbiology* and facilitating active learning during lecture in *Living in the Microbial World*.


## Our Faculty

**Ines Rauschenbach** was chosen to be a mentor for the second year for the ASM Science Teaching Fellowship program.

"I have had the opportunity to participate in the Science Teaching Fellowship that is offered through ASM. I had applied for this program to increase my knowledge and practice in course design as well as creating learning outcomes and assessment projects. After the workshops, for the first time, I had finally understood how to write good learning outcomes and create meaningful activities and assessments. The support and feedback that I had received was meaningful and motivating. The program instilled confidence that I can change the way that we deliver the content of a course to a more student-centered approach. Working closely with my teaching assistants, we have now created an inquiry-based learning environment and assessment has shown that students are better able to apply and explain concepts present in the lab. The best part of the program is that you not only learn more about assessment, learning outcomes, and course design, you become part of a teaching community."

**News from the Barkay Lab** — Our National Science Foundation Office of Polar Programs funded project examining how methylation of mercury is affected by global warming induced changes to wetlands in Alaska is in progress. In July 2015, Tamar and Haiyan Hu (a visiting scientist from China) joined a group of collaborators for two weeks of sampling wetlands in Alaska bringing back hundreds of frozen samples for molecular community analyses. These are analyzed for community structure, and presence and diversity of mercury transforming genes and their transcripts. The results are integrated with our collaborators' biogeochemical findings to reveal how pathways for mercury transformations and methylmercury accumulation are impacted by global climate change.



# Our Faculty

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# Our Faculty

## In Print, Continued


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Zhu C, Delmont TO, Vogel TM, **Bromberg Y** (2015) Functional basis of microorganism classification. PLoS Comput Biol 11 (8), e1004472.


## Awards/Grants/Activities

**Boyd, J.M.** (PI) "Examining the effect of blue light on the survival of *Propionibacterium acnes*." Johnson and Johnson Foundation, $45,000, 1/2016-12/2016.

**Bromberg, Y.** NSF Career Grant: "Molecular functional diversity of microbes and microbiomes", $1,091,177. Microbes dominate life on Earth. Evolutionary pressure exerted on microbial communities by environmental stressors such as climate change and pollution have global impact. Understanding the environment-specific microbial molecular functions is, therefore, a critical challenge. We propose to computationally analyze existing microbial genomic data using a new metric of whole organism molecular function similarity. Our function-based approach will offer a powerful new way of annotating the world's microbial functional diversity, allowing selection of environmentally optimized functionality. Applied to the influx of new "-omic" data our approach will offer a wealth of functional data to guide further experimental research.

**Bromberg, Y.** (PI) AVA,Dx: Analysis of Variation for Association with Disease. Building a computational pipeline for annotating disease predisposition from genome variants. National Institutes of General Medical Sciences (NIGMS), $1,475,896, 10/2015 – 09/2020

**Dismukes, G.C.** (PI) "Probing the Catalytic Core of Photosynthetic Water Oxidation, Atom by Atom" National Science Foundation – Chemistry of Life Processes, #1213772 $350,000 08/12 – 08/16.

**Dismukes, G.C.** (PI) "Revealing and applying the principles of water oxidation by oxygenic photosynthesis" Department of Energy – Basic Energy Sciences, $495,000, "09/13 – 08/16.

**Dismukes, G.C.** (PI), Greenblatt, M. and Garfunkel, R. (CoPIs) "Tunable Photoanode-Photocathode-Catalyst-Interface Systems for Efficient Solar Water Splitting" NSF-CBET/DOE-EERE $799,496, 09/2014 – 082017.

Lun, D. (PI) and **Dismukes, G.C.** (CoPI). **"**Computational and Experimental Systems Biology of Cyanobacterial Metabolism" National Science Foundation-MCB $762,364, 08/2015 - 07/2018.

**Dismukes, G.C.** (PI) "Robust Microalgal Production Strains for High Yield Growth on Fossil Fuel Gas: Toward Cost Effective Biofuels and CO2 Mitigation" Global Climate Energy Project-Stanford, $1,220,127, 10/2015-10/2018.

**Dismukes, G.C.** (PI) and Subramanian, P. (CoPI) EPR of metal doped molecular sieves", BASF-Chemical, Analytical Division, Iselin $69,665, " 07/14 –06/16.

