



# Expression

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**PEOPLE AND PROGRESS 2020 - 2021**

UConn Department of Molecular and Cell Biology

**UCONN**

**DEPARTMENT OF MOLECULAR AND CELL BIOLOGY**

# UConn

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MOLECULAR AND CELL BIOLOGY

## JUNE 2020 - DEC 2021

MCB Expression is published annually for alumni and friends of the Department of Molecular and Cell Biology, College of Liberal Arts and Sciences at the University of Connecticut. Please direct any inquiries about this publication to Department of Molecular & Cell Biology, University of Connecticut, 91 North Eagleville Road, Unit 3125, Storrs, CT 06269-3125 or [susan.vining@uconn.edu](mailto:susan.vining@uconn.edu)

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#### THE COVER: Hanlon Lab:

Metaphase chromosome spread from the ovary of a *Drosophila melanogaster* female carrying B chromosomes. All the chromosomes (magenta) are stained with a dye for DNA (DAPI), and the B chromosomes (cyan) are further illuminated by a fluorescent probe that binds directly to large blocks of the AAGAT repetitive sequence. The AAGAT repeat is abundant on the B chromosomes and is also present within the pericentromeric region of Chromosome 4.

## FROM THE DEPARTMENT HEAD



Dr. Carolyn Teschke  
Professor and Interim  
Department Head

Greetings friends and alumni:

2021 has flown by in a whirl! We find ourselves still in the midst of the COVID-19 pandemic and all the inherent stresses of living and working within that situation. In MCB we are fortunate to have fantastic colleagues and trainees who have done their utmost best to do great research and teach their classes despite the numerous challenges caused by the pandemic. Our undergraduates have persevered and

hopefully thrived through their studies this year. I'm proud of our efforts in these challenging times.

In this issue we highlight the research of our two newest faculty, Dr. Jelena Erceg and Dr. Stacey Hanlon. They arrived last academic year and are establishing their research programs. Dr. Erceg studies gene regulation that occurs through changes in DNA structure, and Dr. Hanlon investigates chromosome segregation during cell replication. We are so happy to have them join our faculty. We also showcase the research of several other MCB faculty, our PSM/PM programs, as well as highlighting awards received by MCB graduate and undergraduate students.

In the next year we will face whatever is dealt us with the same fortitude we've displayed over the last two years. We have shown that we are strong and can rise to the challenges. We look forward to the days when we can meet again in groups to celebrate MCB faculty and student accomplishments.

## David Knecht Awarded 2021 Edward C. Marth Mentorship Award

The Marth Award was established by the UConn AAUP to recognize the leadership and dedication of Edward Marth, former Executive Director of the UConn AAUP Chapter, and to encourage and reward outstanding mentoring of graduate students by UConn Graduate Faculty members. It is awarded annually to a faculty member with an extraordinary record of excellence and effectiveness in graduate student mentoring. Dr. Knecht has demonstrated such a record, and the MCB department is happy that he has been recognized for his exceptional contributions to graduate student mentoring through this award. The Marth Award winner is invited to give a short address at the PhD graduation ceremony in May.



David Knecht

## Goldhamer Awarded NIH R01 grant for \$2.2M to Study Regulation of Satellite Cell Development, Programming and Differentiation by Myogenic Factors



David Goldhamer

The National Institute of Arthritis and Musculoskeletal and Skin Diseases has awarded Professor David Goldhamer a \$2.2 million, 5-year award to study Satellite cells. Satellite cells are responsible for the marked regenerative capacity of skeletal muscle. Although these

stem cells were discovered more than 50 years ago, the molecular mechanisms that program satellite cells for muscle differentiation are not completely understood. Using unique mouse lines and strategies, the proposed studies will determine the functions of two key myogenic regulatory proteins (MyoD and Myf5) in satellite cell development, myogenic programming and differentiation. [View complete abstract here.](#)

## Professors Lynes and Graf part of a team that received a multi-institution grant to study syndrome affecting children with Covid 19



Michael Lynes

Professors Michael Lynes and Joerg Graf are part of a multi-institution grant to develop biomarker signatures for MIS-C (multisystem inflammatory syndrome in children) that can develop in children infected with coronavirus. The Lynes research team will use the grating coupled

surface plasmon resonance imaging systems that they have developed with Ciencia, Inc. to measure biomarker signatures in serum and saliva, and the Graf group will identify the composition of the microbiome in the saliva of these patients. In concert with measures made at the NY Department of Health, Connecticut Children's Hospital, Jackson Laboratory of Genomic Medicine, and NYU, the plan is to use these biomarker signatures both to diagnose and predict the course of MIS-C disease, and to suggest new and effective therapeutic interventions.

[Learn more about these NIH studies here.](#)



Joerg Graf

## MCB Graduate on Finishing School During COVID

Isaac V. Faustino '21 (CLAS), BS

Major: Molecular and Cell Biology

Minor: Ecology and Evolutionary Biology

Hometown: New Haven, CT

COVID has made me realize how easy it is to take things for granted. When it felt like the world was ending in March 2020, there were so many things that I was looking forward to later in the semester, but would understandably be cancelled. Before, I remember saying "there'll be another time" leading me to put something off when in reality, "another time" isn't promised.

If I could time travel before March 2020, I would have spent more time with people knowing that this may be the last time I would see them before we take on adult responsibilities and experience the real world.

*by Amy Chen*



Isaac Faustino, an MCB major with a minor in ecology and evolutionary biology. Courtesy photo.

## MCB PhD Candidate Kate Castellano Receives 2020 GIGA Fellowship



The Global Invertebrate Genomics Alliance (GIGA) has announced that Kate Castellano has received the inaugural GIGA Fellowship in Invertebrate Genomics 2020 Award.

GIGA is dedicated to promoting resources and standards that will

facilitate comparative approaches and collaborations for future generations.

About Kate, GIGA stated, "With these objectives in mind, we are excited to see Kate's research that investigates reproductive life history of salps, a group that is in need for expanded genomic resources. We were impressed by her research statement, thoughtful budget and her desire to train future generations in invertebrate –OMICS research."

# CHROMOSOMES IN 3D; NO VR NEEDED

Written by Thane Papke



photo: Erceg Lab

Everywhere we look, everything is different. The Universe itself is filled with galaxies and stars that are patchily distributed. Even mathematics is not immune from diversity as some sets of infinities are larger than others. However, most of the familiar diversity, or heterogeneity we encounter every day is biological, from the people we meet to the common trees seen in our neighborhoods. Therefore, diversity seems a universal foundational principle, especially for the biological world and even its human witnesses. Indeed, each individual human has a genome containing two versions for most of the approximately 25,000 genes distributed over our 46 chromosomes (i.e., two haploid genomes, one each from our biological parents). Amazingly, that chromosomal and genetic diversity adds up to approximately six billion

nucleotide base pairs, which is about two meters when stretched out end-to-end. That DNA must fit into a cell nucleus 10 millionths of a meter in diameter. This is no trivial feat, and it requires tremendous amounts of DNA folding, a process that generates remarkable physical structure inside each finitely sized nucleus. However, critical answers remain largely a mystery as little is known about how DNA is “packaged” within the nucleus or how that packaging affects gene expression and its regulation, which must take place in the nucleus as well. Luckily, these vastly important answers are being pursued by one of our newest MCB faculty members Dr. Jelena Erceg.

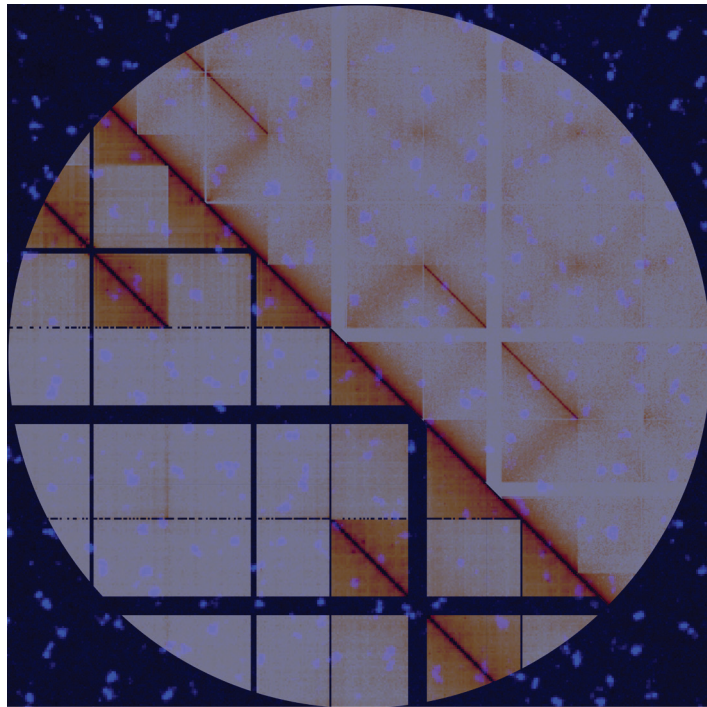
To find those answers, Dr. Erceg first sought a foundational understanding of how regulation of gene expression occurs, which she embarked upon as an undergraduate researcher

at the University of Zagreb, Croatia. There, she did research on DNA methylation of pumpkin chromosomes and wrote a thesis on research that characterized enhancer traps into hox gene clusters. Enhancer traps are a genetic construct containing a transposable element and a reporter gene like LacZ that inserts itself randomly into chromosomes and is used as a proxy for detecting the expression of nearby genes. This molecular biology technique allows researchers to map the location of enhancers (often called transcriptional factors) on chromosomes that hopefully leads to understanding wholesale gene expression patterns across the entire genome. Such knowledge is critical for understanding how a fertilized cell becomes a fully developed animal. Hox genes are important for animal embryo development and determine how, when, and which cells change into different kinds of cells with altered functions.

