Cell Biology & Physiology

CBP In the Loop

Vol. 9
Spring
2026

#1 in the Nation in NIH Funding

University of North Carolina Chapel Hill | Department of Cell Biology and Physiology

Illustrator Notes

Some Assembly Required

By Tanisha Choudhury

What does it mean to conduct multidisciplinary research? This issue of CBP In the Loop features a cover illustration that depicts how the diverse expertise within the Cell Biology and Physiology Department comes together to build a picturesque understanding of human health and disease.

Moving between classes and the lab, I often encounter a scene that makes me stop in my tracks. The communal tables across the medical campus are peppered with jigsaw puzzles. These tables host an eclectic mix of half-finished cityscapes, lush pastoral scenes, and the odd Victorian cat lady – some just begun, others nearly complete, and a few left fully intact as a testament to the collective persistence of passersby.

This quiet, incremental progress, where landscapes change slightly each day as pieces find their place, served as the inspiration for my cover illustration of this edition of *CBP In the Loop*.

Sometimes when you're knee-deep in a specific project, seeing the broader picture can prove difficult. Stuck in the minutiae, you might find yourself holding onto a single, oddly shaped piece, struggling to understand how it might fit into your latest grant proposal.

It's easy to sit with that uncertainty in a bubble, but one of the things I appreciate about the CBP Department is how naturally it pushes against that tendency. Through everyday interactions and settings like CBP FUSION seminars, where students and faculty are exposed to a breadth of research beyond their immediate focus, there are constant opportunities to gain new perspectives.

It's always exciting to recognize proteins or genes that I've set aside as pieces of my own puzzle show up in someone else's work, sometimes in unexpected contexts. It's a reminder of how interconnected these systems are and how they require multiple perspectives to be fully understood.

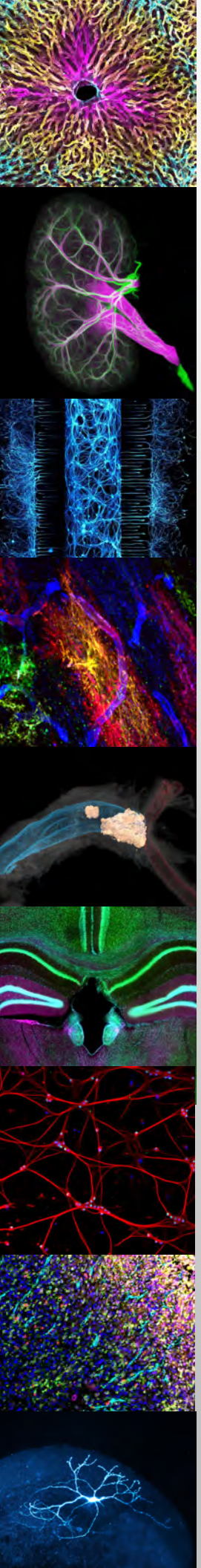
This is why I find our department so unique. The CBP Department unites diverse research areas, from neurobiology and cardiovascular physiology to fundamental cell biology, under the shared goal of better understanding human health and disease. The human body functions as an integrated whole rather than a series of isolated parts; it's natural that our scientific approach to investigating the body must follow suit.

This concept is what I hoped to capture in my cover illustration. You slot in your piece, I slot in mine, and together, we might start to see a more comprehensive image – one that occasionally aligns with our expectations, and at other times, reveals something delightfully unforeseen… like a 19th century Victorian cat lady.

About the illustrator

Tanisha Choudhury is a master's student in Cell Biology and Physiology at UNC-Chapel Hill, where she also earned her undergraduate degree in biology with minors in chemistry and creative writing. She studies lipid biochemistry in the Neher lab and will begin her PhD in biomedical sciences at the University of Virginia this summer. Outside the lab, she enjoys knitting, writing stories, and doodling on her iPad.