**Häggblom, M.** (PI). Fate and Ecotoxicity of Pharmaceuticals and Personal Care Products, Emerging Contaminants in the Hudson River Ecosystem. Hudson River Foundation, $168,886, 9/15-8/17.

Lutz, R. A. and **C. Vetriani.** Vertex Pharmaceuticals VOICE Project Phase II: Deep-sea drug discovery from hydrothermal vents. December 1, 2015 - March 15, 2017. $343,201.

**Vetriani, C**., Giovannelli, D. and Foustoukos, D. Collaborative Research: Evolution of early metabolism: Carbon fixation, anaerobic respiration and ROS detoxification in the anaerobic vent bacterium, *Thermovibrio ammonificans*. National Science Foundation (Cellular Dynamics and Function, MCB). 08/2015 - 08/2018. $472,559 (Total award: $667,190).

Robb, F. T. and **Vetriani, C**. NASA Exobiology: Sentinel Microbes that Utilize Carbon Monoxide as Energy and Carbon Source. 07/2015 - 07/2018. $270,003.

Lutz, R. A. and **Vetriani, C.** Vertex Pharmaceuticals VOICE Project Phase I: Deep-sea drug discovery from hydrothermal vents. 05/2015 - 11/2015. $40,000.

**Sehanat Prasongsuk**, Chulalongkorn University, Bangkok, Thailand has recently been promoted to Associate Professor in Biotechnology with tenure. Sehanat held a joint graduate fellowship, Chulalongkorn and Rutgers Universities) Ph.D. 2003 - biopolymer production by the black yeast *Aureobasidium pullulans*. His outreach research program addresses the application bacterial and fungal biomass-degrading microbes including collaborative programs with Kyoto University (Japan), National Museum of Natural Science (Taiwan), University Putra Malaysia, and Mulawarman University, Brawijaya University and Institute of Technology Sepuluh Nopember (Indonesia). He received the Young Researcher Award from Kyoto University, Japan and has been recognized as Outstanding Faculty for Student Affairs at Chulalongkorn University (contact: Sehanat.P@chula.ac.th).

**Jennifer Rakeman** (B.S. Biotechnology. Cook College, 1994) is Assistant Commissioner, New York City Department of Public Health and Mental Hygiene. Her studies were recently highlighted in the Wall Street Journal monitoring the occurrence of Zika virus in the city. (http://on.wsj.com/2b3VrUp). Jen studied Jim Macmillan and Barbara Zilinskas (Plant Biology) and presented her Cook undergrad honors thesis "Purification of the B component of hemolysin BL from *Bacillus cereus* as expressed in protease-deficient *Escherichia coli*" at the Theobald Smith Society and the ASM 94th Annual Meeting. Following her Ph. D. University of Washington, 2001, Jenn worked at the University of Washington Medical Center and Montefiore Medical Center, NYC, before joining the NYC Department of Public Health, 2009 where responsibilities include consideration of meningitis, Ebola, plague and anthrax and other dastardly diseases. Her aunt, Judy Wilber (Ph.D. 1977), also studied with Jim Macmillan. Jen married Joe Cagno (Ph. D. 1990 with Stan Katz) and they have three children. Yeah for the Cook Honors Program.


**Kathy Maguire** retired this July, after close to three decades of service to Rutgers. Since Kathy joined the Department of Biochemistry and Microbiology in 1998, she has had a range of secretarial roles. She has played a leading role as secretarial assistant for, first, the Undergraduate Program in Microbiology and then also the new Graduate Program in Microbial Biology. She was instrumental in many other functions that service the whole department. Kathy spearheaded the idea for our annual news-letter, the Lipman Log, and has been the co-editor since its inception in 2003. Kathy has also been the force behind our Department Web-site.

It is Kathy's nature to take on any job, no matter how complex or how large. Speaking of large, Kathy has been a force behind the numerous symposia of national and international stature that we have organized: the 50th anniversary symposia of the discovery of Neomycin in 1999, the Centennial of the First Soil Microbiology Department in the country in 2001, plus the opening of the Waksman Museum in Martin Hall, in 2014 we had Sheer Fun - Microbiology with Professor Douglas Eveleigh, and since 2007 the Annual Rutgers Microbiology Symposium. Kathy has been the background leader in all of these meetings - from designing invitations, to programs, symposium dinners, hotel accommodations, indeed the total logistics of running a major symposium. In recognition of this excellence, Kathy received the 2008 School of Environmental and Biological Sciences Staff Recognition Award. Throughout her 28-year tenure at Rutgers, Kathy has exhibited exceptional creativity and resourcefulness. In addition, she has that special talent in being able to get personnel (even Professors) to respond positively in joint projects.

