

## Words from the Department Head, Jeff Becker

As this will be the last column I'll submit to Microscope as Head of Microbiology, I thought I'd start by reminiscing somewhat about our field of study. When I entered into the study of microbiology in the 1960s, molecular biology was in its infancy. In those days microbes were at the center of uncovering basic principles of biology such as the nature of genes and DNA, the "central dogma" of information flow from DNA to RNA to Protein, and the regulation of these processes. In recent years research has shifted somewhat from basic microbiology to translational research using complex organisms. But many of the fundamental principles of living organisms remain undiscovered. For example, at least 20% of all predicted proteins in any cell have no known function! Microbiology endures as the most exciting and readily accessible means to uncover these secrets of life.

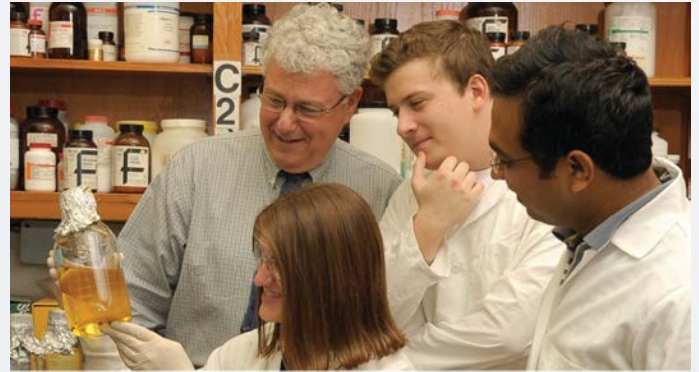
Not only do our microbes - bacteria, archaea, phages, fungi, protists, and viruses - hold the key for future discoveries of biological processes, they also play fundamental roles in the environment and in human health. Microbes hold primary positions in the turnover of key environmental nutrients affecting climate change and carbon and nitrogen cycles; to the delight of microbiologists and the surprise of life scientists, our microbiota affects all aspects of human health and nutrition.

Infectious diseases remain major killers and drivers of morbidity in all

societies. So just as in the 1960s, I believe that the 2020s and beyond will remain the Age of Microbiology. All students of Microbiology will be challenged by an endless frontier awaiting discovery.

As we enter 2016-17, our Microbiology Department at UT will have a new leader: Heidi Goodrich-Blair from the University of Wisconsin, Madison. Prof. Goodrich-Blair is coming to us in August, 2016, with a distinguished record as a researcher, teacher, and academic leader. Her research system bridges the worlds of microbial ecology and microbial pathogenicity, the perfect position for the Head of our Department. I am delighted that our search committee chose, and Dean Theresa Lee appointed, Heidi as our new Head. My best wishes are sincerely given to Heidi and all of our Microbiology family for a stimulating and fulfilling future.

I wish to express my appreciation to the students, faculty, staff, and administrators for support during my years at UT and my fifteen-year tenure as Head. I am eternally grateful to Arthur Brown who offered me the position of Assistant Professor in 1972 and to my academic colleagues in Microbiology with whom I have shared so many



Dr. Becker and his students

wonderful experiences. I won't be retiring entirely as I expect to continue my research program.

It has been a privilege beyond measure to be an academician, a career that I could never have imagined would bring so many personal rewards. My thanks go out to my research partner of forty-three years, Prof. Fred Naider of the College of Staten Island, CUNY, for our wonderful synergistic collaboration and friendship that made our scientific journeys so pleasurable and exciting, and to my collaborators, research assistants, and students, both undergraduate and graduate, without whom this journey would not have been possible. I remain highly excited by science in general, microbiology in particular, by what we are doing at UT Microbiology, and by the growth of our department. I look forward with great anticipation to witnessing the evolution of our "Microbial World."

-Dr. Jeff Becker

## Colleen Jonsson and NIMBioS: The Big Picture of Virology and Biological Research

written by Daniel Shyles

Despite humanity's rapid rise to the top of the food chain and effective release from trepidation of predation by fanged carnivores, we remain vulnerable to deadly organisms invisible to the naked eye. History recalls the bacterial black death that notoriously ravaged the Old World in the middle ages and the viral smallpox that nearly eradicated native inhabitants of the New World. Today, we continue to cope with periodic outbreaks of infectious diseases, with the hantavirus outbreak of 1993, SARS in 2003, Swine Flu in 2009, and a resurgence of a particularly stubborn strain of Ebola in 2015. While human wellbeing and life expectancy is higher than at any time in history, thanks to advances in modern medicine, we often find ourselves nipping at the heels of the next major epidemic. Surely we must always be at the ready to quell a storm of pestilence once it has begun, but we still have much to learn about how outbreaks occur in the first place. What conditions enable a run-away propagation of virulent bugs, and how can we nullify the dangers they present?

Dr. Colleen Jonsson is an expert of infectious disease dynamics and molecular virology, and, since December 2015, has been the new director of the National Institute for Mathematical and Biological Synthesis (NIMBioS) at the University of Tennessee. NIMBioS aims to unify several scientific fields to tackle fundamental biological questions and problems, from understanding the dynamics of cancers, to mapping ecological relationships in nature, to mitigating the spread of invasive species in fragile and protected ecosystems. The institute brings together biologists, mathematicians, and computer scientists to develop models of highly non-linear hierarchical biological systems. Further, NIMBioS incorporates the social sciences, providing thorough analyses designed to shape public policy.