Dr. Erceg’s undergraduate experience and initial understanding of gene expression eventually led her to a graduate program doing research as a Louis-Jeantet Foundation Ph.D. student in the laboratory of Dr. Eileen Furlong at EMBL in Heidelberg, Germany where she further studied the regulation of gene expression during embryonic development. It was during her time in Heidelberg when she discovered that the same enhancer functions in two different developmentally related tissues, where one enhancer will have a flexible motif and the other a conserved motif. Thus, enhancer sequence variation between individuals, including

small deletions or insertions can have dramatic tissue specific effects during development. In a related discovery, Dr. Erceg also uncovered that some regulatory elements have dual activities. Her findings indicate tight regulation of transcription occurs during key developmental transitions, where specific patterns of gene transcription may need to be active in one cell but repressed in another. “Dual elements” says Dr. Erceg “may ensure a finely tuned initiation or silencing of transcription during rapid cell fate decisions,” which are critical to embryonic development.

Dr. Erceg’s undergraduate and Ph.D. research thought of chromosomes and their enhancers as two-dimensional linear objects, which of course, they are. However, as an EMBO Long-Term postdoctoral fellow at Harvard Medical School in the laboratory of Dr. C.-ting Wu, Dr. Erceg examined how gene expression regulation occurs within all three dimensions of the space-limited chromosome filled nucleus, which reflects perhaps more accurately the “real world” by considering the effects of extensive DNA folding and the creation of physical structures. For example, can distantly located homologous genes or enhancers on the same or different chromosomes involved in similar roles be much closer in 3-dimensional space within the nucleus? If so, how does that impact the regulation of gene expression? Thinking 3-dimensionally allowed Dr. Erceg to gain valuable insight into these important questions, demonstrating indeed there is extensive chromosomal organization



The Erceg lab investigates packaging and functional regulation of genomes using single-cell imaging and genomic approaches. photo Erceg Lab

in the nucleus that creates global connections between chromosomes and homologous genes, allowing an all-important road map to be drawn regarding how gene transcription is governed. “This work,” says Dr. Erceg, “provides an exciting framework to accommodate all types of inter-chromosomal interactions”. Her time at Harvard was also spent developing two complementary, innovative, and cutting-edge technologies. The first one allows researchers to distinguish between intra-chromosomal and the understudied inter-chromosomal interactions and contact points. The second one enables super-resolution single-cell imaging of chromosome organization. Both techniques will contribute to a better understanding for how transcription is regulated.

Despite all the recent advances in understanding chromosome organization and the relationship between 3D genome organization and DNA sequence evolution,

there remain countless unanswered questions. Dr. Erceg has already cut a substantial path through the thickets of gene expression regulation, and she plans a career here at UConn that will unveil many more answers to the current mysteries, which she believes may possibly lead to personalized medical treatments for many genetic and developmental diseases.



Dr. Jelena Erceg, Assistant Professor  
Molecular and Cell Biology  
Genetics and Genomics, UConn

# Heaslip Lab Working to Uncover Key to Cellular Mechanisms in Parasite

**T**oxoplasmosis is a common but usually non-life-threatening parasitic infection linked to contaminated food or water. While most people infected by *Toxoplasma gondii* (*T. gondii*), the parasite responsible for toxoplasmosis, will have very mild or no symptoms at all, the parasite can persist in the body for long periods of time, possibly even an entire lifetime.

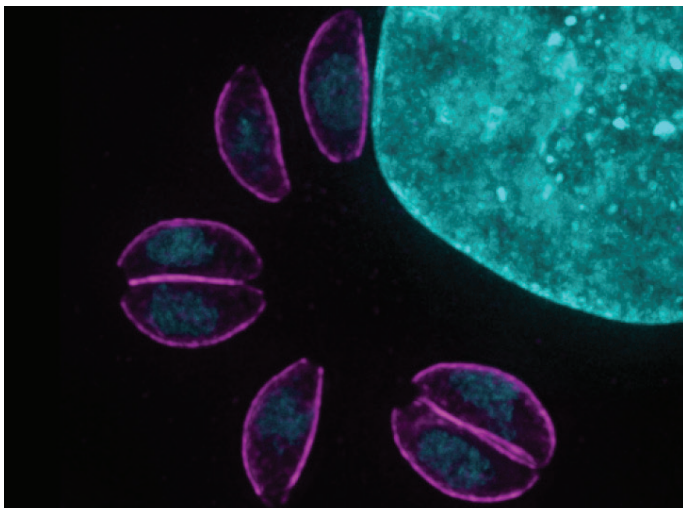
People who are immunocompromised and babies, if infection occurs in utero, can suffer severe symptoms. If a person's immune system cannot combat the infection, it may cause damage to the brain, eyes, or other organs. *T. gondii* is a leading cause of congenital neurological defects.

Professor Aoife Heaslip has received a \$2 million grant from the National Institute of General Medical Sciences to study molecular functions of *T. gondii*. Heaslip hopes this work will provide a better understanding of how this parasite operates and thus pave the way for new therapeutic approaches.

Heaslip will focus on *T. gondii*'s intracellular cargo transport mechanism. This process involves the movement of vesicles — cellular transport containers for materials like proteins — within a cell. Intracellular transport and vesicle secretion are essential cellular functions for all eukaryotes. For *T. gondii*, they are key to this pathogen's ability to invade and grow within its host's cells.

Despite its importance, to date, scientists have only studied cargo transport mechanisms in a small number of model species leaving wide knowledge gaps about how other eukaryotes, like *T. gondii*, complete this task.

The goal of Heaslip's lab is to uncover the cargo transport mechanism in *T. gondii*. Their previously published data



Fluorescence microscopy image of *T. gondii* parasites (magenta) growing inside a human fibroblast cell. Host cell and parasite nuclei are in cyan. (Aoife Heaslip/UConn Photo)



The Heaslip Lab. Top row (L-R) Aoife Heaslip, Irio Schiano, Michael Griffith, Madhavi Devarakonda. Bottom row (L-R) Thomas Sladewski, Camille Pearce and Jacob Kellermeier. (Aoife Heaslip/UConn Photo)

show there are two proteins: actin and unconventional myosin (MyoF), required for intracellular cargo transport in *T. gondii*. Both proteins are part of the *T. gondii*'s cytoskeleton, the part of the cell responsible for maintaining cell shape and locomotion.

This new project will expand on Heaslip's previous work to uncover the details underlying this mechanism.

Heaslip's lab will utilize an interdisciplinary combination of approaches including parasite genetics and cell biology, live cell imaging and quantitative vesicle tracking, and in-vitro biophysical approaches to answer these questions.

"My laboratory occupies a unique niche at the intersection between parasitology and molecular motors fields," Heaslip says. "Utilizing these interdisciplinary approaches makes us ideally positioned to provide new insights into this understudied process."

Heaslip will work to understand how the cells regulate MyoF activity and how cargo packaged in vesicles interact with the actin cytoskeleton. She will also identify if there are additional molecular plays required for cargo transport and how they work with actin and MyoF to accomplish this task.

This work is relevant beyond toxoplasmosis as *T. gondii* is closely related to parasites that cause malaria and life-threatening diarrheal diseases. Understanding *T. gondii*'s transport mechanism will also provide insights into these parasites.

By understanding how a parasite like *T. gondii* completes cargo transport functions, scientists can leverage that knowledge to develop ways to interrupt this process with drugs that would kill the parasite.

by Anna Zarra Aldrich, UConn Today

## ALDER RESEARCH GROUP RECEIVES MULTIPLE GRANT AWARDS



Dr. Nathan Alder

Professor Nathan Alder leads a group of investigators from MCB, The Johns Hopkins University School of Medicine, and Alexandria Launch Labs in a project funded by The Barth Syndrome Foundation. The

Foundation awarded the group a \$50K grant to develop peptide-based therapeutics specifically for the treatment of Barth Syndrome (BTHS), “Development of Mitochondria-Targeted Peptide Compounds as Barth Syndrome Therapeutics.” BTHS is an X-linked genetic disease resulting from defects in the transacylase enzyme tafazzin, involved in biosynthetic remodeling of the mitochondrial phospholipid cardiolipin. Using a host of biophysical approaches with model membrane systems and disease models, this work will explore a library of compound variants optimized as therapeutics for treating dysfunctional cardiolipin biogenesis. [Learn here](#) about how this grant will be used.

