



Expression

People and Progress 2017-2018
UConn Department of Molecular and Cell Biology

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Expression

September 2017-August 2018

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ON THE COVER:

Photo by Prof. Thane Papke taken at his main collection site for halophilic archaea, the Isla Cristina solar saltern near Huelva, Spain, on the southern coast of Spain near Portugal on the Atlantic Ocean. The red/orange color is due to carotenoid pigments that haloarchaea produce. The white encrustations on shore are salt crystals resulting from evaporation of the water.

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From the Department Head



Michael Lynes

Professor and Head

I am pleased to report that MCB continues to grow and develop to meet new challenges and opportunities.

More faculty are now engaged in entrepreneurial efforts to translate

their intellectual property into tangible results. For example, Prof. James Cole has formed a company to develop some of his intellectual property as described in this issue of *Expression*. In other news, nearly a quarter of MCB faculty labs moved from Beach Hall to the new Engineering Science Building whose dedication is featured in this issue. Some of the vacated space in Beach has been repurposed to support both experiential learning of the SEA-Phage and the Tiny Earth undergraduate experiential programs as well as the regular teaching of our Professional Science Masters Program modular courses. This year also witnessed the inauguration of a new MS program in Applied Biochemistry and Cell Biology that adds a significant new feature to MCB's professional development opportunities.

MCB faculty members have created a series of novel and exciting new courses. Prof. Leighton Core offered his bioinformatics class via distance learning at the Storrs, Avery Point, and Farmington campuses. Prof. Nichole Broderick again hosted her summer course "Microbe Hunting; Crowdsourcing" for professors interested in teaching versions of her Small World Initiative/Tiny Earth course. Inside look for the description of the SEA-Phage course newly offered by Profs. Carolyn Teschke, Simon White, Peter Gogarten and Noah Reid.

MCB experienced a strong recruiting year in our PhD program. We bring the best applicants into our research laboratories with the assistance of a very effective recruiting program that is managed by our Recruiting Committee. With grant support from the Provost, two highly sought students who are specifically interested in microbiome research were enrolled.

This year Assistant Professor Simon White joined our faculty, coming to us from the University of Leeds. He works on the mechanism of assembly of RNA viruses, and is an expert in the very exciting new technology of cryoelectron microscopy. Inside see an interview with him about his work on Picornaviruses.

Finally, we invite MCB alumni to let us know of any new developments in your life that you would like to share here. We look forward to another year of outstanding achievements of our faculty, students, and alumni.



Professor Carolyn Teschke received the 2018 Alice C. Evans Award from the American Society for Microbiology and was featured at a special reception at the annual ASM Microbe

meeting in Atlanta, Georgia. The Award honors a member of ASM for their major contributions toward full participation and advancement of women in microbiology. The Award is given in memory of Alice C. Evans, the first woman to be elected ASM President in 1928.

Professor Kenneth Noll was awarded the 2017 Provost's Award for Excellence in Public Engagement in the Tenure Track Faculty member category. He was recognized for achievements in outreach including radio and podcast broadcasts about science topics, presenting several summer microbiology research programs for children, and his ongoing presentations portraying **Charles Darwin**. He was recognized, along with other engagement award recipients at the Excellence in Public Engagement Reception.



Professor Rachel O'Neill was appointed Director of the Institute for Systems Genomics (ISG). The ISG was founded to facilitate and expand genomic research at UConn and recently celebrated its 5th year. Over the next three years as Director, Prof. O'Neill will complete an external review of the ISG, facilitate successful, collaborative research among its members, and support the expanding faculty in genomics research.



Professor Eric May was named one of four recipients of "The OpenEye Outstanding Junior Faculty Award in Computational Chemistry" by the American Chemical Society. The Awards are designed to assist new faculty members in gaining visibility within the computational chemistry community.

The Award provides \$1,000 to up to four outstanding tenure-track junior faculty members to present their work in the computational chemistry poster session at the annual ACS meeting. The other three awardees were from MIT and the University of Pittsburgh. The award was presented to Prof. May at the ACS annual meeting in New Orleans.



Professor Spencer Nyholm recently presented findings from his research on bobtail squids at the 7th Conference on Beneficial Microbes in Madison, Wisconsin. His team discovered that these squid protect their eggs from infection by

the fungus *Fusarium keratoplasticum* using helpful bacteria stored in a gland in the mother squid. These bacteria, Verrucomicrobia and Rhodobacteraciae, are collected from seawater when the female's glands develop at two to three months age. Working with Prof. Marcy Balunas in Pharmaceutical Sciences, Nyholm is searching for anti fungal compounds that might be useful in human fungal infections.



Nyholm's presentation was covered in articles both in **Newsweek** and **Science News**.

Birds do it, bees do it, even salty haloarchaea

At the cellular level, sex in eukaryotes, like plants, animals and many protists, involves the fusion of two gamete cells, each of which carries half the chromosomal DNA of non-gamete cells. The fused cell goes on to become a new organism, the offspring of the donors of the gamete cells. In bacteria and archaea, sexual reproduction of this kind does not happen. Though, in the opinion of **Professor Thane Papke**, some haloarchaeal cells come close.

Haloarchaea, organisms that live in extremely salty environments, have a single chromosome like all archaea and bacteria, though some may have up to 50 copies of that chromosome. Some haloarchaea species can fuse their cells and exchange chromosomal DNA. The chromosomal DNAs from each cell can recombine with one another producing hybrid molecules. The two cells reform, with at least one having the new hybrid chromosome. The fusion mechanism of two cells is unique among archaea and bacteria apparently mimicking aspects of the cell fusion part of eukaryotic sex.

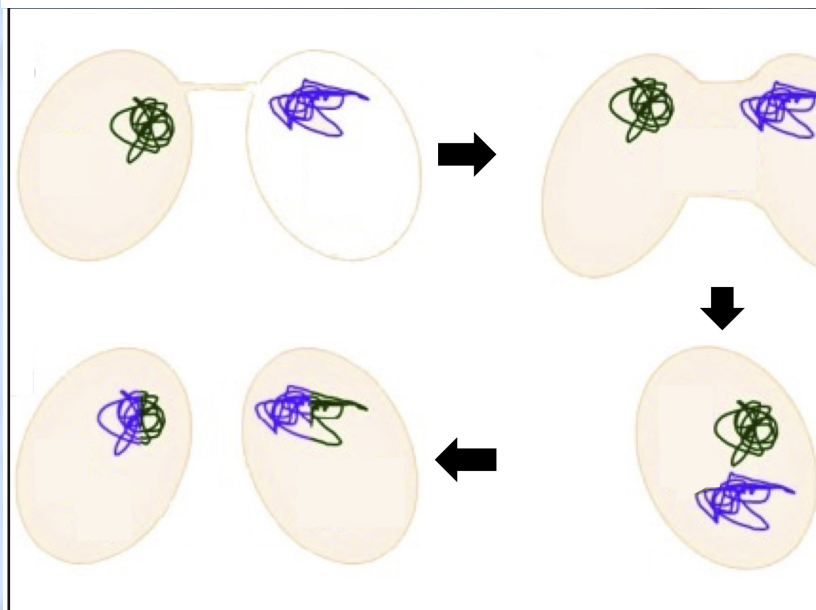
The recombination of the two chromosomes is also unusual among bacteria and archaea, but all these organisms share at least parts of their chromosomal DNA in a process called horizontal gene transfer. The haloarchaea are known to share genes at a very high frequency. "Horizontal gene transfer and recombination are occurring so frequently in these populations it looks

like they are sexually reproducing populations, but they don't do sex," Papke says. "They are doing recombination and reproduction separately." Consequently, their evolution is impacted by gene recombination as much as are eukaryotes.

These similarities between eukaryotic sex and haloarchaeal cell




Prof. Papke takes samples of water from the Isla Cristina solar salt pond. The water is pink because the halophilic archaea produce a pigment. The



do it, even sea do it



ern near Huelva, Spain to collect extremely halophilic archaea. The
ese archaea are nearly the sole living creatures in this pond.



Two *Haloferax* cells with slightly different chromosomes first join by a narrow cellular extension that then expands until the cells are fully fused at which time portions of their chromosomal DNA exchange. Finally the cells separate, each with altered chromosomes.

fusion-mediated gene exchange prompted NASA to fund a project by Prof. Papke to study the details of cell fusion and genetic recombination in the haloarchaeon *Haloferax volcanii* to learn how eukaryotic sex may have come to be.

The latest theories of the origin of eukaryotic cells holds that archaeal and bacterial cells fused to give rise to the eukaryotic cell having a nucleus that

contains its chromosomes in pairs. Papke thinks that at least some of the necessary molecular machinery of eukaryotic sex must have arisen in the bacterial and archaeal ancestors of those cells so that the new eukaryotic cells could reproduce.

One of the important features of eukaryotic sex is that the two parental gamete cells have to recognize one another as being from the same species. Haloarchaeal cells may not be so selective in their choice of fusion partners. *H. volcanii* cells do fuse with cells of other species in the laboratory, but not as frequently as they do with those of their own species. "It is dangerous for cells to take up just any DNA," Papke says. He will determine how promiscuous it can be and examine what cellular features limit out-of-species associations.

Papke thinks one way that haloarchaeal cells might assure that fusion occurs between cells of the same species is by sensing if cells of their own kind are around them. *H. volcanii* is known to make and detect molecules that cells release to make their presence known. When cells sense that enough of their kind surrounds them, then they begin cooperative processes that involve all the cells of their kind can participate in, like cell fusions. These cells effectively take a head count to determine if a quorum exists, so the process is called quorum sensing.

Once a quorum is achieved, cells might begin the process of sending out cell extensions that could, perhaps through sensory proteins on their cell surface, recognize potential fusion partners. Papke will examine these and other possible features of quorum sensing in this study.

He will also examine the features of these bridging cell extensions and the physical process of cell fusion using newly devised microscopy techniques including cryo-scanning electron microscopy and cryo-electron tomography. To aid him in this work, Papke has begun a collaboration with newly arrived MCB **Professor Simon White** whose research on virus structure involves use of these sophisticated and extremely high resolution microscopic methods. Some of the work will be carried out that the UConn Bioscience Electron Microscopy Laboratory while the tomography experiments will be done at the University of Massachusetts Medical School Cryo-EM Core Facility.

It seems a large evolutionary jump from the mechanism of reproduction of bacterial and archaeal cells to that of eukaryotic cells and many details remain to be discovered. The halophilic archaea may provide some important clues to solving this mystery and Papke's efforts will certainly open the door a crack to allow us to view more details of how this occurred.

UConn Program in Innovative Therapeutics for

The PITCH program jointly sponsored by UConn and Yale University was established in 2016 to encourage commercialization of the discovery of novel drug compounds. The initiative is supported by a three-year, \$10 million investment managed by the UConn Technology Incubation Program.

TARGETING THE FLU WITH A NOVEL ANTIVIRAL DRUG

Professor
perspective

industry, thanks to support from UConn's tech transfer experts and the PITCH program.

"While universities provide many important resources, the support facilities for translational research are often lacking. That is



The Cole lab is taking a novel approach to attack the flu virus because of its importance and potential. They are targeting the host in their quest to develop a drug to treat the flu.

Cole explains, "With PITCH we began to screen for small molecules that would function as adjuvants to the immune system to enhance its ability to fight the virus.

Through PITCH, Jim Cole was able to create a company (**Emphutos Therapeutics**) with the goal of commercializing his research. PITCH recently assisted Cole with the writing and submission of a US Government small business antiviral drug project.

"PITCH made creating the company so easy for us. The range of disciplines required to translate research into a drug is often difficult for academics to set up those teams on their own. We've had access to people

represented in my department or even on my campus."