Dr. Jonsson's directorship seems an inevitable consequence of her journey as a scientist. No stranger



In the Atlantic Forest in Paraguay with (from left to right) Carles Solà Riera of Karolinska Institutet, Evan Williams of the University of Tennessee, Vico Martinez of Universidad Asuncion, and Dr. Colleen Jonsson, 2016

to the phenomena of viral outbreaks, she has worked to understand how they occur since the wave of Hantavirus Pulmonary Syndrome broke in the southwestern United States in 1993. At the time, she was a new assistant professor at New Mexico State University and, as a biochemist focused on virology, became intrigued with the outbreak in the region. Her curiosity led her down a rabbit hole that she calls her “accidental long-term detour,” which ultimately landed her in the Atlantic Forest in the Chaco region of Paraguay. There, she and her team, funded by the National Institutes of Health (NIH), conducted fieldwork studying the ecology of hantavirus and how it spreads among hosts in isolated forest environments.

For Dr. Jonsson, RNA viruses like hantavirus and its cousins Ebola, SARS, and H1N1 (Swine Flu), provide entry points for understanding viral ecology and evolution due to their rapid mutation rate and massive population, factors which allow a high degree of adaptability. Each time we mitigate an outbreak, though the responsible species may be deterred, it's not long before other strains emerge with resistance to earlier bio-medical tactics. “We see one new RNA virus every nineteen months, on average,” Dr. Jonsson explains, “Hantaviruses are nice models of an RNA virus that spills over from other species into humans and causes disease.”

To study RNA virus transmission among rodents in the

Atlantic Forest, Dr. Jonsson and her team erected predator exclosures to control the rodent population and access to resources. By influencing the biodiversity of the rodent species carrying the virus, she hopes to shed light on how the virus propagates under various ecological conditions, and determine those that may ultimately lead to an outbreak. “I really think this is unique as this is the first time we’ve really manipulated the field to simulate an ecological change to determine how that would impact the virus’s epidemiology in the mice.”

Dr. Jonsson’s initial excursion to Paraguay resulted from a willingness to explore opportunities, take risks, and cultivate a big-picture mentality. “When the 1993 outbreak happened and I had the opportunity to go to Paraguay, I was initially reluctant taking that step because I had never done field work. It wasn’t part of my concept at the time as a new assistant professor with training as a laboratory experimentalist. But, once there, I became enamored with the idea of being able to have a component of my program focused on human health and the study of viruses in the field.”

When she returned to New Mexico State, she discovered that there was considerable interest in understanding viruses affecting the region, and an eagerness among her students to get involved. “We held a public health fair where we started freely surveying people for whether or not they had ever been exposed to hantavirus. It was totally out of my box! The next thing I knew, I was working with some wonderful women at a clinic on the border between the US and Mexico. These ladies and the people in the community were so excited about being able to participate in their own health. The whole state was talking about hantavirus, yet no one was doing anything in southern New Mexico.”

Shortly thereafter, Colleen was rewarded by the state of New Mexico for bringing attention to the situation near the border, and her invaluable contributions to the community. But, it wasn’t long before she discovered a new problem; while her work with the community was fruitful in identifying the prevalence of hantavirus, she noted that there were no therapeutics available to assuage the effects.

She and her colleague, Connie Schmaljohn from USAMRIID (United States Army Institute of Infectious Diseases), became the first to identify attributes of a drug responsible for treating the effects of the virus.

“That only took fifteen years,” she chuckled. Her work led her to a position within the Antiviral Discovery Program at Southern Research in Birmingham, Alabama. “But at each part of the journey I realized something... In New Mexico I was working with the public, but realized we didn’t have any antivirals to treat anybody. Then in Birmingham we were successful making antivirals but we didn’t have any good animal models... So I was recruited to the University of Louisville in 2008 to develop the Center for Predictive Medicine, where we focused on just that.”

Current animal models, such as those using rodents, are a reasonable proxy for human physiology used to predict the effectiveness of a drug or development of disease. However, trials generally require the recruitment of many animal “volunteers,” and leave much to be desired when attempting to simulate effects among human populations. While at the University of Louisville, Colleen and Dr. Julio Ramirez, the chief of infectious disease at the hospital there, “charted a course to work across disciplines to understand how my animal model might benefit what they know in the hospital and vice versa.” Thus, the two fields, medicine and virology, directly informed each other through their mutual efforts. Together, and with PET-CT equipment in the BSL3 containment laboratory, they conducted real-time imaging of the 2009 influenza virus infection in ferrets. Dr. Jonsson explains that real-time imaging would enable a reduction in the number of animals required for a study, and provide visualization of how infections evolve when an antiviral is introduced. Ultimately, her goal is to further understand such events within human subjects.