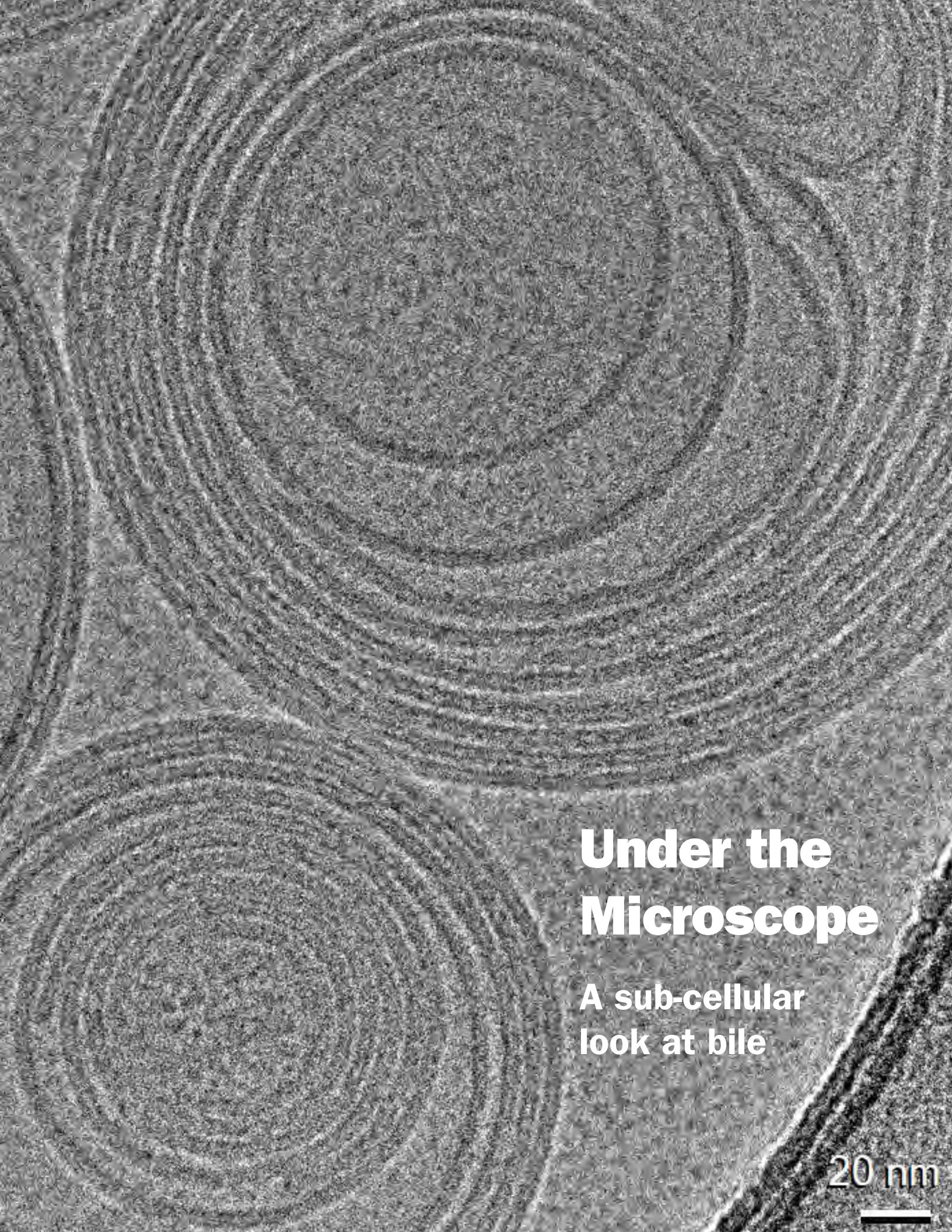
Tanisha Choudhury



Cell Biology & Physiology

TABLE OF CONTENTS

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


Under the Microscope
A sub-cellular look at bile
20 nm

Under the Microscope

A sub-cellular look at bile

What does this image show?

This Cryo-TEM micrograph shows multilamellar vesicles formed in normal porcine bile collected from the gallbladder. These concentric lipid bilayer vesicles are spontaneously formed in bile, a biological fluid comprised of cholesterol, phospholipids, and bile acids. Multilamellar vesicles are important for solubilizing cholesterol, and protect against the development of gallstones. In the gastrointestinal tract they are important for fat digestion after a meal. Multilamellar vesicles can take up, store, and transport dietary components, and potentially medications, to the gut epithelial cells for absorption.

How does this image help advance the Bhatt Pharmacomicrobiomics Lab?

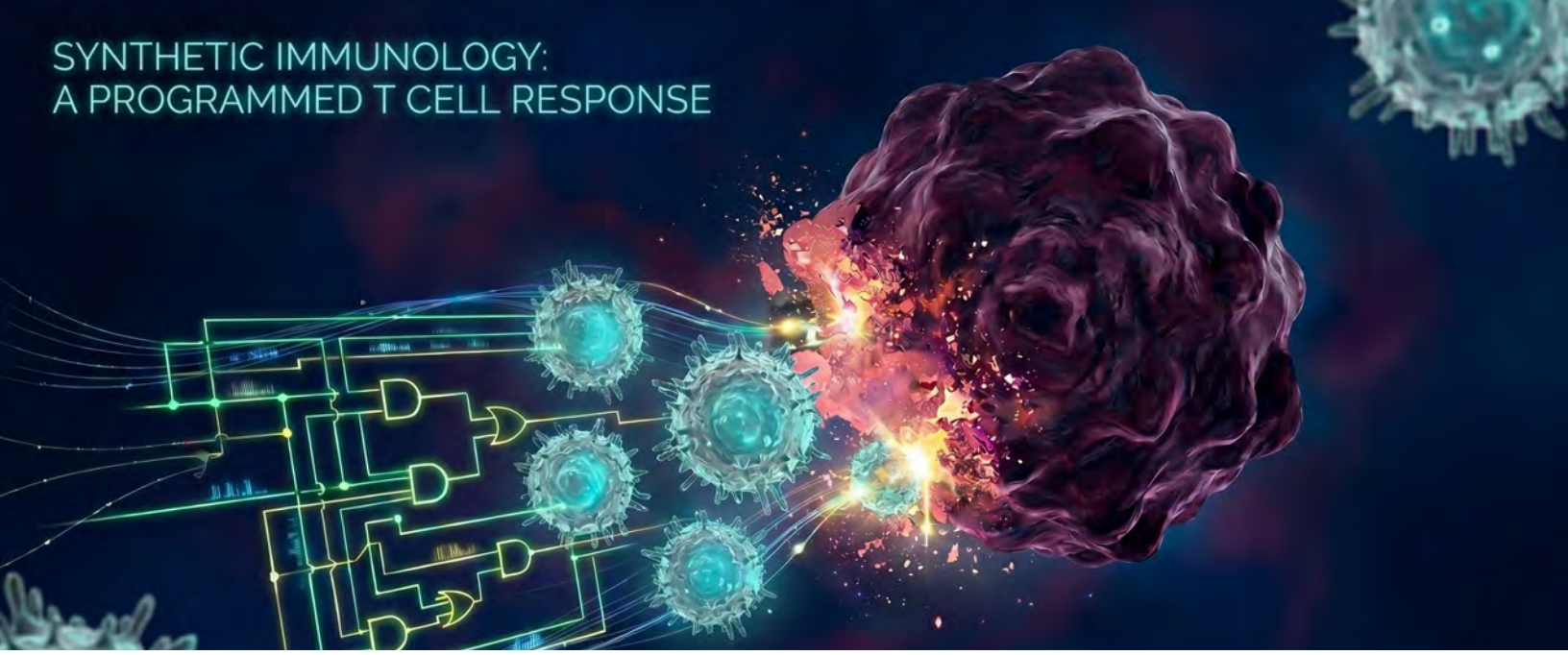
Pharmacomicrobiomics integrates the complex role of bacterial drug biotransformation, either direct or indirect, which alter drug responses (efficacy and toxicity). Bile contains host-derived primary bile acids which, when eliminated through the gut, are biochemically tranformed by intestinal bacteria to yield secondary bile acid species with distinct biochemical and biophysical properties. Intestinal bacteria encode a plethora of bile acid modifying enzymes with an emerging importance for host homeostasis. Due to their enterohepatic recirculation, we hypothesized that bacterially-transformed bile acids alter the absorption, distribution, metabolism, and excretion of biliary excreted drugs. We are testing our hypothesis using interdisciplinary approaches to interrogate pharmacomicrobiomic alterations resulting from bile acid metabolism.