Cole's company hit a major milestone recently when they secured space in the UConn Technology Incubation Program – designed to support the development of faculty or external entrepreneurs. For Cole, PITCH has been an essential "connector and convener" to broaden the reach of his research.

ROBINSON BEGINS PROJECT FOR ANTIBIOTIC DEVELOPMENT

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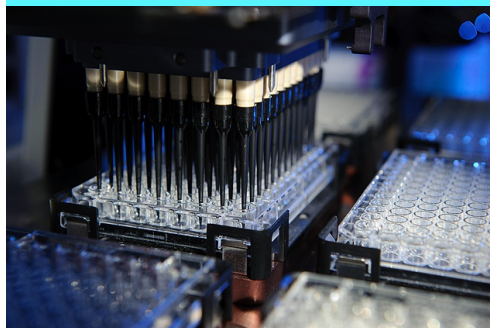
Robinson and her team will study the role of the prokaryotic translational GTPase BipA in bacterial processes, mobility and adaptive stress responses in bacterial cells, which all make it essential for survival.

In stressful or fluctuating environments, BipA binds to a unique ribosomal species and regulates gene expression under these conditions. Without BipA, bacteria adapt poorly to changed surroundings, thereby decreasing their survival.

Little is known about how BipA functions in bacteria. Any insights could lead to the development of new antibiotics in the face of increasing resistance of bacteria to existing drugs.

Robinson and her team are completing this project with PITCH support. The grant will also secure future PITCH support through access to Yale's resources for drug development, screening, and clinical treatment.

PITCH PROMISING AWARD TO FIND INHIBITORS OF



Professor Adam Zweifach received a PITCH Promising Project award for a project to identify inhibitors of the enzyme implicated in many cancers.

The funding will allow Zweifach to obtain a commercially available compound that inhibits the enzyme HK2, which is over-produced in many types of cancer. HK2 contributes to an energy-producing pathway that allows cancer cells to proliferate rapidly. Non-cancerous cells do not use this mechanism of energy production.

There are currently no potent, specific inhibitors for HK2 on the market that are used to treat cancer. This award will allow Zweifach to use the commercially available compound to validate a novel screen to identify new lead HK2 inhibitors that could possibly lead to new cancer drugs.

"I'm really grateful to PITCH for the support. I think the program can really help jumpstart research that is not otherwise possible."

Zweifach received his Ph.D. from Yale University. He completed his postdoctoral training at Stanford. His research interests include the study of cytotoxic T cells, and phenotypic screening for drug discovery.

or Connecticut's Health

ercialization of research from the state's universities through
by Connecticut Innovations.

essor **James Cole** as a former scientist at Merck, has a unique
ve on the drug discovery process. He is reentering the world of

why PITCH is so essential for the work that we are doing."
evidence as a seasonal disease. Instead of targeting the virus, they

ivators." These molecules could activate the host's innate

al of moving this project forward by attracting grants and investor
all business grant to obtain funding for the next stage of the novel

te basic research into therapeutically useful science is very large
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ed to spur company growth for high-potential companies
each of his work.

Edited from Jessica McBride, Office of the VP for Research

ia Robinson received a promising project award from the
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creasing their overall fitness.

development of novel antibiotics, an unmet clinical need in the

will help Robinson advance her research and apply for potential
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Edited from Anna Zarra Aldrich, Office of the VP for Research

F CANCER-CAUSING CELL

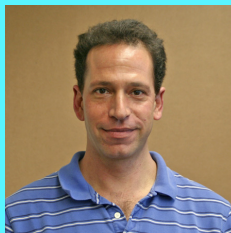
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inhibits hexokinase 2 (HK2). HK2 is an enzyme
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ostart biotech in Connecticut," says Zweifach.

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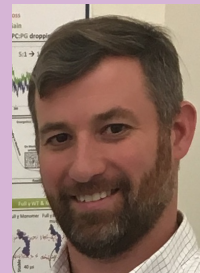
Edited from Anna Zarra Aldrich, Office of the Vice President for Research




UConn has been selected to join the Howard Hughes Medical Institute's Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (**SEA-PHAGES**) program in its 11th cohort of schools. MCB faculty **Carol Teschke, Simon White, Peter Gogarten** and **Noah Reid** applied to be part of the program, in which first or second year undergraduates participate in a two-semester, discovery-based undergraduate research course that begins with simple digging in the soil to find new bacterial viruses, and progresses through a variety of microbiology techniques to isolate or enrich those viruses and then to complex genome sequencing, annotation, and bioinformatic analyses.

NFIP

National Fellowships
Incentive Program



Professors Sarah Hird, Eric May and Spencer Nyholm received rewards from the UConn Office of National Scholarships and Fellowships' National Fellowships Incentive Program for mentoring graduate students through the process of developing proposals and submitting applications for eligible awards. Faculty are eligible for up to \$1,500 in rewards.



Scientists crack koala's genetic code

An international team of scientists including UConn genomicist **Professor Rachel O'Neill** have sequenced the first full koala genome, they report today in Nature Genetics. The koala's genes have already revealed some of the furry tree dweller's secrets, from how it digests toxic eucalyptus leaves to why it's susceptible to chlamydia.

Koalas are marsupials, along with kangaroos, wombats, Tasmanian devils, and opossums. Marsupials give birth when their young are still very small and underdeveloped, and then raise the babies in a pouch for several additional months. They diverged from other mammals a very long time ago, and scientists have suspected that the marsupial genome could answer many questions about how early mammals evolved.

"Koalas are an iconic marsupial mammal," says O'Neill. "Everyone knows what a koala looks like, which makes it

a great species to use as an educational tool. But they are at risk due to population crashes in the distant past and an emerging infectious virus."

Stuart Humphreys/Australian Museum

Figuring out their genome – spelling out all the genes and which chromosome, or DNA molecule, each gene is on – gives biologists the opportunity to identify genes related to the koala's response to viruses, and identify boundaries of population diversity that can direct conservation efforts, she says. O'Neill, director of UConn's Systems Genomics Institute, specializes in marsupials, and was also involved in the first marsupial genome ever sequenced – the tammar wallaby.

The koala genome that has just been published is the most complete marsupial genome sequenced to date, on par with the human genome. The consortium of scientists –



54 researchers from 29 different institutions across seven countries – sequenced more than 26,000 genes in the koala genome, making it slightly larger than the human one. And in one way, says O'Neill, the koala genome is actually better than the human one: the koala genome has had its centromeres defined. Think of the centromere as the spot where the two halves of each chromosome are attached; if you imagine the 'X' chromosome, the centromere is at the cross of the X. It's a special part of the genome that helps the DNA copy itself.

"This is the first full genome assembly in any animal to contain centromeres that have been functionally defined," O'Neill says. Compared to a

already answered questions about the koala that have puzzled people for decades.

For example, koalas live in eucalyptus forests in Australia and subsist almost entirely upon eucalyptus leaves, which contain poisonous compounds that make other mammals sick if eaten in large amounts. Researchers from the Earlham Institute in the UK noticed that the koala genome has a greater number and diversity of genes known to code for metabolic enzymes in the liver that help break down toxins like those found in eucalyptus leaves.

Another important discovery was the composition of koala milk. Because koala babies (called joeys) are born at such an early stage of development – just 5 weeks gestation, compared to the 9 weeks for dogs or 40 weeks for humans – they need very different types and amounts of milk as they grow and suckle inside their mother's pouch.

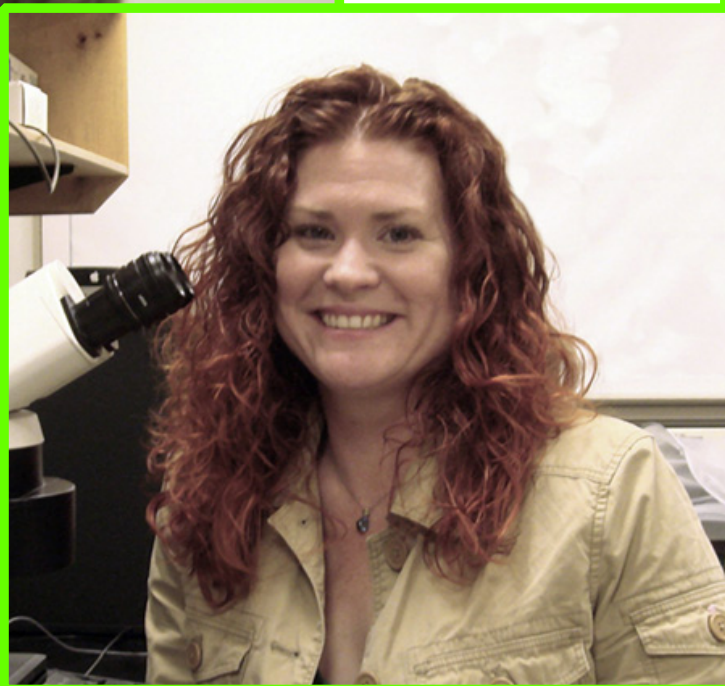
"Thanks to the high-quality genome, the team was able to analyze and discover koala-specific milk proteins that are critical for various stages of development, says the University of Sydney's Katherine Belov, one of the lead authors on the study. It also appears these proteins may have an antimicrobial role, showing activity against a range of bacterial and fungal species, including *Chlamydia pecorum*, the strain known to cause blindness and infertility in koalas.

Chlamydia has severely reduced koala populations in New South Wales and Queensland. Using information gained from the koala genome, scientists hope to develop a vaccine.

"The genome enables a holistic and scientifically grounded approach to koala conservation," says Rebecca Johnson, director of the Australian Museum Research Institute and another lead author.

Wild koalas are currently found in eucalyptus forest and woodlands across Eastern Australia (Victoria, New South Wales, and Queensland), and have been translocated to other sites, such as south eastern South Australia and onto some islands.

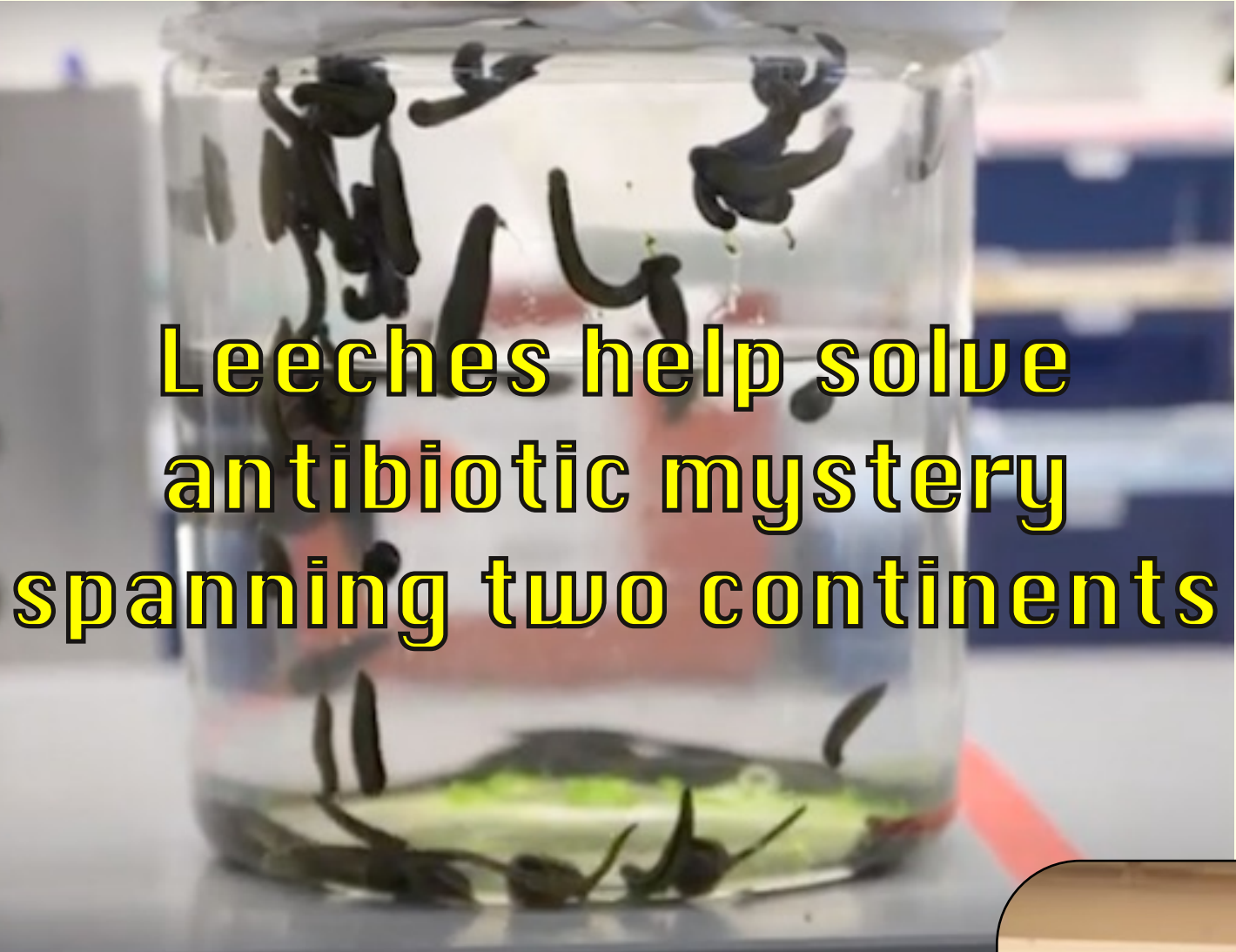
Their unique and highly specific diet of eucalyptus tree leaves has resulted in koalas being especially vulnerable to habitat loss due to the clearing of native vegetation for agriculture and urban development. The Australian federal government lists koala populations in Queensland, New South Wales, and Australian Capital Territory as 'vulnerable' under national environment law. The research team hopes that findings from the koala genome will help efforts to conserve and protect the species.