Dr. Jonsson’s long-term challenge to understand how outbreaks occur has engaged her in a cascade of experiences in the laboratory and field, advancing public



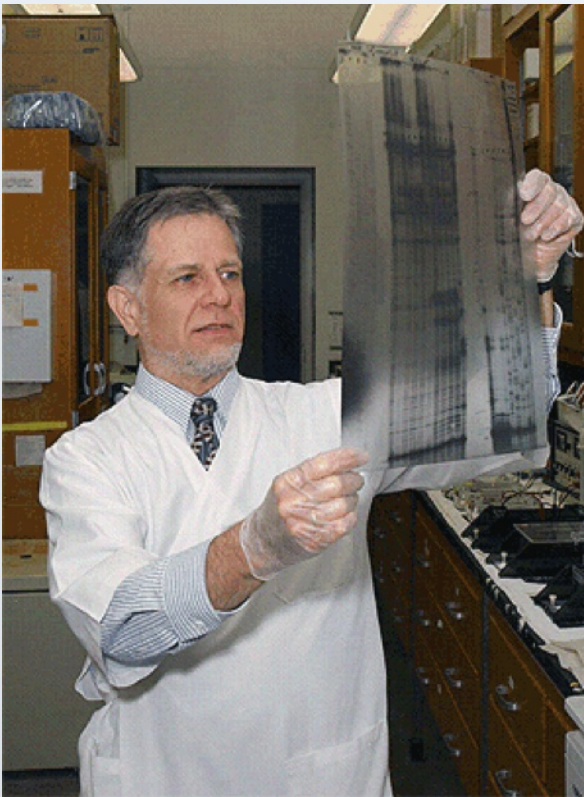
University of Tennessee graduate student, Evan Williams gathers Sherman traps in the Atlantic Forest, 2016

outreach, and cross-disciplinary discovery. As director of NIMBioS, she recognizes that the institute's objective to unify the sciences follows from the unity of the systems in the world. In many circumstances, as we continue to uncover nature's symbioses, a synthesis of the fields of science appears not only a good idea, but a necessity. "I think that government organizations like NIH and the National Science Foundation have realized that in order to address the larger problems certain disciplines need to come together," says Jonsson.

At NIMBioS, she enjoys bringing together experts across departments, and is especially interested in facilitating projects that members find most interesting. "When you marry a person with something they enjoy, it naturally evolves in that direction. You don't have to worry about creating a vision, you just have to create groups of people who want to work together and solve big problems. They're motivated by it, and run the extra mile for it."

As Dr. Jonsson reflects upon her own journey, it's clear that she was never really certain of the outcome. It seems that with a good bit of curiosity and an adaptive outlook, she has found her contribution to the scientific enterprise to be more gratifying than she had ever anticipated. "These types of opportunities are what motivate me as a scientist. I hadn't really thought about the impact I'm making as much as the fact that I'm really enjoying myself."

## Obituary: David Brian



In Fall of 2014 we lost Dr. David Brian. Dr. David Brian was Emeritus Professor at the UT College of Veterinary Medicine, and held a joint appointment in the Department of Microbiology for many years. Dr. Brian graduated with a B.A. in Biology from Manchester College in Indiana and received both his Doctor of Veterinary Medicine (with honors) and Ph.D. in Molecular Virology from Michigan State University. Dr. Brian retired in June 2014 after 38 years.

Dr. Brian's research program in molecular virology focused on the medically-important coronavirus family. In 2003, he was at the forefront of the international scientific community's efforts to understand severe acute respiratory syndrome (SARS), and his research aided the Centers for Disease Control and Prevention in identifying the SARS virus as a coronavirus.

Dr. Brian's research resulted in numerous internationally-recognized contributions, leading to his 23-year membership on the Coronavirus Study Group, Subcommittee of the International Committee on Taxonomy of Viruses, and invitations to present two State-of-the-Art lectures at the Annual Meeting of the American Society for Virology. Dr. Brian received the UTCVM Beecham Award for Excellence in Biomedical Research in 1988 and 1993, The University of Tennessee Provost Award for Excellence in Research and Creative Activity in 2000, and the College of Veterinary Medicine Pfizer Animal Health Award for Research Excellence in 2011. He will be remembered as an esteemed colleague and a wonderful mentor to many MS and Ph.D. students in our Department.

# The MicroScope

## Alumni Spotlight: Academia

### Jeff Morris and the Black Queen Hypothesis

*written by Daniel Shyles*

Experimental evolution, a major field of biological research, entails devising experiments in which one can directly observe the effects of selective alteration of a specimen's environment on its evolution. Since evolution is an incremental process, it is especially difficult to observe evolution of macroscopic lifeforms with lifetimes comparable to their human observers. However, the microcosm of Earth in which microbes reproduce on tractable timescales allows direct and repeatable observation of evolution, which can be extrapolated to that of life on Earth.

With an adequate method to observe evolution, new hypotheses based on organismal interactions in various ecosystems can be tested directly under a laboratory microscope. Using such methods, Dr. Jeff Morris, a 2011 doctoral graduate from the University of Tennessee microbiology program, now assistant professor at the University of Alabama in Birmingham, aims to test an extension to evolutionary theory called the Black Queen Hypothesis (BQH).

