Cell Biology & Physiology

CBP In the Loop

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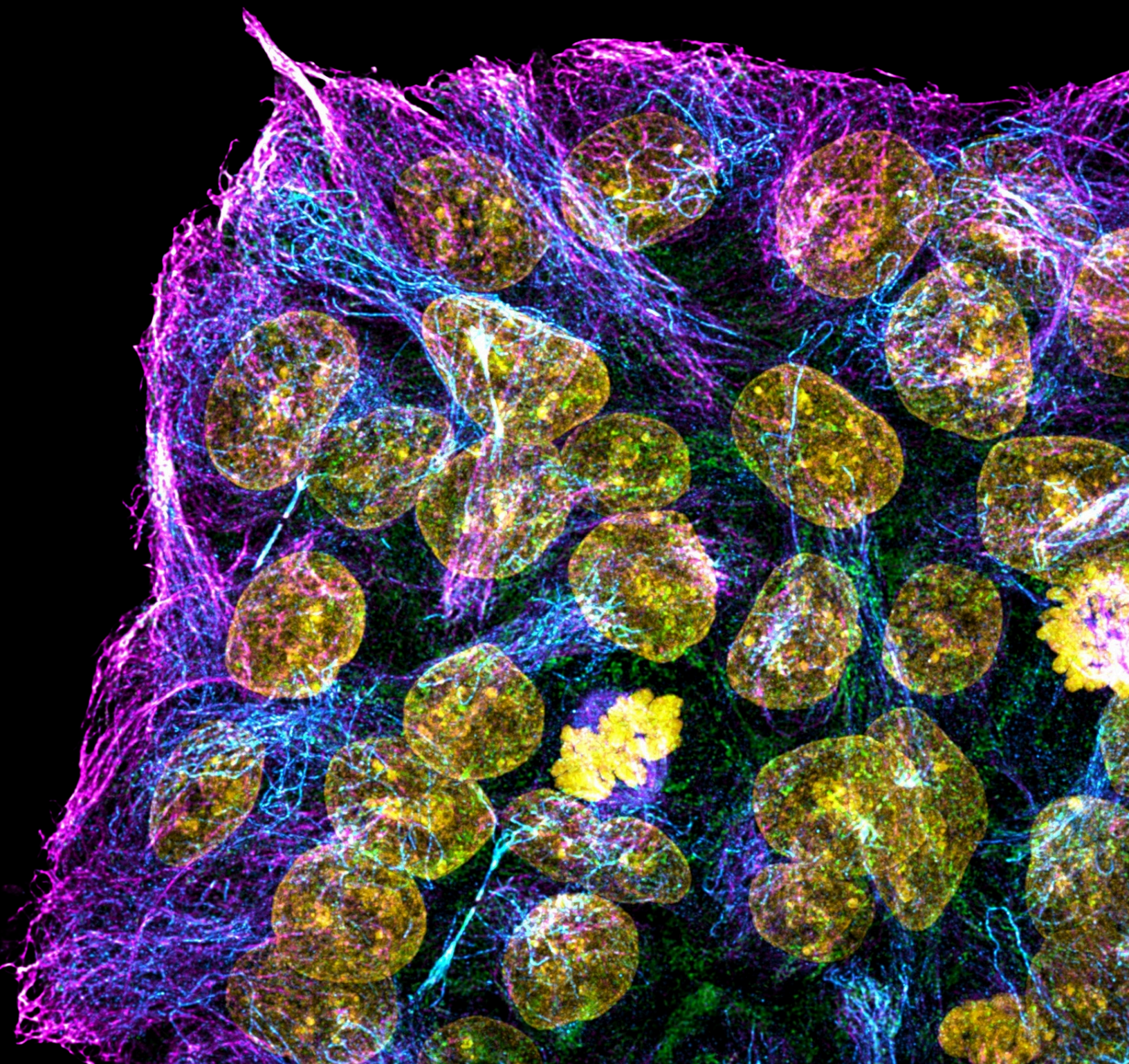
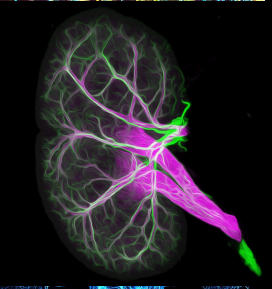
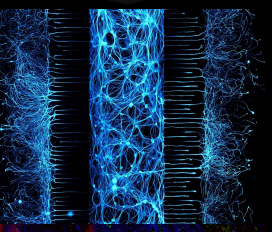
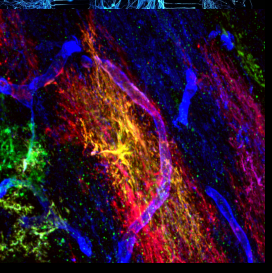
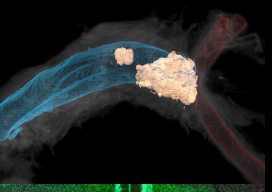
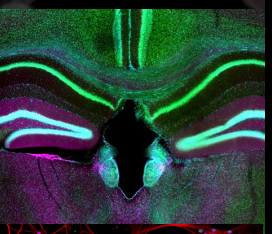
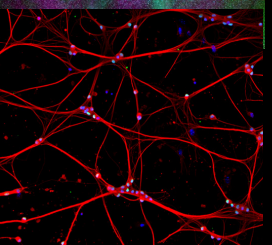
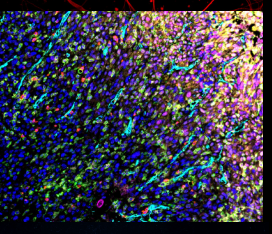
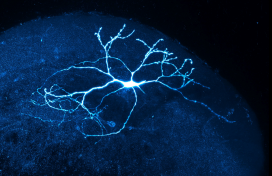
#3 in the Nation in NIH Funding



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If you would like to write an article for the CBP In the Loop newsletter, contact Tiffany Garbutt, PhD.

Under the Microscope

Cracking the secret stem cell highways behind Alzheimer's disease

What does this image show?
The image shows human induced pluripotent stem cells carrying the apolipoprotein E (APOE) variant, the strongest genetic risk factor for late-onset Alzheimer's disease, immunostained for tyrosinated tubulin (magenta), detyrosinated tubulin (cyan), acetylated tubulin (green) and nucleus (yellow). Condensed chromatin can be seen in dividing cells.

How does this image help advance the research of your lab/team?
The microtubule network is a dynamic set of "highways" that guides organelle positioning and supports cell function. Its post-translational modifications—the "tubulin code"—can act as master regulators of complex interactions between organelles. Using human induced pluripotent stem cells, we track how organelle morphology, dynamics, and contacts are rewired as cells differentiate into neurons, and how these processes alter with neurodegeneration-linked gene variants or change in the tubulin code. By visualizing the hidden architecture of microtubules, we uncover how disease-linked genetic variants shape the fundamental blueprint of the cell.

How was this image taken?
The sample was imaged with an inverted Zeiss 800 laser scanning confocal microscope and processed with Huygens deconvolution.

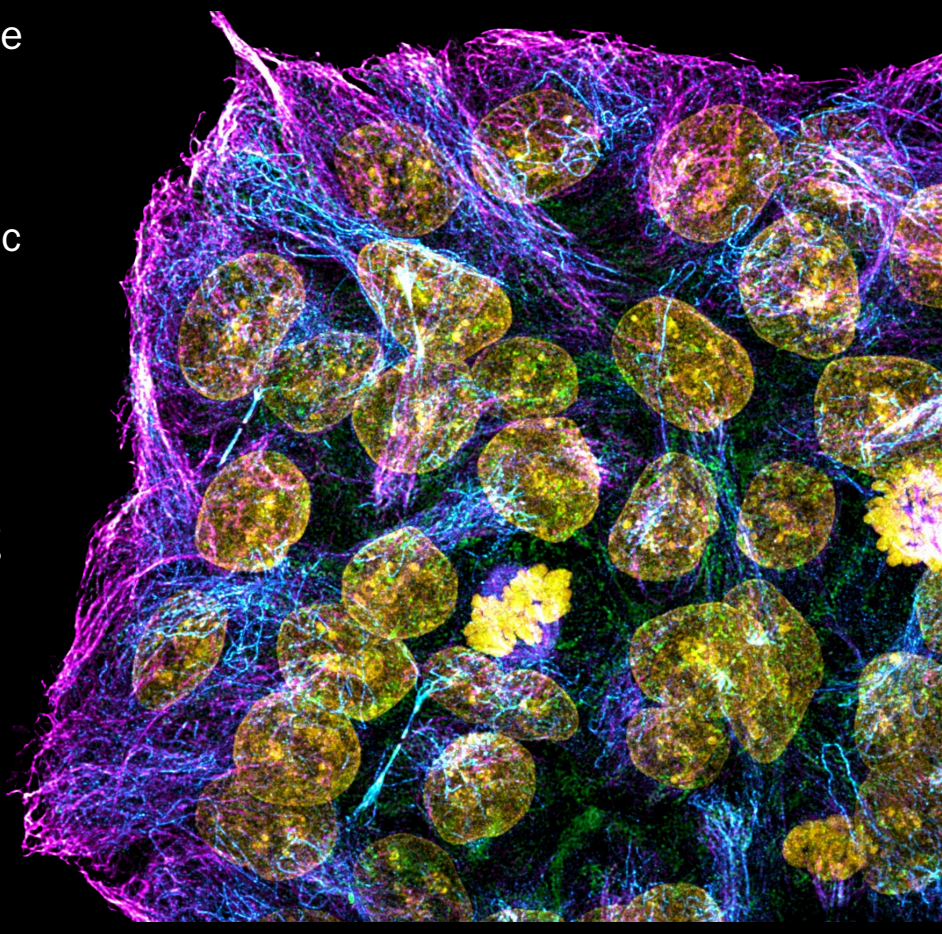
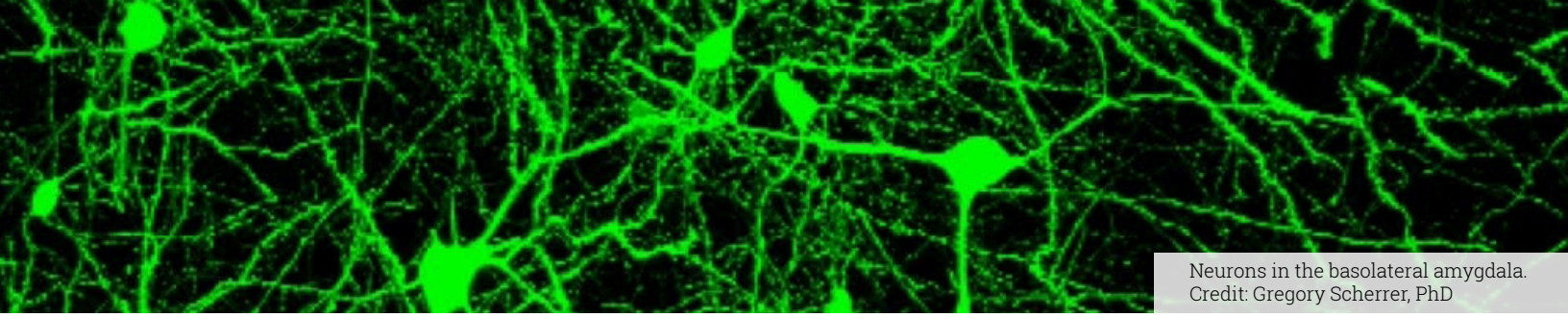


Image and text credit:
Chih-Hsuan (Sherry) Hsu
Lab of Dr. Sarah Cohen



Neurons in the basolateral amygdala. Credit: Gregory Scherrer, PhD

A new, non-addictive painkiller is on the horizon

By Kendall Daniels Rovinsky | August 20, 2025

Appeared in UNC Health and UNC School of Medicine Newsroom

Experts at the UNC School of Medicine and UNC Eshelman School of Pharmacy are focused on a pain drug candidate that can target an area of the brain that controls the 'unpleasantness' associated with pain.