Photo

human's, the koala centromeres are small, disordered, and full of 'jumping genes', pieces of DNA that can move around within the genome.

Several unusual patterns in the koala genome have



Leeches help solve antibiotic mystery spanning two continents

Plastic surgery patients were getting antibiotic-resistant infections, and doctors didn't know why. It took a University of Connecticut microbiologist to unravel the mystery – turning up clues that connected the dots between sterile American hospitals, European leech farms, and poultry husbandry.

The research by **Professor Joerg Graf** and colleagues, [published in mBio](#), provides proof that tiny levels of antibiotics found in the environment can result in antibiotic-resistant bacteria. Drug resistance is a major and growing concern in healthcare, given that it could lead to untreatable illnesses.

The Leech Lead

Prof. Graf is intimately familiar with leech guts, where bacteria can live without making the animals sick. He's examined the contents of thousands of leeches over the years – both those from the farm and those from the wild.

Graf thought he knew the bacteria in their digestive systems just as well. But in 2011, he got a surprise.

One of his graduate students, Sophie Colston, was having trouble growing a strain of *Aeromonas* bacteria in

the leeches. They would feed the *Aeromonas* strain to a leech and later check how well it was growing. This time, the *Aeromonas* strain was having trouble.

At the same time, plastic surgeons began to report problems with patients getting infected with *Aeromonas* bacteria resistant to ciprofloxacin (Cipro), an important antibiotic. Normally they are easily treated with Cipro.

Graf's interest was piqued because the plastic surgery patients had all been treated with a regular protocol of farm-raised leeches to improve blood flow at surgical sites. Leeches in medicine are raised on specialty farms, fed a controlled diet, and used just once on a single patient, so they seemed an unlikely source of contamination.



“Without ever having been in a hospital, without having seen a patient, these leeches contained Cipro-resistant bacteria,” Graf said, standing in front of a jar containing a mob of leeches – long flat ribbons, brown on top and green below, swimming, squirming, and climbing through the water, then extending weirdly into space, casting for prey. How could that happen, he wondered.

The Chicken Came First

Leeches are used in medicine because they are effective at increasing blood circulation and breaking up blood clots.

When they are being raised, leeches are hungry for blood. And they are not picky about where it comes from. At one point the source was cows but, when the mad cow disease outbreak made it undesirable to use cattle blood, a major medical leech farmer in Europe switched to

must survive in order to be considered “resistant.” Could such trace levels of Cipro, hundredths of a microgram, really be causing antibiotic resistance?

Graf and Beka and their colleagues isolated strains of *Aeromonas* from leeches contaminated with antibiotics, and sequenced their genomes. Two colleagues, Matt Fullmer and Peter Gogarten, confirmed that they contained the three bits of DNA, two genes with mutations and a plasmid, necessary for resistance to Cipro.

Indeed, when the Cipro-resistant *Aeromonas* were grown alongside the test strain of *Aeromonas* in a clean lab medium or inside a leech, the test strain grew all over them. But if there was even a tiny bit of antibiotic added into the mix, the Cipro-resistant variety dominated.

“This was the first time such low levels of antibiotics



feeding the leeches poultry blood instead. In Europe, the use of antibiotics has not been banned in poultry farms as it has in the

U.S.

So, Graf and his team, including Colston and Lidia Beka, another graduate student, analyzed the gut contents of leeches from the farm that used poultry blood.

They found their answer: Traces of both ciprofloxacin and enrofloxacin, Cipro’s veterinary counterpart.

But the amount of antibiotic present was vanishingly low. Just around 0.01 micrograms per milliliter, four hundred times less than the concentration a bacteria

were observed doing this in the natural environment,” Graf says.

This is worrisome, because ciprofloxacin and related drugs don’t break down very well in the environment. They persist. They’re found in hospital wastewater, in effluent from pharmaceutical manufacturers and farms, and even sometimes in sewage. And, apparently, in poultry blood.

The research of Graf and colleagues demonstrates that levels of the antibiotics circulating in the environment matter – even the tiniest of levels.

Kim Krieger - UConn Communications

[Click here to listen to an interview with Prof. Graf](#)

Expression 2017-2018 10

UConn celebrated opening of Engineering & Science Building



Gov. Dannel Malloy, right, and President Susan Herbst share a laugh at the dedication of the Engineering & Science Building. (Peter Morenus/UConn Photo)

On June 11, the University of Connecticut celebrated the opening of its new Engineering & Science Building, a state-of-the-art facility whose carefully planned design and modern labs will help the University and its researchers drive new innovations in a range of scientific disciplines.

Gov. Dannel P. Malloy, UConn President Susan Herbst, industry partners, students and researchers, and others gathered to cut the ribbon to celebrate the opening of the five-story building, which sits strategically on campus adjacent to buildings housing UConn's programs in chemistry, pharmacy, and other sciences.

The building was completed this spring and now houses programs in engineering and life sciences, including the Institute for Systems Genomics.

It represents yet another milestone in the Next Generation Connecticut initiative, which funded the \$95 million project cost as part of the state's larger plan to expand STEM (science, technology, engineering, and math) at UConn as a pathway to economic growth in the state.

"This building is the culmination of significant investment by the state of Connecticut in the field of STEM, and in the future of engineering," said Kazem Kazerounian, dean of the UConn School of Engineering.

The new five-story Engineering & Science

building comprises 118,000 gross square feet of laboratories, research space, meeting and gathering spaces, offices, and other amenities meant to foster cross-campus and interdisciplinary collaborations between Storrs, UConn Health, and UConn's other campuses.

The School of Engineering uses three floors, housing programs such as robotics, advanced manufacturing, cyber physics, virtual and augmented reality, mechatronics, and other topics. The Institute for Systems Genomics is on two floors, including its Center for Genome Innovation, microbial analysis and resource service, and other programs.

UConn and its researchers have ongoing partnerships with many companies as part of the innovation taking place in the new building. It also supports UConn's work to fuel Connecticut's economy with new technologies, highly skilled graduates, marketable patents and licenses, and the creation of high-wage jobs in new and emerging companies.

The building also incorporates an open-concept lab design, which will help foster collaboration between researchers with various specialties. That design also allows for equipment to be placed together rather than spread across different floors or buildings, letting researchers spend more time on their core work and reducing or eliminating the need to transport their work between locations.

The new structure also gives scientists access to a high-speed broadband network that delivers the



Opening of innovative new Engineering & Science Building



capacity they need to process large amounts of data quickly – a necessity in many research fields today.

The first floor houses the Computational Design Lab whose research activities are in the area of Computational Design and Synthesis of Mechanical Systems. Also on the first floor is the

Robotics and Controls Lab that works on various estimation and control problems for applications in robotics and other engineering domains. Finally, the Manufacturing Systems Lab advances information technology and mathematical optimization techniques in areas such as Intelligent Manufacturing Systems, Smart and Green Buildings and Smart Power Systems-smart grid.

On the second and third floors is the Institute for Systems Genomics. This is UConn's premier genomics research and training program. It includes faculty from multiple disciplines: Molecular & Cell Biology, Ecology and Evolutionary Biology, Allied Health Sciences, and UConn Health. Offices for researchers from UConn Health's Department of Genetics and Genome Sciences are included in this space, emphasizing the cross-campus collaborative nature of the research area.

Center for Genome Innovation also occupies these floors providing the core service and training center for UConn's genomics and cytogenetics programs. Its new space features some of the latest instrumentation for next-generation genome sequencing, analysis, and genotyping. The Center for Genome Innovation supports more than 120 labs at UConn campuses

in Storrs, Farmington, and Avery Point and provides services for clients outside of UConn.

Additional core facilities are provided by Microbial Analysis, Resources, and Services that assists researchers by performing microbiome, targeted amplicon, and small genome sequencing, along with the Computational Biology Core that provides crucial computational power and technical support to UConn researchers and affiliates.

Two Master's Degree programs are centered here. The Genetic Counseling Master's Degree Program, Affiliated with Allied Health Sciences, will teach students how to interpret genetic testing results, a rapidly growing aspect of health care. The Professional Science Master's in Health Care Genetics program offers a science degree "plus" experiential and professional development training designed to increase knowledge and prepare leaders in health care genetics who translate discoveries in genetic sciences to products, policies, and practices.

The fourth floor hosts Biointegrated Materials and Devices at Nano- and Micro-scales, Neuroengineering and Pain Research, and Smart Imaging.

On the fifth floor is the Center for Clean Energy Engineering, Process Systems and Operations Research, and the Sustainable Water and Energy Learning Laboratory.

The structure, designed by Mitchell Giurgola Architects LLP, was built to achieve LEED Silver Certification in sustainability and energy efficiency, and to comply with Connecticut High-Performance Building Standards. It was built by Fusco Corp., with construction starting in 2015.

Edited from combined reports -- UConn Today

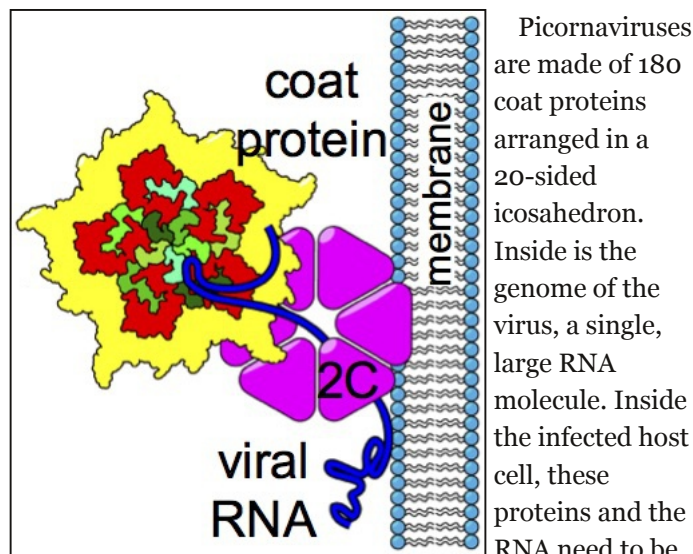


Kanika Malani '20 (MCB and Anthropology) speaks at the dedication of the Engineering & Science Building. (Peter Morenus/UConn Photo)

A NEW LOOK AT VIRAL COAT ASSEMBLY

According to **Professor Simon White**, when viruses infect a cell, they form a “viral factory.” “Upon infection, the virus completely reorganizes the host cell’s membrane into these little viral factories,” he explains. “And in the viral factories, that’s where you get the new viral RNA replication and you get packaging.”