To date, our data indicate that biophysical properties of bile influence absorption of hydrophobic drugs. Altering the primary and secondary bile acid pools may protect the gut epithelium from hydrophobic drug toxicity, or alternatively, enhance bioavailability of poorly-absorbed compounds. We are elucidating the mechanisms whereby bile acids and their bacterial modifications influence drug pharmacokinetics; one mechanism appears to depend on the formation of large multilamellar vesicles that contain biliary excreted medications. Cryo-TEM allows for visualization of large multilamellar vesicles, which, when complemented with additonal biophysical characterization, allows us to address the hypothesis that bacterial bile acid metabolism influences drug pharmacokinetics, a novel aspect of drug-microbiome (pharmacomicrobiomic) interactions.

How was this image taken?

This micrograph was acquired by Clara Lenger and Joshua Strauss at the UNC Cryo-Transmission Electron Microscopy Core. To accomplish this, diluted porcine bile was added to microscopic copper mesh (Lacey) cryo-grids, and frozen using a Vitrobot Mark IV. Images were collected using ThermoFisher Scientific Talos Arctica CryoTEM (200 keV).

Image credit and text: Rachel DuMez-Kornegay, PhD and Aadra Bhatt, PhD



Rewiring T Cell Signals in Cancer

By Tiffany Garbutt, PhD

Researchers are developing programmable immune strategies that allow T cells to resist exhaustion and sustain anti-tumor responses.

Tumors survive in part by sending "don't attack me" signals to T cells. Many current immunotherapies rely on antibody drugs to block these signals, but these treatments don't work for all patients and can lose effectiveness over time. Kay Chung, an assistant professor in the Department of Cell Biology and Physiology and a member of the UNC Lineberger Comprehensive Cancer Center at the University of North Carolina at Chapel Hill, is working to change that.

"We're moving beyond simply blocking inhibitory signals," said Chung. "Our goal is to rewire how T cells interpret those signals—so what normally suppresses them instead activates them."


Kay Chung, PhD

She partnered with Xin Zhou at the Dana-Farber Cancer Institute, her former graduate school colleague with a shared vision of integrating synthetic biology and immunology to create next-generation cell therapies. The two recently received a Chan Zuckerberg Biohub grant to rewire T cell signals, enabling T cells to reinterpret tumor-derived cues and sustain anti-tumor activity. This approach represents a paradigm shift in the field from blocking immune signals with antibodies or drugs to programming how immune cells interpret them.

Chung's recent work defined the regulatory circuitry that governs T cell state transitions, identifying key transcription factors that drive activation and exhaustion (1). Building on this foundation, she is developing next-generation synthetic platforms to reprogram how T cells interpret signals, integrating transcription factor engineering with programmable intracellular logic circuits.

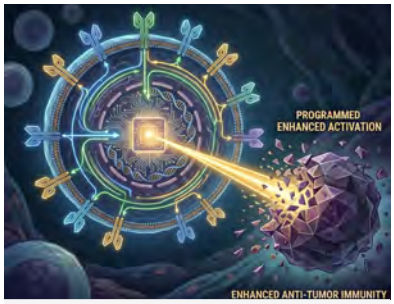
Chung and Zhou's newly funded project through the Chan Zuckerberg Biohub combines Chung's T cell programming framework with Zhou's protein engineering to build programmable intracellular signaling systems. Using synthetic protein binders developed by Zhou to precisely control intracellular signaling (2), the team plans to engineer T cells that can convert suppressive signals from the tumor microenvironment into activation cues, effectively flipping the signal.

"When a tumor tries to turn T cells off, we want that signal to do the opposite—to wake them up," Chung said.

> "When a tumor tries to turn T cells off, we want that signal to do the opposite—to wake them up," Chung said.

Chung and Zhou are also developing a complementary strategy: a drug-controllable system that temporarily disables inhibitory receptors on T cells. Some inhibitory receptors are essential for T cell activity and survival, so completely knocking out those receptors could have negative consequences. "Think of it as a molecular remote control," Chung said. "We can tune T cell responses dynamically rather than locking them into a single state."

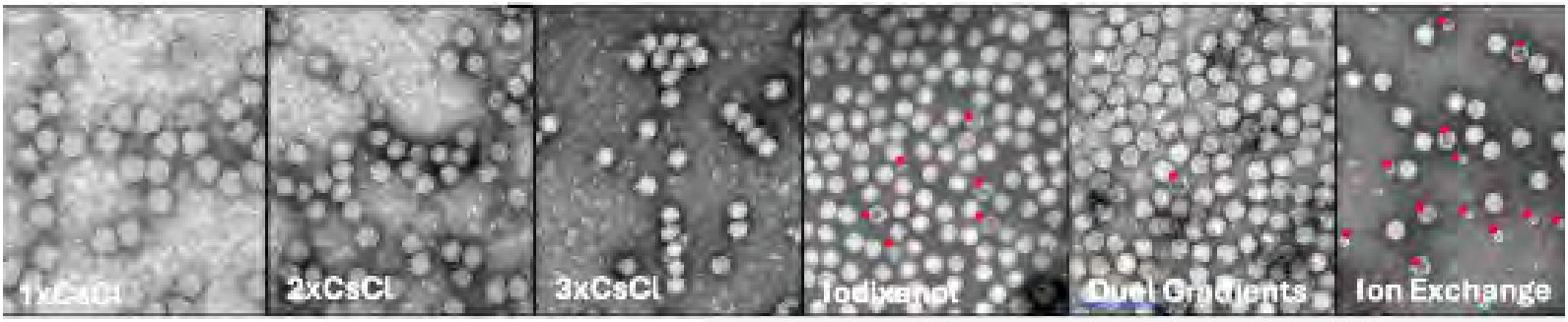
Together, these approaches are designed to create a new class of immunotherapies with greater precision, adaptability, and durability than current treatments. If successful, this work will be a step toward a future in which immune responses can be precisely designed to meet the demands of complex diseases like cancer.