Chronic pain is a struggle for so many and has staggering impact on the lives it affects. Matt Mauck, MD, PhD, an anesthesiologist, pain medicine physician, and chronic pain researcher at the UNC Hospitals Pain Management Center, sees this every day.

"Chronic pain impacts quality of life, relationships, general activity, sleep and so many other essential life functions, and often is accompanied with many symptoms such as fatigue and low mood," said Mauck. "Research is needed to develop new therapies to help these patients."

Pain management providers use a combination of evidence-based treatment options that involve medications, therapy, injections, and specialized procedures to improve pain. But sometimes, these therapies are not enough to enable patients to have control over their pain. Opioid medications, like oxycodone and tramadol, can help in the short-term but the long-term use can be problematic and complicated by developing tolerance and addiction.

Researchers, like Gregory Scherrer, PharmD, PhD, are determined to create a new pain medication that can offer relief to those in need—without the addictive properties. Now supported by a multi-million U19 grant from the National Institutes of Health (NIH), the research team is in the process of converting their basic science findings into clinically relevant results.

Grégory Scherrer, PharmD, PhD

"The fundamental problem is that pain is unpleasant," said Scherrer, who is an associate professor in the UNC Department of Cell Biology and Physiology, the UNC Neuroscience Center, and the UNC Department of Pharmacology. "We are currently working on several drug candidates that can target specific neurons in the brain and turn off the 'unpleasantness' of pain, while maintaining sensation in the body."

The Purpose of Pain

Pain serves as a warning signal to our bodies, alerting us that something is actually or potentially harming the body's tissues.

When a painful stimulus is first sensed by neurons in nerves, that information is relayed to the spinal cord and up to the brain. From there, the pain becomes a conscious, emotional experience. It is this painful, negative signal that motivates us to avoid whatever is causing pain, whether that be by removing our hand off a hot stove or mending a bone fracture.

However, when someone has chronic pain—or pain that lasts for six months or longer after an injury—the pain continues long after their "hand" has been off the stove.

Pharmaceutical companies have attempted to create medications to help address chronic pain, but with limited success—and not without significant side effects. Opioid medications, along with the natural derivative opium, have been in use for thousands of years for pain relief. They work by binding to specific receptors in the brain, providing pain relief and the sensation of euphoria.

"Where it gets tricky is that some pain management treatments like local anesthetics can prevent you from feeling any sensation at all, painful or otherwise," said Scherrer. "On the other hand, opioids directly activate reward circuits in the brain and can lead to dependence or withdrawal symptoms once the therapy is stopped."

A New Way to Target Pain

To reduce suffering pain more efficiently and with reduced side effects, Scherrer has focused his research on the nervous system and how it perceives pain and pain relief. But for many years, researchers weren't sure what specific neurons were responsible for making pain unpleasant.

"We thought that if we could find these cells somewhere in the brain, we might be able to treat pain in a whole new way," said Scherrer. "By targeting these cells, chronic pain would be less unpleasant, but you could still sense that you have a problem."

After years of research, Scherrer was able to pinpoint those exact brain cells. As revealed in a 2019 study in Science, these cells are located in the amygdala, a peanut-sized area of the brain that regulates emotional responses to pain and fear.

Using a miniature microscope situated on the head of a mouse model, researchers tracked what nerves would "light up" in response to pain. Out of 17,000 neurons in the amygdala, one specific set of cells were constantly activated during pain.

After his ground-breaking study in 2019, Scherrer needed to know what receptors within these cells could serve as docking stations for a drug-like molecule. With funding from the National Institutes of Health's HEAL (Helping to End Addiction Long-term) Initiative, he isolated these neurons and used a technique known as RNA sequencing to identify these docking sites, and small molecules for these receptors, termed ligands.

Now, The Preclinical Development Stage

In March, Scherrer's research received a $12 million U19 grant from the NIH to further his research. A U19 grant from the NIH is a prestigious, multi-year cooperative award that supports complex, research collaborations addressing high-priority scientific or public health challenges.

Experts from the UNC School of Medicine, Stanford University, and the University of California, San Francisco, are now developing a small molecule with drug-like properties that can activate receptors in mouse models and the human amygdala.

Jeff Aubé, PhD, a medicinal chemist at the UNC Eshelman School of Pharmacy, and Bryan Roth, MD, PhD, an expert on therapeutic drug discovery at the UNC School of Medicine, will be working alongside Scherrer to elevate their research efforts. Although far from clinical trials, the team is closer than ever to creating a new pain drug,

"Our goal over the next five years or more is to develop a pain drug candidate and then to file an Investigational New Drug (IND) application with the FDA to begin clinical trials," said Scherrer.

Thaxton's team injected mouse tumors with a hypoxia protein marker shown in yellow and a marker for ATF4 shown in red. The two regions overlapped perfectly, implicating ATF4 in immune cell stress in tumors.
Credit: Jessica Thaxton, PhD

Alleviating immune cell stress and maximizing immunotherapy success

By Tiffany Garbutt, PhD | September 26, 2025

Cells get stressed too and when they do, cancer therapies fail. A UNC researcher may be on the cusp of finding a solution to T cell exhaustion.

When the immune system experiences prolonged cell stress, immunotherapy fails. Immunotherapy uses the body's own immune cells, such as T cells or B cells, to attack and destroy cancer cells. The only problem is that immune cells can become exhausted from the fight.

"My lab focuses on the concept that immune cells in solid tumors experience profound metabolic stress, and we can help cells overcome cell stress to enhance immunotherapy," said Jessica Thaxton, an associate professor in the Cell Biology and Physiology Department and the Lineberger Comprehensive Cancer Center at the University of North Carolina at Chapel Hill.

Thaxton and her team discovered a conserved stress sensing pathway in immune cells that, if inhibited, halts immune cell stress and even helps immune cells form a molecular memory of cancer. Her team recently received an 800,000-dollar Translational Award from the V Foundation to expand their research discoveries at the bench into patient samples in hopes of generating a new immunotherapy to reverse T cell exhaustion.

Jessica Thaxton, PhD

Cancer causes a different kind of stress

Scientists know the hallmarks of an exhausted T cell largely by studying models where T cells fight viral infections. "T cells in a tumor microenvironment, though, create a unique slew of intracellular metabolic dysregulation," said Thaxton. Solid tumors are hypoxic, meaning they have poor oxygen supply, which adds an immense amount of stress to healthy cells. Markers of T cell exhaustion identified in a viral setting have generally not worked effectively to treat cancer because the molecular stress in cancer is more severe.

Thaxton and her team found a key protein in evolutionarily conserved cell stress pathways called activating transcription factor 4 (ATF4) that they believe could be the lynchpin in controlling immune cell stress in a tumor microenvironment. To test their hypothesis, Thaxton's team labeled mouse tumors with a hypoxia stress marker and a marker for ATF4.

A microscope image showing the overlap of hypoxia shown in yellow and a cell stress marker shown in red in the tumor microenvironment
Thaxton's team injected mouse tumors with a hypoxia protein marker shown in yellow and a marker for ATF4 shown in red. The two regions overlapped perfectly, implicating ATF4 in immune cell stress in tumors.
"Our most unexpected finding was that the cell stress response, measured by ATF4 expression in tumors, directly overlapped with areas of hypoxic stress. Where hypoxia was high in tumors, ATF4 was similarly high. We were able to observe cell stress in the spatial context of the tumor, and it was beautiful," said Thaxton. "Immediately, we knew, any immune cell that got close to that region would be high in ATF4 and become defective."

She shared her results with Robert Ferris, the director of the UNC Lineberger Comprehensive Cancer Center, who had just completed a next generation clinical trial of doublet immune checkpoint inhibitor therapies for patients with head and neck cancer. Remarkably, Thaxton and Ferris found that T cells in tumors from patients that were non-responsive to treatment in Ferris' trial also had an ATF4-directed molecular stress signature.

Potential for a new global cancer drug

The V Foundation Award will empower Thaxton to translate her research on ATF4 expression and inhibition in mice to patients with head and neck cancer, ultimately laying the foundation for the development of a first-in-class ATF4 inhibitor drug. Thaxton's team is looking into ISRIB, a relatively new compound originally described in 2017, with the potential to act as a non-toxic inhibitor of cell stress.

Several biopharmaceutical companies are already manufacturing the drug for clinical trials related to neurodegenerative diseases, where cell stress can lead to protein misfolding and become particularly problematic. "Our goal is to partner with one of these companies and move into a clinical trial," said Thaxton.

When her team administered ISRIB in mice, it significantly reduced ATF4 expression in immune cells and reshaped the mice's adaptive immune response to cancer. "We paired the drug with immune checkpoint inhibitors, and the tumors went away. The mice gained what is called immunological memory, which means they were protected from re-emergent cancer," said Thaxton. This indicates, the drug may be useful in helping to train patients' immune cells to guard against metastatic disease.

"One reason I love being an immunologist and why I love studying the cell stress response is because, in targeting a stressful metabolic microenvironment in tumors, there is an immense opportunity to translate new therapies to multiple solid tumor types with similar metabolic stress," said Thaxton. According to her team's preliminary data, there is a shared stress signature in immune cells across human lung, melanoma, and head and neck cancers.

If this signature could be safely inhibited, then it could expand immunotherapy possibilities across multiple cancer types. The V Foundation award is the first step to exploring this possibility. "As a translational researcher who is very clinically minded, I am excited to see if we can get a drug to patients," said Thaxton.