Prof. White, the newest faculty member in MCB, studies the assembly of virus particles of the picornaviruses. Picornaviruses are major infective agents in mammals and birds and include the causative agents of polio, hepatitis A, the common cold, and foot-and-mouth disease.



Picornaviruses are made of 180 coat proteins arranged in a 20-sided icosahedron. Inside is the genome of the virus, a single, large RNA molecule. Inside the infected host cell, these proteins and the RNA need to be assembled so that new viral particles can be released. Another viral protein, the 2C protein, is involved in the assembly process. White seeks to specifically identify the role of 2C in this process by purifying it and determining its structure.

There is controversy about how assembly occurs. “We have these two mechanisms one of which is protein driven and the other one by which the RNA has a more important role in it,” White says. White theorizes that the real process is a combination of these two proposed mechanisms.

During his post-doctoral work at Leeds, White found that the RNA binds to the inside of the coat proteins at specific sites along the RNA, and so the RNA likely plays an important role in assembling the coat proteins into an icosahedron. “What I think is happening is that you can bring the (mechanisms) together,” he says. The 2C protein, he believes, comes in to make the packing signals

on the RNA more available to the coat proteins.

White and his students are working to get a structure of the 2C protein. The protein is recalcitrant to typical protein crystallization methods, so White will use newer methodologies. White has expertise in cryoelectron microscopy, a technique that allows one to literally photograph a protein at such high resolution that its detailed structure is revealed. Extremely low temperatures freeze the protein molecule into a rigid shape so clear images can be obtained in an electron microscope.

He might also employ electron cryotomography to obtain images of the viral factories. The frozen virally induced assemblages are imaged in an electron microscope as they are tilted several times, resulting in a series of 2-dimensional images that can be combined to produce a 3-dimensional image.

Though the structure of the 2C protein should give clues to its role in viral assembly, it may not be easy to tease out all its functions. “This protein has so many different roles that it is difficult to pull apart what it is doing,” White says. Its roles include: RNA replication, viral assembly, modulation of host cell immune response, and reorganization of host cell membranes.

White’s studies have practical implications for using 2C as a target for drug development. “The 2C is a really good target because it is the most conserved protein in the virus family, so if you want to get a broad-range antiviral, 2C is a good target,” White notes.

White has found the research environment in MCB and UConn to be very good for his work. He can work with several people here who have complimentary interests in viral assembly and protein structure. Though UConn does not have the sophisticated microscopes he will use, they are close by in national facilities in Boston and New York City. He hopes to eventually assemble a team of researchers at UConn to secure funding for the purchase of a lower cost microscope that will allow users to obtain lower resolution images that can be used to direct experiments on the higher resolution microscopes at national facilities.



Kenneth Noll



Malone participates in United Nations Youth Forum

Professor John Malone was invited to participate in the 2018 United Nations Economic and Social Council Youth Forum. The Forum provided a platform for youth to engage in a dialogue with UN Member States and to discuss the policy frameworks and promote innovative, institutionalized approaches and initiatives for advancing the youth development agenda at national, regional, and global levels. Youth leaders from around the world gathered at the United Nations Headquarters in New York to generate new ideas for achieving the 2030 Agenda for Sustainable Development. Malone was part of the delegation of the Global Young Academy, an international organization of 200 young scientists who seek to make global decision making evidence-based and inclusive.



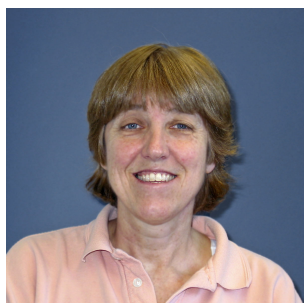
The Forum took place January 30th and 31st and Malone participated in the panel discussions both days. He contributed to development of the concept note for Sustainable Development Goal 17: The use of science, technology, and innovations in facilitating youth engagement, development, and resilience. During the Forum, Malone specifically outlined how biological and molecular science can be used to create opportunity and ensure that science as a profession is an attractive option for youth worldwide.

The SDG 17 session focused on the importance of leveraging science, technology and innovation within the youth sector both because they will require those skills to engage in the workforce, policy making and social inclusion, but also, according to UN representatives, because youth can bring to the table a crucial perspective within their communities. Youth can actually “drive development of tools because youth have a keen understanding of their communities.”

Kenneth Noll

Staff retirements

After four decades of service, teaching lab technician **Deborah Hanna** has retired. Although the announcement was sad news for MCB, it marked a well-deserved respite for Deborah. Hanna had served for many years as academic support for microbiology and genetics undergraduate laboratory courses. Gino Intrieri, Laboratory Supervisor, remarked, “I cannot begin to say how much Deb has meant to the success of the labs.” Deborah could always be counted on “to have the labs all set up and ready to go and that the media was made and cultures were always done and ready for the students,” he said.

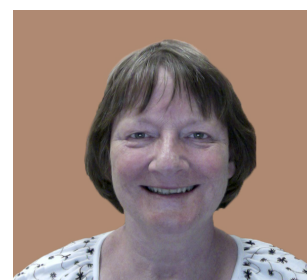


Deborah worked as a lab technician in the laboratory of Professor David Benson from 1981-1983 on Frankia isolation and characterization when Benson was a new Assistant Professor. “Those were fun times,” Benson remembered. He commented on her “consistent good humor and ability to keep life...interesting for my students and myself as we struggled to get going, working on the cheap in the days before start-up funds.”

Benson also praised her for her efforts supporting the undergraduate microbiology labs. Benson calculated that she poured well over 1 million Petri plates, tubes and flasks during her years in the “media room.” Her expertise, sense of humor, constancy, and ability to get things done on a massive scale will be missed.

From the MCB front office, also retiring was **Lisa Dejesse**. Lisa was a departmental secretary with MCB since 2005 and was the face of MCB in the main office since 2009. Lisa previously worked in PNB and the School of Fine Arts.

We will all going to miss Deborah and Lisa’s devoted service and friendly smiles. We all send them best wishes for a great retirement.



Kenneth Noll, with Gino Intrieri and David Benson

Rare genes evolve ways to persist



Since bacteria and archaea reproduce by simple division of cells, one would think that each cell of in a single strain would have the same genes. With the advent of genome sequencing that assumption proved false. In a recent study, 228 genomes of the same strain of *Escherichia coli* found that, though each cell had about 5,000 genes, there were over 11,000 different genes in all the genomes, called the pan-genome of the strain. Only about 2,700 of these were common to all 228 genome sequences, the core genome, so about half the genes in a genome are not found in all the cells of a strain. Some of the genes of the pan-genome are only rarely found in members of this strain.

Why do these rare genes remain in pan-genomes since they seem to be of little importance? **Professor J. Peter Gogarten** posed this question in a proposal to the Molecular and Cell Biology program at the National Science Foundation and NSF recently granted him and **Professor Thane Papke** \$817,279 to address it. Funding was provided jointly by NSF and the US-Israeli Binational Science Foundation (BSF) which provided an additional \$171,500 for the Israeli team.

If rare genes serve no purpose to cells, then they should not have remained in the pan-genome. "They should have been fixed in the population a long time ago and then, (when any selection for them disappeared), they should have disappeared, too," Gogarten says.

15 Expression 2017-2018

Gogarten assembled a team including Papke and Professors Uri Gophna and Lilach Hadany from Tel-Aviv University to examine the factors that lead to the distribution of rare genes through populations of the salt-loving, or halophilic, archaea *Haloferax* and *Halorubrum*. They will also attempt to find out why these genes are maintained in these populations. This team has previously been funded by BSF to study this organism's genetics and Gogarten received a Fulbright Fellowship in 2009 to work in Israel with Gophna. These previous efforts provided data that supported their current study.

Gogarten's research group provides the bioinformatic expertise to the team. He is particularly interested in how small genetic elements that appear selfish distribute themselves through a population and what factors determine whether a population maintains them or not. One such element, called an intein, encodes a homing endonuclease, an enzyme that allows the intein to insert its gene into a specific chromosomal gene. If DNA encoding an intein is transferred into another cell that contains the target gene not yet invaded by the intein, the intein gene will become inserted into the uninvaded gene. Inteins rely on the naturally occurring gene flow between cells. In this manner the intein distributes itself into new hosts.



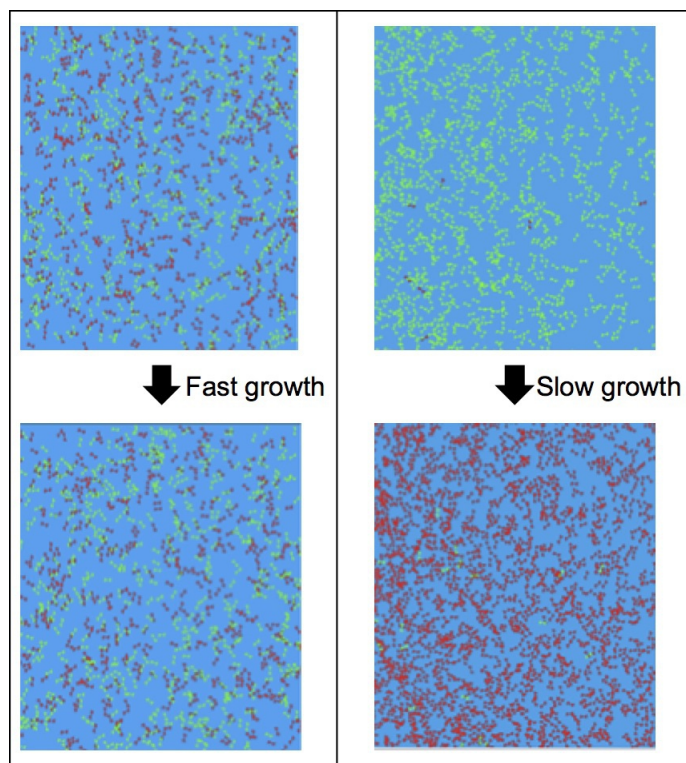
Though inteins have an effective method to spread themselves throughout a population, they can be lost through mutation events. “There is no benefit to the cell for keeping it,” says Gogarten. “One explanation for why they disappear is that the intein has a large fitness cost.” The collaboration between the Gophna and Gogarten labs has shown that the rate at which cells with inteins divide is slower than those without inteins. Consequently, if such cells are growing together, the cells without inteins would eventually outnumber those with inteins.

“The solution [to long term survival] is that you need different environments,” Gogarten says.

Prolonged rapid growth conditions could result in the total loss of the intein from the population since the rate of rapid growth is greater than the rate of intein intercellular transfer by horizontal gene transfer. Slow growth of halophilic archaea is found in [Antarctica’s Deep Lake](#). Despite its name, Deep Lake is a surface lake with a high salt concentration, so it does not freeze.

Haloarchaeal cells there grow very slowly and are found to have shared genes with one another perhaps much more extensively than haloarchaea in warmer waters. Papke and Gophna will sample some of these warmer environments to measure the extent of gene transfer there to test their hypotheses regarding the association of growth rate and gene exchange.