Chung's lab develops synthetic transcription factor and signaling circuit platforms to program T cell behavior.

References

1. Chung, H.K., Liu, C., Battu, A., et al. Atlas-guided discovery of transcription factors for T cell programing. Nature 651, 1077-1087 (2026).
2. Ma, Zhixing, Hellweg, L., Elledge, S.K., et al. Synthetic signaling platform uncovers and rewires cellular responses to PD-1 perturbation. bioRxiv (2025).



Red markers indicate unpackaged viral particles that can affect viral titering and dosing.
Credit: Aaliyah O'Dell

Beyond the Vial

By Aaliyah O'Dell

Purification protocols shape the biological reality of gene delivery in the leading viral vector and could impact experimental results.

Adeno-associated virus (AAV) is the gene delivery tool of choice for both basic and clinical research. As scientists, we often focus our intellectual energy on an AAV's payload or the tissue specificity of an AAV's capsid. However, a commonly overlooked but critical experiment-altering step exists between vector design and the final vial of purified AAV: the purification process.

The molecular fingerprint of purification

The primary strategies for AAV purification include ultracentrifugation using density gradients, such as cesium chloride (CsCl) and iodixanol, or chromatography approaches that use ion exchange or affinity columns. The final AAV vectors produced using these strategies appear similar, if not identical. However, each purification method leaves a molecular fingerprint, a unique profile of non-viral protein contaminants, as well as varying degrees of unpackaged or partially packaged AAV capsids, on the final product. These differences can have significant effects on experimental results and lead to data that is difficult to interpret or replicate. Our team at the University of North Carolina at Chapel Hill's NeuroTools Viral Vector Core recently explored these differences and their consequences, the results of which will be published in bioRxiv in the coming months.

Fingerprints with big impacts

Traditional methods for AAV titering involve ITR-targeted droplet digital PCR and quantitative PCR to determine viral yield post purification. These strategies, however, do not provide information on the effective packaging of full viral vectors and their payloads. A high concentration of AAV particles that do not contain all the genes necessary to express a payload can result in underdosing or overdosing.

CsCl density gradients rely on refractive index readings to resolve the proportion of unpurified to purified viral particles and can provide greater insights into the percentage of full viral vectors carrying the gene of interest. Other strategies do not allow for such separation, leading to an increase in unpackaged viral particles. However, CsCl gradients are not perfect. They do not typically remove non-viral proteins as well as other methods like affinity columns, which rely on the molecular recognition between viral capsids and a purification column coated in a virus-specific ligand to separate viral particles. This highly specific interaction decreases the likelihood that non-viral contaminants will be retained post purification, reducing possible immune reactions in vivo. However, AAV preparations with some level of non-viral protein can disturb protective cellular layers and promote entry into target cells, increasing payload expression in difficult to label areas.

White arrows indicate a change in expression in the rat superior colliculus across different degrees of prep purity (1x, 2x, and 3x rounds of CsCl).
Credit: Aaliyah O'Dell

The quality of an AAV preparation is multidimensional. The outcome of an experiment relying on a viral vector can depend on the animal model and molecular target as much as the purification strategy. A viral preparation with a higher percentage of full viral particles could perform worse than one with a lower percentage of full viral particles, depending on various contaminating proteins and even the molecular target.

Controlling AAV variation

The responsibility to thoroughly characterize AAV vector preparations lies with the manufacturers. However, individual investigators can look beyond the label on the vial and take measures to control for viral purification differences.

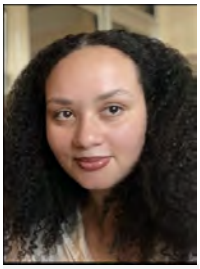
When replicating experiments, try to source vectors from the same production unit, preferably the same lot. If a vector is not performing as expected, investigators should not hesitate to make an inquiry with their vendor. While not many vendors will provide the option to select the viral purification method, they may have insights into improvements that can be made to the experimental design or handling technique of the virus. Many cores, including UNC-CH's NeuroTools Viral Vector Core, directed by Kimberly Ritola, will consider requests for change in purification strategy and provide tailored guidance based on virus design and experimental needs. For researchers interested in independently troubleshooting their AAV-based experiments, UNC-CH has numerous core facilities with highly trained personnel that can analyze nearly any attribute of viral vector quality.

Aaliyah and Dr. Ritola have been spreading the word on AAV variation at conferences across the country.

Acknowledgments
MLS Core, UNC-CH, Martin Bohlen, Duke University, NeuroTools Viral Vector Core, UNC- CH

About the author

Aaliyah O'Dell is originally from Nantahala, North Carolina (very far west) and came to the UNC-Chapel Hill after completing her undergraduate degree in cellular biology at the University of Georgia. She worked as a research technician at NeuroTools/Ritola Lab until she was admitted to CBP's Biomedical Master Program. After graduation she will continue to work at NeuroTools/Ritola Lab while preparing her applications to biomedical sciences PhD Programs, with the long-term goal of leading research initiatives in synthetic virology at an R1 institution.



Aaliyah O'Dell

Fixing Tiny Hearts

By Alyssa LaFaro

Originally published in *UNC Research Stories*

Whitney Edwards studies how the heart develops to pinpoint when congenital heart disease occurs and improve treatment options for high-risk cases.

Whitney Edwards is an assistant professor of cell biology and physiology within the UNC School of Medicine. Credit: Alyssa LaFaro/UNC Research

How does a human heart develop? Whitney Edwards thinks about this question a lot.

"We have puzzle pieces, but we don't have the whole story," Edwards says.

Here's what we know: As a fetus grows, its cells carry the blueprint for building the heart and other organs. They start by forming a simple tube of muscle, which elongates and twists to create two early heart chambers. Walls divide each chamber, forming the two atria above and two ventricles below. Finally, the heart's valves and vessels develop, enabling blood to circulate throughout the body.

By the middle of pregnancy, all the heart's basic structures are in place. Then, phase two begins: those valves, vessels, and chambers mature; their walls thicken; and the heart strengthens to handle increased pressure from the circulatory system. After birth, it grows again to support the surge of blood needed to fuel a rapidly developing body.

But we're missing a lot of details about what drives those processes.