Kathy's work ethic and efficiency is superior. She has provided sustained service and has taken on major tasks well beyond those appearing in her job description. In all of these tasks she has exhibited exceptional creativity and resourcefulness. As we all know, Kathy has that special talent in being able to get personnel to respond positively in joint projects. We are indebted to Kathy in so many ways. She will be sorely missed. We wish her all the best!

**Zuelay Rosario-Cruz,** Microbial Biology (Ph.D. 2016)
Advisor: Jeff Boyd
**Insights into mechanisms of metal homeostasis in *Staphylococcus aureus***

*Staphylococcus aureus* is a human commensal and a leading cause of infections worldwide. Because pathogens like S. aureus face metal stress during host infection, they must find ways to maintain metal homeostasis. This work shows (i) a role for the low-molecular-weight thiol bacillithiol in iron-sulfur cluster biogenesis, and (ii) a role of a two-gene operon, encoded within a mobile genetic element, in preventing copper intoxication, providing insights into additional mechanisms of metal homeostasis in *S. aureus*.

**Xiao Qian**, Microbial Biology (Ph.D. 2016)
Advisor: G. Charles Dismukes
**From light to dark: Mapping fluxes of model Cyanobacteria for biofuel applications**

Cyanobacteria fix $CO_2$ and release $O_2$ under light. This process is believed to have created the oxygen rich atmosphere on the early earth. Now, scientists are using technologies to try to make cyanobacterial "cell factories" that produce valuable chemicals and biofuel. Accomplishing such ambitious redesign requires a comprehensive understanding of cyanobacterial metabolism under various conditions. To undertake this work I have constructed a mathematical model of primary carbon and energy metabolism for the whole organism to arrive at a system level in silico picture of how metabolism works in a cyanobacterium. I have then measured cellular metabolites quantitatively; both pool sizes and fluxes, under various photoautotrophic and dark anaerobic conditions to further validate and improve the predicted metabolic map. Additionally, using a genetically transformable cyanobacterium I have extended the measurements to a targeted mutant to further augment the data. Using this approach my work has shown these new features: (i) a gluconeogenesis-pentose phosphate hybrid pathway that converts fixed $CO_2$ into glycogen during photosynthesis; (ii) a combinational effect at two carbon flux distribution branching points that leads to the elevated intracellular glycogen content under N deprivation; (iii) a malic cyclic route that is critical for photosynthetic protein biosynthesis; and (iv) a mutant capable of producing dark fermentative H2 at a high rate even in the presence of nitrate.

**Ryan Rieder,** Microbial Biology (MS 2016)
Advisor: Sara Campbell
**The Influence of the gut microbiota on anxiety and depression**

The aim of my review was to examine the current literature related to (1) implication of the gut microbial community on central nervous system function and behavior, specifically of anxious and depressive like behaviors through examination of host stress response on microbes and the effect of the microbial community on the host stress response, and (2) to discuss alternative treatment options involving use of probiotics, antibiotics, and fecal transplants to combat depression and anxiety.

**Kennida Polanco Espinal**, Microbial Biology (MS 2015)
Advisor: Max Häggbom
**Microbial degradation of three novel bisphenols compounds**

The objective of this study was to evaluate the potential for biodegradation of three novel bisphenol analogs, which show chemical properties that made them suitable for substituting BPA in industrial usage/ Enrichment cultures using Arthur Kill sediment as inoculum degraded the three test compounds under methanogenic, sulfate reducing and aerobic conditions These data suggest that the new bisphenol analogs are biodegradable under anoxic and oxic conditions where BPA is recalcitrant.

**Ishita Jain,** Microbial Biology (MS 2015)
Advisor: Max Häggblom
**Characterization of the three distinct arsenic resistant microorganisms isolated from the agricultural soils of Mekong Delta in Vietnam**

An enrichment culture and cultivation approach combined with molecular techniques was employed to analyze the microbial composition of the Mekong delta agricultural soil contaminated with high levels of arsenic. Microorganisms are known to play a critical role in arsenic biogeochemical cycling, so it is important to identify and characterize the microbial community which may enhance the mobility of arsenic in these soils. Three phylogenetic and physiologically distinct arsenate-reducing bacterial strains belonging to the genera *Shewanella*, *Klebsiella* and *Enterobacter*, were isolated, identified and characterized. These bacteria may contribute to arsenic mobilization in the agricultural soils contaminated with high amounts of arsenic.