The group also received a grant from the National Institute of General Medical Sciences Grant (R01GM136975), “Mitochondrial Membrane Compartmentalization”. This is a multi-PI grant, with collaborator Dr. Steven Claypool (JHU School of Medicine), for \$774K over two years. The objective of this work is to elucidate spatial and temporal distribution of lipids and proteins within the subcompartments of the morphologically complex mitochondrion. This will identify how the organelle establishes its ultrastructure as well as differences in spatiotemporal macromolecular distribution relevant to human disease and cellular stressors. This work utilizes novel membrane-active copolymers that extract membrane nanoparticles amenable for protein and lipid analysis. [You can read an abstract of the grant proposal here.](#)

To learn more about the Alder Lab and their research, visit their [lab website](#).

## Two MCB Professors Receive 2020 Research Excellence Award in the Category of Covid-19 Rapid Seed Funding Program

The Office of the Vice President for Research (OVPR) recently announced recipients in the 2020 Research Excellence Program (REP) for the Storrs/regional campuses and UConn Health.

The primary goal of the REP is to provide seed funding to fuel innovative research, scholarship, and creative endeavors with strong potential for significant extramural funding and/or achievements consistent with the highest standards of accomplishment in the discipline. Multi-PI, interdisciplinary projects are encouraged, with the goal of adding to UConn’s reputation for innovative research, scholarship, and creative activities.

Forty-two REP grants were awarded in four categories after a highly selective competition, with 115 total applications. Awards range from \$10,000 to \$100,000. For a full list of REP recipients, [visit the program website](#).

One category of awards was the Covid-19 Rapid Seed Funding (RSF) Program. COVID-RSF supports the development of promising projects related to COVID-19. Many funding agencies have responded to the pandemic by creating emergency/rapid funding mechanisms that address key scientific problems related to the detection, diagnosis, treatment, and prevention of this disease. This internal funding mechanism seeks to identify and support novel technologies and approaches with strong potential to be competitive for emergency funding opportunities addressing COVID-19. COVID-RSF seeks proposals for potentially high-impact projects that are ready to launch in a short period of time.

Two MCB professors were awarded Covid-19 RSF awards. Professor James Cole was awarded \$43,439 for his project entitled *Targeting the Endoribonuclease of Coronaviruses* which will be conducted with Prof. Mark Pecuh, Chemistry

Professor Rachel O’Neill was awarded \$50,000 to conduct a program entitled *An integrated surveillance program for improved detection, containment and mitigation of COVID-19*. That work will be conducted with co-PIs Kendra Maas, UConn MARS; Joel Salisbury, Digital Media and Design; Michael Vertefeuille, UConn Digital Media and Design; Suzanne Onorato, UConn Student Health and Wellness; Judy Brown, Institute for Systems Genomics; Mike Jednak, Facilities Operations; Jessica Healthcote, Information Technology Services; Emily Wilson, Center for Land Use Education and Research; Dan Schwartz, Core2e.

modified from Jessica McBride, UConn Today, OVPR



Dr. James Cole



Dr. Rachel O’Neill

# Two UConn MCB Students Named 2021 Goldwater Scholars

Two University of Connecticut students have been recently named Goldwater Scholars. The Goldwater Scholarship is considered the nation's premier scholarship for undergraduates studying math, natural sciences, and engineering. Schools can nominate a maximum of four students per year.

The students are: Katherine Lee '22 (CLAS) of Monroe, and Seema Patel '22 (CLAS) of North Haven.

The UConn winners are among just 410 students selected nationally for the award.

"Having two UConn students selected for one of the nation's most competitive scholarships is a testament to the quality of our undergraduate research experience," says Rowena Grainger, the STEM Fellowships Advisor in the Office of National Scholarships and Fellowships. "Katherine and Seema displayed their intellectual curiosity, commitment to a research career and have already contributed to their fields. I am immensely proud of them and look forward to seeing the impact of their discoveries in the years to come."

Lee is an honors student majoring in structural biology and biophysics. She plans to pursue a doctorate in computational biology in order to conduct research and teach at an academic institution.

She has been working in Associate Professor of Molecular and Cell Biology Eric May's laboratory since the summer of 2019 studying the binding affinities and specificities of antibodies to hyperphosphorylated tau protein found in the early stages of Alzheimer's disease. Lee has studied the allosteric communication networks in these proteins to understand the effect of mutations upon protein dynamics in order to potentially design improved diagnostic antibodies and new therapeutics.

Lee received a Summer Undergraduate Research Fund (SURF) grant in 2020 to extend this work through studying the various conformational ensembles a given antibody can assume and use these principles to determine binding energetics.

She has been selected as a University Scholar and is investigating novel machine learning methods to predict the biochemical function of antibody variants given

structural data.

Outside of the lab, Lee is a math tutor for UConn's Q Center, a staff columnist for the opinion section of The Daily Campus, and has served as an EMT in her hometown.

"I am beyond grateful for receiving the Goldwater Scholarship and to the many people who have supported me to make



L-R, Katherine Lee and Seema Patel

this possible," says Lee. "I would especially like to thank my mentor, Professor Eric May, for guiding me through each step of my research and always entertaining my zany ideas, and Rowena Grainger from the Office of National Scholarships and Fellowships and the Office of Undergraduate Research, for helping me put together my application.

"Research comes with thrilling highs but also long periods of discipline in which you must be patient and keep doing the silent work that may not appear in a journal, but is required for you to get there. The Goldwater Scholarship has been an amazing affirmation that I am on the right track and that scientific research is where I belong."

Patel is majoring in molecular and cell biology and minoring in health care management and insurance studies. After graduation, she plans to pursue a combined medical and doctoral degree in pharmacology to investigate effective chemotherapeutic strategies for cancer patients. She is a Rowe Scholar, which is a program that provides opportunities (financial, academic, and experiential) to students from backgrounds underrepresented in health fields.

Her research career began in 2017 when she interned in the Chung Lab at the Yale School of Medicine, where she investigated the role of CatSper ion channels on sperm motility and fertility. Patel has been working in the Hadden Lab in the UConn School of Pharmacy since the spring of her freshman year, where she investigates the inhibition of a DNA repair mechanism called translesion synthesis (TLS). She has focused on the development and testing of potent anti-cancer drugs that disrupt a specific protein-protein interaction, termed Rev7/Rev3, of the TLS machinery. Using in vitro approaches, Seema has identified three novel TLS Rev7/Rev3 inhibitors and is currently characterizing their inhibitory potential in an ovarian cancer cell model for her University Scholar project.

Patel received a SURF grant in 2020, for which she wrote a review paper on the development of TLS inhibitors published in the journal [Expert Opinion on Investigational Drugs](#).

Outside of the laboratory, Patel volunteers for Paper Airplanes, a nonprofit that teaches English to conflict-afflicted students in the Middle East.

Inspired by the abrupt shift to virtual learning following the COVID-19 pandemic, last year Patel co-founded the UConn branch of Learn To Be, a national nonprofit tutoring organization, where she will train UConn students to teach STEM courses to students from underprivileged backgrounds.

She is also an editorial assistant for the Elsevier Social Science and Medicine peer-reviewed journal *Health Psychology*.

“I think the process of applying for the Goldwater Scholarship taught me much about myself and what I envision my future career to look like,” says Patel. “It was a reflective journey, because I had to ask myself tough questions about why I am doing what I am doing. After having gone through the process, I have a clearer picture of my post-graduate plans. Completing the application strengthened my communication skills and taught me how to present my interests and me as a researcher and a student in the best light.