Here's what we don't know: what guides chamber formation, how heart muscle cells mature, and what drives the formation and strengthening of valves and vessels.

Edwards is determined to fill those gaps. Because the more researchers understand how the heart forms step by step, the better chance Edwards and her lab in the UNC Department of Cell Biology and Physiology have at uncovering when — and why — congenital heart disease begins.

Congenital heart disease is the most common birth defect, affecting nearly 1% of newborns — about 40,000 babies each year in the U.S. In more than half of cases, doctors can't identify a cause. Severity ranges from small holes that heal on their own to serious malformations requiring multiple surgeries. Some people live full lives with minor defects while those with more complex conditions often face shorter lifespans.

"It's like this huge black box," Edwards says. "We have no idea why most people have a congenital heart defect. And, for me, the heart is one of the most interesting and structurally complex organs in the body. I want to know how it forms — and where things go wrong."

Diagnosing the problem

Think of the heart like a car engine: countless tiny parts — pistons, rings, valves, spark plugs — must work in harmony. When an engine falters, the many processes taking place beneath the hood make it difficult to pinpoint the exact cause.

Edwards approaches congenital heart disease the same way, studying how developmental misfires accumulate inside an organ that's building itself in real time. Her team focuses on a chemical modification that occurs when enzymes attach fats to proteins. These attachments help proteins reach the right place in a cell and perform the right job.

Edwards wants to understand how these enzymes guide normal heart development and what happens when they don't. Her lab uses two approaches.

First, they isolate heart muscle cells in a petri dish and disrupt enzyme activity to see how the cells respond. When fats can't attach to proteins, the heart muscle cells stop contracting.

"That's just one enzyme, and there's a lot of other enzymes we could target," Edwards shares.

Second, they use genetic editing to delete this enzyme at specific times during development. When they do, severe congenital heart defects emerge. Most notably, the ventricles, which are the chambers responsible for pumping blood throughout the body, don't form properly.

The team also identifies which proteins receive these fat attachments and explores how cell metabolism — the reactions that allow a cell to grow, reproduce, and maintain its structure — shapes this process.

"If we can map out these pathways, we might be able to develop treatments for congenital heart disease in the future," Edwards says. "But we are at the cusp of trying to address this."

Just as a mechanic might trace an engine problem back to a single faulty component or an interaction between parts, Edwards aims to map how molecular misfires ripple through the developing heart. By teasing apart which enzymes, pathways, and metabolic processes are essential, and what happens when one piece slips out of sync, her team hopes to reveal why small disruptions can have far-reaching consequences.

Pursuing her own pathway

Like her research, Edwards' path to science wasn't straightforward, and it began far from a lab bench. All four years of high school, she performed in plays and immersed herself in creative pursuits, enough that she seriously considered majoring in drama.

But during her first year of college, a chemistry course changed everything. The professor had previously worked in the biotechnology industry. That was Edwards' first exposure to a scientist who built a career outside academia.

Fixing Tiny Hearts (Continued)

Originally published in *UNC Research Stories*

"I didn't know that was even a thing people did," she says with a laugh. "I think it was her combination of teaching abilities and connecting with these challenging aspects of science that made me think this was a real career path I could take."

Edwards switched her major to biochemistry and, after graduating, spent a year working for a medical company. The work was repetitive, and she didn't have room to grow. She wanted less sample prepping and more freedom to ask big questions — which meant pursuing a PhD.

Early in her graduate studies, she became passionate about developmental biology. What captivated her then is the same idea that fuels her work today: that a single cell can become an entire organ.

"It's crazy that we even exist," she says. "The complexities of making cells and different cell types and then creating this 3D functional shape from them. How does that actually happen?"

Humanizing science

For all the molecular puzzles Edwards works to piece together, one experience brought the stakes into sharp focus.

She recently attended an investigators' meeting with Additional Ventures, a foundation dedicated to studying single-ventricle diseases, among the most severe forms of congenital heart disease. These are the cases where newborns undergo reconstructive heart surgery within days of birth, returning to the operating room again as toddlers, teenagers, and adults.

Impact Report

Whitney Edwards investigates the root causes of congenital heart disease — which affects one in every 100 U.S. babies — to generate insights that could ultimately improve care for children and adults living with the condition.

Congenital heart disease is the most common birth defect, affecting nearly 40,000 babies in the U.S., according to the Centers for Disease Control and Prevention.

Parents spoke about the moment their child was diagnosed and the series of surgeries that followed. Adult patients described navigating school, jobs, relationships, and daily life with a heart that has been rebuilt multiple times. What struck Edwards most was not just the physical and emotional burden but the financial struggle of undergoing major heart surgery again and again.

This was the first time she'd heard patients and families share their stories directly.

"It was incredibly eye-opening," she says. "You don't always get that opportunity in basic science. For me, it really amplified how these are lifelong diseases."

It made Edwards think about where she could focus her efforts. These diseases are incredibly complex. Patients with single-ventricle defects may also have problems with their valves or the vasculature. So understanding even one piece of ventricular development could eventually make a difference.

"When you're in basic research, you may not get the chance to interact with patients," she says. "But hearing their stories — hearing what they've been through and how medical interventions have extended their lives — it absolutely informs our research directions. It reminds us that what we're doing matters."

Faculty in the News

- **Jose Rodríguez-Romaguera, PhD**
  - *UNC Research Stories* - Eyes on the brain
- **Kay Chung, PhD**
  - *Medical Express* – A genetic blueprint for avoiding killer T cell exhaustion
- **Grégory Scherrer, PharmD, PhD**
  - *Carolina Stories* – Developing non-addictive pain meds
- **2025 Office of Research Annual Report** features multiple CBP scientists
  - Dr. Mohanish Deshmukh
  - Dr. Kathleen Caron
  - Dr. Mark Zylka
  - Dr. Grégory Scherrer
  - Dr. Sarah Cohen
  - Dr. Michelle Itano
  - Dr. Douglas Cyr
  - PhD Candidate: Chih-Hsuan Hsu
  - PhD Graduate: Dr. Reginal Edwards

Faculty Awards

Natasha Snider, PhD

Research Grant

AbbVie, Inc.