References

1. del Mar Alicea Pauneto, C., Riessenberg, B.P., Gandy, E.J., et al. Intra-tumoral hypoxia promotes CD8+ T cell dysfunction via chronic activation of integrated stress response transcription factor ATF4. Immunity 58, 1-16 (2025)
2. Chou, A., Krukowski, K., Jopson, T., et al. Inhibition of the integrated stress response reverses cognitive deficits after traumatic brain injury. PNAS 114(31), E6420-E6426 (2017).

UNC startup, Carolina Instruments, awarded NIH STTR grant to commercialize Pupil-Light technology

Carolina Instruments | December 3, 2025

An innovative, wearable device developed by UNC researchers to measure pupil responses provides new insight into brain states that shape cognition and behavior.

Pupil responses are widely recognized indicators of brain function and behavior, reflecting activity across distributed neural circuits. Changes in pupil size reveal shifts in arousal and activity across the brain's signaling networks. For example, pupils widen during periods of high alertness and constrict as the brain moves into more relaxed or fatigued states. Tracking these subtle dynamics provides valuable insight into internal states that influence attention, engagement, and behavioral responses.

Carolina Instruments, a startup founded from a collaborative research effort at UNC, recently received a Small Business Technology Transfer (STTR) grant from the National Institutes of Health (NIH) to commercialize a compact wearable system capable of measuring pupil dynamics with exceptional speed and resolution. The new funding will allow the team to refine early prototypes and expand the technology for translational animal studies while advancing parallel development for human use.

Existing pupil-tracking systems are often camera-based, which makes them bulky, costly, or limited in temporal resolution. The new system, called Pupil-Light, delivers a camera-free alternative that allows researchers to examine rapid changes in pupil size and eye motion with greater flexibility. This optical sensing approach has the potential to enhance the utility of pupil measurements across research, including studies of cognitive function, mental health, and neurological conditions or injury. Beyond research, the technology also shows promise for integration into advanced consumer devices such as Augmented and Virtual Reality systems.

"Pupil-Light provides a practical way to measure pupillary dynamics and interpret how we respond to the world around us," said Jose Rodriguez-Romaguera, an associate professor in the Cell Biology and Physiology and Psychiatry Departments at the University of North Carolina at Chapel Hill (UNC) and co-founder of Carolina Instruments. "This Phase I STTR grant will fund both Carolina Instruments and our UNC research group to support the commercialization of this technology. We're excited to be one step closer to seeing how this technology can accelerate discoveries in neuroscience, psychiatry, and beyond."

Jose Rodriguez-Romaguera, PhD

Nicolas Pégard, PhD

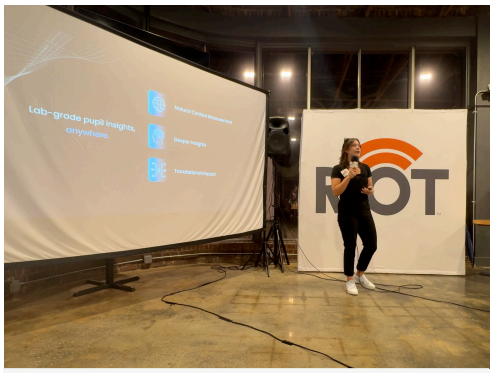
Rodriguez-Romaguera partnered with Nicolas Pégard, an optical engineer in the Department of Applied Physical Sciences at UNC, and Ellora McTaggart, a graduate of the UNC/NC State Lampe Joint Department of Biomedical Engineering to co-found Carolina Instruments. Their collaboration combines Pégard's expertise in optical engineering, Rodriguez-Romaguera's neuroscience research, and McTaggart's biomedical engineering background to create innovative tools that advance neuroscience and behavioral research. "Our labs are a great example of how collaborative research leads to discoveries with large scale impacts," said Pégard.

Ellora McTaggart demonstrated Carolina Instrument's technologies at an industry event.

Ellora McTaggart previously served as the laboratory manager for both groups and led early development of the technology. Rather than pursuing a traditional PhD track, McTaggart decided to focus on translating the technology beyond the academic setting. She now leads the company's commercialization efforts, with an eye toward applications in neuroscience and emerging markets such as Augmented / Virtual Reality and performance monitoring.

The company has received support from Innovate Carolina's KickStart Venture Services, which helps faculty and students translate research innovations to market. KickStart provided Entrepreneur-in-Residence (EIR) mentorship, regulatory guidance, market research funding, and advisory support. Beyond UNC, Carolina Instruments has benefited from the broader Triangle startup community. The company received an NC IDEA grant following its launch in Fall 2024. They also participated in the RIoT Accelerator Program, which helped strengthen the company's operational foundation. At the program's Demo Night during the 2025 All Things Open Conference in Raleigh, Carolina Instruments earned the audience investment award, recognizing strong community support for the technology.

"This grant is a major milestone for both our company and the research group," McTaggart said. "I'm really grateful to UNC and the faculty mentors who gave me the opportunity to translate this technology beyond the lab. We have already received so much support from the NC startup ecosystem, and now with this NIH funding, we can take the next step toward expanding the reach of Pupil-Light."



Ellora McTaggart presented the company's technology at the RIoT Accelerator Program.

With the NIH award, the team at Carolina Instruments will continue refining its prototypes and working with early adopters in neuroscience. The team aims to extend the technology's impact beyond research settings into applications that support clinical research and emerging consumer technologies. The innovation underway at Carolina Instruments embodies UNC's broader mission to lead advancements that will benefit society, a vision reinforced by federal investment in translational neuroscience research and innovation.

Notable faculty awards

Sarah Cohen, PhD

Hettleman Prize
University of North Carolina at Chapel Hill
This award is given to just five promising early-career faculty who exemplify groundbreaking and innovative research with future career promise

WICB Junior Award for Research Excellence
American Society for Cell Biology

Grégory Scherrer, PharmD, PhD

Wellcome Leap Grant
Wellcome Leap Foundation
He is the first researcher at UNC to receive a Wellcome Leap grant.

Jessica Thaxton, PhD

2025 Translational Award
The V Foundation
This award will help her team translate their research on immune cell stress into patient samples in hopes of generating a new immunotherapy to reverse T cell exhaustion.

Jose Rodriguez-Romaguera, PhD

Small Business Technology Transfer (STTR) grant
The National Institutes of Health
This award will is to commercialize a compact wearable system capable of measuring pupil dynamics with exceptional speed and resolution.

Faculty promotions

Lori O'Brien, PhD

Associate Professor
with Tenure

Sarah Cohen, PhD

Associate Professor
with Tenure

Graham Diering, PhD

Associate Professor
with Tenure

Emily Moorefield, PhD

Associate Professor

Jessica Thaxton, PhD

Associate Professor
with Tenure

Faculty in the news

- **Kathleen Caron, PhD**
  - *New Scientist* - The extraordinary influence of the lymphatic system on our health
- **Sarah Cohen, PhD**
  - *The Well* – Alzheimer's risk gene may disrupt brain health
  - *UNC Research* – Hettleman prizes awarded to five exceptional early-career faculty
  - *ASBMB Today* – ASBMB members recognized as Allen Investigators
  - *American Society for Cell Biology* – ASCB announces 2025 honorific award winners
- **Grégory Scherrer, PharmD, PhD**
  - *UNC Vital Signs* – A new, non-addictive pain killer is on the horizon
  - *The Well* – Scherrer lab explores how the brain can stop pain

Welcome new faculty!

By Matthew Billard, Ph.D.

Aadra Bhatt, Ph.D.

Welcome Dr. Aadra Bhatt, Ph.D., an Assistant Professor and expert in intestinal epithelial barrier functions and how microbiotic metabolism in the gut affects drug responses. Her interdisciplinary work comprises an emerging field called pharmacomicrobiomics that interrogates the ways bacterial drug metabolism contributes to interindividual drug responses. The overall goal of her research program is to develop a mechanistic understanding of how intestinal microbiota metabolize endobiotic and xenobiotic substances to influence intestinal health, with a particular focus on the epithelial barrier whose perturbation is now implicated in a variety of human diseases. Pharmacomicrobiomics can help understand how drug responses are shaped by modifiable and unmodifiable factors like age, sex, diet, geographical location, socioeconomic status, and environmental exposures, all of which are known modifiers of intestinal microbiota composition and function.

Dr. Bhatt is a member of the Center for Gastrointestinal Biology and Disease (CGIBD), and an Associate member of the Molecular Therapeutics Program of the UNC Lineberger Comprehensive Cancer Center. Aadra began her independent career in the Department of Medicine, (Division of Gastroenterology and Hepatology), and now has a primary affiliation as a tenure track Assistant Professor in the Department of Cell Biology and Physiology. Aadra earned her Bachelor of Science in Biology from the College of Charleston (S.C.) in 2003. Dr. Bhatt received her Ph.D. in Microbiology and Immunology from the University of North Carolina at Chapel Hill in 2013. In the lab of Dr. Blossom Damania, Aadra discovered that a KSHV protein is a viral homolog of a cellular kinase and investigated the functional relevance of this viral mimicry in the context of cellular transformation. Her subsequent postdoctoral research in the lab of Dr. Matthew Redinbo (UNC) focused on a class of bacterial enzymes called β-glucuronidase that plays an exceedingly important role in drug metabolism. In 2018, Aadra moved from the Department of Chemistry to the Department of Medicine as a Research Assistant Professor where she continued to collaborate with Dr. Redinbo while developing her own research directions. Her training in host-microbiome interactions served as the basis for her launching her independent research program in pharmacomicrobiomics, supported by a Maximizing Investigators Research Award (MIRA/R35) from the National Institutes for General Medical Sciences.

Adam Gracz, Ph.D.

Welcome Dr. Adam Gracz, Ph.D., an Associate Professor and expert in the regenerative and developmental biology of the intestine and liver. From 2020-2025, he was a tenure track Assistant Professor in the Departments of Medicine and Human Genetics at Emory University. Dr. Gracz was recently recruited back to UNC in a joint effort between the Department of Cell Biology & Physiology and the Center for Gastrointestinal Biology & Disease. Adam focuses on the molecular mechanisms of stemness in gastrointestinal physiology and disease using models of tissue maturation, homeostasis, and regeneration. The overarching goal of his lab is to understand how stem cells maintain an undifferentiated state while "priming" for differentiation and how this compels genetic principles of multi potency. Dr. Gracz is also interested in discovering how stem cells are affected by prior cycles of injury/regeneration as the "cost of regeneration."