**Hang T. Dam**, Microbial Biology (Ph.D. 2016)
Advisor: Max Häggblom
**Reductive dechlorination of polychlorinated dibenzo-*p*-dioxins by *Dehalococcoides*-enriched cultures from contaminated soils and sediments**

Polychlorinated dibenzo-*p*-dioxins (PCDDs) are pervasive environmental pollutants and resistant to biodegradation in soils and sediment environments. This thesis provided data to support the hypothesis that even though PCDDs are highly persistent, the capacity for microbial reductive dechlorination of PCDDs in anoxic environments is not rare. In fact, PCDD dechlorinating anaerobic bacteria appear ubiquitous, and their activity was observed in almost all enrichment cultures established using soils and sediments collected from sites of different contamination backgrounds. *Dehalococcoides* spp. have been identified as the main bacterial species that couple dechlorination of PCDDs to growth. Comparative genome analysis suggested that a reductive dehalogenase cbrA ortholog is responsible for reductive dechlorination of 1,2,3,4-TeCDD in a respiratory process. Genome analysis provided preliminary evidence for the function of reductive dehalogenases in PCDD dechlorination which have not been studied before due to the complex nutritional requirements and slow growth of *Dehalococcoides* spp. Understanding the organisms and specific genes involved in dechlorination of PCDDs may help design a strategy to evaluate the bioremediation capacity of PCDD contaminated sites and develop an effective bioremediation approach to reduce negative effects of residual PCDDs in the environment.

**Questions for Mohamad and Ahmed Anwar**
**B.S. Microbiology 2016, Interviewed by J. Boyd**

L-R: Mohamad Anwar, Dr. Costa Vetriani, Ahmed Anwar

***Where did you grow up?*** Mohamad and I were born in Alexandria, Egypt and spent the first couple of years of our lives there. I was one and Mohamad was eight when we came to the United States. We spent the majority of our youth in Avenel New Jersey, but we moved to Edison New Jersey in 2012.

***How and when did you become interested in microbiology?*** We became interested in the study of Microbiology after taking General Microbiology with Dr. Erin Christensen at Middlesex County College (MCC). Dr. Christensen taught her subject with such passion that we could not help but fall in love with it as well. She was the reason that we, and several of our friends, transferred from MCC to Rutgers as Microbiology majors.

***Did you have a defining moment as a young person that fortified your interest in microbiology?*** **Ahmed:** When I was in my High school Biology class we had a lab in which we sampled different items and inanimate objects around the school and grew out our results on agar plates. After several days of incubation we looked at the results and saw all the bacterial growth. This was the first time I appreciated " The world within our world" as I like to call it. I understood and appreciated that there is so much life that I could not see yet knowing it was there was amazing. Seeing those plates piqued my interest in the field and then Dr. Christensen's course crystallized my love for the subject. **Mohamad:** As a child I was always finding my way into the messiest of situations, whether it's playing with mud or grabbing frogs from the back yard. No matter what it was, my parents always told me to go wash those germs off of my hands. At the time I didn't have a solid concept as to how something could be on me if I can't see it, which led me to ask lots of questions. It wasn't until I asked my uncle who is a doctor that landed me the answer that there are tiny living organisms all over our bodies and the environment. This fascinating new information led my curiosity in the direction that placed me where I am today.

***What impact did your parents have on your desire to obtain of an undergraduate degree in microbiology?*** Our parents thought it was an amazing Idea to choose microbiology. They knew it had several benefits, the biggest one of course being that it would propagate us deeper into the world of microorganisms, which have a great deal to do with medicine; a career that both wish to pursue. This led them to support us in every way, shape, and form, never ceasing to encourage us and help out whenever they could. My mother was trained as a teacher, and my father as an archaeologist, so they are not strangers to the world of academia; this allowed them to appreciate the value of our Microbiology degree at Rutgers.