To develop a method for obtaining a high-resolution cryoEM structure of glial fibrillary acidic protein

Heather McCauley, PhD

National Institute of Diabetes, Digestive, and Kidney Diseases (R03) Award

National Institute of Health

To investigate enteroendocrine regulation of intestinal barrier function

Kay Chung, PhD

Chan Zuckerberg Biohub Grant

Silicon Valley Community Foundation (SVCF)

To develop novel receptor signal biocircuits and degraders in T cells

Matthew Billard, PhD

Tiffany Garbutt, PhD

Curricular Innovation & Pilot Funding

UNC School of Medicine's Accelerate Forward Together Education Pillar

Launch the Storytelling and Research Training (START) program to help students start writing a first-author paper earlier in graduate school

We're #1!

Cell Biology and Physiology

Ranked #1
for NIH Funding

by the Blue Ridge Institute for Medical Research

The Blue Ridge Institute for Medical Research is a nonprofit organization that analyzes publicly available NIH data to produce annual, independent rankings of U.S. medical schools, departments, and institutions based on total NIH research funding. Within the biomedical research community, these rankings serve as a widely used benchmark of an institution's research scale, competitiveness, and sustained success in securing peer-reviewed federal funding.

2025 CBP Departmental Award Winners

The Department of Cell Biology and Physiology held its annual holiday party on December 10, 2025.

Students, faculty, and staff gathered on December 10 to celebrate another successful year of research and collaboration. The event included an array of food and desserts as well as Summer Orr's Christmas Bingo, featuring secret fun facts from CBP members. Fun facts included: a staff member who got a full-ride basketball scholarship to attend college (Tonya Murrell), a faculty member who was competitive trampolinist (Heather McCauley, PhD), a faculty member who memorizes lyrics to rap songs to write scientific song parodies (Katie Baldwin, PhD), and more!

At the beginning of the event, Dr. Kathleen Caron, the CBP Chair, announced the annual departmental awards. These awards are presented to faculty, trainees, and staff members nominated by their peers in recognition of their excellence throughout the year. The CBP Community is a success because of the countless contributions of many who generously apply their time and talents to fulfill the department's mission of leading the way in education, research, and service. Read the names of this year's award winners below.

Pictured from left to right in the front row, Zachary Williamson, Kathleen Caron, Kristen Scherrer, Christine R. Casingal (first author of the Anton lab paper), Calvin Dempsey, and Ace Lane. Pictured in the back row from left to right, Jay Brenman and Eva Anton

Faculty Mentoring Award – Matt Judson, PhD
Recognition of outstanding mentoring to any of the following groups: junior faculty, postdocs, graduate students, and/or undergraduate students

Innovation in Teaching Award – Kristen Scherrer, PhD
Recognition of new and innovative teaching techniques proven to be useful in achieving the department's teaching mission

Publication of the Year Award – The labs of Jessica Thaxton, PhD, MsCR and Eva Anton, PhD
Recognition of best scientific publication, showing a high degree of innovation, publicity, conceptual advancement, and prestige

Jessica Thaxton's Immunity paper identified a conserved stress-sensing pathway in tumor-infiltrating T cells that, when chronically active, induces an exhausted cell state.

Eva Anton's Nature paper identified how the tuberous sclerosis complex (TSC), a collection of proteins that regulate cell metabolism, shapes the architecture of the developing human brain.

Extra Mile for CBP Graduate Students – Pierre N'Guetta (O'Brien Lab)
Recognition of outstanding research endeavors, outstanding leadership abilities, and/or outstanding service to fellow students and curriculum

Extra Mile for CBP Postdocs and EHRA non-faculty – Maria Clara Zanellati (Cohen Lab)
Recognition of outstanding research endeavors, outstanding leadership abilities, and/or outstanding service to lab and department

Staff Excellence Award – Calvin Dempsey (Business Services Coordinator) and Adrienne (Ace) Lane (Grégory Scherrer Lab)
Recognition of outstanding work performance and customer service skills; demonstrating dedication, cooperation, and a positive attitude

CBP Service Award – Zach Williamson, PhD (Student Services Manager)
Recognition of exceptional service to the CBP department or curriculum, to the university, and/or to the surrounding community

The Chair's Award – Jay Brenman, PhD
Recognition of outstanding accomplishments and/or service to the cell biology and physiology department and community

Extending the Reach of Lymphatics

By Tiffany Garbutt, PhD

A postdoctoral research talk about lymphatics inspires the next generation of scientific teachers and researchers.

Research on the lymphatic system has long been overlooked, with studies on lymphatic vessels representing only a small fraction of those on blood vessels. However, the lymphatic system has attracted more attention lately from Hollywood, with celebrities donning stylized compression suits and getting weekly lymphatic massages to maintain their health and beauty. Now, the topic of lymphatics has even made its way into a fifth grade classroom, although for a completely different purpose: education.

The lymphatic system is essential for draining excess fluid and cellular waste from surrounding tissues, filtering it, and recycling the fluid back into the bloodstream. Failure to effectively remove and recycle excess fluid through the lymphatic system can cause lymphedema, a chronic tissue-swelling condition with limited effective treatments. This caught the attention of Emily Dong, a fifth grade student whose mom, Yanna Tian, works as a postdoctoral research associate at the University of North Carolina at Chapel Hill, investigating the role lymphatics play in physiology and disease conditions.

Emily's class was studying the circulatory system when a word appeared on their vocabulary list. "It was the word lymph. I was super excited. I thought, 'My mom researches that,'" said Emily. "I was expecting to see it more often, but I was disappointed when it never showed up again." Instead of letting the moment pass, Emily decided to step in and fill the knowledge gap. She asked her teacher if she could give a short presentation to her class on lymphatics, and he agreed.

A couple of months earlier, Emily had seen her mom and a fellow postdoctoral researcher, Lazlo Balint, give a similar talk for the general public at the Chapel Hill public library as part of the UNC's Research Café program. "At first, I thought, 'I'm going to be so bored doing this,' but when I listened, I found it interesting," said Emily. She was surprised by how understudied the lymphatic system is and how few medical options exist to treat lymphatic conditions, such as lymphedema.