Dr. Gracz received his Bachelor of Arts in Biology from the University of North Carolina at Chapel Hill in 2008 and earned his Ph.D. in Cell Biology and Physiology in 2013 at UNC Chapel Hill. Adam's dissertation work in the lab of Dr. Scott Magness focused on the mechanisms that regulate potency in the intestinal stem cell niche. In 2010, Dr. Magness and Adam were the first researchers in the United States to grow intestinal stem cells outside of the body. Following these and other successes, Dr. Gracz returned to the laboratory of Dr. Magness as a postdoc. Dr. Gracz's rigorous, insightful research, impressive funding record, and steady productivity positioned him for a successful tenure-track appointment in the Departments of Medicine and Human Genetics at Emory University. In 2025, Dr. Gracz was recruited back to UNC in a joint effort between the Department of Cell Biology & Physiology and the Center for Gastrointestinal Biology & Disease. His independent research focuses on understanding how transcriptional and chromatin regulatory mechanisms establish and maintain cellular identity, specifically in the intestine and liver. The NIH has recently announced a plan to augment human-based research through technologies such as organoids, tissue chips, IPSCs, and computational models. Dr. Gracz is perfectly suited to propel forward in this initiative here at UNC.

CBP-Wake Tech summer research intensive internships begin

By Tiffany Garbutt, PhD | June 4, 2025

As part of a continued collaboration, four Wake Technical Community College students will complete research intensive summer internships under the mentorship of UNC Cell Biology and Physiology principal investigators.

The Department of Cell Biology and Physiology (CBP) welcomed four Wake Technical Community College students on May 19th as part of a continued collaboration to share in the culture of science. The four Wake Technical Community College students – Shirley Baltazar, Kaylyn Jennings, Milena Papayan, and Carla Moore – will conduct a 10-week-long, 20-hour-a-week research intensive internship in translational research labs in CBP.

The new summer program is a collaboration between Natasha Snider, an associate professor and co-director of graduate studies for the CBP PhD Curriculum, and Jackie Swanik, the program director for the STEM Academic Research & Training (START) program at Wake Technical Community College. Through opportunities offered by the START program, some of the students have prior experience working in microbial research labs as part of the Small World and Tiny Earth Initiatives.

The CBP-Wake Tech summer interns joined their CBP lab hosts on May 19th to kick off their 10-week research intensive internship. Pictured from left to right: Dr. Lori O'Brien, Dr. Jackie Swanik (program director of Wake Tech's START program), Liz Douglas (representing Dr. Kathleen Caron's lab), Shirley Baltazar, Kaylyn Jennings, Milena Papayan, Carla Moore, Dr. Phillip Clapp, and Dr. Natasha Snider.

Four Wake Technical Community College students will conduct research in CBP labs this summer. Pictured from left to right: Shirley Baltazar, Kaylyn Jennings, Milena Papayan, and Carla Moore

To be selected for the CBP-Wake Tech research-intensive summer internship, the students had to demonstrate academic excellence and express continued interest in expanding their research skills in the biomedical sciences. All four students intend to enroll in four-year universities to earn their bachelor's degrees after completing their associate degrees at Wake Technical Community College.

At CBP, the four Wake Technical Community College students will work on a variety of projects involving induced pluripotent stem cells, kidney research, and more under the mentorship of CBP researchers. Shirley Baltazar joined Phillip Clapp's lab, Kaylyn Jennings joined Lori O'Brien's lab, Carla Moore joined Natasha Snider's lab, and Milena Papayan joined Kathleen Caron's lab for the summer. If you see them around, be sure to give them a kind CBP welcome!

Pioneering graduate education: CBP launches the first year of its Biomedical Master's Program

By Matthew Billard, PhD | August 14, 2025

UNC's Department of Cell Biology and Physiology launched its first Biomedical Master of Science program this fall, welcoming 34 students to an intensive curriculum blending biomedical coursework and hands-on research.

In August of 2025, the Department of Cell Biology and Physiology officially launched our Master of Science in Cell Biology & Physiology program and welcomed the inaugural class with Orientation Day! This biomedical sciences Master's degree program brings together expertise in multiple biomedical disciplines to comprehensively teach, mentor, and support student professional development by combining a strong foundation of scientific knowledge with the practical hands-on experience needed for students to expand their skillset for different careers in the biomedical sciences and healthcare fields. The CBP-MS program was developed by Emily Moorefield and a committee of educational leaders including Kurt Gilliland, Kristen Scherrer, Jay Brenman, Matthew Billard, Tiffany Garbutt, and Zach Williamson.

Orientation was held on Thursday, August 14th and began with breakfast and networking with our faculty, leadership, and the 34 new Master's students. This inaugural class consisted of 29 graduates of North Carolina colleges and universities, including 16 UNC Chapel Hill alums. Our unique program is an intensive nine-month, full-time curriculum comprised of coursework in physiology and biomedical sciences, professional development, and a hands-on research practicum culminating in a non-thesis Master of Science degree. The research practicum involves over 90 potential faculty mentors

Deans Donita Robinson and Blossom Damania (left) joined Kathleen Caron and Emily Moorefield (right) to welcome the students during the orientation event.

Four new master's students, Roberto Perez, Mariana Quinonez Medina, Zalma Ontiveros, and Hannah Ellyson, got together for a picture at the orientation event.

spread across four UNC schools and approximately 20 individual departments. Support for the new program was evident at orientation as students were welcomed by remarks from Kathleen Caron, CBP Distinguished Professor and Chair, Blossom Damania, Chief Scientific Officer of UNC Heath and SOM Vice Dean for Research, and Donita Robinson, Associate Dean of Graduate Education. Individual students were then introduced by Emily Moorefield before moving outside for the inaugural class photo. Orientation included short introductions to the individual courses, topics, and faculty and ended with a CBP Department Social with the entire CBP department, staff, and both MS and PhD students.

Student orientation was extended into the following week of August 18-22 as a "Base Camp" to provide crash courses in graduate school expectations and research fundamentals. Each day students were primed with presentations on learning styles and modalities, time management, study skills, growth mindset, basic research ethics, and being a good lab citizen. They were also given quick refreshers (or introductions) to basic research skills involving lab safety, equipment and resources, lab note books, common techniques, and presentation skills. The goal of the Base Camp week was to establish a foundation for 34 students entering graduate school and independent research labs with various levels of prior experience. Feedback from the orientation and Base Camp weeks will help refine the activities and goals for year two. We are thrilled with our first semester and are looking forward to our first graduating class in Spring 2026!

Off to the races in Taylor Hall

By Tanisha Choudhury | December 1, 2025

Get an inside look at the inaugural Cell Biology and Physiology Master's cohort and discover the growing sense of community along the way.

Tucked away in a corner of Taylor Hall's first floor is a small classroom. Arrive early, and you'll find students whiteboarding cell signaling pathways in a nearby nook. Arrive late, and you'll likely have to weave yourself between gaggles of students outside setting up a makeshift grill, carefully arranging a charcuterie board, or preparing pitchers of steaming hot apple cider. Amid your own worries of fast-approaching deadlines and unread Outlook notifications, you might wonder: Who are these students?

Tanisha Choudhury

We are the inaugural biomedical master's cohort in the Department of Cell Biology and Physiology. After three strenuous yet fulfilling months, I feel confident likening the program to a marathon. The curriculum is a nine-month, intensive training program for students heading into various scientific disciplines. In the morning, we move through blocks in biomedical sciences and physiology. As an aspiring research scientist, I value the combination of broad physiological context with granular molecular detail. If you can't conceptualize how multiple organ systems coordinate to balance energy use during fasting and feeding, the importance of a single regulatory enzyme won't click. As our histology professor reminds us, sometimes you have to zoom out to see which details matter.

In the afternoons, we trade our laptops for pipettes. In Dr. Saskia Neher's lab, I investigate lipoprotein lipase, a vital enzyme that breaks down circulating fats. Recently, I purified this protein, setting the stage to ask compelling follow-up questions about how metabolic dysregulation and cellular stress affect the proper folding of lipoprotein lipase. This practicum is a crash course in the critical thinking, time management, and synthesis skills that research demands.

Along the way, there are plenty of opportunities to train for your own self-improvement. I chose to exercise my communication skills through the university-wide Three Minute Thesis (3MT) competition, sharing my research with a general audience in just three minutes. While the prospect of commanding a room's full attention was initially nerve-wracking, the nerves quickly gave way to the excitement of sharing my new project with others. The experience ultimately left me more confident in my own understanding of my project's trajectory.

Tanisha presented her master's research in the Neher Lab at the UNC Graduate School 3-Minute Thesis Competition (3MT). Credit: The UNC Graduate School.

Speaking of trajectories, although my classmates and I may be running toward different destinations after this marathon – some to medical school, others to dentistry, industry, or academic research like me – our paths intersect at this pivotal junction in our careers. Between class and lab, we make the long run feel communal: studying together before exams, bringing baked goods to celebrate the end of a lecture block, or commiserating over silly mishaps at the bench. Next time you pass Taylor Hall, I hope you think of the marathon runners inside, fueling each other with camaraderie (and the occasional apple cider).

An unexpected finding

By Hedille Al-Dhalimy | December 1, 2025

When I joined the Cell Biology & Physiology biomedical master's program, I did not expect to find a sense of community and family.

Coming into this program, I truly did not know what to expect. I thought I would meet classmates, learn a lot, and spend a good portion of my time buried in lab and lecture slides. But now, almost halfway through, I have realized I did not just walk into a master's program, but instead, I walked into a family. Somewhere between building new traditions and simply showing up to class together every day, this cohort has grown into a real community.

Our class potluck Friendsgiving, newly created intramural basketball team that plays regularly, Friday grilling between classes with a different menu every week, and our little post-exam celebrations, all of which have been initiated and developed by students, have become some of the things I look forward to most. Even simple traditions, such as everyone chatting outside after class, the GroupMe we made during the first week that keeps our community intact, have become the little things

Students, family, and friends gathered for a potluck Friendsgiving eating dinner together outside on the back porch of a friend's house.

that make this experience feel meaningful. What I appreciate most is that nothing is obligatory. People can choose what they want to be part of, join a study session, or skip the night out, but no matter what, everyone still feels included.

Students, family, and friends gathered around the firepit roasting marshmallows and making smores at Friendsgiving after dinner.

And it is not just the fun parts that make us feel like a family. It is the way people show up for each other. Someone always shares a study guide before tests. Professors bring snacks for the class on Fridays during our professional development class. People offer help, check in on each other, or send a reassuring, "We've got this" text the night before a test. It is comforting to know that on any given day, someone understands exactly what you're going through because they are living it alongside you.

Hedille Al-Dhalimy

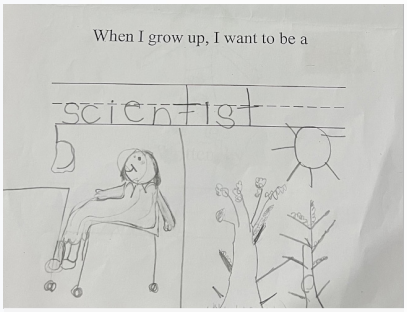
I never expected community to shape my experience here as much as it has, and I am not even sure how it developed. But these friendships, these small traditions, and these people have become the foundation of my time in the program. They have turned challenging weeks into manageable ones and ordinary days into something meaningful. Looking around, I am grateful that this cohort is not just a group of students; it is a built-in community I did not know I would find.