***It is unusual to have two brothers graduate with the same degree at the same time from the same department. Did one of you influence the other to pursue an undergraduate degree in microbiology? What is the story behind this?*** Although it is peculiar that both of us are graduating with the same degree at the same time, it is not unusual that it is a Microbiology degree, because the prestige of this degree is high. When transitioning to Rutgers from MCC we were almost going to continue as regular biology majors. However, when we saw a Microbiology option we both looked at each other and instantaneously knew this would be our path for the remainder of our B.S. degree. It also helped a lot having several of our friends that were biology majors at MCC transfer with us as Microbiology majors. With our future goals in mind, a Microbiology degree was sure to put us a step ahead of the competition.

***Mohamad, I understand that you are a "non-traditional" student. What inspired you to return to school in pursuit of a bachelor's degree?*** **Mohamad:** Returning to School was one of the hardest things I've ever done in my life. After being away for so long, getting back on the wagon was almost near impossible. But men do great things when they have great inspiration. Even though while away from school I had a job that afforded me financial comfort, I still felt unfulfilled. Deep down inside I had a yearning to become something more, not for financial reasons, but because I wanted to feel that the man in the mirror staring back at me contributes to society in a fruitful manner. Continuing my education and getting back on track gave me a sense of purpose and joy, a sentiment I hadn't known in a long time. It's a very different feeling when people look at you versus when people look to you, with the latter being my ultimate goal as an inspiration to others that are in the same place I was before making that decision to return to the world of academia.

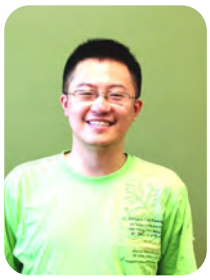
***You both have conducted undergraduate research in Costa Vetriani's laboratory. How did conducting independent laboratory based undergraduate research benefit to your Rutgers education?*** Working in Dr. Vetriani's lab has allowed us to grow in several ways. Not only did we learn numerous lab techniques that can benefit any student of science regardless of their aspirations, but we were also able to put what we have been learning to use. We did not have a lab manual in which we mindlessly followed a protocol to reach an anticipated result; we actually had to improvise several things based purely off of our microbial knowledge. We were finally able to integrate our knowledge with our practice without being limited to a lab procedure being overlooked by a TA for a grade. We have built several relationships with grad and undergrad students alike that have all taught us something in one way or another and we have grown mentally with knowledge, as well as, intellectually by actually applying that learned knowledge.

***What are your plans after graduation from Rutgers?*** **Ahmed**: I plan on attending Lake Erie College of Osteopathic Medicine to begin my medical education and one day becoming a Pediatric Emergency Medical Doctor and help children in become well again. **Mohamad:** After graduation I plan on attending New York College of Podiatric Medicine, to pursue my passion for surgery while at the same time being granted opportunity to help my patients and see them walk again.

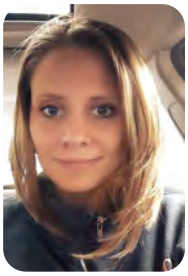
***Will you keep in touch with the Department of Biochemistry and Microbiology to inform us of your future activities and successes?*** Of course we are both planning on keeping in touch with the Department to inform you of our future activities and successes. This department has taught us a great deal, not just content, but how to be great students and logical thinkers.

***Any other comments to add?*** Because we are both Learning Assistants for General Microbiology at Rutgers, we have been exposed to microbiology as students, as well as, instructors. We have learned the facts, but once we get to teach them to other students we gain an appreciation of the knowledge unlike before. It is amazing to help someone understand something they previously had not, especially when that something has to do with Microbiology.

# Our Graduate and Undergraduate Students



**Chengsheng Zhu (Bromberg Lab)** was the recipient of the Robert S. and Eileen A. Robison Scholarship Award for 2015. Congratulations!! The Robert S. and Eileen A. Robison Scholarship Award For Excellence in Graduate Studies was established in 2003 and is supported by the Robison family. The scholarship is awarded to a graduate student who has demonstrated competence and accomplishment in their academic and research program while at Rutgers University, has shown an active participation in or a leadership role in the activities of the department, college, university or community, and is motivated to help and improve the human condition at this time and upon graduation. Dr. Robert Robison earned his BS and MS degrees at Cornell University, and a PhD degree at Rutgers University in Microbiology in 1954. His research at Rutgers was in soil microbiology and streptomycin synthesis in actinomycetes under the supervision of Selman Waksman, Robert Starkey and Walter Nickerson.



Congratulations to **Ashley Grosche** who was nominated by the GSNB to visit Jilin University in China in May 2016. At Jilin University she attended a graduate student forum and meetings with students.