Emily was inspired to learn more about lymphatics by her mom, Yanna Tian's talk on lymphatics at a local public library.

Inspired by her mom's research, Emily Dong gave a presentation to her fifth-grade class on the lymphatic system and its importance to human health.

> "If you think something is cool and it's on a topic you really want to share, just share it." - Emily Dong

"In our presentation, we discussed how important the lymphatic system is and how it is understudied. There are only a handful of lymphatic medical centers around the world to treat lymphedema," said Tian. They also discussed how medical textbooks have thousands of pages with in-depth information about the human body, but just half a page on the lymphatic system. The example drew a striking parallel in the lack of information, even at the medical school level, to Emily's fifth-grade class, where the only mention of lymphatics was a single word.

"Because its underrated, I felt it would be cool for at least 21 more people to learn more about it," said Emily. She took on the task of looking up more information about lymphatics and making the presentation herself. She only asked her mom to review the slides to make sure they were correct.

"I was very surprised and happy for her to volunteer to give a talk like that, especially when she said she would make the slides on her own. I am happy for her and other students to learn something outside their textbook and teach each other," said Tian.

Emily's presentation went great. Students gathered around the front of the classroom to hear her, some sitting on the carpet and rapidly taking pages of notes. Just like her mom, months earlier, she shared her joy and scientific curiosity about lymphatics with others.

"I think it's cool to just learn more about it because it's an interesting topic," said Emily. "And if you think something is cool and it's on a topic you really want to share, just share it."

Two Cultured, Two Perspectives

By Akshi Pant and Kavya Balasubramanian

Co-founders, co-hosts, and friends Akshi and Kavya reflect on the launch of BBSP's first official science communication podcast.

Two Cultured is a science podcast created and run by a group of graduate students from UNC Chapel Hill, with one mission: to make science more accessible and approachable for everyone. Each episode features conversations with scientists, at various stages and career paths, about their research, while also highlighting the human stories behind the science. Co-founders Akshi and Kavya met in a neuroscience class during the first year of their PhD, but the idea for *Two Cultured* was born on a car ride to Washington D.C. after they realized their joint passion for science communication. With the launch of *Two Cultured* in September 2025, they hope to make accessible their love for science to anyone who is curious. Here, the co-hosts give a little peak behind the curtain on building the podcast and their ambitions for it.

Why we chose to launch this podcast?

Akshi: This is my favorite question. Graduate students have one of the coolest professions in the world. While pushing the boundaries of scientific knowledge, we also find ourselves in constant interface with a community of people committed to doing the same, each in their own unique way. The first goal of Two Cultured was to give that love for scientific discovery and the journey behind it, a platform and a voice. Our second goal, and possibly the front-runner driving the decision, was to make sure research and its impact was not lost in translation. It is not uncommon that accessibility to impactful research is hindered by a lack of effective communication. Our intent is to present the purpose, process, and output of research in a way that does not require prior expertise to understand. It integrates the machine that is the academic community with the global population, whose needs are the driving force that gives research its purpose and impact.

This is the official cover for our podcast. The petri dish reflects cell culture work, and the people swimming represent the "human" side of science and scientists. The logo shows the blend of these two ideas.

Naming and building the podcast

Akshi: A lot of thought went behind naming the podcast *Two Cultured*. Kavya and I come from different cultures in India. While I am an international student, Kavya was born and raised in Portland, Oregon. We wanted to make sure our podcast reflected the unique perspectives we each bring to the table and highlight underrepresented voices in STEM. Additionally, we both routinely work with cell culture systems, so the play on words was inevitable.

Although called "Two" Cultured, there is a whole team of graduate students dedicated to our shared endeavor of making science accessible. Our scriptwriters Annalee Schmidt and Emma Kraft are second year students in the Cell Biology and Physiology and Chemistry Departments, respectively. Gates Schneider is a third year student in the Neuroscience Department, and she is our resident audio technician. Ross Sibley runs our publicity alongside being a second-year student in the Chemical Biology and Medicinal Chemistry Department. Finally, Lauren Sapienza, a third-year student in the Toxicology Department, is the face behind the beautiful artwork for our episodes.

Two Cultured, Two Perspectives (Continued)

Lessons learned along the way

Akshi: It feels a little cliché, but similar to the process of earning a PhD, the biggest thing we've learned is there is always something new to discover. Whether about a field, a career, a question, a way to question, or a reason to question, I constantly find myself uncovering new aspects and perspectives of academia. In a more technical sense, I have learned that it takes a very talented team (shoutout to our very talented team) to propel the impact and reach we have had within just under a year of *Two Cultured* launching.

Our favorite episodes, so far

Kavya: One of the most rewarding aspects of this experience so far has been chatting with our guests about the moment they realized they wanted to pursue a scientific career. For some, that passion for discovery started in childhood or evolved from a personal experience. Others found a love for science serendipitously or through the influence of a close mentor. Either way, I love understanding how each person's story informs their approach to science, while also reflecting on the forces that shaped my own journey.

Akshi: We have had such a wide array of episodes so far, spanning from discussions on bridging biology, ethics, and medicine as a MD/PhD student, to the importance of getting involved in science policy and outreach. Some of my favorite episodes have included discussions with PIs and current students on the community of academia and how fostering a supportive environment allows researchers to put their best foot forward.

Looking ahead: future goals for the podcast

Kavya: Beyond outreach, another important goal of starting this podcast was to highlight the breadth of career trajectories within science. When the average person envisions a scientist, the picture that comes to mind is of someone hunched over an experiment for hours on end. However, it is important to also highlight scientists in various sectors of our society such as biotech, health policy, and business and their invaluable contributions to improving human health and scientific knowledge.

Meet the team of graduate students behind Two Cultured. Left to right; front: Gates Schneider (audio technician), Akshi Pant (co-founder and co-host), Kavya Balasubramanian (co-founder and co-host), Lauren Sapienza (art). Left to right; back: Emma Kraft (scriptwriter), Ross Sibley (publicity), Annalee Schmidt (scriptwriter).

While getting our fellow colleagues excited about our conversations is easy, I t is an immediate and worthy challenge to brainstorm ways to engage listeners beyond the UNC. Our hope is that we can do so by showcasing the people behind the science. We welcome feedback on which topics matter most to the public and are always ready to learn, explore, and share new science stories with our listeners.