“On decision day, I was definitely nervous about the results but being awarded this scholarship gave me the confidence to believe in my strengths and hard work and know that it is possible to achieve anything I set out to do. I believe receiving the Goldwater Scholarship was a product of not just my merits but the extraordinary support I received from my mentors and friends.”

by Mike Enright, UConn Today



*The Barry Goldwater Scholarship and Excellence in Education Foundation was established by Congress in 1986 to serve as a living memorial to honor the lifetime work of Senator Barry Goldwater, who served his country for 56 years as a soldier and statesman, including 30 years in the U.S. Senate. The scholarship's purpose is to identify students of outstanding ability and promise, and encourage them to pursue advanced study and research careers. Scholars receive one or two-year awards that cover the cost of tuition, fees, books, and room and board up to a maximum of \$7,500 per year.*

*As the result of a partnership with the Department of Defense National Defense Education Programs (NDEP), Mrs. Peggy Goldwater Clay, Chair of the Board of Trustees of the Barry Goldwater Scholarship and Excellence in Education Foundation, announced that the Trustees of the Goldwater Board have increased the number of Goldwater scholarships it has awarded for the 2021-2022 academic year to 408 college students from across the United States. “As it is vitally important that the Nation ensures that it has the scientific talent it needs to maintain its global competitiveness and security, we saw partnering with the Goldwater Foundation as a way to help ensure the U.S. is developing this talent,” said Dr. Jagadeesh Pamulapati, Director of the NDEP program, as he explained the partnership. With the 2021 awards, this brings the number of scholarships awarded since 1989 by the Goldwater Foundation to 9456.*

*From an estimated pool of over 5,000 college sophomores and juniors, 1256 natural science, engineering and mathematics students were nominated by 438 academic institutions to compete for the 2021 Goldwater scholarships. Of students who reported, 198 of the Scholars are men, 206 are women, and virtually all intend to obtain a Ph.D. as their highest degree objective. Fifty-one Scholars are mathematics and computer science majors, 290 are majoring in the natural sciences, and 68 are majoring in engineering. Many of the Scholars have published their research in leading professional journals and have presented their work at professional society conferences. [goldwaterscholarship.gov](http://goldwaterscholarship.gov)*

# Raising the Odds Against Viral Infection

Learning how viruses slip into cells, with an eye toward making it harder for them

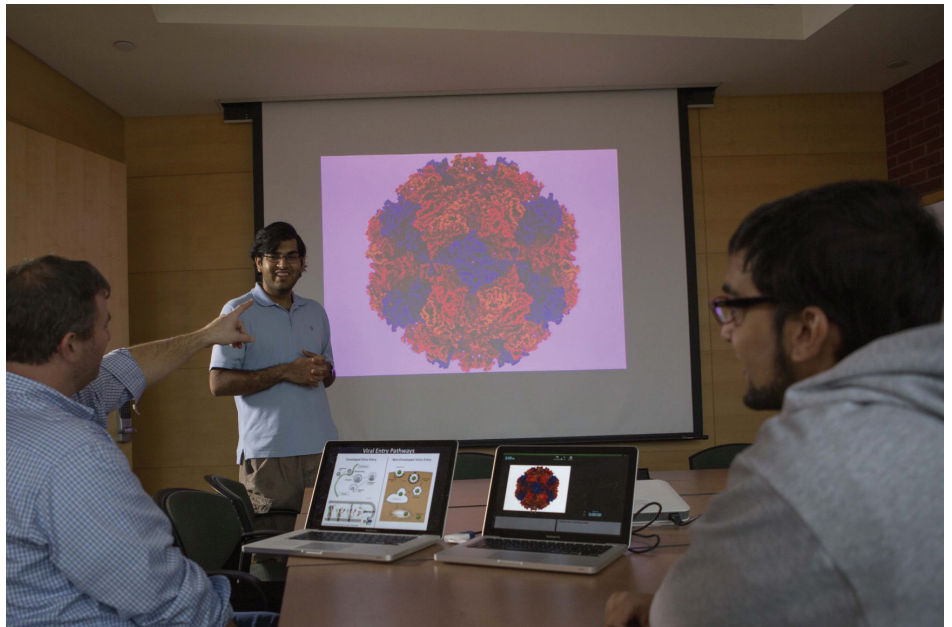
**V**iruses sneak into your body, hijack your cells' machinery, and force your cells to commit suicide. Sounds like a mission from a game like *Assassin's Creed*, but it's just a virus's daily life. Now a UConn biophysics lab has figured out how one type of virus slips into our cells—and perhaps how we can stop them.

For a virus, infiltrating a human cell is a multistep process. In UConn computational biologist Professor Eric May's lab, they model the steps of infection using computer simulations to see how the virus does it, and whether there are any weak points where we can sabotage it. Such work requires heavy duty computing power; May's lab uses supercomputers containing graphical processing units (aka GPUs, the kind used in gaming systems like the Xbox).

May and a former researcher in his lab, Asis Jana, currently a postdoctoral researcher at the University of Oklahoma, recently completed a study on Flock House Virus (FHV), published April 14 in *Science Advances*. FHV itself doesn't actually infect humans, but it's related to other viruses that do threaten human health such as polio and coxsackie virus. Because FHV is safe to study in labs, scientists have a very good portrait of the virus: its shape, its proteins, and the way its molecules move in simple situations.

But infecting a cell isn't simple—it's complicated, requiring many rather complex molecular events to happen. To understand how the process works, May's lab wanted to look at the virus right at the point when a cell has "eaten it," locking it inside a compartment called an endosome. How does the virus get out of the endosome?

[This video](#) shows the FHV virus when it's trapped inside an endosome. Endosomes help sort proteins and other molecules in the cell. The endosome has an acidic environment inside, which helps groups of molecules separate from each other so they can be individually



Dr. Eric May (left) discusses virus research with students Prakhkar Bansal (standing) and Shaan Kamal (right) (Sean Flynn/UConn Photo).

sorted to the right place. But FHV and many related viruses exploit that acidic environment. They use the acidity to open up a hole in a corner of their shell. That's what's happening in the video above. That little yellow squiggle you see peeking out of the shell? That's important. [See this next video:](#)

That hole in the virus's shell now opens wide enough for the yellow squiggle to come out entirely. The squiggle is actually a small protein that acts like a knife to slice open the endosome's membrane and set the virus free to invade the cell. Achievement unlocked.

What's so interesting about these videos is not just that they show how the virus works. It's that this complex viral behavior emerges from a tiny package of proteins with no brain and no nervous system. Everything that happens in the video is due to random fluctuations between molecules, made more or less likely by the environment. The simulations done by May's lab are based on physical models called molecular dynamics simulations, and have to be run for a very long time—hundreds of hours—in order to see the important (and unlikely) events

happen. May uses advanced simulation techniques called enhanced sampling to increase the probability of "seeing" these rare events. Not only does this show how hard it is to study viruses at the molecular level, it also shows why just being exposed to a single virus particle rarely results in infection. A whole series of statistically unlikely events have to go just right in order for a virus to infect you. And yet, it happens all the time.

As May explains, that means that finding an intervention that would block one or more of those statistically unlikely events from happening could stop viral infections in their tracks. It wouldn't have to work all the time; just stopping some of those events some of the time could tip the balance in our favor.

Right now, May's lab is analyzing the process to find targets for drugs that could make the virus's shell more stable, preventing the protein knife from emerging. The virus would never emerge from the endosome to invade the cell. Game over.

by Kim Krieger, UConn Today

# UConn Researchers Collaborate with TIP Company Shoreline Biome to Study Microbiome in NICU



Dr. Joerg Graf

**B**acteria tend to get a bad rap. But oftentimes it's one bad apple that ruins the reputation of the bunch.

For example, *E. coli*, commonly known as bacteria that cause sickness, also has beneficial strains that can help protect us from pathogens. Being able to differentiate between bacterial strains is critical for researchers working to understand the microbiome – the complex environment of bacteria living in and on our bodies.

A collaboration between researchers at UConn, Connecticut Children's, and Technology Incubation Program company Shoreline Biome has yielded promising findings about bacterial infection in premature infants in the Neonatal Intensive Care Unit (NICU). The group [published their findings in mBio in February](#).

Using Shoreline Biome's patented microbiome assay technology, the group was able to identify previously un-sequenced bacterial strains that appeared in the stool microbiome of two sets of twins in the Connecticut Children's NICU.

"It gives us unprecedented resolution and the ability to differentiate bacteria to the species or even strain level," Professor Joerg Graf says.

Premature infants in the NICU are at a high risk of infections because their immune system and digestive tract are not fully developed. The researchers were particularly interested in intestinal infections caused by certain strains of *Klebsiella*. They also identified strains of *Escherichia coli*, and *Enterobacter*.

The researchers identified unique microbiome fingerprints between and within the sets of twins. This provided valuable insight into the colonization processes in the NICU by looking at which bacteria appear and how they spread.

Normally, the first two years of life, starting the moment a baby goes through the birth canal, is a critical period for developing a healthy microbiome to carry for the entire lifetime. Babies in the NICU are rigorously protected from possible infection, which helps prevent them from getting sick, but also disrupts normal colonization patterns of commensal bacteria.

The researchers plan to continue this research in NICUs in other geographic areas, other parts of the hospital, and other microbiomes, such as those on our skin or in our mouths.

The researchers hope to eventually be able to detect a single genetic fingerprint associated with infection which would pave the way for better strategies to track and combat harmful bacteria.

"That would be a critical finding to improving the overall health of premature babies," Adam Matson, Connecticut Children's researcher

and assistant professor of pediatrics and immunology at UConn Health, says.

Shoreline Biome's high-throughput, high-resolution technology sequences a large portion of the ribosomal operon. This part of the bacterial genome contains highly conserved, or similar regions, and other regions that are very diverse. The conserved regions make it possible to use polymerase chain reaction amplification to make thousands of copies of the bacteria's genetic information.

After sequencing, researchers can study other variable regions of the operon to identify the bacteria more precisely. This also helps identify a bacterium's evolutionary relationship to known bacteria.

There are two ways to open bacteria to look at their genomes: cracking them open hard, which risks damaging the DNA, or doing it more gently and risking not accessing the DNA from difficult to crack bacteria. Shoreline Biome's technology combines the best of both, cracking open all bacteria without damaging the DNA.