**Zuelay Rosario-Cruz** was awarded best poster at the 2016 Joint Molecular Biosciences Graduate Student Association Annual Symposium; Title of poster: "Reexamining the mechanisms of copper detoxification in *Staphylococcus aureus*."

**Xiao Qian** received a Travel Fund Award from the Microbial Biology program to attend the Algae Biomass Summit conference and present a poster: "Close the truncated tricarboxylic acid cycle in the cyanobacterium *Synechococcus* sp. PCC 7002".

**Sheldon Campbell**, Associate Professor of Laboratory Medicine at Yale University School of Medicine (seated center with guitar) after his Fermentation Club Seminar "Stories, Sex and Songs; Teaching Microbiology with Clarity and Passion" hosted by Joan Bennett, September 25, 2015

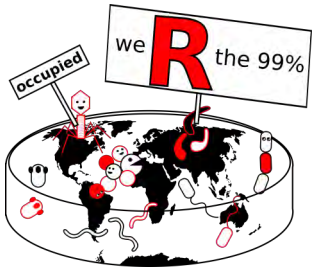
## Undergraduate Program Awards

Congratulations to our Biochemistry and Microbiology majors who earned awards for academic excellence:

Waksman Award: Ahmed Anwar (page 10), (GPA 3.95)
Strumeyer Award: Kathryn Sinko (GPA 3.9) and Timur Ganapolsky (GPA 3.9) (we have a tie!)
Chase Award: Jason Latham (GPA 3.8) and Xiangyu (Chianti) Shi (GPA 3.8)

K. Sinko, T. Ganapolsky, J. Latham

## ASM Student Chapter




**Peter Anderson** (center) is recognized by the ASM Student Chapter Presidents **Ann Charles** and **Nicole Lloyd** for his service and support of Chapter activities.

**Kathy Maguire** at her retirement party surrounded by Graduate Students Ananya Agarwal, Ashley Grosche, Javiera Norambuena Morales, Sushmita Patwardhan and Nicole Lloyd.

## Pictures from Rutgers Day/AgField Day April 2016

The "Cheese or Feet" olfactory evaluation. Can you tell the difference between a gourmet cheese and a dirty sock?

## Make a Gift to the Department of Biochemistry and Microbiology

Through the years, students in the Department of Biochemistry and Microbiology at Rutgers University School of Environmental and Biological Sciences (SEBS) have been supported in many ways - grants, assistantships, corporate support and fellowships endowed by individuals, just to name a few. Financial support is critical to the ongoing success of our students, and allows them the opportunity to focus fully on their education and research. The next generation of gifted scientists in microbiology and biochemistry need your support. As traditional funding mechanisms become more difficult to secure, we turn to our community of dedicated alumni and friends to support those who will come after them, and continue their legacy of achievement.

There are many ways for you to have an impact. Please consider investing in our students by making a gift to the following funds:

1. **The Douglas E. Eveleigh Endowed Graduate Fellowship:**
   The Douglas E. Eveleigh Endowed Graduate Fellowship is being established to honor Dr. Eveleigh and his decades of service to Rutgers and our students. Our goal is to fully endow this graduate fellowship at $750,000, which will provide a stipend plus full tuition for a first-year student in the Microbial Biology Graduate Program.
2. **Graduate Student Travel Awards**:
   **The Stephen M. Cuskey Graduate Student Travel Award**
   **The Douglas E. Eveleigh Graduate Student Travel Award**
   The Stephen M. Cuskey Graduate Student Travel Award honors the memory of the late Dr. Stephen Cuskey (’82). The Douglas E. Eveleigh Graduate Student Travel Award honors the legacy of Prof. Doug Eveleigh and his steadfast commitment to students at Rutgers. Both awards are given annually to one or more students travelling to academic or industry conferences related to their research.
3. **Department of Biochemistry and Microbiology Fund**:
   Donations to our department gift fund will support research and travel for our undergraduate students in biochemistry and microbiology, graduation awards, the invitation of seminar speakers to our Fermentation Club Seminar series, and other activities of the department.

**For online donations, http://dbm.rutgers.edu/sheerfun.html**


Department of Biochemistry and Microbiology · School of Environmental and Biological Sciences
Rutgers, The State University of New Jersey · 76 Lipman Drive · New Brunswick, NJ 08901-8525
Lipman Hall | 848-932-9763 | Fax: 848-932-8965 | Website: dbm.rutgers.edu
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