Gogarten uses computer modeling of cell growth to test



this idea. The figure below shows that populations of fast-growing cells that contain (red dots) or not contain (green dots) inteins will, after many generations, lose the cells containing inteins (red dots). In slower growing cells, intein-containing cells can constitute up to about half the population. In nature, nutrient concentrations control the rate of cell growth, so populations continually go through boom-and-bust nutrient conditions. Papke and Gophna will examine natural populations to determine the intein content and attempt to relate this to their environmental conditions.

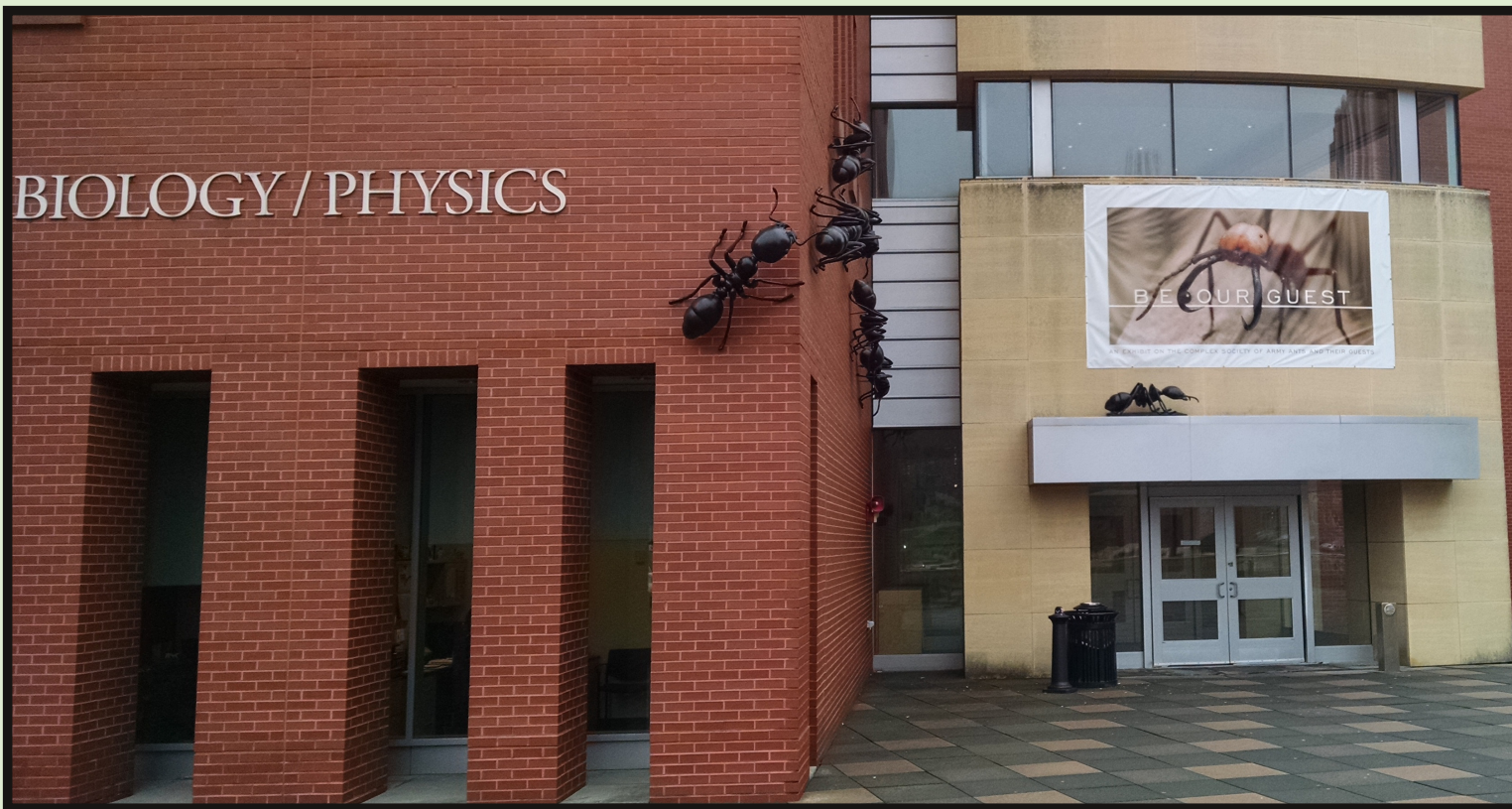


Deep Lake, Antarctica. Photo Damon Ward/Australian Antarctic Division.

Other small genetic elements that exhibit other features will be examined. Some of these will kill their host cell if the cell should lose the element, thus helping to assure the element remains in the population of viable cells.

Some rare genes allow cells to use large nutrient molecules that lie outside cells and that require specific enzymes to break them into smaller molecules that cells can use. Only a few cells in a population may encode the necessary enzymes in their chromosomes, but the enzymes they produce will provide enough small molecules that other nearby cells that lack the genes for this enzyme will still be able to use those small molecules. Consequently, these “cheater” cells will reap the benefits from the “altruistic” cells nearby. The team will examine the dynamics of these kinds of genes both through computational modeling and in real world environments.

This work will lead to a better understanding of how microbial genomes operate and evolve to adapt to new conditions and to maintain a level of preparedness to respond to changing environmental conditions. Some genes, though rare in populations, play important roles so evolution has selected the means to assure they are not lost.



Ants 4 feet long are crawling up the walls outside the Biology/Physics Building, MCB's home. And an 8-footer is crawling down a column in the lobby outside the MCB office. These are all part of the AntU project funded by a 4-year, \$500,000 grant from the National Science Foundation (NSF) Collections in Support of Biological Research program to Ecology and Evolutionary Biology faculty in 2016.

Ant U involves a variety of academic disciplines to engage a broad audience in the wonders of the complex biological systems of army ants and their hundreds of associated species or "guests." EEB faculty work in partnership with the Connecticut State Museum

"Ants are so much like livestock, launch armies to alarm and confuse, in child labour, exchange do everything but work"



of Natural History, to preserve and curate the Carl W. and Marian E. Rettenmeyer Army Ant Guest Collection. This world-class collection of over 2 million army ants and their guests is the result of 50 years of careful, detailed fieldwork in Central and South America by the Rettenmeyers. Ant U expands existing outreach components of the grant in an effort to share the secrets revealed by this project with

BIOLOGY/PHYSICS BUILDING INVADED BY GIANT ANTS!



ke human beings as to be an
y farm fungi, raise aphids as
ies into war, use chemical sprays
e enemies, capture slaves, engage
ange information ceaselessly. They
atch television."

Lewis Thomas

society at large.

Multiple departments and schools across UConn campuses are participating in AntU over the four year life of the grant.

MCB **Professor Jonathan Klassen** participates with a living display of his fungus-growing ants, *Trachymyrmex septentrionalis*. These fungus-growing ants have an obligate nutritional symbiosis with a specific, co-evolved food fungus that they host in underground garden chambers. The ants also use a symbioses with *Pseudonocardia* bacteria that produce antifungal chemicals that inhibit a pathogenic fungus. Klaassen's lab conducts research to understand the community interactions within the *T. septentrionalis* symbiosis community.

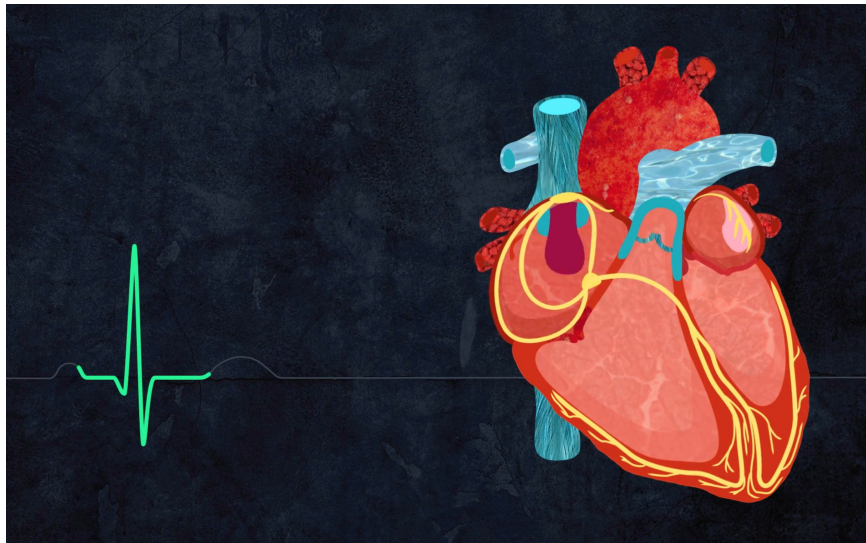
Kenneth Noll



"If ants are such busy workers, how come they find time to go to all the picnics?"

Marie Dressler

ANIMATING BIOLOGICAL



More than 700 students enroll each semester in Principles of Biology, Biology 1107, using a textbook of more than 1,300 pages, with chapter headings ranging from the chemical basis of life, animal nervous systems, and green algae and land plants, to ecosystems and global ecology.

Students enrolling in the laboratory section of Biology 1107 in Spring 2018 were among the first students to benefit from a series of five instructional animations created by School of Fine Arts students from the departments of Digital Media and Design (DMD) and Art and Art History.

The animations helped students better understand complex biological systems keyed to the teaching of basic science concepts. “Using pre-made resources, you almost always have to make compromises in the curriculum you’re presenting to the student, or you have to tell them to ignore part of the video,” says **Dr. Christopher Malinoski** ’05 (CLAS), ’13 Ph.D. Cell Biology, manager of the Biology 1100 laboratories. “Having an opportunity working with students where we could have tailor-made animations specific to the content the way we teach it was very appealing. It makes the delivery of the information that much more successful for our undergraduate students.”

Malinoski and graduate teaching assistant JD Tamucci ’16 (CLAS) sought assistance with developing scientific animation after learning about such a class offered last spring by Anna Lindemann, an assistant professor in DMD, who had received requests from STEM faculty for

assistance in presenting research findings. Similar requests for assistance from STEM faculty for scientific illustration had come to Alison Paul, an assistant professor of art.

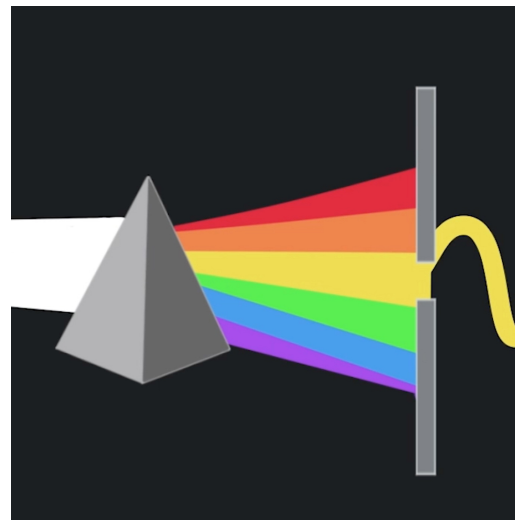
Lindemann and Paul developed a course titled “Scientific Visualization” to bring together a select class of DMD and art students. The class undertook collaborative projects in groups with at least one animator from DMD and one illustrator from art. In the end, four out of the six art students were either double majors in science disciplines, such as Chemistry and Biology, or science majors with a minor in Art.

“What’s so exciting about this class is that

it really is a collaboration where everyone is bringing something to the table,” Lindemann says. “Alison [Paul] is supporting the illustration work students are doing, I am supporting the animation work based on the illustrations, and our whole class is relying on input from science faculty and staff to create accurate and engaging scientific visualizations. It’s everyone feeding off each other.”

The faculty initially discussed a list of potential animations students could create for BIOL 1107 instruction. The five animations, some with narration, that the DMD and art students created are between three and five minutes in length and include: “The Human Heart,” “Tonicity,” “Cellular Respiration,” “Joints and Articulations,” and “Spectrophotometry.”