"If you don't see DNA, you can't sequence it," Mark Driscoll, Shoreline Biome co-founder and chief scientific officer, says. "Now that we can see it, we can actually start to study it."

Shoreline Biome's technology allows researchers to analyze multiple samples at once. This is a major advantage for microbiome research. Many microbiome studies suffer from having small sample sizes due to the technical difficulty and costs of analyzing the samples.

Shoreline Biome's technology delivers scientists and physicians with actionable results. Knowing which strains are showing up in patient biomes can help them to track where they are coming from.

Eventually, this could lead to rapid tests to see if someone entering the NICU is carrying a harmful bacterium. Conversely, they could also track beneficial bacteria infants should be exposed to.

"We're actively looking at ways to apply this technology to track pathogens and encourage colonization of healthy microbiomes," Matson says.

The collaboration between Shoreline Biome and the researchers extends beyond this project. Graduate students from the Professional Science Master's Programs in Applied Microbial Systems Analysis Graf directs now work for Shoreline Biome, retaining a valuable workforce in the state.

"It's great for us to be able to work with experts to deepen the technology," Driscoll says. "It's a great ecosystem."

by Anna Zarra Aldrich, UConn Today

# Faculty News

## MCB NEW FACULTY

Jelena Erceg, Assistant Professor

Stacey Hanlon, Assistant Professor

Jonathan Gilbert, Instructor in Residence - Stamford

Andrea Makkay, Assistant Professor in Residence

Michele Maltz-Matyschysk, Assistant Research Professor

Aprita Ray, Assistant Professor in Residence - Waterbury

## MCB PROMOTIONS

Nathan Alder, Professor

Kathleen Feldman, Associate Professor in Residence

Barbara Mellone, Professor

Spencer Nyholm, Professor

Adam Zweifach, Professor

## MCB RETIREMENTS

Mary Bruno

Judith Landin

## IN MEMORIUM

*Emory Braswell*

MCB Emeritus Professor Emory H. Braswell died September 27, 2021, leaving his wife Frima Braswell, three grown children and five grandchildren. Dr. Braswell started his career at UConn in 1962 in the Department of Chemistry. In 1967 he transferred to the Biochemistry and Biophysics Section of the Biological Sciences Group, the common ancestor of the Molecular and Cell Biology (MCB), Physiology and Neuro Biology (PNB) and Ecology and Evolutionary Biology (EEB) departments.

He became director of MCB's undergraduate biophysics degree program in 1993 and developed courses in molecular biophysics, biophysical methods, laboratory computing and instrumentation. His research focused on methodology for determining the mass, size, and shape of macromolecules, as well as establishing the mode and thermodynamics of their self-association and assembly.

From 1986 until he retired in 2002, Professor Braswell served as Head of the National Analytical Ultracentrifugation Facility at UConn, which was funded by the National Science Foundation for collaborative research with both academia and industry.

Professor Braswell was active in university affairs, and in the 1980s he was vocal in urging faculty adoption of the AAUP as a bargaining agent in sometimes difficult dealings with the UConn administration and state legislature on faculty governance and salary issues. He was an elected member of the Connecticut Academy of Arts and Sciences.

[View Dr. Braswell's Obituary](#)



## NATIONAL FELLOWSHIPS INCENTIVE PROGRAM RECIPIENTS

Professors Eric May, Rachel O'Neill, Vicoria Robinson



## MCB Professor Dan Gage Among UConn Researchers Studying Mussels in the Filtration of Microplastics

UConn's Water Pollution Control Facility. (Photo: Baikun Li)

Professor Dan Gage is among UConn researchers involved in a study to use mussels in the filtration of microplastics funded by a \$2 million grant from the National Science Foundation's Emerging Frontiers in Research and Innovation (EFRI). They will study the use of mussels (part of the bivalve family), combined with microplastic-degrading bacteria, in the filtration of microplastics from the discharge that flows back into our surface water from wastewater treatment plants.

On a hot summer day in Connecticut, it's common to go to a beach-side restaurant, eat some fresh oysters and mussels, and enjoy the crashing of the waves against the sand. For a group of University of Connecticut faculty and a Florida Atlantic University professor, their plan is to skip the beach and the restaurant and use relatives of

those delicious animals for another reason—filtering the harmful microplastics that end up back in our environment.

“Suspension-feeding bivalves, such as oysters, clams, and zebra mussels are very efficient at filtering water and capturing on their gills (the ‘filter’) particles as small as four micrometers in size [less than 1000th of an inch]. Their

‘filter’ is self-cleaning and they often filter water for 12 or more hours per day. They are nature’s perfect filtering ‘machine,’” Marine Sciences Professor J. Evan Ward says.

Over the next four years, the group – including Associate Dean Leslie Shor, Chemical and Biomolecular Engineering Professor Kelly Burke, Molecular and Cell Biology

Professor Daniel Gage, Civil and Environmental Engineering Professor Baikun Li, and Ward – will use a \$2 million grant from the National Science Foundation’s Emerging Frontiers in Research and Innovation (EFRI) program to study the use of mussels (part of the bivalve family), combined with microplastic-degrading bacteria, in the filtration of microplastics from the discharge that flows back into our surface water from wastewater treatment plants.

Other faculty members involved in the project include CEE Professor Christine Kirchhoff, CBE Professor Matthew Stuber, CBE Professor

designed and built, plastics simply did not exist in the variety or quantity that they do today.”

Kirchhoff explains that even if the technical hurdles are overcome, there still may be a problem.

“Retrofitting existing infrastructure is an expensive proposition, and there are also many regulatory obstacles standing in the way. Better understanding the non-science obstacles to implementing innovative technology is a key aspect of our research project.”

UConn’s Water Pollution Control Facility (courtesy of Baikun Li).



Dr. Dan Gage

## “Nature’s perfect filtering machines to the rescue”

Jeff McCutcheon, Marine Sciences Professor George McManus, and Florida Atlantic University Biology Professor Tracy Mincer.

Microplastics, an umbrella term for particles of many different shapes, sizes (<5 mm), and polymer types, are commonly found in the environment through the shedding of synthetic fibers that wash off clothes in the laundry and tiny plastic fragments that are produced in the environment by different processes.

“Most wastewater treatment plants rely on old technology—over 100 years-old—and in some cases use basic approaches like sand filtration that have been known since ancient times,” Li says. “In fact, most wastewater treatment plants around the nation are themselves over 50-years old. When these facilities were

Because of the limitations of wastewater treatment, and also because larger plastics break down in the environment, microplastics end up all over our environment, and many types are tough to break down. The concern is that microplastics could cause harm to animals, plant life, and eventually humans.

According to Mincer, it has been shown that plastic particles less than 150 micrometers can make their way into our lymphatic systems, causing systemic exposure and, perhaps, affecting human health.

“Microplastics can also act as sponges, gathering up other harmful things in the environment. Many studies have shown that concentrations of other common contaminants such as harmful chemicals, pathogenic

bacteria, and even viruses can be much higher in microplastics than they are in the surrounding water. Consuming microplastics is therefore a way to be exposed to other harmful contaminants,” Mincer says.

In the end, the group hopes learning from nature and working with stakeholders on the barriers to adopting new technology will lead to a sustainable way to better treat wastewater.

“If the project is successful, not only will we develop innovative microplastic wastewater treatment technology, but we will also quantify drivers and barriers to adoption of this new technology with the ultimate goal of increasing its uptake,” Kirchhoff says.

The group also received a Research Experience & Mentoring supplement for their award for the summer of 2021, and in addition to recruiting graduate students, are currently recruiting undergraduates, high school students, and local teachers for paid summer projects. For more information on Shor’s research, please click here.

by Eli Freund, UConn Today

# Lynes and Teschke Awarded Fulbright Scholarships



Professor Michael Lynes



Professor Carolyn Teschke

The University of Connecticut has been recognized among the top producers of Fulbright U.S. Scholars from research institutions for the third time in the past five years. Among the UConn Scholars are MCB Professors and Department Head Michael Lynes and Professor Carolyn Teschke.

Department head and professor of Molecular and Cell Biology Michael Lynes, was originally awarded to teach and conduct research abroad in the 2020-2021 academic year but was re-selected for the current year after the pandemic prevented his going to the University of Bergen last year.

Lynes has developed a therapeutic antibody that can prevent the progression of Type 1 diabetes in mice, he wrote in a proposal. During his research at the Center for Diabetes Research at the University of Bergen, he is exploring the relevance of that treatment

to human disease, and whether it could effectively be used in treating patients.

Lynes is also seeking to establish an ongoing relationship to expand collaboration between the University of Bergen, Norway and UConn's MCB department. Lynes was also awarded grants from NIH and Biohaven Pharmaceuticals to support the ongoing development of this work.