Originally proposed by Dr. Morris, his UT graduate advisor, Dr. Erik Zinser, and Dr. Richard Lenski of Michigan State University, the BQH suggests that in a given ecosystem, when multifunctional organisms benefit from behavior or byproducts of a "helper" organism, their descendants may cease to bear traits shared with the helper. By suppressing expression of those genes, they conserve energy that would otherwise be necessary to produce benefits for themselves. Instead, such organisms may specialize in attributes not supplied by the community for which they may inadvertently become the supplier. It follows that ecosystems themselves tend to evolve so that responsibilities are shared and diversified among members. This "reductive evolution" simplifies the genome of individuals until the cost of further streamlining balances the benefit of shared functionality. Among manifold implications, Dr. Morris thinks the BQH may provide some insight into the transition of early ecosystems of single-celled organisms to multicellular organisms.

As an undergraduate at Kennesaw State University in Georgia, Jeff began his studies with hopes of working in the Georgia Aquarium as a handler. Then, after trying his hand in a lab, he jumped at the opportunity to join the UT Microbiology graduate program, which landed him on a five-week



Dr. Jeff Morris

research cruise between Hawaii and Australia studying microbes, measuring rates of hydrogen peroxide production and decomposition, and studying how interactions between peroxide sensitive and resistant organisms might be explained by the Black Queen Hypothesis. A memorable moment, he says, occurred during a sleepless thirty-hour experiment when the crew encountered the monolithic Ball's Pyramid, rising from the Tasman Sea between New Zealand and Australia. Obviously, research endeavors like these provide great potential to discover the beautiful splendors of the world both large and small.

Following his graduate studies at UT, Jeff was a NASA Astrobiology postdoctoral fellow under Dr. Richard Lenski at the University of Michigan. There, they investigated questions relevant to early evolution on Earth, specifically focusing on social evolution among early living communities. They used computer and mathematical models to compare the evolution of multifunctional organisms that exhibit relatively little interaction within their community to that of conglomerates of simpler forms with a greater reliance on the productivity of others in the population.

Though computer models may reflect the evolution of real biological systems quite well, direct observation of evolution that agrees with the model is crucial to



Ball's Pyramid between Australia and New Zealand.

advancing their theory. As Jeff puts it, it's difficult to pinpoint experimental evidence for evolution since we usually think of evolution on massive timescales. As a result, claims are often made for selective pressures without undergoing any real testing. Since we can't simply throw our hands in the air, calling an end to the quest to better understand evolution, we find systems that grow fast enough so that we can directly observe such systems changing before our eyes. For example, bacteria such as *E. coli* and fungi grow quickly, allowing us to observe the equivalent of thousands of years of human evolution, and devise selective pressures to tease a population into evolving a certain way. The method allows us to ask questions such as: How does a population adapt to a particular stress? Does it reach a steady state in which it is as adapted as it can possibly be, or do organisms keep getting better and more refined forever? In fact, Jeff argues, there are instances in nature where simple organisms develop from complex ancestors. This is apparent in microscopic symbionts living in our gut that have lost the ability their ancestors had to metabolize certain nutrients, and instead rely on their hosts for nourishment.

Through continued research of the BQH, Jeff hopes to understand how social cooperation develops from purely selfish Darwinian evolution. He proposes that the evolution of symbiosis and altruism can fool some into thinking that an organism evolves "for the good of

the group," when in fact it can be explained as selfish behavior. The BQH suggests that some biological functions are inherently "leaky," and that some organisms cannot help but give some assistance to neighbors by way of its selfish behavior or unconscious production of some nutrient for its own benefit.

Jeff looks forward to continuing his research on the Black Queen Hypothesis at the University of Alabama, and sharing with his students the amazing world of biology all around us, and within us. Recalling his graduate studies, Jeff reports that he "learned everything he knows about being a scientist at UT." He greatly appreciates the guidance he received from Dr. Erik Zinser, Dr. Steve Wilhelm and other faculty who taught him firsthand how to do science and participate within the scientific community. Now, as a graduate, he reflects on what it takes for budding scientists to get to that point. "Pick something you're passionate about, focus on it, and work really hard. Be persistent and build upon what you have already accomplished."

Jeff's work is important not only for understanding how organisms interact, but how they incorporate into ecosystems, which are the building blocks of complex life. His research on the BQH aims to develop a greater understanding of the interconnectedness and ingenuity of bio-systems on Earth, a reality humanity ought to consider while developing its global civilization.

"The thing about evolution that blows my mind is how much better it is at designing things than human intelligence." It is amazing, to be sure, that given eons of time (or hours in a petri dish), success and failure of organisms determined solely through natural selection yields those best equipped for survival. Though operating solely for the individual's own benefit, each organism is still embedded within the environment, each branch of the tree of life interwoven among the others. We are one with our home, simply a part of the great machine, a microbe within the great organism called Earth.



Dr. Morris' University of Alabama lab group in Summer 2015

## Nathan Cude and a Sustainable Agriculture Revolution

written by Daniel Shyles

As agriculture has become increasingly industrialized in the last century, farmers and food companies have searched for ways to increase productivity to accommodate ever expanding markets for growing global populations. Unfortunately, many methods used to support a crop's growth or promote resistance to disease and insects often incorporate chemicals and tactics with unintended environmental detriments. This demands a prompt adoption of sustainable agricultural and industrial practices to secure a future in which the human family and life in general may continue to thrive.