Tamucci says part of determining which topics to address was the absence of existing animation on those subjects. “There is



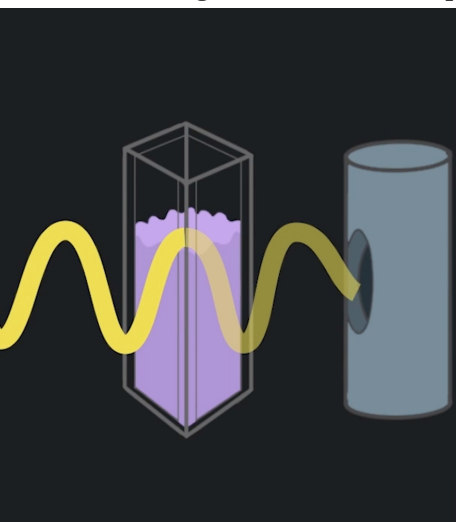
Today’s students are a generation of ‘visual learners,’ and developing new animation, video, and other visual resources will continue. — Christopher Malinoski

AL CONCEPTS

nothing that explains joints in that way. There's nothing that explains spectrophotometry, color absorption, and light absorption, either," he says. "It's cool to get things that you can't find anywhere else."

Such collaboration between creative artists and scientists is part of an expanding detente in the national debate over STEM versus arts education and the possibilities for combining the two, now known as STEAM – science, technology, engineering, arts, and math – which often holds up the example of Leonardo da Vinci, the Renaissance polymath known for both his painting and scientific inventions.

Paul says there were challenges for the students including learning how to communicate clearly with the scientists. "We all had to learn some new vocabulary as we navigated these interdisciplinary projects," she says.



"We've been able to work with Chris [Malinoski] and the TAs with our students on how to talk with clients."

Adds Malinoski, the manager of the Biology 1100 laboratories, "It's going both ways. The arts students are helping us immensely, and we're contributing to their education learning to work with clients, and in

this case, having that experience in the safety of a classroom. I think it's great we've been able to collaborate in that way."

Malinoski says today's students are a generation of "visual learners," and developing new animation, video, and other visual resources will continue.

Malinoski says that as other animations with narratives are developed, it may be possible to post them online as an open educational resource for other science faculty.

Edited from Kenneth Best - UConn Communications

Click on these titles to watch the animated videos "[The Human Heart](#)" and "[Tonicity](#)" by clicking on each name.



Professor Thomas Abbott was named Outstanding Faculty Advisor for 2017-2018. Prof. Abbott was nominated by his students for this award, conferred by the UConn

Center for Excellence in Teaching and Learning. He was selected for the Award in his official capacity as an advisor. He advises Honor students, and is the faculty Predental advisor. In his unofficial capacity, he advises a large contingent of Biology 1107 students. The award was presented at a ceremony in the Spring.

Professor Michael Lynes was elected as a fellow of the Cell Stress Society International for his work on metallothionein and its role in stress-mediated immunomodulation.



Hightower article selected as distinguished contribution

Authors Eric Zuiderweg, **Professor Emeritus Larry Hightower** and Jason Gestwicki were selected by Springer Nature for inclusion in their 2018 Change the World Initiative. The Editors-in-Chief of Springer Nature journals across disciplines to select the scientific findings published in 2017 that they believe could have an impact on society's most pressing problems. Prof. Hightower and colleagues Zuiderweg, Professor of Biological Chemistry at the University of Michigan Medical School, and Gestwicki, Professor at the Institute for Neurodegenerative Diseases at UC San Francisco, published the article "The remarkable multivalency of the Hsp70 chaperones" in *Cell Stress & Chaperones* (Vol 22: 173-189. 2017.)



MCB Graduate Students Summer Fellowships

Claire Berg Graduate Fellowship in Genetics

Kavitha Kannan, Genetics & Genomics, Zhang laboratory

Savannah Klein, Genetics & Genomics, R. O'Neill laboratory

Arthur Chovnick Graduate Fellowship in Genetics

Jason Palladino, Genetics & Genomics, Mellone laboratory

Richard C. Crain, Jr. Memorial Fellowship

Jason Pattis, Structural Biology, Biochemistry and Biophysics, May laboratory

Cross-Disciplinary Fellowship in MCB and Pharmaceutical Sciences

Jin Lin, Medicinal and Natural Products Chemistry, Wiemer laboratory (Pharmaceutical Sciences)

Jean Lucas-Lenard Special Summer Fellowship in Biochemistry

Lorraine Apuzzo, Cell Biology, Goldhamer laboratory

Anne Kaplan, Structural Biology, Biochemistry and Biophysics, Alexandrescu laboratory

Philip I. Marcus Graduate Student Fellowship in Virology

Stephen Hesler, Biochemistry, Cole laboratory

Pfizer Summer Fellowship in Molecular and Cell Biology

Rose Dziedzic, Cell Biology, Broderick laboratory

Sarah McAnulty, Molecular and Cell Biology, Nyholm laboratory

Antronio H. & Marjorie J. Romano Graduate Education Fellowship

Lidia Beka, Microbiology, Graf laboratory

Charles Bridges, Microbiology, Gage laboratory

Outstanding Teaching Assistant Awards

Rebecca Bova-Seliga, Microbiology, Benson laboratory: MCB2600 Fundamentals of Microbiology

Cory Jubinville, Genetics & Genomics, Goldhamer laboratory: MCB2400 Human genetics and MCB3841 Research Literature in MCB



2018 Summer Fellowship Recipients

Combined degree graduate students

The demands of the biotechnology, pharmaceutical, and health care industries has created the need for professionals with advanced training and experience in both the molecular biological sciences and business principles and practices. Recognizing this lucrative job market, several current graduate students are pursuing combined PhD and entrepreneurial professional degrees. Tony Petulanas (Cell Biology, Goldhamer lab) is pursuing PhD/MPP degrees (Masters in Public Policy). Students pursuing PhD/MBA degrees (Masters in Business Administration) include Iris Schiano (Microbiology, Haeslip lab), Sarah Goldstein (Microbiology, Klassen lab), Amy Thees (Biochemistry, Lynes lab), and Ala Shaqra (SB3, Robinson lab).

News

Sarah McAnulty, MCB PhD student in Prof. Spencer Nyholm's laboratory, was awarded a \$20,000 dissertation fellowship from the American Association of University Women (AAUW). AAUW seeks to ease the pressure of financing academic and community work by helping women tackle the growing burden of student debt and focus their efforts on developing the skills and experience they need to excel in their fields and lead innovative community projects to empower women and girls. In the 2018-19 academic year, AAUW supported 250 women and community projects serving women and girls.

Graduate Degrees Conferred

August 2017

Benamino, Jacquelynn Marie, PhD, MCB
Bleiler, Marina Anatolyevna, MS, Applied Genomics
Breaker, Erin Rae, MS, Applied Microbial Systems
Chaugule, Jui Shivaji, MS, MCB
Cope, Ethan Hunter, MS, Applied Microbial Systems
Divinagracia, Emmanuel Galsim, MS, Applied Microbial Systems
Kannan, Kavitha, MS, MCB
Kerwin, Allison Helen, PhD, Microbiology
Mayo, Christopher B., PhD, Biochemistry
Laprise, Dylan Martin, MS, MCB
Sanford, Nathan, MS, MCB
Ward, Michael, MS, MCB
Zink, Frida, MS, MCB

Lajoie, Jessica Marie, MS, MCB
Lakheram, Deaneira, MS, MCB
Lin, Matthew J, MS, MCB
Miller, Jacob Andrew, MS, MCB
Mocanu, Bianca, MS, MCB
Nip, Isabel, MS, MCB
Obla Kumares, Ajay Babu, PhD, MCB
Peshkepja, Paola, MS, Applied Genomics
Pflugrad, Elizabeth Ashley, MS, MCB
Pi, Xiaote, MS, Applied Genomics
Skaleski, Joseph Anton, MS, MCB
Velle, Katrina Bellemore, PhD, MCB
Yang, Xiuyi Alexander, MS, MCB_MS
Yaqoob, Sharon, MS, Applied Genomics
Zhao, Ziyang, PhD, MCB

December 2017

Banks, Matthew Reed, MS, MCB
Daman, Tyler Homer, PhD, Biochemistry
Florian, Amy E, MS, MCB
Dong, Fengjun, MS, Applied Microbial Systems
Gjomerac, Alexander Michael, MS, Applied Microbial Systems
Huang, Jennifer, MS, Applied Genomics
Kuhlberg, Christopher William, MS, MCB
Spitzer, Daniel, MS, Applied Microbial Systems

May 2018

Biswas, Arpita Arup, PhD, Genetics
Capunitan, Darien Corbin, MS, MCB
Englander, Ryan P, MS, MCB
Harrison, Lauren, MS, MCB



PROFESSIONAL SCIENCE MASTERS PROGRAM NEWS



MCB faculty provide two Professional Science Masters (PSM) degree programs, Microbial Systems Analysis (MSA) and Applied Genomics (AG), and a new Professional Masters program, Applied Biochemistry and Cell Biology (ABCB). Each program offers cross-training for business, governmental or corporate environments. As part of their training, students participate in internships, typically with partnering companies.

RECENT INTERNSHIPS

APPLIED GENOMICS PROGRAM

Affrin Ahmed, Center for Cell Analysis and Modeling, UConn Health, Dr. Ji Yu laboratory. Project: "Technological advancement to quantify SH2 binding to phosphotyrosine of its target proteins in mammalian cells.

Khalia Cain, Department of Molecular and Cell Biology, Dr. Jonathan Klassen laboratory. Project: genetic characterization of microbial symbionts of the fungus-growing ant *Trachymyrmex septentrionalis*.

Matthew Costello, Azitra, Inc. Project: Genome engineering of a protease deficient strain of *Staphylococcus epidermidis*.

Samantha Holmes, Blueprint Medicines, Cambridge, MA. Regulatory Affairs intern.

Paola Peshkepaja, JAX-GM, Farmington, CT, Dr. Julia Oh laboratory. Project: Impact of microbiome therapy on cancer immunotherapy.

Xiaote Pi, L2 Diagnostics, LLC, New Haven, CT, Dr. Elizabeth Peterson-Roth laboratory. PCR assays, cell culture, and immunoassays.

Sharon Yaqoob, Interpace Diagnostics, New Haven, CT, Dr. Gyanendra Kumar laboratory. Thyroid cancer research.

MICROBIAL SYSTEMS ANALYSIS PROGRAM

Edward Beauregard, JAX-GM, Farmington, CT, Dr. Julia Oh laboratory. Project: Discovering antimicrobials from cryptic biosynthetic gene clusters against *Staphylococcus aureus*.