Lessons from lab research

By Ava Langaker | December 1, 2025

In this article, I reflect on what I have learned about failure, resilience, and managing career goals through a semester of graduate research.

In childhood, my idea of doing science involved mixing test tubes of fluorescent green chemicals, followed by an emphatic explosion and a puff of smoke. This is likely the image I had in my mind when I told people in kindergarten that I wanted to be a scientist. Like many people, my interests shifted as I grew up, and by college, I had gravitated towards medicine. Just as my idea about what it meant to be someone who does science evolved from my elementary school imagination, my perspective has changed profoundly during my first semester of graduate school. Beyond gaining an appreciation for those who devote their lives to research, I have learned two vital lessons for anyone in a transitional period of their career:



The above drawing is an excerpt from my 1st grade writing project, featuring me at a desk presumably doing science.

(1) You can adjust the timeline without sacrificing the end goal.
Like many students pursuing a biomedical master's degree, I have high career aspirations. I admit there are times I wish I were on a timeline to reach them sooner. It is disappointing to feel like you are falling behind a schedule you set years ago. However, my recent lab experience illustrates why this thinking is flawed. I began this semester with grand plans of performing complex experiments on cancer cell lines with novel drug treatments. In my mind, the data would be immediate and impressive. In reality, I spent the first month repeatedly killing my cells.

This was frustrating and embarrassing. I had successfully cultured cells for the past year in my undergraduate lab. Eventually, after several long, awkward conversations with my mentors, I realized that I had not only been accidentally adding a lysis buffer to my media every time I made it but also leaving my cells in trypsin for twice as long as necessary. Essentially, I was continuously rupturing and digesting my cells during every experiment.

By the time I recognized these fatal errors, my overly idealistic expectations had withered away. I had to slow down, step back, and rethink the timeline for completing my experiments. In doing so, I noticed a parallel to my career path. Just as my experimental goals needed a revised and more realistic timeline, my career path requires this master's program to ensure I am truly ready to be a healthcare provider. A deviation in a timeline does not mean the goal is lost; instead, it often means the foundation will be stronger when you arrive.

(2) Resilience is a prerequisite for any form of science.
Watching researchers has taught me that failure is not an anomaly in science; it is a guarantee. If something does not work the first time—which is almost always the case—they do not give up. They come in the next day, troubleshoot, consult, and try again. Repeatedly.

Ava Langaker

When I could not figure out why my cells were dying, it was difficult not to let frustration dissuade me. However, my mentor reminded me that I would later be grateful for the experience, not because the failure was positive, but because I learned how to sit with the frustration inherent to the work and push through it anyway.

Possessing even half the resilience that laboratory scientists display would benefit anyone who wishes to pursue a career in any science-adjacent field. Whether science is front and center on the wet bench or in the background of the clinic, its presence guarantees the unexpected. Therefore, it is vital to learn how to overcome failures and keep striving forward.

Regardless of our future paths, there are important lessons to take from this research experience. We are learning that doing science is not just about the passion for learning that we had as kids; it is about having the patience and the grit to keep going when the plan does not go exactly as expected.

Celebrating a successful research career

By Tiffany Garbutt, PhD | July 2, 2025

From working with wild squirrels to discovering unknown G protein-coupled receptor kinases, Ellen Weiss's research opened new doors for understanding the human eye and retinal degenerative diseases.

In 1990, when Ellen Weiss picked up the phone as a postdoc in Gary Johnson's lab at the National Jewish Center in Denver, Colorado, she had no clue what the person on the other end of the call was saying. The lab was noisy. People were vortexing things, running gels, and talking loudly. Finally, Weiss made out a few words as the person on the other end of the call said, "Would you like me to transfer you to him now? Do you have the time to speak with him?" Instead of saying, "I'm sorry, I couldn't hear you," Weiss blindly said yes.

Ellen Weiss posed in her office in the Molecular Biomedical Research Building a few days before retiring.

She was transferred to Charles Hackenbrock, the then chair of the Cell Biology and Anatomy Department at the University of North Carolina at Chapel Hill (UNC-CH), who was trying to recruit research faculty. Weiss proceeded with the phone interview, the entire time not knowing who she was talking with or where they were calling from until she was transferred back to the receptionist to schedule an in-person interview. "Whoa, was that a bad idea — but it really wasn't," said Weiss with a smile. That impromptu decision led to a thirty-five-year-long successful research career as a professor in the Cell Biology and Physiology Department at UNC-CH. On June 30, 2025, Weiss retired.

During her time at UNC-CH, Weiss made several foundational discoveries that influence how researchers study the human eye and vision-related diseases today. "With profound curiosity, deep knowledge, and a cheerful dose of wit and humor, Ellen's impacts on the research and educational missions of the department and her broader discipline have been inspiring," said Kathleen Caron, the current department chair of the UNC-CH Cell Biology and Physiology Department.

Cloning a G protein-coupled receptor kinase from wild squirrels

Weiss's lab was one of the first to clone the G protein-coupled receptor kinase 7 (GRK7). G protein-coupled receptors and their kinases regulate cellular signaling in response to external stimuli in various physiological pathways, including vision, dietary response, and heartbeat. At the beginning of her career, rhodopsin, which functions in rod cells of the eye to detect dim light, was one of the few G protein-coupled receptors that had been sequenced.

"I began by trying to figure out how rhodopsin interacted with its binding partners, but then we became more interested in cone cells," said Weiss. The retina's cone cells enable animals to detect color and bright light. Together with Shoji Osawa, her husband and research partner, Weiss began hunting for GRKs in cone cells from the 13-lined ground squirrel, a cone-dominant mammal.

The 13-lined ground squirrel has more cones in its retinas than rods. Credit: Wikimedia Commons

"At the time, these squirrels were mostly pests in the Midwest. People would get these wild animals and send them to researchers who did vision studies," said Weiss. Working with 13-lined ground squirrels was not easy. They were wild, aggressive animals that would often bite. "One of them even went up the pipes in the chemical hood, and we had to lure it down with food," said Weiss.

By that time, various research groups had identified six GRKs. When Weiss and Osawa dissected the squirrels' retinas, they found a seventh undiscovered GRK, which they called GRK7, that was absent from the retinas of mice. This discovery led to the surprising finding that some species have different GRKs in their retinal cones, prompting scientists to rethink which animal models they use to investigate human cone-related diseases. In particular, it helped clarify differences in the pathophysiology between the retinas of patients with Oguchi disease, a night blindness disease, and its mouse model.

Trailblazing eye proteomics and metabolomics studies

Weiss's lab was also one of the first to apply metabolomics and proteomics to investigate the role of cellular metabolism in neurodegenerative retinal diseases. Using a mouse model for retinitis pigmentosa, a rare eye disease, they investigated changes in cellular metabolism and found a pivotal role for mitochondrial proteins at the peak of retinal rod degeneration. There are almost no treatments for retinal degenerative diseases. "I wanted to study the metabolism of retinal degeneration because my idea and a lot of people's idea is that we can go back and find some sort of broad-spectrum therapeutic that will work for diseases caused by different genetic mutations," said Weiss. Her discoveries help lay the foundation for future work in this unresolved area of research.

Making an impact with kindness and humor

Weiss has also used her talents to benefit others globally. She participates in several charities where she crochets toys for children in need. She's crocheted toy bears for children in sub-Saharan Africa, smaller bears that fit into suitcases for children in Ukraine, and bears for children in impoverished regions across the United States. She's also crocheted bookmarks and emotional support chickens for a few close friends.

Weiss crocheted the bear on the left for a child in Ukraine and emotional support chicken on the right. Credit: Ellen Weiss, PhD

"Ellen's kindness, compassion, endless curiosity, and sense of humor made working next door to her such a pleasure," said Natasha Snider, an associate professor in the Cell Biology and Physiology Department, whose lab has neighbored Weiss's lab for ten years. "Ellen is a fierce advocate for science and a most supportive colleague. I am forever grateful for her friendship and for the time we shared in Cell Biology and Physiology."

On June 25, Weiss gathered with a few current and retired colleagues. The group shared fun memories and celebrated her many accomplishments as an educator and researcher. For the next generation of scientists, Weiss shared a few words of advice.

Weiss shared memories with colleagues at her retirement lunch on June 25th.

"Right now, it is a tough time in the world of research as well as for everyone," she said. "Do what you can to make it a better place but also focus on your studies because when opportunities come suddenly, you need to be prepared to take advantage of them — even when they come as a random serious call in a loud lab."

Leadership with heart

By Tiffany Garbutt, PhD | December 5, 2025

Vicki Morgan will retire in March 2026 after 33 years of service to the Department of Cell Biology and Physiology, leaving behind a legacy of care, dedication, and excellence.

To abridge a famous quote from Maya Angelou, people remember how you made them feel. Victoria Morgan, affectionately known as Vicki, the business manager for the Cell Biology and Physiology Department (CBP) at the University of North Carolina (UNC) at Chapel Hill, has always made the faculty, students, and administrative staff feel cared for and supported. "She is genuine and nice, no matter what is going on," said Tonya Murrell, the department's account manager who has worked with Morgan for 18 years. After 33 years of helping the people of CBP, Vicki Morgan is set to retire in March 2026.

Vicki Morgan, the CBP business manager, will retire in March 2026.

Morgan first joined the department in 1992 and has seen the department change and evolve in many ways over time, including exponential growth in people and funds. Morgan has changed, too. With a college degree from UNC-Chapel Hill in communications, she initially joined the department as an accounting technician.

"I kind of fell into the accounting job, but found I really liked it," said Morgan. "I liked the precision of accounting work. There were no gray areas." She continued to learn and grow her skills in accounting, eventually becoming the department business manager in 2017.

"I have to thank Kathleen Caron [the Department Chair] for giving me a chance at the business manager position," said Morgan. The two talked, and Morgan asked to try the position. She explained that she would do her best, and if it didn't work out, she would step down. "Kathleen had enough faith in me to let me try it," said Morgan.

"Vicki has done an incredible job in leading our unit through a variety of fiscal and policy changes and new initiatives. It is to her credit and exceptional fiscal management that we have been able to rise as one of the nation's leading Cell Biology & Physiology departments." Said Kathleen Caron, chair of Cell Biology & Physiology.

Quietly helping research success

Morgan's tenure as business manager more than worked out. Her can-do approach gave faculty the reassurance and support they needed to excel in their research programs. "Vicki met the many needs of a demanding department with skill, effort, and a positive attitude that I am confident will leave a lasting imprint," said Ben Philpot, a professor in CBP who has worked with Morgan for about 20 years.