Nathan Cude, a 2013 alumnus from UT's microbiology doctoral program, is now a research scientist at Novozymes along with graduates of UT's microbiology master's program, Claire Pelligra (formerly Campbell) and Abby Smartt. Novozymes is a Danish biotechnology company with a strong sustainability mission. The company aims to supply many industries, not only agriculture, with sustainable and biological alternatives and improvements to various industrial processes and products. For example, Dr. Cude explains, "Many of our industries focus on enzyme technologies that can do chemical reactions with fewer inputs and biodegradable wastes. In biofuels, we have developed enzymes to preprocess starch and cellulose prior to fermentation, lowering the amount of chemical hydrolysis and heat needed," which reduces required energy input.

While at UT, Cude worked in Dr. Alison Buchan's lab studying *Roseobacters*, a marine bacterium that "plays important roles in the degradation of plant material in coastal marshes, which can contribute heavily to the global carbon and sulfur cycles." He considers the work he did in Dr. Buchan's lab as well as his coursework as a graduate student in the microbiology department vital to his current work at Novozymes. "My classes and research at UT prepared me to think like a microbe," and often inspires his discoveries and innovations in his lab.

Now at the Microbial Discovery Group at Novozymes'

US headquarters in North Carolina, Nathan investigates microbes that show resilience to certain environmental stresses such as drought, or more adequately produce necessary nutrients in relatively nutrient-poor soil. Similar to the



Dr. Nathan Cude

"microbiome in our guts that helps us digest food and take up nutrients", our taxonomic cousins from the plant kingdom also rely on a microbiome established around their root systems that manage nutrient availability and general plant health. Each plant species has evolved a microbiome ideally suited for its success within its native environment. But, what if we could transplant one species' natural defense against an arid environment or insect attacks to another to fit our agricultural needs? *Rhizobia*, which latch to the roots of legumes and convert atmospheric nitrogen into usable compounds for its host have been shown to significantly boost yield when introduced to field crops like maize. Dr. Cude and his team are on the hunt for other bacteria that can strengthen the microbial arsenals of many agricultural staples.

While humanity has long manipulated and selected crops to make them more hardy, nourishing, or tasty, it is only in recent decades that we have developed a detailed enough picture of nature that allows us to resolve the minute foundation sustaining life as we know it. Nathan's team uses microorganisms in novel ways to benefit many macroscopic species. They are taking advantage of billions of years of evolution that has equipped organisms to thrive in essentially every terrestrial environment, and provided each with adequate defenses against almost any conceivable natural ailment. Nathan reflects that to him, "the intricacies of life at the smallest levels are awe inspiring." Thus it seems appropriate that as we awaken to nature's profound sophistication, we should learn to wield the best it has to offer.

# The MicroScope REU Review

written by Daniel Shyles

For students planning to attend graduate school in STEM fields, hands-on laboratory experience is valuable preparation. The Microbiology Research Experience for Undergraduates (REU) program at the University of Tennessee provides fundamental research experience to undergraduates spanning a variety of microbiology-related disciplines. Students come from around the country, often from institutions that offer limited research opportunities. The REU program gives students a taste of life as graduate researcher, which can guide their decisions as they approach the end of their undergraduate careers.

“That’s what we’re encouraged to do as an REU program,” says Gary LeCclair, director of the Microbiology REU program at UT. “We want to bring in students from a wide range of backgrounds, ethnicities, and research experience.” While all projects share a theme considering microbial community interactions and their functions in the environment, the REU program extends to the departments of Earth and Planetary Sciences, Biosystems Engineering and Soil Science, and Environmental Engineering.

In 2015, REU students included Winode Handagama, who worked with Dr. Steve Ripp studying “bioreporters,” which are living cells that are used to report information about their environment with bioluminescence. Winode continued working with Dr. Ripp after the program ended, and is now developing a gene delivery system to incorporate bioluminescent stem cells into bacteria that trigger light emission upon degradation of certain compounds, indicating molecular concentrations in the microbe’s environment.

Another 2015 REU student, Alex Grossman, worked with Dr. Alison Buchan, studying the effects of infecting cultures of *Roseobacters* with genetically similar viruses. Though the virus genomes are about ninety-nine percent similar, they had significantly different effects on the same bacteria. Alex characterized differences in phenotypes between the viruses when introduced to the same bacteria, which is a first step in determining subtle but potentially significant genetic differences among viruses.



Dr. LeCclair and the 2015 REU Crew explore the Smokies

During the summer program, students have a number of chances to interact with graduate students who are at UT for the long haul. When new students come on board, they are appointed a “big sibling,” a grad student to work alongside them, and help them get acquainted and comfortable in the lab. Newbies also attend information panels hosted by graduate students who are themselves at different points in their own careers, seeking a variety of degrees.

“I think there’s hope that some percentage of the students will apply to the department as a graduate student,” LeCclair comments. In fact, a number of students from the program’s first three years have joined UT as graduate students. “I think we’re up to five students now who have joined us.” LeCclair thinks that their attraction to UT partially stems from the cohesion and atmosphere of the department itself. “It’s very active and inclusive. People exchange ideas with one another a lot.”

One of the former REU students, now a graduate student in the Microbiology Department, told LeCclair that he came to UT because he didn’t feel like there was a ‘cut-throat’ atmosphere among students. “The students are here to help each other, and the faculty is here to facilitate learning and good research.” A competitive spirit can be a good driver in scientific progress, but too much can detract from the “soul” of science, which primarily aims to decipher the mysteries of nature.