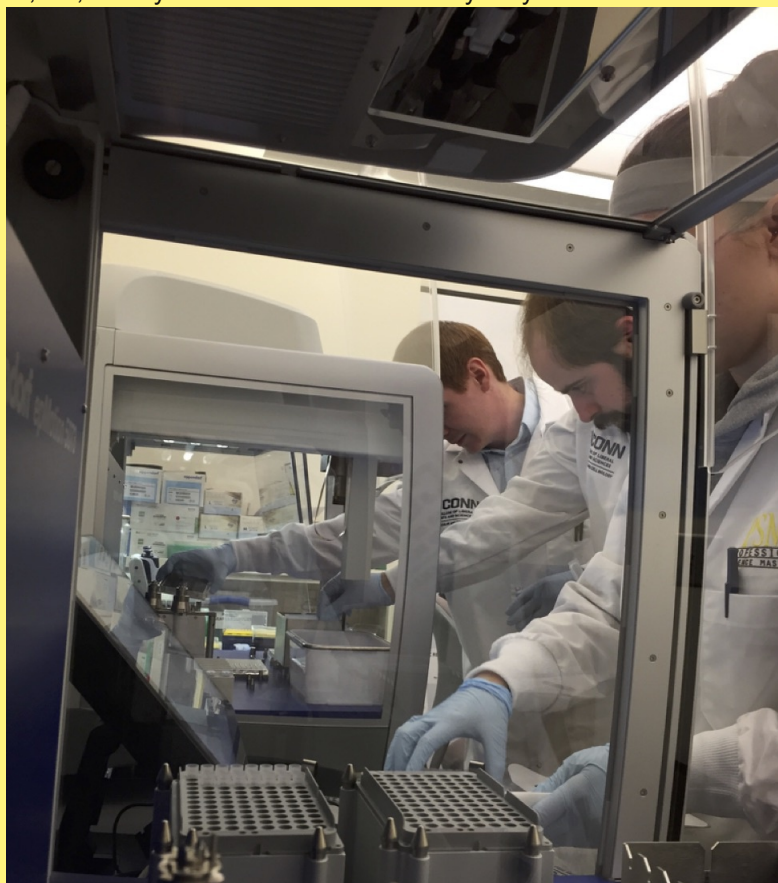
Dominique Carrillo, Shoreline Biome, Farmington, CT. Implementation of production and quality control systems on microbiome analysis kits, development and planning of quality control procedures, documenting production and quality control SOPs, and analyzing data.

Ahmad Hassan, Department of Molecular and Cell Biology, Dr. Joerg Graf laboratory. Lab and field analysis specialist conducting DNA extraction, PCR, DNA library preparation, and data analysis.

Luoxuan Ouyang, Genewiz, South Plainfield, NJ. Next generation sequencing laboratory.

Nahian Rahman, Department of Molecular and Cell Biology, Dr. Simon White laboratory. Project: poliovirus research, isolating and studying the structure of the 2C protein.

Sasha Richardson, Yale School of Medicine, Dr. Naftali Kaminski laboratory. Project: idiopathic pulmonary fibrosis.



PSM Automated Liquid Handling Module Course. left to right: Marat Vasilenko (MSA), Edward Beauregard (MSA), and Presley Galloway (AG).

APPLIED GENOMICS GRADUATES

Samantha Homes was hired as a Regulatory Affairs Associate immediately upon graduation from the AG program in summer 2018.

Jennifer Huang continues her work at Yale University as a Clinical Technologist II looking at genomic testing in cancer patients, which is the work she did during her time as a part-time student in the AG program.

Nhut Nguyen accepted a position at Pfizer, Inc. in Groton, CT with the primary pharmacology group doing high throughput screening for oncology research using flow cytometry.

Didem Ozcan and **Ryan Drennan** will enter the MCB Ph.D. program in fall 2018. **Matthew Costello** will enter the Pathobiology Ph.D. program in fall 2018.

Paola Peshkepija has continued her work at JAX-GM upon graduation from the AG program in spring 2018.

Xiaote Pi has continued her work at L2 Diagnostics upon graduation from the AG program in spring 2018.

Sharon Yaqoob has continued her work at Interpace Diagnostics upon graduation from the AG program in spring 2018.

MICROBIAL SYSTEMS ANALYSIS GRADUATES

Emmanuel Divinagracia is currently a lecturer at the University of the Philippines.

Alexander Gojmerac has accepted a microbiology position in the energy department of The Dow Chemical Co., Collegeville, PA. Alex is very excited about this position which will be a combination of microbiology and engineering.

Daniel Spitzer is now an Associate Translational Scientist at Enzo Life Sciences, Inc. in Stony Brook, NY.

PSM NEWS

Professional Science Masters students **Ethan Cope** (MSA) and **Alex Gojmerac** (MSA), were among 18 students who presented their experiences working with startup companies housed in UConn's Technology Incubation Program (TIP) at the 2017 annual Summer Fellowship Research Day. Cope and Gojmerac were UConn-TIP Summer Immersion Fellowship Program participants that allowed them to learn about startups and entrepreneurship during a 10-week immersion program. Cope TIP mentor company was Oral Fluid Dynamics, LLC and Gojmerac worked with Azitra.

Partnership in Innovation and Education Fellowship. During summer 2018, the MCB PSM programs participated in the [Partnership in Innovation and Education \(PIE\) Fellowship program](#) organizing workshops on molecular biology techniques and 16S rRNA gene sequencing for the student fellows in the program.

A new PSM program. The new Professional Master's program, M.S. in Applied Biochemistry and Cell Biology, welcomed its first student in spring 2018 and will have three additional new students enter in fall 2018. The PM program, co-directed by Dr. Victoria Robinson and Dr. Adam Zweifach, already offers short intensive modules in flow cytometry, protein purification, and molecular graphics.

PSM Seminars. Professional Development seminars included speakers from the following companies and research institutions, and included 9 MCB PSM alumni: Pfizer (Brendan Tierney, M.S. AG), Interpace Diagnostics, Moderna (Joe Cabral, M.S. AG), Broad Institute and Novartis (Angelica Messina, M.S. AG, and Joe Raymond, M.S. AG), Thetis, Alexion, Metrum (Lonni Shulz, M.S. AG), CaroGen Corporation, Sema4 (Matt Capozziello, M.S. AG), ThermoFisher, UConn Career Center, UConn-TIP Program, Connecticut Veterinary Medical Diagnostic Laboratory, JAX-GM, Boehringer Ingelheim (Jon Hill, M.S. AG), Abcam (Dister Deoss, M.S. MSA), Center of Chronobiology at UCSD, Shoreline Biome (Ryan Beach, M.S. AG), and the Entrepreneur in Residence from Yale University.



PSM 16S rRNA Sequencing Module Course. from left to right: Sulaiman Aljasir (visiting student), Dan Silverstein (MCB undergraduate student), Andrea Suria (MCB Ph.D. student and Module Instructor), Presley Galloway (AG), and Susanna Lenz (MSA).

MCB Undergraduates

Awards

University Scholars

The following undergraduates who work with MCB professors were named 2018 University Scholars (of a total of 25 Scholars). University Scholars is a prestigious UConn undergraduate program in which students design and pursue an in-depth research project and craft individual Plans of Study for their final 3 semesters.

Tyler Ackley, Pharmacy Studies and MCB, Project title: Soluble epidermal growth factor receptor isoforms: Functional roles and potential therapeutic application in rheumatoid arthritis; Committee: Caroline Dealy, Reconstructive Science (chair); Brian Aneskievich, Pharmaceutical Sciences; Andrea Hubbard, Pharmaceutical Sciences

Brian Aguilera, MCB, Project title: Role of CD13 in the formation and function of tunneling nanotubes; Committee: Mallika Ghosh, Center for Vascular Biology (chair); David Daggett, MCB; Ken Campellone, MCB

Suleyman Bozal, SB&B, Project title: A robust delivery system for siRNA therapeutics and the CRISPR/Cas9 system in gene regulation and editing; Committee: Diane Burgess, Pharmaceutical Sciences (chair); Eric May, MCB; Antonio Costa, Pharmaceutical Sciences

Sarah Ferrigno, Psychological Sciences and MCB, Project title: Investigating the role of the 5-HT1B receptor regarding motivational symptoms of major depressive disorder; Committee: John Salamone, Psychological Sciences (chair); Aoife Heaslip, MCB; William Bailey, Chemistry

Ming-Yeah Hu, MCB and Allied Health Sciences, Project title: Stem cell spheroids for cartilage regeneration; Committee: Syam Nukavarapu, Orthopedic Surgery (chair); Jeanne McCaffrey, Allied Health Sci.; Mary Bruno, MCB

Craig Mendonca, PNB and MCB, Project title: Development and ex vivo characterization of enteric coated chitosan microspheres for Crohn's disease management; Committee: Diane Burgess, Pharmaceutical Sciences (chair); Mary Bruno, MCB; Akiko Nishiyama, PNB

Jennifer Messina, MCB, Project title: Cancer and signaling pathways of metallothionein induced chemotaxis; Committee: Michael Lynes, MCB (chair); Adam Zweifach, MCB; Nichole Broderick, MCB

Avi Patel, MCB and Individualized Major: Social Perspectives on Health, Project title: Development of a sonically powered biodegradable nanogenerator for bone regeneration; Committee: Thanh Nguyen, Biomedical Engineering and Mechanical Engineering (chair); David Goldhamer, MCB; Maryann Morris, Allied Health Sciences

Usra Qureshi, MCB and Human Rights, Project title: Assessment of access to maternal healthcare for Syrian refugee women in Greece: A human rights perspective; Committee: Kathryn Libal, Human Rights Institute (chair); Judith Landin, MCB; César Abadia, Anthropology

Lt. Paul Drotch Memorial Scholarship

Celina Caetano, MCB '19 and **Annie Jin**, MCB '19

Todd M. Schuster Award

Aberdeen Taylor, SB&B, Research supervisor: Eric May

Biology Undergraduate Research Colloquium Awards

Awards presented for talks given during the 36th Annual Biology Undergraduate Research Colloquium

Outstanding Senior in EEB Award - Zoe Mandese; Research supervisor: Charles Henry; Global distribution of agriculturally important lacewing *Chrysoperla zastrowi sillemi*.

Outstanding Senior in MCB Award - Alyssa Mathiowetz; Research supervisor: Kenneth Campellone; Autophagy in disease and development: from clinical samples to model organisms.

Outstanding Senior in PNB Award - Elizabeth Rodier; Research supervisor: Anastasios Tzingounis; Inhibition of KCNQ2/3 channels depends on the outer vestibule conformation.

Clair Berg Award - Megan Boyer, MCB; Research supervisor: Barbara Mellone; An investigation of the proteins involved in centromere establishment.

Biology Director's Award (2) - Jacob Naparstek, PNB; Research supervisor: Alexander Jackson, PNB; Neuroanatomical characterization of lateral hypothalamic somatostatin neurons and their projections in the mouse brain. **Courtney Wallace**, MCB; Research supervisor: Daniel Gage, MCB; Bacteria as an alternative food source for termite gut protists.

Margaret F. Ertman Award - Nicholas Russo, EEB; Research supervisor: Morgan Tingley; Avian spring migration as a dispersal mechanism for a forest insect invasion.

Excellence in Applied Genetics and Technology Award - Madison Caballero, MCB; Research supervisor: Jill Wegrzyn, EEB; Mine the onion: genotyping assay design for loblolly pine populations.

Honors Award in Life Sciences - Craig Mendonca, MCB/PNB; Research supervisor: Diane Burgess, Pharmaceutical Sciences; Continuous glucose monitoring with implantable biosensors.

IDEA Grant Awardees

The UConn IDEA Grant program awards funding to support student-designed and student-led projects, including creative endeavors, community service initiatives, entrepreneurial ventures, research projects, and other original and innovative projects. Awards can be up to \$4,000 per student.

Annie Jin, MCB '19, Project title: Identification of early gene differentiation markers in progenitor cells involved in the onset of Fibrodysplasia Ossificans Progressiva (FOP); Mentor: David Goldhamer, MCB

Dhruv Shah, MCB '19, Project title: Snapshots of the healthcare provider experience; Mentor: Bruce Cohen, English

Suleyman Bozal, SB&B '19, Project title: A robust delivery method for the CRISPR-Cas9 system in gene editing

Jamie Georgelos, MCB '19, Project title: The role of probiotic lactic acid bacteria in treating *Clostridium difficile* infections

Michael Zhu, MCB '21, Project title: The effect of an intravenous infection on the pathogenesis of Alzheimer's disease and reactive oxygen species levels

Ama Appiah, MCB & Communications '19; **Meeshali Patel**, Allied Health '19; **Sejal Patel**, MCB '19; **Sai Vietla**, PNB '19, Project title: Urinary analysis on the effects of dietary intake on sulfur-containing metabolites in newborns at risk for Autism Spectrum Disorder (ASD)

Michael Costello, Biomedical Engineering '19; **Sahil Laul**, MCB & Global Health '19, Project title: An exploration of social, political, and economic implications of language in Catalonia through documentary film

SURF Award Awardees

Summer Undergraduate Research Fund (SURF) Awards support UConn full-time undergraduate students in summer research or creative projects. SURF awards are available to students in all majors at all UConn campuses. SURF project proposals are reviewed by a faculty committee and the maximum award is \$4,000.