Over the years, research faculty have had many unusual requests, and she always worked hard to meet their needs. Whether it was finding a way to hire a consultant, adding someone onto conference travel plans at the last minute, or working out a way to transfer money to an internal collaborator, Morgan always seemed to find a way to accommodate and help. "We can always count on Vicki to deeply research different solutions to financial management issues and come back to the table with innovative, accurate, and wise solutions," said Caron.

Vicki Morgan and Mary Wright, the former executive assistant for two department chairs, formed a long lasting friendship.

"Whereas many people might have been exacerbated by my many asks, Vicki always met me with a 'Sure, I'll see if I can find a way to do that' attitude and never complained. I couldn't have navigated complicated finances and financial situations without Vicki's unwavering support, and for that, I am indebted," said Philpot.

Leading with care

Morgan's administrative team echoed Caron's and Philpot's sentiments. As a people manager, Morgan demonstrated poise, compassion, and thoughtful leadership. "Vicki never gets stressed, well, at least she doesn't show it. She's always steady and takes time to speak to others, even when she really doesn't have the time," said Murrell.

The administrative team for the department changed throughout the years, but they developed lasting friendships. Before the pandemic, they would often get together for parties, particularly around the holidays. As a leader, Morgan made sure that everyone felt included and happy. She was even known to purposely take the worst white elephant gifts at the holiday parties so that everyone left with something they liked. "Vicki is one of a kind and will be missed by all. She is not just a friend; I care for her just like family," said Murrell.

Over the years, Vicki Morgan and the CBP administrative staff often got together during the holidays.

Many of the friendships Morgan developed over time with CBP faculty and staff persist to this day. "Being able to work with good people, whether admin staff or faculty, has kept me in the same department for this many years," said Morgan.

CBP's current administrative team is considered lean compared to other departments, but they work hard to accomplish everything efficiently. "We have a good team that cares and who care about doing their work well," said Morgan. Her advice for the next business manager is to take the time to understand the people and the work. She also advises approaching each new change or challenge with flexibility.

Looking forward

"There's always something new to learn. As long as I have been here, I learn something new every day. That's what makes the job so interesting. You don't have to have all the answers. As long as you know who to connect people with, then you're okay," said Morgan.

Vicki Morgan's impact on CBP cannot be measured in budgets or spreadsheets, but in the trust, friendships, and sense of community she built. As she steps into retirement, she's looking forward to spending more time with her family, including her siblings and 92-year-old mother. She's also looking forward to spending more time with her grandkids.

When asked about her proudest accomplishment, Morgan replied, "It started out as a kind of test. I'm proudest of pushing myself and realizing that I could be a good business manager. I certainly have my strengths and weaknesses, but for the most part, I think I passed the test." For 33 years, Vicki Morgan made the people of CBP feel valued and supported, a legacy that will remain in the hearts of faculty and staff.

Congrats to Becky Hirsch!

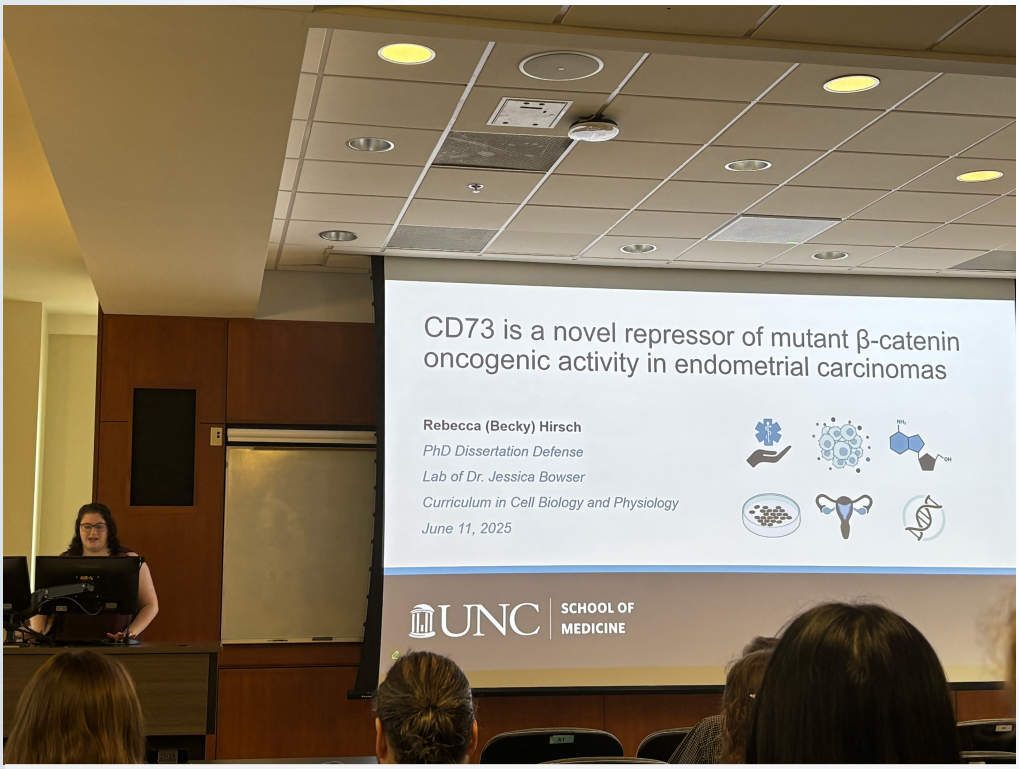
Ph.D. Defense – June 11, 2025

What was your research hypothesis or goal?

I had two research goals. My first goal was to determine how CD73, a cell surface enzyme, limits the oncogenic activity of mutated β-catenin in endometrial cancer, and how loss of CD73 likely contributes to endometrial cancer recurrence. My second research goal was to evaluate the oncogenic activity of patient-relevant β-catenin mutations with loss of CD73 in endometrial cancer.

Can you summarize your major findings?

We showed that loss of CD73 increased transcriptional activity of 7 patient-specific β-catenin mutants; loss of CD73 increased nuclear localization of mutant β-catenin; loss of A1R expression but not A2BR expression increased transcriptional activity of several β-catenin mutants; different β-catenin mutants showed unique and pro-cancer transcriptional signatures with CD73 loss



Becky Hirsh presented her research findings in her public defense presentation. Hirsh completed her PhD under the mentorship of Dr. Jessica Bowser.

What are you most proud of from your graduate career?

I'm most proud of giving an oral presentation at the American Association for Cancer Research Special Conference for Endometrial Cancer. I am laso the most proud of the many students I mentored and taught while in graduate school.

What was your most memorable experience in CBP?

The CBP Research Day retreats were the most memorable experiences for me in CBP.

What is your career goal and what are you doing next?

I want to teach. I am currently an adjunct professor at Durham Technical Community College, and I am doing research coaching at the North Carolina School of Science and Mathematics in Durham. Next, I am applying for full-time teaching faculty roles, including at UNC!

Congrats to Whitney Bell!

Ph.D. Defense – September 10, 2025

What was your research hypothesis or goal?

My research goal was to identify if there were functional contributions of a gastric protein (Gastrokine 2) that is de novo expressed in pancreatic neoplasia and cancer.

Can you summarize your major findings?

We found that loss of GKN2 created a more aggressive pancreatic cancer cell phenotype that was more migratory and had upregulation of axonal guidance factors. I never would have predicted the axonal guidance factor part of this project but it's fascinating. We also identified 2 possible mechanisms of oncogenic signaling that can inhibit GKN2 expression iduring pancreatic cancer progression.

What are you most proud of from your graduate career?

I'm most proud of the resiliency and critical thinking I've developed. Halfway through my third BBSP rotation, everything shut down because of the pandemic. My cohort had to navigate our final rotation, graduate classes, thesis lab selection remotely. The initial year you join your thesis lab is a very formative and crucial time and we were limited by reagent availability, lab time, bench mentorship and so many other things for almost 2 years. The persistence, stubbornness, and resilience from that time provided a solid foundation that I built upon for the next 4 years. And persistence is so important in science. I have so much negative data and data that didn't make it into the manuscript. While positive data is always exciting, I think we gain a lot from negative data too and I want to remind students of that.

Whitney Bell posed after her defense with her PhD research mentor, Dr. Yuliya Pylayeva-Gupta.

Whitney Bell got together with friends after her defense to celebrate.

What was your most memorable experience in CBP?

My most memorable experience with CBP is probably the final student seminar I gave. That felt like closing a chapter and one of the last presentations I was going to give before my defense.

What is your career goal and what are you doing next?

I've always been interested in the intersection of business and science so I found a career path that enables me to pursue both. I'm joining a firm as a life science consultant and am really excited to begin this new chapter in Boston.

After her defense, Bell celebrated with her family.

Congrats to Danica Dy!

Ph.D. Defense – September 19, 2025

What was your research hypothesis or goal?

Cardiovascular disease remains the leading cause of morbidity and mortality nationally and across the globe. Motivated by the translational value of this exploration, my research aimed to get to the "heart" of the problem by understanding how disease develops at its most fundamental levels. My dissertation investigated the cellular and molecular mechanisms through which specific genes drive clinical coronary artery disease in multiple vascular cell types.

Danica Dy and her PhD research mentor, Dr. Rob Wirka, celebrated her successful defense.

Can you summarize your major findings?

Our gene of interest, TWIST1, has previously been described in the contexts of development and cancer. However, my work supports human genetic evidence that TWIST1 is a causal gene for coronary artery disease. I investigated the role of TWIST1 in both endothelial cells and smooth muscle cells and found that it promotes phenotypic changes in both cell types that contribute to characteristics of less stable atherosclerotic lesions.

What are you most proud of from your graduate career?

I would say that I am most proud of being part of establishing a new lab. As the Wirka Lab's first graduate student, my graduate training included a lot more than just experiments. It was both challenging and exciting to be building something new and setting a foundation for future students and trainees. I couldn't have asked for a better mentor throughout the process, and it has been amazing to see other graduate students find their own success based on things I helped set up.

Danica Dy posed with her family during a celebration party after her defense.

What was your most memorable experience in CBP?

Starting graduate school in 2020 meant that for the first couple of years, all classes and meetings were held over Zoom. Consequently, it wasn't until 2022 when I helped organize a year-end social for the Department that my cohort finally got to meet in-person. This was the first time we were able to sit down and have conversations about our experiences and interests. I will always remember thinking "wow, these are probably some of the most resilient scientists I have ever met", considering that we braved a global pandemic in the name of science.

What is your career goal and what are you doing next?

A huge component of my graduate training was getting involved with science communication and ensuring that the knowledge we possess is publicly accessible and comprehensible to those outside of the "ivory tower". As I transition to science in industry, I am eager to share my skills and passion for science in ways that will benefit society as a whole.

Congrats to Jennifer Nwako!