Dr. Carolyn Teschke was also selected as a Fulbright Scholar and plans to visit the University of York during the Spring of 2022. Teschke plans to mathematically model virus assembly reactions to better understand how the process is controlled to produce proper virus capsids. Teschke will work with University of York professors Riedun Twarock, a mathematician who studies virus architecture, and Fred Antson, who studies large bacteriophages, to mathematically model how viruses assemble using experimental data generated in her lab and Twarock's mathematics expertise in the geometry of virus capsids, or its outer protein-based shell, to understand on a more detailed level how the different proteins of P22 assemble. In collaborating with Antson, Teschke hopes to understand how a virus evolves to grow bigger over time, and whether she can change the proteins in her model virus to become bigger, like the ones Antson works with. This would help her understand the process of virus evolution, where a virus accumulates mutations that affect the viral capsid geometry.



The Fulbright Program is the federal government's flagship international educational exchange program.

Scholars are selected for their academic merit and leadership potential, with the opportunity to exchange ideas and contribute to finding solutions to shared international concerns.

The University of Connecticut has been recognized among the top producers of Fulbright U.S. Scholars from research institutions for the third time in the past five years and is proud to be a 20-21 Top Producer.

The Fulbright Program is funded through an annual appropriation by the United States Congress to the Department of State. Participating governments and host institutions, corporations, and foundations in foreign countries and the U.S. also provide direct and indirect support.

# TO BE OR NOT TO B CHROMOSOME

Written by Andrei Alexandrescu

**W**hat determines our species - our membership in team Homo sapiens? Or our assigned gender at birth? In part, we are classified by our chromosomes – the supramolecular assemblies that organize our genomes. How chromosomes are passed down through generations, and the consequences of defects in chromosome dynamics on health and evolution are amongst the research themes of our new MCB faculty member Professor Stacey Hanlon.

Professor Hanlon's introduction to research was as an undergraduate at Texas A&M University, where she was using classic genetic techniques to map a mutation that produced abnormal courtship behavior in the fruit fly, *Drosophila melanogaster*. Switching to a simpler model system for her doctoral studies at the University of California, San Francisco, Professor Hanlon focused on DNA replication control in budding yeast. Loss of replication control can lead to chromosome instability, and her work in Prof. Joachim Li's lab focused on how re-replication through the centromeric region affected chromosome segregation. Using modern

molecular genetic techniques, Professor Hanlon found that chromosomes with a re-replicated centromere often missegregated during cell division, leading to an abnormal number of chromosomes in the daughter cells. These studies spurred on continued interest in chromosome dynamics. For her post-doctoral work, Professor Hanlon looked for a project that would allow her to continue her interest in chromosome biology while letting her carve out her scientific niche. She joined Prof. Scott Hawley's lab at the Stowers Institute in Kansas City, MO, just as the presence of B chromosomes in *Drosophila melanogaster* was becoming known.

B chromosomes have nothing to do with bees but are designated as 'B' chromosomes because, unlike the essential 'A' chromosomes, they are not critical for growth and reproduction and can be lost. B chromosomes have been known for over 100 years in organisms as varied as plants, fish, mice, grasshoppers, and yes, even bees!\*\*\* Operationally, B chromosomes are also relevant to humans, since about 0.06% of the population carries small abnormal supernumerary chromosomes that can be associated



New MCB faculty member Assistant Professor Stacey L. Hanlon

with intellectual disability or infertility but can also have no recognizable effects.

The *D. melanogaster* B chromosome that Prof. Hanlon studies appears to have arisen from Chromosome 4 through an unknown mechanism. The B chromosome does not appear to carry any protein coding genes, which begs the existential question: what causes the B chromosome to be, or not to be? Prof. Hanlon's working hypothesis is that the B chromosomes have been maintained in their original stock through an intriguing phenomenon called meiotic drive. The textbook view of meiosis – the specialized cell division that produces eggs in females and sperm in males – is that each pair of chromosomes are randomly segregated, meaning both copies have an equal chance of ending up in the egg or the sperm. This process is in accordance with Mendel's Law of Segregation, which predicts that 'everything is fair' (based on our interview I gathered that 'everything is fair' may be Prof.

Hanlon's favorite expression). When meiotic drive is in effect, however, inheritance of elements such as the B chromosome is anything but random. During her postdoctoral work, Professor Hanlon discovered that the B chromosomes are genetic renegades that cheat during meiosis and are inherited at a higher frequency than expected! Since these B chromosomes do not carry protein-coding genes, what's the harm of having a few around? It turns out these small B chromosomes pack a big punch during meiosis and can disrupt the segregation of the A chromosomes, which poses a significant genomic conflict: the B chromosomes have a mechanism to act selfishly and get passed to progeny at a high frequency, but natural selection is working against the B chromosomes because their presence wreaks havoc during meiosis and lead to a reduction in fertility. Whether 'tis nobler of the fly to suffer, the slings and arrows of outrageous fortune, or to take arms against a B of troubles?

Professor Hanlon's lab is profoundly interested in the genetic factors that resolve the genomic conflict between what is best for the host and what is best for the B chromosomes. What keeps the balance between Mendelian inheritance and natural selection versus the meiotic drive of a selfish genetic element? Are protein gradients involved or does the structure of the B chromosome have to do with its selfish behavior during meiosis? How do cells count chromosomes, to ensure the proper number? How do small chromosomes affect the behavior of the others during meiosis? Answers to these questions will shed fundamental light on our understanding of aneuploidy, the occurrence of one or more



The new Hanlon lab outside of the new UConn Engineering and Science Building L>R Paulo Belato, Stacey Hanlon, Kaylah Samuelson (photo: Courtesy Hanlon )



Graduate student Kaylah Samuelson examining tiny fruit flies with a big microscope (photo: Hanlon)

extra or missing chromosomes. Aneuploidy occurs due to errors in chromosome segregation, and when this occurs during meiosis, it can result in infertility and disorders such as Down syndrome. From an evolutionary perspective, we can expect new insights into how and where new chromosomes arise, as well as what can influence their frequency of formation such as maternal age or exposure to a small molecule. Equally important for the progress of the research, is the

recruitment of talented students. In the Hanlon lab, students can expect to receive training in modern molecular biology techniques, classic genetics, and cytogenetics, amongst other areas. Everything being fair, we expect the Hanlon lab to provide many contributions to our understanding of chromosome segregation, meiotic drive, and genomic conflict in the years to come.

\*\* (Comp Cytogenet. 2018; 12(4): 471–482.

2020-2021

## **MCB GRADUATE AWARDS**

### **2021 Summer Fellowship Awards**

Claire M. Berg Graduate Fellowship in Genetics

Prachi Tandale

Biohaven Pharmaceuticals Fellowship

Virginia (Lyle) King

Arthur Chovnick Graduate Fellowship in Genetics

Savannah Hoyt

Richard C. Crain, Jr. Memorial Fellowship

Shannon Sullivan

Cross-Disciplinary Fellowships in MCB and Pharmaceutical Sciences

Shipra Malik

Jean Lucas-Lenard Special Summer Fellowship in Biochemistry

Nadine Lebek, Irio Schiano

Pfizer Summer Fellowships in Molecular and Cell Biology

Sean Stoessel

Antonio H. & Marjorie J. Romano Graduate Education Fellowship

Emily Green, Elizabeth Herder

### **2020/2021 Outstanding TA Awards**

Katelyn Denegre and Nina Wang

### **Microbiome Research Fellowships**

Spring 2021 (Fall 2020, none)

Khalia Cain, Elizabeth Herder, and Jamie Micciulla

Summer 2021

Ryan Duggan, Derrick Kamp, Kathleen Kyle

### **DEMI Awards**

Fall 2020:

Savannah Klein, Amy Thees, Emily Green

Spring 2021:

Marina Bleiler, Sean Stoessel, Lauren Wainman

### **Spring 2021 Conference Participation Award** (formerly the Doctoral Student Travel Award)

Jeffrey Tamucci, Didem Ozcan, Nidhi Vijayan

## Fall 2020 Student Evaluations of Teaching (SET) Awards

### FACULTY

Dylan Audette  
Barbara Mellone  
Dan Gage  
Elizabeth Kline  
Joerg Graf  
Leighton Core  
Mary Bruno  
Philip Yeagle  
Victoria Robinson  
Melissa Durstin

### GRAD ASSISTANTS

Alyssa Coulter  
Amanda Harrop  
Camille Pearce  
Corey Theodore  
Emily Baranowski  
Evan McCabe  
Nadine Lebek  
Ryan Drennan  
Tyler McDermott

## Doctoral Dissertation Fellowship

### Spring 2021:

Lauren Wainman, Jamie Micciulla, Parvathi Devarakonda

### Fall 2021

Emery Ng, Didem Ozcan, Virginia King, Wayne Mitchell

2020-2021

**MCB GRADUATE DEGREES CONFERRED**

### December 2020

David Mouser, Fall 2020, PhD Biochemistry, Cole

### May 2021

Stephen Hesler, Spring 2021, PhD, Biochemistry, Cole

Anthony Patelunas, Spring 2021, PhD, Cell and Developmental Biology, Goldhamer

Amy Thees, Spring 2021, PhD, Microbiology, Lynes

Ashley Latibeaudiere, Summer 2021, MS, Microbiology, Graf

2020-2021

# MCB UNDERGRADUATE AWARDS

## University Scholars

The following undergraduates who work with MCB professors were named 2021 University Scholars (of 23 total Scholars). University Scholars is a prestigious UConn undergraduate program in which students design and pursue an in-depth research project and craft individualized plans of study during their final 3 semesters.