Now in its fourth year, LeCclair looks forward to meeting the newest REU students, and helping facilitate another immersive and memorable experience. “Each year, when I send them their acceptance letters, I try to convey that they should be proud, as it’s a really competitive program. I tell them that in one way or another their experience will influence their future. Above all, I guarantee that they’re going to learn a lot, work hard, and have a ton of fun.”



# MUC Updates

written by Daniel Shyles

It is often challenging for students to get a handle on the stresses and expectations of university life, especially in a STEM major like microbiology. Beyond pressures to excel in classes, uncertainty commonly arises regarding other endeavors such as how to get involved with research, or preparation for post-collegiate life. We also need a place to blow off steam, meet new people, and have a little fun. The Microbiology Undergraduate Club (MUC) is a student organization promoting community and opportunity within the microbiology department at UT.

Since its inception in 2010, MUC has nurtured life-long friendships and memorable experiences, while providing invaluable support from fellow students, faculty and colleagues; it is a great asset to students exploring the playing field at UT. Open to all majors, MUC also fosters interest in microbiology throughout the university, across all disciplines.

In 2010, Dr. Liz Fozo began mustering interest among a core group of students in her microbial pathogenesis course. With her spark, the group enthusiastically began coordinating the club, getting others involved. Now the club meets bi-monthly for seminars, field trips, cookouts, study sessions, and many other events. Often, the club invites speakers from across campus to talk microbiology, such as Dr. Jennifer DeBruyn from Biosystems Engineering & Soil Science and the Body Farm who spoke about microbes pertaining to forensic anthropology. Dr. Matt Gray, professor of wetland ecology, came to talk about Rhinovirus in frogs, and David Golden from the department of food science spoke about microbiology in several lectures on beer making. Dr. Fozo chuckled, "We had a beer lecture... we never made beer, we swear!"

In addition to developing a more cohesive undergraduate community, the club extends students' experiences beyond the confines of the classroom to investigate practical aspects of the college experience. Fozo says she wants to help students unravel some overwhelming questions like, "How does one really get into grad school? We try to bring in people who can talk to them about best practices that really work." Some of MUC'S seminars focus on how to get positive letters of recommendation.

The club's tight-knit community within the department facilitates opportunities to get to know professors, and get involved in research at UT and Oak Ridge National Laboratory. Such opportunities allow students to explore the realities of doing scientific research, while providing valuable experience to those seeking science careers. Dr. Fozo acknowledges that research is not for everyone, and is not necessarily the deciding factor when discerning a student's future endeavors. Really, it is most important to understand that there are many ways to get involved, beyond being in the lab. MUC is a great way to explore all that is available to budding microbiologists and scientists in general, and the department aims to connect students to opportunities wherever they may arise.

It's through a continued effort by members and its supporters that make MUC possible. "We would like to thank Amy Leonard for her generous support over the years. She has been a wonderful help. Also, grad students like Jackson Gainer, Steve Higgins, Abby Smartt have lent a big hand." Fozo also extends gratitude to Jeremy Chandler for introducing students to bread making from a microbiologist's point of view.

"I have had a ton of fun with it," Fozo remarks. She is especially glad to have developed lasting relationships with longtime members who stuck with MUC during their time at UT. "I've been really grateful to have tight connections with these students. It's really great to see them grow up."

Going forward, Dr. Fozo is pleased to announce that Dr. Sarah Lebeis will be picking up the mantle as supervisor beginning in Fall 2016. "It's time to get some fresh blood and new ideas. We know that Sarah will bring in a wonderful perspective and has exciting plans for MUC."

In the new semester, a major focus, Dr. Lebeis says, will be to develop a greater emphasis on public outreach, especially in public schools around Knoxville. MUC hopes to see UT microbiology students and faculty going into classrooms to show young students firsthand the wonders of science from the perspective of active scientists. To many high schoolers, interactions with their elders in university can provide valuable insight that may spur more serious interest in those who already love science, or plant new seeds of inspiration in those who have yet to become acquainted with it. In this way, MUC hopes to play an important role in the community and help cultivate future generations of scientists.