Ph.D. Defense – October 30, 2025

What was your research hypothesis or goal?

My research goal was to understand if enteroendocrine cells (EECs) and its hormones can regulate physiological function in the intestine, particularly during disease.

Can you summarize your major findings?

Enteroendocrine cells (EECs) are rare nutrient-sensing cells in the intestinal epithelium that synthesize and secrete hormones and are often dysregulated in gastrointestinal (GI) diseases such as inflammatory bowel disease (IBD). However, little is known about how EECs regulate their local intestinal environment. To investigate the mechanisms between EECs and ceramides, we analyzed intestinal tissue permeability and barrier function in EEC-deficient human epithelial enteroids plated on transwells. We observed a significant decrease in barrier integrity and permeability compared to control cultures. The addition of TNF and Interferon significantly exacerbated this decrease. We show that the localization of junctional proteins promoting a tight epithelial barrier is altered. We demonstrate that ceramides bind to tight junctions in membrane microdomains, and this interaction is lost in EEC-deficient enteroids. Additionally, ceramide synthases that synthesize long-chain ceramides are reduced in EEC-deficient intestinal tissue.

Jennifer Nwako celebrated her successful defense with her PhD research mentor, Dr. Heather McCauley, and her labmates.

What are you proudest of from your graduate career?

I'm most proud of my publications and my undergraduate mentees.

What was your most memorable experience in CBP?

I enjoyed presenting at the CBP Research Day retreat at the North Carolina Art Museum.

What is your career goal and what are you doing next?

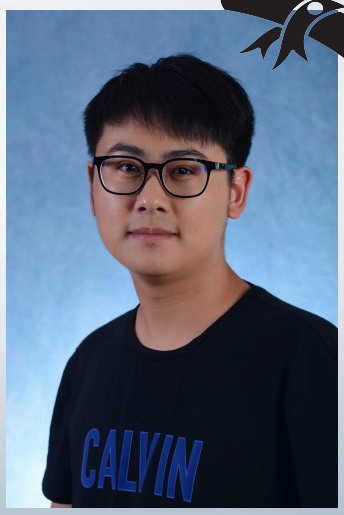
I'm interested in a pre-clinical research career in the pharmaceutical industry. I'll be a postdoctoral student at Abbvie next.

Congrats to Chris Ho!

Ph.D. Defense – October 28, 2025

Mentor:
Stephanie Gupton, PhD

Defense Title:
Mechanisms of netrin-dependent neuronal morphogenesis



Congrats to Pu Zhang!

Ph.D. Defense – October 31, 2025

What was your research hypothesis or goal?

My research goal is to understand how actomyosin dynamics drive apical constriction by systematically tagging and mapping actin-binding proteins

Can you summarize your major findings?

I investigated how the actomyosin network is spatially organized and dynamically remodeled during apical constriction in C. elegans gastrulation. By CRISPR-tagging nearly all actin-binding proteins expressed in early embryos, I created a comprehensive spatial map of their localization and uncovered that basolateral Rac-WAVE-Arp2/3 signaling is essential for effective apical constriction. I also identified discrete subcellular "hubs" enriched for specific ABP sets, suggesting that cells compartmentalize actin-regulatory activities to build and remodel the contractile network. This systematic, spatially resolved approach offers new insight into how cytoskeletal regulation drives morphogenesis.

Pu Zhang celebrated her successful defense with her PhD mentor, Dr. Bob Goldstein, his wife, Jenny Goldstein, and her mom, Jinpu Jia.

What are you most proud of from your graduate career?

I am most proud that I showed up every day committed to growing as an independent scientist. I put my full effort into each experiment and into supporting the work of our lab. I have pushed myself to learn, think critically, and persevere – I am proud to start the next chapter with no regrets.

Pu Zhang also celebrated her accomplishments with her fellow lab members, friends, and family.

What was your most memorable experience in CBP?

Every class I took in CBP was genuinely memorable. The depth and breadth of the lectures made quantitative cell biology far more accessible, and the critical thinking skills I developed during our literature discussions continue to benefit me today. The presentation and grant-writing courses were especially impactful – they made preparing for the oral exam, one of the biggest challenges during graduate school, much more manageable. It was a privilege to learn in an environment where so many professors and staff invested deeply in our development as scientists.

What is your career goal and what are you doing next?

My career goal is to spend my life growing, learning, and helping others through making scientific discoveries. For my next career stage, I will be starting a new lab with my friend, Xuhang Li, at Peking University, where we will study metabolism at the systems level using C. elegans and human cells.

Congrats to Reginald Edwards!

Ph.D. Defense – December 12, 2025

What was your research hypothesis or goal?

I had 2 research goals during graduate school. My first in Damaris Lorenzo's lab was to understand how loss of cytoskeletal protein Beta-2-Spectrin in specific neurons in cerebellum produced seizure-like phenotypes in mice. This was important as children with Beta-2-Spectrin variants had seizures, along with other neurodevelopmental deficits.

My second research goal, under the supervision of Paul Manis was understanding how the central auditory system is affected by age-related hearing loss and noise-induced hearing loss. We specifically looked at the effects of these two types of hearing loss on neurons in the cochlear nucleus, the first auditory brain structure to receive signal from the cochlea.

Can you summarize your major findings?

For the project in the Lorenzo lab, I found that loss of Beta-2-Spectrin in cerebellar granule cells altered their intrinsic firing properties, disrupted key macromolecular domains within the cell, and altered release of neurotransmitters. These alterations in activity we believe affected the cerebellum and consequently other downstream brain regions, resulting in the behavioral abnormalities we observed, like seizure-like phenotypes.

For the project in the Manis lab, I found that key inhibitory cells within the cochlear nucleus change their excitability in response to loud noise exposure. In terms of age-related hearing loss, fusiform cells (the primary output cell of the dorsal cochlear nucleus) change their intrinsic firing rate and dendritic complexity with age. Both of these changes in response to noise and age appear to be compensatory mechanisms of the auditory system in an attempt to "function normally".

Reginald Edwards celebrated with his family and friends after his public defense presentation.

Reginald Edwards celebrated his successful defense with his parents.

What are you most proud of from your graduate career?

I am most proud of being able to use my dad in most of my presentations. He was in the military and suffers from noise-induced hearing loss because of his service. I am proud to make my science relatable to the public, something I have always tried to do throughout my scientific journey ,through him. I am also happy give him the respect he deserves by telling his story.

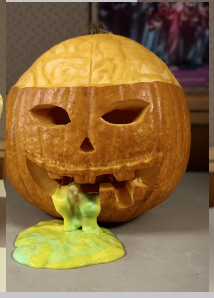
What was your most memorable experience in CBP?

My most memorable experience must be attending the synaptic transmission conference in Barga, Italy. It was amazing to meet international scientists and understand their approach to scientific problems. I also had the change to explore the small, secluded portions of Italy and be fully immersed in a new culture.

What is your career goal and what are you doing next?

This is a hard question, as I feel I am just starting on my career journey. I am currently in conversation with three international labs for postdoctoral positions, with two of them being in Bordeaux and one being in Berlin. I have also been recruited to do a postdoc at St. Jude Children's Research Hospital and have opportunities to work in industry around the RTP area. I am going were the next open door takes me.



Happy Halloween

Congrats to the Snider Lab for their winning pumpkin!

The Mouse House









Cellular Systems and Integrative Physiology (CSIP) T32 Training Program

The mission of the CSIP Training Program is to develop a diverse pool of responsible, rigorous scientists who have the skills to investigate the integrative, regulatory, and development physiology of higher organisms and their organ systems by elucidating the functional cellular components of these processes and furthermore, can transition these skills into a wide variety of careers in the biomedical workforce and overall society.

Current supported students

Kavya Balasubramanian

Mentor: Shahzad Khan, PhD

Focus: Investigating how intraflagellar transport complex dysfunction causes primary cilium elongation and G protein-coupled receptor accumulation in Alzheimer's disease

Mady Chlebowski

Mentor: Celia Shiau, PhD & Jiakun Chen, PhD

Focus: Leveraging a larval zebrafish model system to characterize the cell-cell interactions and vesicle trafficking dynamics underpinning progressive peripheral neuron degeneration

Katie Holmes

Mentor: Katie Baldwin, PhD

Focus: Investigating the morphological and molecular development of the brain's white matter astrocytes throughout postnatal mouse development, using a combination of novel viral tools, sophisticated microscopy, and spatial proteomics

Annalee Schmidt

Mentor: Rob Dowen, PhD

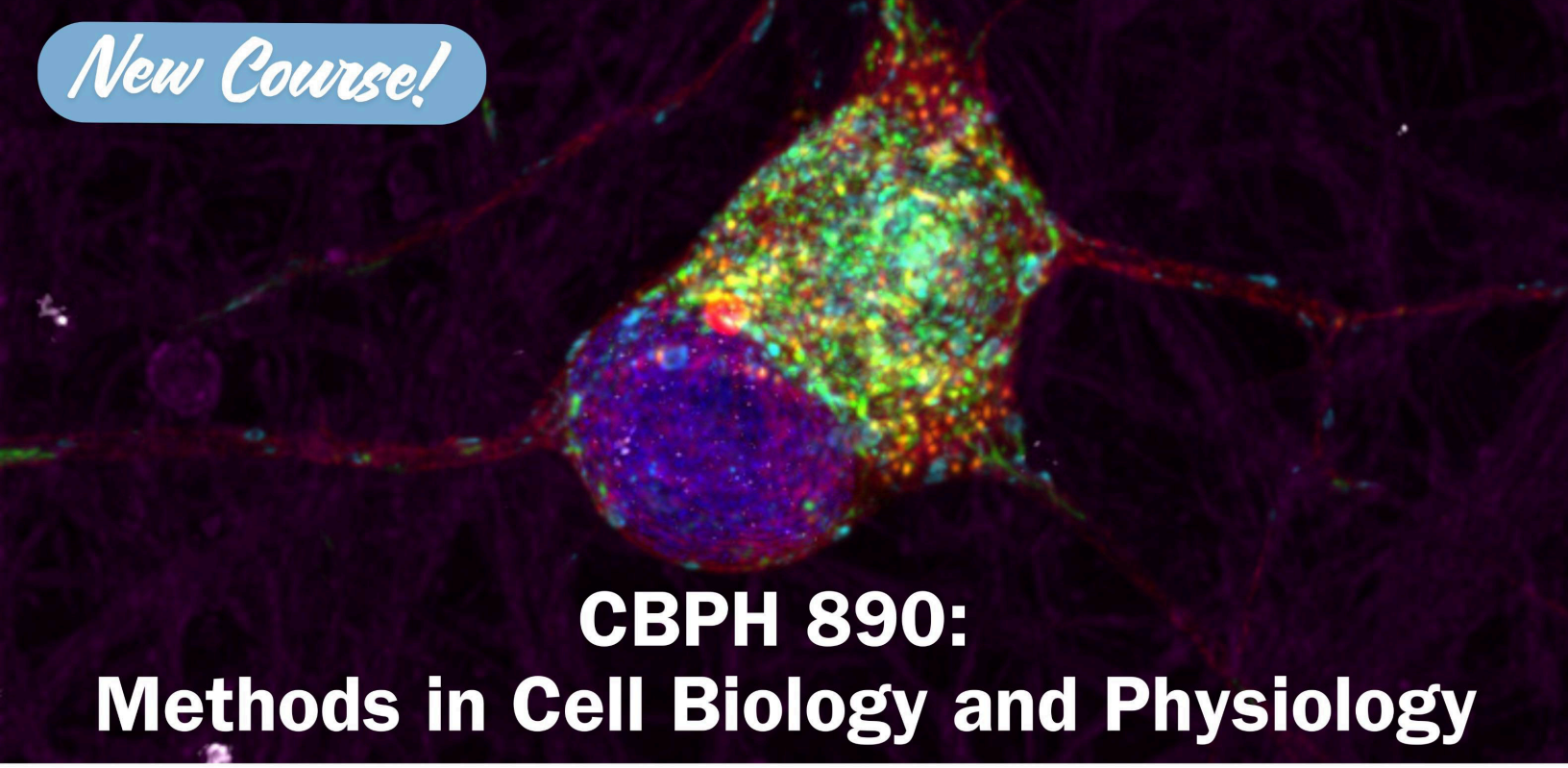
Focus: Exploring the mechanisms by which consumption of Kombucha-associated microbes reshapes host metabolic pathways to increase longevity