### **Amy Backal**

Major: Molecular and Cell Biology

Project Title: The Effect of Fibrodysplasia Ossificans Progressiva (FOP) on the Tongue

Committee: David Goldhamer, Molecular and Cell Biology (chair); Aoife Heaslip, Molecular and Cell Biology; and Rachel O'Neill, Molecular and Cell Biology.

### **Suzannah De Almeida**

Major: Molecular and Cell Biology

Project Title: Novel Epigenetic Therapeutics of Opioid Use Disorder

Committee: Gregory Sartor, Pharmaceutical Sciences (chair); Nathaniel Rickles, Pharmacy Practice; and Barbara Mellone, Molecular and Cell Biology.

### **Katherine Lee**

Major: Structural Biology/Biophysics

Project Title: Computational Investigations into Binding Dynamics of Tau Protein Antibodies: Using Machine Learning and Biophysical Models to Build a Better Reality

Committee: Eric May, Molecular and Cell Biology (chair); Adam Zweifach, Molecular and Cell Biology; Yongku Cho, Chemical and Biomolecular Engineering.

### **Mehreen Pasha**

Major: Molecular and Cell Biology

Project Title: When Problems Become Solutions: Harnessing the Osteogenic Capacity of Disease-Causing Stem Cells to Repair Bone Fractures

Committee: David Goldhamer, Molecular and Cell Biology (chair); Geoffrey Tanner, Physiology and Neurobiology; Adam Zweifach, Molecular and Cell Biology.

### **Seema Patel**

Major: Molecular and Cell Biology

Project Title: Translesion Synthesis Inhibitors: A New Class of Cancer Chemotherapeutics

Committee: Kyle Hadden, Pharmaceutical Sciences (chair); Ashis Basu, Chemistry; and Charles Giardina, Molecular and Cell Biology.

## Todd M. Schuster Award

**Julia Mazur**

## All-Biology Undergraduate Research Symposium Awards

Awards presented for talks given during the 2021 Annual Biology Undergraduate Research Colloquium

**Outstanding Senior in MCB Award - Emily Kilian**; Research supervisor: Dr. Elizabeth Kline/Dr. Sharon Smith  
“Language Acculturation Traits and BMI in Hispanic-American Children”

**Excellence in Applied Genetics and Technology Award - James He**; Research Supervisor: Dr. Loturco; “Identifying the Cell Composition and Clonal Diversity of Supratentorial Ependymoma Using Single Cell RNA-Sequencing”

**Biology Director’s Award - Akriti Bhattarai** Research supervisor: Dr. Jill Wegrzyn, “Identifying Potential Disease Resistance Genes in White Pines”

## SURF Awards

14 out of the 56 undergraduate SURF Award recipients for Summer 2021 are MCB students. These UConn students were selected from an exceptionally strong group of applicants representing diverse areas of academic inquiry. These students are:

**Michelle Antony '23** Project Title: “EGFR Signals in the Chondroprogenitor Response to Articular Cartilage Injury”  
Faculty Mentor: Dr. Caroline Dealy, Reconstructive Sciences, Orthopedic Surgery & Cell Biology

**Amy Backal '22** Project Title: “The Effect of Fibrodysplasia Ossificans Progressiva (FOP) on the Tongue” Faculty Mentor:  
Dr. David Goldhamer, Molecular and Cell Biology

**Poorna Balakumar '23** Project Title: “The Role of Hydrogen Peroxide as a Virulence Mechanism of Mycoplasma pneumoniae In Vivo Faculty” Mentor: Dr. Steven Geary, Molecular and Cell Biology

**Ashiti Damania '23** Project Title: “Validation of RGC Subtypes Via Molecular Markers Using Single-Cell RNA Sequencing”  
Faculty Mentor: Dr. Feliks Trakhtenberg, Neuroscience

**Brian Fox '22** Project Title: “Defining CIQL1 Protein Signaling in Oligodendrocyte Progenitor Cell Differentiation for Central Nervous System Remyelination with Implications for Multiple Sclerosis” Faculty Mentor: Dr. David Martinelli, Neuroscience

**Varsha Irvathraya '23** Project Title: “Chromosomal Rearrangement of CCND1 on the Development of Parathyroid Tumors and Hyperparathyroidism” Faculty Mentor: Dr. Jessica Costa, Center for Molecular Oncology

**Paul Isaac '23** Project Title: “Save the Crabs: An Investigation of the Genomic and Cellular Components of the Limulus polyphemus Immune Response” Faculty Mentor: Dr. Rachel O’Neill, Molecular and Cell Biology

**William Odell '22** Project Title: “Inhibitory Effect of Sugar Kelp Supplementation on Inflammation in Mice with Atherosclerosis” Faculty Mentor: Dr. Ji-Young Lee, Nutritional Sciences

**Cindy Pan '22** Project Title: “Weighing-In on Weight: A Qualitative Study on an Online Weight Loss Intervention” Faculty Mentor: Dr. Sherry Pagoto, Allied Health Sciences

**Avin Sapowadia '22** Project Title: “Lubricin Delivery System via Biomimetic Nano-Matrix for Treatment of Age-Related Macular Degeneration” Faculty Mentor: Dr. Yupeng Chen, Biomedical Engineering

**Stephen Stanio '22** Project Title: “The Mutagenic and Toxic Effects of Formamidopyrimidine” Faculty Mentor: Dr. Ashis Basu, Chemistry

**Audrey Worth '22** Project Title: “Controlling Pathogen Growth in Raw and Pasteurized Milk with Commercial Bacteriophages” Faculty Mentor: Dr. Dennis D’Amico, Animal Science

**Joshua Yu '23** Project Title: “Correlating Uptake and Intracellular Distribution of Nanoparticle Therapeutics with Cytotoxicity” Faculty Mentor: Dr. Xiuling Lu, Pharmaceutical Sciences

**Humza Zaidi '22** Project Title: “Identifying an Early, Novel Biomarker in the Retina for Alzheimer’s Disease” Faculty Mentor: Dr. Royce Mohan, Neuroscience

## Spring 2021 UConn IDEA Grant Recipients

**Mahima Mehta '22**, MCB, Project: “Exploring the Effects of Nest Temperature on the DNA Methylation of Eastern Bluebirds”

**Saumya Vodapally '22**, MCB & Women’s, Gender, and Sexuality Studies, Project: “RiSE: Refugees in STEM Education”

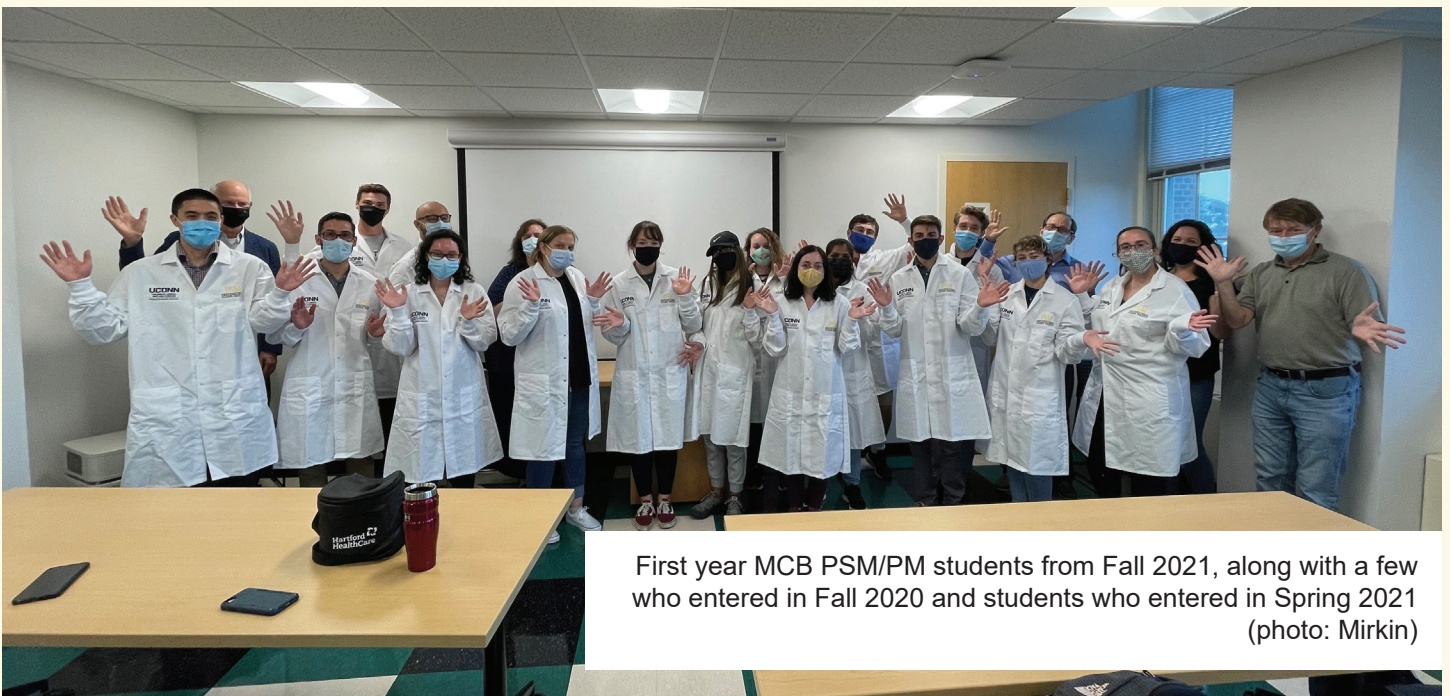
## NEW! Judith A. and David C. Kelly Summer MCB Research Fellowship

The Judith A. and David C. Kelly Summer MCB Research Fellowship program supported three rising senior MCB majors in their research activities in an MCB Faculty laboratory during the summer of 2021. These three fellowships, funded jointly by the Kellys and MCB, in the amount of \$8,000 each, are intended to support students with demonstrated financial need who are MCB majors in good standing, and who have career goals aligned with the major.