Marlene Abouaassi, MCB '20, Project title: Synonymous polymorphism to predict population size and dN/dS to indicate the type of selection pressures; Mentor: Johann Peter Gogarten, MCB

Brian Aguilera, MCB '19, Project title: Role of CD13 in the formation and function of tunneling nanotubes? Faculty Mentor: Mallika Ghosh, Center for Vascular Biology, UConn Health

Suleyman Bozal, SB&B '19, Project title: A robust delivery system for siRNA therapeutics and the CRISPR/Cas9 system in gene regulation and editing; Mentor: Diane Burgess, Pharmaceutical Sciences

Celina Caetano, MCB '19, Project title: Determination of prostaglandin signaling in follicle rupture and ovulation of *Drosophila melanogaster*; Mentor: Jianjun Sun, PNB

Hope Dieffenbach, Biological Sciences '19, Project title: Antifouling effects provided by bacterial symbionts in the Hawaiian bobtail squid egg; Mentor: Spencer Nyholm, MCB

Alessandro Fisher, Mechanical Engineering & MCB '20, Project title: Computational analysis of non-spherical CPLS nanoparticles; Mentor: Ying Li, Mechanical Engineering

Mitchell Godin, MCB '18, Project title: Defining the structural features of VAI RNA required for PKR inhibition; Mentor: James Cole, MCB

Liam Iorio, SB&B '19, Project Title: Study of putative Aronia transcription factors involved in anthocyanin and proanthocyanidin biosynthesis; Mentor: Huanzhong Wang, Plant Science and Landscape Architecture

Shana Morel, MCB '19, Project title: The effect of itraconazole on smoothed localization in the primary cilium; Mentor: Kyle Hadden, Pharmaceutical Sciences

Daniel Netting, MCB '19, Project title: Identity of the downstream partners of Sma0113; Mentor: Daniel Gage, MCB
Esther Nof, MCB '18, Project title: siRNA dose-dependency of cyclin D1 knockdown in HR+ breast cancer cell lines; Mentor: Xiuling Lu, Pharmaceutical Sciences

Brandon O'Sullivan, MCB '19, Project title: Examining the potential for nitrogen fixation by bacteria present in the *Trachymyrmex septentrionalis* fungus gardens; Mentor: Jonathan Klassen, MCB

Natasha Patel, MCB `19, Project title: The utilization of collagen IV-derived peptide to prevent bony bridge formation in injured growth plates of Col2a1 genetic reporter mice; Mentor: Liisa Kuhn, Biomedical Engineering

Usra Qureshi, MCB & Human Rights `19, Project title: Assessment of access to maternal healthcare for refugee women in Greece: human rights perspective; Mentor: Kathryn Libal, Human Rights and School of Social Work

Ryan Ramos, MCB & Psychological Sciences `18, Project title: Determining parafibromin's Paf1 complex-dependent and complex-independent roles in mesenchymal stem cells; Mentor: Jessica Costa-Guda, Center for Molecular Oncology, UConn Health

Aberdeen Taylor, SB&B `19, Project title: Computational study of designed Tau protein antibodies with enhanced binding characteristics; Mentor: Eric May, MCB

Benjamin Teerlinck, MCB & Geosciences `19, Project title: Geochemical signatures of life in extreme environments: An analogue for life on Mars?; Mentor: Michael Hren, Chemistry

Melinda Wei, MCB `19, Project title: Identification and characterization of the roles of MicroRNA sequences in *Salpa thompsoni*; Mentor: Rachel O'Neill, MCB

Phi Beta Kappa Inductees

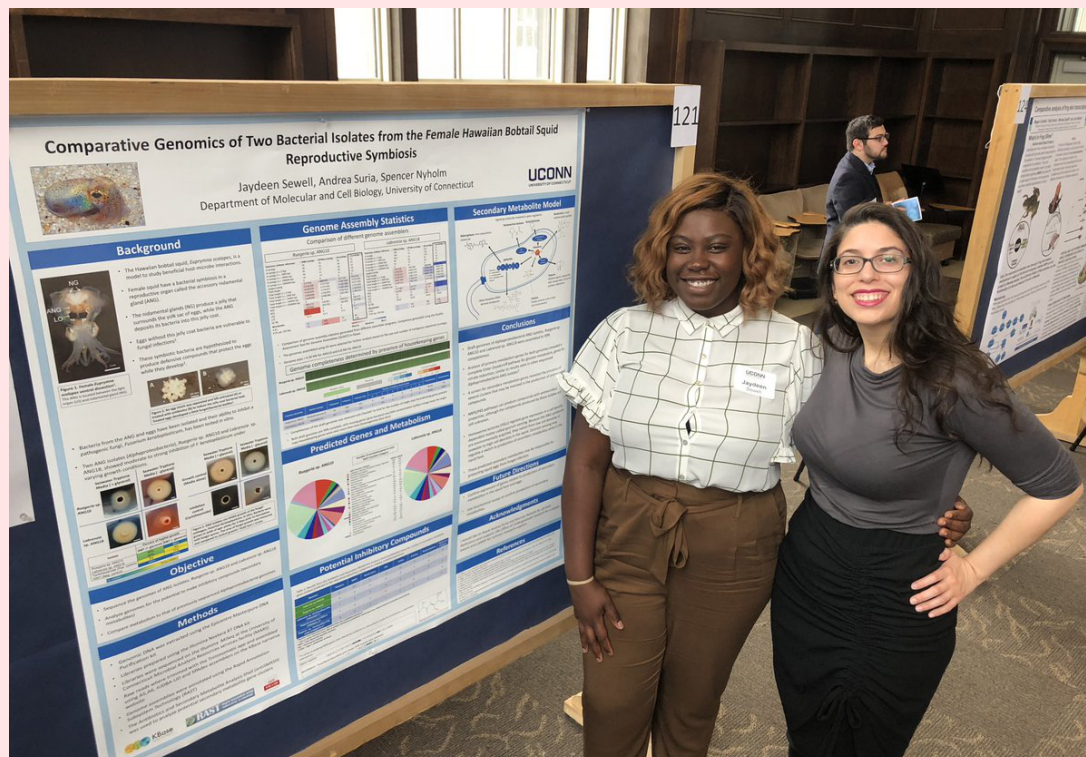
Congratulations go out to those of our majors in Molecular and Cell Biology for their election to Phi Beta Kappa in 2018.

Molecular and Cell Biology

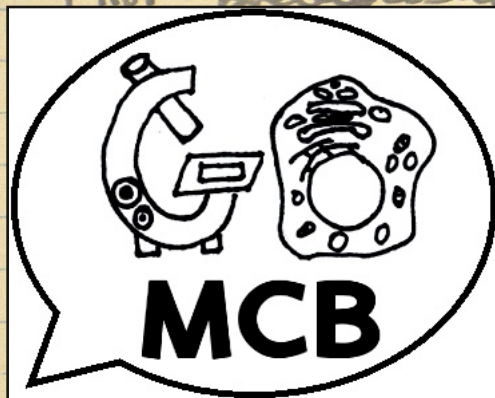
Adams, Madison Elizabeth
 Antony, Maria
 Aspir, Tori Brooke
 Avner, Eidan
 Barber, Halle M
 Barrack, Daniel Robert
 Boyer, Megan Elizabeth
 Caetano, Celina Marie Lopes
 Clark, Kevin Charles
 Donofrio, Gabi
 Eudy, Elizabeth
 Feldmeier, Dylan E
 Ferrigno, Sarah Marie
 Gilbert, Angelique Nguyen
 Hage, Jeffrey Pierre

Hanna, Tyler Roger
 Hastings, Jon Jeffrey
 Herr, Victoria Rhodes
 Hu, Ming
 Hursid, Melek
 Jackson, Eric Arthur
 Kaseta, Timothy
 Kumara, Nimanthi Charika
 Lee, Aria
 Lohret, Jessica Margaret
 Malani, Kanika Ajay
 Messina, Jennifer
 Mishra, Shashank Shekhar
 Munteanu, Daniel Andrew
 Nof, Esther Leah
 Patel, Avi
 Patten, Justin Joseph

Pazienza, Matthew
 Rajahraman, Vinaya
 Santovasi, Samantha
 Shah, Dhruv
 Silver, Elizabeth Sarah
 Simao, Taylor Marie
 Smith, Rajohn
 Tan, Zewen
 Tran, ThuyDuong Thi
 Verlaque-Amara, Margaux Leigh
 Wickenheisser, Natalie Elise



Undergraduates majoring in MCB or SB&B or who worked under an MCB professor exhibited 58 out of 141 posters presented at the 21st Annual Frontiers in Undergraduate Research Poster Exhibition in April. Shown here is the poster by Jayden Sewell (left), Honors student and Biological Sciences major who performed her Honors thesis research in the laboratory of Prof. Spencer Nyholm under the direction of Microbiology PhD graduate student Andrea Suria (right).



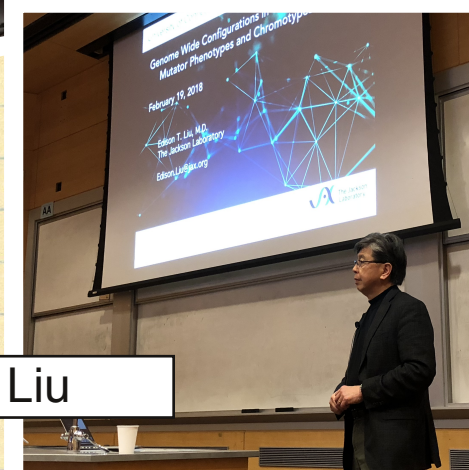
GO:MCB NEWS



Dr. O'Connell



Dr. Arnold



Dr. Liu



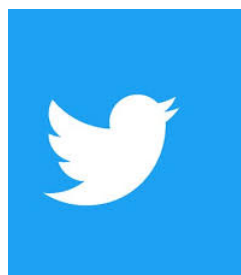
Drink With A Scientist

GO:MCB, the Graduate Organization for Molecular and cell Biology, had an active year! In February, we hosted Dr. Edison Liu, President of The Jackson Laboratory, for the annual Fisher-Sparks Distinguished Lecture Series. He presented his research studying the genetics of breast cancer, met with individual graduate students to advise on their projects, and participated in a Q&A with graduate students to discuss his career path and the current philosophy of graduate education. In conjunction with the PSM program, we initiated a career development seminar series to introduce our students to careers outside academia. As part of the series, Dr. Todd Arnold, the chief Laboratory Operations officer at Sema4 in Branford, CT, delivered an enthusiastic message to the MCB Professional Science Master's (PSM) and Ph.D. students on taking advantage of a variety of career opportunities. In May, Dr. Christine O'Connell visited from the Alan Alda center for communicating Science at Stony Brook university. She led students and professors from a variety of departments in improvisational activities meant to help us better communicate complex topics to a wide audience. Putting these skills to use, we continued our Drink With A Scientist nights. This year, we expanded our reach, visiting bars in Willimantic, Coventry, Manchester, West Hartford, and Norwalk, CT. We look forward to another busy and exciting year!

Rose Dziedzic

Expression 2017-2018 28

Your contributions to MCB are appreciated. To give, visit www.mcb.uconn.edu/giving/



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MOLECULAR AND CELL BIOLOGY

Scenes from the
2018 MCB Retreat
at Avery Point