# Departmental Awards and Accolades

## External awards and accolades

- Fellowship in the American Academy of Microbiology - Steven Wilhelm, Professor; Frank Löffler, Professor
- Alfred P. Sloan Research Fellow in Ocean Sciences - Karen Lloyd, Assistant Professor
- Simons Early Career Investigator in Marine Microbial Ecology and Evolution Award - Karen Lloyd, Assistant Professor
- Kavli Fellow – National Academy of Sciences – Karen Lloyd, Assistant Professor
- Fulbright Fellowship - Chunlei Su, Associate Professor
- Kenneth & Blaire Mossman Endowed Professor - Steven Wilhelm, Professor
- David and Sandra White Endowed Professor - Jeffrey Becker, Professor
- Carolyn W Fite Endowed Professorship – Alison Buchan, Associate Professor
- Steven Wilhelm named Sustaining Fellow, American Society for Limnology and Oceanography
- Director of the Institute for a Secure and Sustainable Environment - Terry Hazen, Professor
- Chancellor's Research and Creative Achievement - Professional Promise Award - Erik Zinser, Associate Professor
- ESTCP, Project-of-the-Year Award for Environmental Restoration - Frank Löffler, Professor (together with Carmen A. Lebrón [PI], John Wilson, Todd Wiedemeier, Yi Yang, Rob Hinchee, Mike Singletary)
- Quest Scholars - Vitaly Ganusov, Assistant Professor; Karen Lloyd, Assistant Professor; Todd Reynolds, Associate Professor; Sarah Lebeis, Assistant Professor
- Faculty Trailblazer, College of Arts and Sciences - Alison Buchan, Associate Professor
- US Department of Energy Women@Energy Program profile - Andrea Rocha (postdoc in the Hazen lab)
- Science Alliance Award - Nana Ankrah, doctoral student in the Buchan lab
- Graduate Student Biology Cokkinias Award - Mohammad Moniruzzaman, doctoral student in the Wilhelm lab
- Penley Fellowship, College of Arts and Sciences UTK – Mohammad Moniruzzaman, doctoral student in the Wilhelm lab
- 2015 Comparative & Experimental Medicine and Public Health Research Symposium Presentation Award Winner - Chelsi Cassily (doctoral student in the Reynolds lab), 1st place; Caroline Grunenwald (doctoral student in the Su lab), 2nd place
- Certificate of Appreciation for Outstanding Service on the 2015 Oak Ridge Postdoctoral Association Executive Committee - Nannan Jiang, doctoral student in the Löffler lab
- American Society for Microbiology Student Travel Award - Jenny Onley, doctoral student in the Löffler lab
- Exhibition of Undergraduate Research and Creative Achievement (EURECA) Award - Justin Dinsmore (Reynolds lab), First Place, A&S; Haylie Lam (Ripp lab), First Place A&S; Kathleen Fitzgerald (Hazen lab), Honorable Mention A&S; Kathryn McBride (Hazen lab), Honorable Mention A&S; Kelly Arnholt (Ripp lab), Honorable Mention, A&S
- Ed Hawkins Memorial Scholarship (Pre-Medicine) - Christal Marie Lane
- Molly and Jimmy Seal Pre-Medicine Scholarship - Katielynn Parrott
- NSF predoctoral fellowship - Olivia Thompson, UGA (former UT Microbiology undergrad)
- Winner of Best Talk, Southeastern Biogeochemistry Symposium 2016 – Joy Buongiorno, doctoral student of Lloyd Lab

## Recent hires & promotions - Microbiology Department and graduate program alumni

- Colleen Jonsson, Beaman Distinguished Professor of Microbiology; Director, National Institute for Mathematical and Biological Synthesis
- Jeff Morris, who graduated with his doctoral degree from Zinser's laboratory, was hired as a tenure-track assistant professor in the Department of Biology at the University of Alabama at Birmingham
- Jeremy Chandler, who graduated with his doctoral degree from Zinser's laboratory, was hired as a Lecturer in the Division of Biology at the University of Tennessee
- Gary LeCleur, a former postdoctoral fellow and research associate with Dr. Wilhelm, was appointed as Research Assistant Professor & Lecturer

## Departmental Awards

- Staff Award - Rachelle Allen
- Undergraduate Faculty Teaching Award - Dr. Jeremy Chandler, Lecturer
- D. Frank Holtman Microbiology Undergraduate Academic Achievement Award - Alivia Shasteen
- Lisa Kahn Memorial Undergraduate Research Award - Enolia Marr (Sayler lab), Margaret McDaniel (Ganusov lab)
- Dr. Krishna and Sandy Reddy Endowed Scholarship - Emily Rosson
- Goss Summer Research Awards - Mark McDonald (Wilhelm lab), Kathleen McGuire (Lebeis lab), Timothy Westbrooks (Sparer lab)
- William Hutson Award for Excellence in Graduate Research - Nana Ankrah (Buchan lab), Mohammad Moniruzzaman (Wilhelm lab)
- Graduate Teaching Award - Pranay Dogra (Sparer lab), Jia Wen (Fozo lab)
- David C. White Travel Awards - Nana Ankrah (Buchan Lab), Pranay Dogra (Sparer Lab), Jackson Gainer (Wilhelm Lab), Caroline Grunenwald (Su Lab), John Harp (Fozo Lab), Enolia Marr (Sayler Lab), Mohammad Moniruzzaman (Wilhelm Lab), Jenny Onley (Löffler Lab), Elisabeth Pitt (Sparer Lab), Holly Saito (Fozo Lab), Pooja Saraf (Su Lab), Keats Shwab (Su Lab), Jia Wen (Fozo Lab)

## Alumni Awards

- Dr. Mark Lubkowitz, Teacher of the Year Award, Saint Michaels College (Highest award for faculty member)