The recipients are **Danielle Arsenault** (Peter Gogarten lab), **Celeste Cuellar** (Sarah Hird lab), and **Shirley Guo** (Ken Campellone lab).

# Professional Science Masters Program News

In response to the national priority for training graduate students at the master's level for careers outside of academia, the MCB department offers a Professional Science Master's (PSM) program with MS degrees in Applied Genomics (AG) and Applied Microbial Systems Analysis (MSA) and a Professional Master (PM) program with a MS degree in Applied Biochemistry and Cell Biology (ABCB). PSM/PM programs are designed for students who are seeking to further their scientific knowledge in these disciplines and train for careers in the biotechnology and pharmaceutical industries or government agencies. These programs allow students to pursue advanced training, while developing highly valued professional skills and performing a hands-on internship.



First year MCB PSM/PM students from Fall 2021, along with a few who entered in Fall 2020 and students who entered in Spring 2021 (photo: Mirkin)

## MCB Professional Science Master's (PSM) Professional Development Seminar

Invited speakers included CEOs, upper management, independent consultants, and MCB PSM alumni from a variety of large companies, startups, non-academic institutions, etc., across the biotechnology and pharmaceutical spectrum. The companies and institutions represented included JAX-GM, UConn TIP program, KSQ Therapeutics, Goldbelt C6, Sema4, CCMC, Abcam, UConn Career Center, Sophia Consulting Firm, Shoreline Biome, Bios Partners, Azitra, LambdaVision, Confocal Imaging Facility at Princeton University, Vanessa Research, Bristol Myers Squibb, Kleo Pharmaceuticals, Flagship Pioneering,

Precision & Translational Genomics consultant, Altasciences, Thermo Fisher, Boehringer Ingelheim, Chameleon Communications International, and Virology Research, Ohio State University.

## MCB PSM Program-Specific Courses

We continue training students to meet the needs of the Connecticut biotechnology sector. We developed a new module "COVID-19 Diagnosis: SARS-CoV-2 quantification, mutation detection and genome sequencing" and offered it during the May term, 2021. In this module, the students were taught the CDC protocol for the detection of SARS-CoV-2, the detection of variants using different primers sets and the sequencing of SARS-CoV-2 genomes using the minION.

## Internships

**Maron Ansong** (ABCB) – Clinical diagnosis and management of COVID-19, LabCorp Integrated Genetics.

**Hailey Donohue** (MSA) - Skin microbiome research, Oh Lab, JAX-GM.

**Berivan Hamoto** (ABCB) - Develop qPCR assay to detect and quantify SARS-CoV-2 in saliva samples, Graf Lab, MCB, UConn.

**Zaide Ibic** (AG) – Science instructor, Windham Middle School.

**Julia Jerolamon** (ABCB) - Research GTPase enzyme BipA, Robinson lab, MCB.

**Reagan O’Loughlin** (ABCB) – Protein production for sequence variants of a domain and screening of the variants, Aneskievich lab, Pharmaceutical Sciences, UConn.

**Namita Prabhu** (ABCB) – Advanced genomics in a new and expanding genotyping and women’s health lab, Center for DNA-Guided Medicine.

**Rytis Sidabras** (MSA) – Bioinformatic analysis on genetic data related to cancer research, Yale School of Medicine.

## Recent Graduate Employment or Further Education

**Maron Ansong** (ABCB) – Clinical Technician, Clinical diagnosis and management of COVID-19, LabCorp Integrated Genetics.

**Feissal Djoule** (MSA) - Research Scientist, Cell therapy process development, NECT.

**Jonathan Gazsi** (ABCB) – Scientific Associate, Seqirus.

**Julia Jerolamon** (ABCB) - PhD student, MCB.

**Dominique Carrillo Juall** (MSA) – R&D Scientist, PCR-quality rapid at-home COVID-19 testing kits, Detect.

**Namita Prabhu** (ABCB) – Research Specialist, Gene Therapy program, UPenn.

**Zoe Scholar** (MSA) - Research Assistant, microbiologist studying the impact of the microbiome on disease state, Oh Lab, JAX-GM.

**Rytis Sidabras** (MSA) – Research Associate, Yale University Therapeutic Radiology Department, Bindra Lab, Yale School of Medicine.

## A Passion for Science and Public Health



**Marsenia Harrison Mathis, MPH, M.S. Microbial Systems Analysis, Spring 2009, Department of Molecular and Cell Biology, University of Connecticut**

Marsenia Mathis considers herself a public health advocate, scientist, and STEMist. After a long career working with the Centers for Disease Control (CDC), Marsenia now works at Goldbelt C6. In addition to her current position, Marsenia is also an entrepreneur as the founder and creator of The Nerdy CEO.

After her undergraduate studies at Stillman College, Marsenia wanted to pursue further education for a career in the sciences. Dr. Lee Aggison, her professor at Stillman and later the director of the Microbial Systems Analysis (MSA) program, recommended Marsenia apply to the program. Marsenia was one of the first students to enroll in the program and as she says, “It was one of the best decisions of my life.”

At UConn, Marsenia found the MSA program “offered exactly what I was looking for.” One course in particular, Mechanisms of Bacterial Pathogenicity, sparked Marsenia’s interest in infectious disease. “I knew right away I wanted to work at the CDC.” Marsenia found the MSA program prepared her well for the workforce. “I gained more expertise, skillsets, and knowledge in Microbiology that applied to my career.”

After graduation, Marsenia spent nine years “chasing infectious diseases, particularly respiratory illnesses by way of the CDC.” In her current role at Goldbelt C6, Marsenia manages and oversees federal government contracts with the CDC, which includes staff recruiting, customer relationship development, project growth, and staff leadership.

Marsenia recently created the online platform, The Nerdy CEO, (thenerdyceo.com), a limited liability company, “to educate and encourage individuals in STEM professions ensuring they have the support, resources, self-confidence, and conviction to achieve their goals.”

As to her assessment of the MSA program, “I think this program is a wonderful opportunity. It definitely positions you with the skillsets and knowledge to perform to the best of your ability.”

## From Engineering to Translational Research



Maria del Carmen Rosas, M.S.  
Applied Genomics, Spring 2020,  
Department of Molecular and Cell  
Biology, University of Connecticut

It was an interest in Sanger sequencing and its applications to biotechnology that led Maria Rosas to the Applied Genomics PSM program at UConn. The program allowed Maria to develop the skills needed to pursue her interest in the real-world application of laboratory research. Maria currently works as the sole laboratory technician in the Biobehavioral Research Laboratory at the School of Nursing, UConn.

There were few opportunities to learn Sanger sequencing and other related technologies in Peru, where Maria received her undergraduate training in chemical and biotechnology engineering. While researching biotechnology programs in the U.S., Maria had the opportunity to discuss the PSM program

with Dr. Charlie Giardina, the Director of the Applied Genomics program at UConn. “The program had what I was looking for, hands-on training with real applications! And those skills could be applied to different settings, research and industry,” Maria recalls.

Maria currently manages the new Biobehavioral Research Laboratory. Her duties include equipment acquisition, overseeing grant budgets, operating the service center, training graduate assistants, and obtaining IBC approval for new projects. In addition, she performs different types of sample analysis. Currently, Maria is developing and validating SOPs for assays of common biomarkers in saliva and fecal samples from babies using a new multiplex platform (ELLA) acquired by the facility.

As to how well the PSM program prepared her, Maria says, “The program provided me with the skills needed for my job, the technical and the soft ones, such as the training in laboratory management and communication, two things I was not trained in before. I can prepare budgets, manage a good number of samples, assist with research protocols, and communicate effectively with people.” She recommends the program for those who “love to work in a laboratory setting and want to be exposed to cutting-edge technologies and applications.”

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