Past recipients

Jocelyn Alvarado
Leo Blondel
Keith Breau
Amber Gomez
Shenice Hrrison
Anna Kim
Juliet King
Frankie Marchan
Alex Powers
Samantha Ryken
Allison Skinkle
Matt Zimmerman

Recent graduates

Rhianna Lee
Julie Necarsulmer
Nate Nelson-Maney
Jennifer Nwako



New Course!

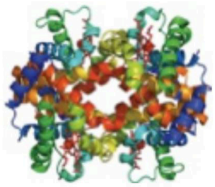
CBPH 890:
Methods in Cell Biology and Physiology

Spring 2026, Tues/Thurs 3:00-4:30 PM (3.0 credits)

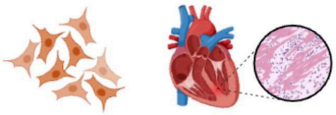
Learn about new techniques

Nucleic Acids → Proteins → Cells & Tissues → Model Organisms

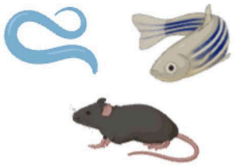
- Cloning
- CRISPR
- Sequencing
- Chromatin structure



- Protein structure
- Antibody methods
- Proteomics
- Metabolomics



- Cell manipulations
- Organoids
- Microscopy



- Invertebrate models
- Vertebrate models

Workshops on the creative process!

Skill building exercises!

NO Exams!

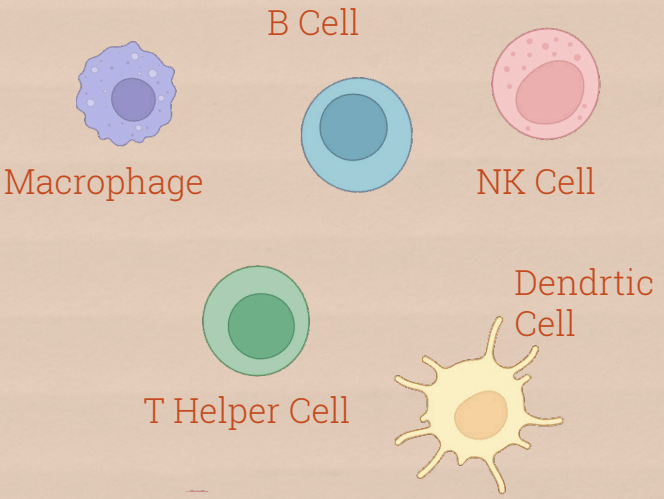
Course Directors: Drs. Mike Bressan, Rae Cho, and Sarah Cohen

Register *Email zachary.williamson@med.unc.edu*


Save the date
Research Day
April 30, 2026
The Unoriginal Dr. Diering's
Trivia Game

QUIZ

Which immune cell are you?



Questions

Q1. When a deadline suddenly moves up, what do you do?
A. Jump in and start hacking away — Macrophage
B. Call a group huddle to reorganize — T Helper
C. Make a fresh plan and prioritize — B Cell
D. Quietly handle it yourself — NK
E. Observe and predict what will cause problems — Dendritic

Q2. Your ideal work style is...
A. Active and hands-on — Macrophage
B. Collaborative and communicative — T Helper
C. Structured and planned — B Cell
D. Independent and efficient — NK
E. Analytical and reflective — Dendritic

Q3. On the first day of a big project, you...
A. Start working immediately — Macrophage
B. Check in with everyone to align — T Helper
C. Outline the roadmap — B Cell
D. Handle your part without fanfare — NK
E. Watch how the system works before acting — Dendritic

Q4. How do you deal with conflict?
A. Address it directly — Macrophage
B. Facilitate a discussion — T Helper
C. Think before responding — B Cell
D. Neutralize the issue quickly — NK
E. Observe dynamics to understand root causes — Dendritic

Q5. What motivates you most?
A. Solving problems fast — Macrophage
B. Helping others succeed — T Helper
C. Achieving lasting results — B Cell
D. Protecting the group — NK
E. Knowing how things work — Dendritic

Q6. Pick a weekend plan.
A. Hiking, climbing, adventure — Macrophage
B. Hosting dinner with friends — T Helper
C. Reading, organizing, planning — B Cell
D. Solo mission or personal project — NK
E. People-watching, learning, exploring — Dendritic

Q7. Which phrase fits you best?
A. "I'll get it done now." — Macrophage
B. "Let's talk through it." — T Helper
C. "Let's think about this." — B Cell
D. "Leave it with me." — NK
E. "I see the pattern." — Dendritic

Q8. What's your approach to new information?
A. Put it into action — Macrophage
B. Share it widely — T Helper
C. File it for future use — B Cell
D. Use it to make quick decisions — NK
E. Study it deeply — Dendritic

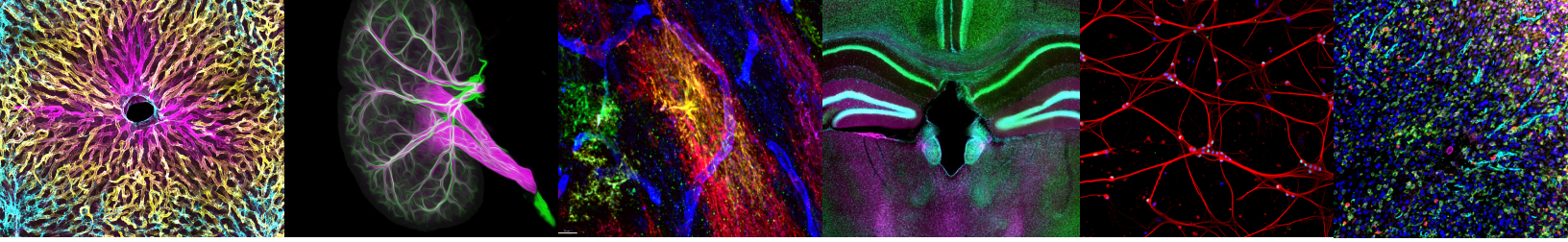
Q9. When plans change, you...
A. Adapt immediately — Macrophage
B. Make sure everyone knows — T Helper
C. Update the strategy — B Cell
D. Take care of your part — NK
E. Step back and analyze — Dendritic

Q10. Pick a personal motto.
A. "Act now." — Macrophage
B. "Together is better." — T Helper
C. "Think ahead." — B Cell
D. "I've got this." — NK
E. "See the big picture." — Dendritic

Scoring
Each answer gives 1 point to the linked cell.
For dual options (e.g., NK / Macrophage), give 1 point to both.
Highest total wins.

If tied, use tie-breaker:
NK > Macrophage > T Helper > B Cell > Dendritic (because innate cells act first).

Possible Results
Macrophage – brave, adaptable, problem-solver
T helper cell – coordinator, communicator
B cell / Plasma cell – planner, memory, detail
NK cell – fast, decisive, independent, protector
Dendritic cell – observer, analyzer, strategist



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WE'RE HERE FOR YOU!

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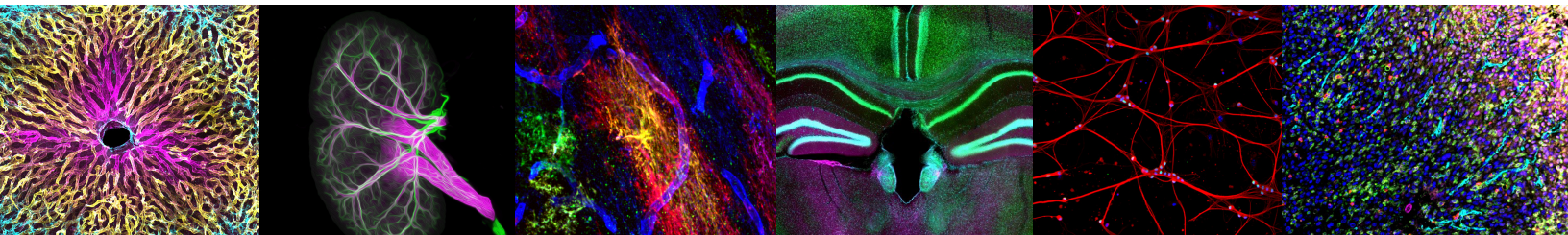
If you would like to write an article for the CBP In the Loop newsletter, contact Tiffany Garbutt, PhD.



OPPORTUNITIES TO GIVE

https://www.med.unc.edu/cellbiophysio/make-a-gift/funding-opportunities

CELL BIOLOGY AND PHYSIOLOGY GIFT TRUST

This fund is a general fund to help support invited experts, informative speakers, and events that foster collaboration, professional development, and scientific growth.

MAREN TRUST FOR GRADUATE STUDENTS

The Thomas P. Maren Graduate Student Fund is intended to provide CBP Curriculum graduate students with opportunities to learn new skills and gain experience with emerging technologies.

CELL BIOLOGY AND PHYSIOLOGY POST-DOC FUND

This fund is intended to provide CBP postdoctoral trainees with funds to support travel expenses and registration fees for scientific conferences and specialized training opportunities or workshops.

STAY CONNECTED

Website

https://www.med.unc.edu/cellbiophysio

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