## Faculty Plenary / Keynote Invited Talks

- Terry Hazen, Professor
  - RemTEC Summit. (Plenary) and Microbial Insights, September, 2014, Knoxville (Invited Webinar)
  - Genome Canada, Ottawa, Canada, November 2014 (Plenary)
  - Al Hammamet, Tunisia. MedRem Conference. January, 2014 (Keynote)
- Frank Löffler, Professor
  - Remtec Summit, Westminster, CO, March 2015 (Session Keynote)
  - American Society for Microbiology, New Orleans, June, 2015 (Division Lecture)
- Igor Jouline, Professor
  - Gordon Conference on Sensory Transduction in Microorganisms. January 2014, Ventura, CA (Discussion Leader)
  - American Society for Microbiology, New Orleans, June, 2015 (Symposium)
- Steven Wilhelm, Professor
  - American Society for Virology, London, ON, July 2015 (Keynote)
  - American Society for Microbiology, New Orleans, June 2015 (Symposium)
  - NSF Workshop Global HABS, Bowling Green, OH, April 2015 (Opening Keynote)
- Erik Zinser, Associate Professor
  - 12th Annual Harold B. Amos Symposium of Ryan Fellows, North Conway, NH, May 2015 (Keynote)
- Vitaly Ganusov, Assistant Professor
  - Workshop on Innovative Mathematical Modeling for the Analysis of Infectious Disease Data, Sapporo, Japan (Plenary)
- Jill Mikucki, Assistant Professor
  - Royal Society meeting on Subglacial Antarctic Lake exploration, Buckinghamshire, England, March 2015

## Participation in competitive international courses and events

- Sheridan Brewer (Hazen Lab) - selected to represent UT at the 2015 Posters at the Capitol event, February 25, 2015 in Nashville, TN
- Kathryn McBride (Hazen lab) and Sheridan Brewer (Hazen lab) - will present at the National Conference on Undergraduate Research conference in Asheville, NC in April 2016
- Elizabeth Padilla-Crespo (doctoral student of Löffler) - STEM Summit, April 2014 (US Capitol Hill talk)
- Joy Buongiorno (doctoral student of Lloyd) - Served as co-president of 2015 Darwin Day. Chosen to participate in the Agouron Institute 2015 International Geobiology summer course, Catalina Island, CA.
- Jenny Onley (doctoral student of Löffler) - Served as Microbiology Grad Student President. Young investigator oral presentation at ASM and invited to speak at the International Conference on Nitrification and Related Processes (ICoN4) in June 2015
- Andrea Rocha (postdoc of Hazen) - Environmental Biotechnology Workshop in Milan, Italy
- Lauren Krausfeldt (doctoral student of Wilhelm) - Great Lakes National Scholarship
- Rachelle Allen - 2015 UT Administrative Professionals Retreat in Gatlinburg, TN, November
- Mohammad Moniruzzaman received an EMBO / Gordon & Betty Moore Foundation award to travel to Heidelberg and present at the EMBO Symposium on Aquatic Microeukaryotes

# Contributors to the Microbiology Department in Fiscal Year 2015

We gratefully acknowledge those alumni and friends who have contributed to the Microbiology Enrichment Fund and to other Microbiology funds over the last fiscal year as listed below. The Microbiology Enrichment Fund allows the department to recruit, retain, and reward faculty, to support graduate and undergraduate research, and to respond flexibly to areas of greatest need. Donors can give [online here](#)\*. Donors should enter the gift amount \$XX, then click designation **Other Fund Not Listed** and enter **Microbiology Enrichment Fund MICRO\_18**.

Abby Smartt	Guy Caldwell	Ramani Reddy
Alison Buchan	Heather A. Petry	Richard Matheson
Allen Hodges	Helena Pound	Robert & Gina Candler
Angus L. Dawe	Houjian Cai	Robert & Karen Burlage
Barbara W. Bernstein	Jamila Bagash	Roberta Herz
Barry & Karen Goss	Janice Brenner Elston	Rodney & Karen Bunn
Bernard Bendriem	Jeffrey Abrams-Cohen	Sandra White
Bernard Rosenblatt	Jeffrey Michael Williams, A.I.A.	Sarah J. Kauffman
Bill & Nancy Fortner	Jenifer A. Ohriner	Sarah Lebeis
Bob Koppel	Jill Mikucki	Sheldon M. Cohen
Bruce Harmony	John Davis	Sheridan Brewer
Carol Harris	Joseph Alan May	Steve Beber
Carolyn Schwenn	Judith Fish	Steven Wilhelm
Chunlei Su	Karen Lloyd	Susan A. Silber
Cynthia Gehl	Kennth Beattie	Ted Scurlock
Cynthia M. Kahn	Leonard J. Gardberg	Teresa Compton
Dan Cohen-Vogel	Linda H. Van Beke	Tim Sparer
Daniel & Deborah Starnes	Linda Wenig	Tim Townes
Daniel Deana	Loren and Melinda Hauser	Todd Reynolds
David Kidwell	Marian Jay	Trudy N. Dreyer
David Logan	Mark Camblin	Vitaly Ganusov
Derek Hilton Alderman	Martin Reed	Wendell & Kathy Thomas
Don L. Eisenberg	Mary Anne Hoskins	
Elizabeth Fozo	Mary Linda Schwarzbart	
Ellen Kern	Melanie D. Craig	
Elyse Vaughn	Michael Allen	
Erik Zinser	Michael B. Zemel	
Erika McDonald	Michael T. McClamroch	
Frank Bowden III	Micheal & Kimhoung Thigpen	
Gary LeCleur	Monica Montgomery	
Gilya Gerda Schmidt	Pamela Hilemon Gross	
Glenn Silber	Pamela Small	
Gregory M. Stein	Piper Black	

\*<https://goo.gl/xbseYT>

*Edited and designed by Daniel Shyles*