Spotify **Apple**

<u>The most recent episode</u>

Akshi: In our most recent episode, we spoke with JP Flores, a recent PhD graduate from Doug Phansteil's lab about what the student journey of academia entails and the various ways to actively give back to the community that has provided so much for our enrichment. You can find this episode, and all the others, on Spotify and Apple Podcasts under *Two Cultured*.

Congratulations Dr. Keith Breau

What was your research hypothesis or goal?

My research focused on the Planar Cell Polarity pathway with two goals in mind. First I wanted to show that intestinal epithelium uses the PCP pathway to coordinate cellular migration. Second, I sought to build a mathematical model of PCP protein interactions, to understand how the individual protein interactions in the pathway work together to form tissue level cell polarity.

What were the major findings from your PhD research?

We found that PCP had a strong role in controlling intestinal migration, and that a recently identified set of localized PCP phosphorylation reactions is a sufficient mechanism to drive known tissue-level PCP phenotypes.

Keith Breau defended his PhD research in Dr. Tim Elston's and Dr. Scott Magness' labs on December 18, 2025.

What are you most proud of from your graduate career?

I am most proud of my collaboration record, which led me to 12 publications during my graduate career, as well as my two NIH grants.

What was your most memorable experience in CBP?

At one of the CBP retreats, all the students had to do a group communication exercise. It was a little awkward at first, but it ended up being an absolute riot by the end.

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

I am starting my own business, providing researchers with a wide array of computational bioscience services.

Congratulations Dr. Danial Babaki

What was your research hypothesis or goal?

We hypothesized that class I electrophilic Nrf2 activators suppress neointimal hyperplasia (NH) by inhibiting the proliferation, migration, and phenotypic modulation of vascular smooth muscle cells.

What were the major findings from your PhD research?

Nrf2 activation increases antioxidant enzyme expression and prevents VSMCs from switching to a disease-linked "synthetic" state. In animal models, we showed that periadventitial delivery of these activators significantly reduced arterial and venous stenosis.

Danial Babaki defended his PhD research in Dr. Edward Bahnson's lab on March 16, 2026.

What are you most proud of from your graduate career?

I am most proud of the personal and professional growth I achieved throughout this journey. It taught me resilience and how to think critically. I am also proud of the lasting relationships I built and the opportunity to mentor others within the department.

What was your most memorable experience in CBP?

My most memorable experiences in CBP were the daily troubleshooting sessions and collaborative conversations with my lab mates. Beyond the lab, I will always remember the times we spent playing table tennis, pickleball, and tennis together, which provided a balance to the rigors of doctoral research.

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

I am excited to transition into the biotechnology and dental industries, where I can use my clinical background and research skills to support strategic business growth and the development of next generation therapies.

Congratulations

Dr. Andrew Scott Kennedy Jr.

What was your research hypothesis or goal?

The central question of my work was: "why do some immunotherapies fail in solid cancers?". We focused on T cells which infiltrate tumors and destroy cancer cells - I hypothesized that the hostile environment of the solid tumor alters the cell biology of T cells, and asked if preventing those changes to the T cell could improve immunotherapy.

What were the major findings from your PhD research?

I studied T cells, the main immune cell that fights against cancer in immunotherapy. When looking at these T cells taken from cancer patients, I found that the endoplasmic reticulum (an organelle where a lot of protein is made) becomes enlarged due to the upregulation of a structural protein called CKAP4. This enlargement happens in hypoxic environments, which are commonly found in solid tumors. Excitingly, we could limit this enlargement from occurring by adding inhibitors to cell stress or removing the CKAP4 gene from cells. These treatments enabled the cell to make much more protein and were superior at controlling tumor growth in mice.

Andrew Kennedy, Jr. gave his PhD talk on December 11, 2025.

Andrew defended his PhD research in Dr. Jessica Thaxton's lab.

What are you most proud of from your graduate career?

Combining classical cell biology approaches to cutting-edge translational science questions. Between rotations, classes, and various experiences with CBP faculty, I've received a variety of cell biology training, and I am really proud that I was able to bring those techniques to cross-disciplinary questions in cancer immunobiology.

What was your most memorable experience in CBP?

Those initial gatherings with my cohort in the pandemic! We never got to interact with each other on-campus at that time, so we all organized various outdoor gatherings off campus which were a blast.

Andrew celebrated his successful defense with his wife, Erin Kennedy, his son Arthur Kennedy, and Dr. Jessica Thaxton.

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

My real passion lies in taking what we learn at the bench and actually getting it to patients. Lately, I've realized that I can make the biggest difference by focusing on the business side of science to actually bring these discoveries to the clinic, though I'm still keeping a few different doors open. For now, I'm staying on as a postdoc in Jessica Thaxton's lab to continue my research while I map out my next steps.

Congratulations

Dr. Pierre-Emmanuel Yoann N'Guetta

What was your research hypothesis or goal?

My research goal is to understand how different type of renal nerves innervate the kidney, establish neuro-effector junctions and innervated developing renal structures. In addition, we aim to understand how renal nerve mediate kidney development and impact renal function.

Pierre N'Guetta defended his PhD research on March 6, 2026.

What were the major findings from your PhD research?

In our study, we provided a comprehensive, high-resolution map of sensory and sympathetic innervation in the developing mouse kidney, offering critical insights into how renal neural networks are established during organogenesis and postnatal maturation. We delineate the spatial and temporal dynamics of distinct nerve populations, revealing that renal innervation begins in concert with arterial differentiation and progressively innervate with nephrons during development. We established the conserved innervation patterns in both mouse and human kidneys underscoring their physiological relevance. Moreover, renal nerves establish neuroeffector junctions with kidney structures during development. Finaly, we showed that in utero renal denervation leads to lower number of nephrons during development. This established that nerve-derived paracrine cues modulate nephrogenesis, revealing bidirectional signaling crosstalk between peripheral nerves and the developing renal tissue.

What are you most proud of from your graduate career?

I am very proud of all the effort and passion I have poured from the very beginning in my work. I came to the USA right after high school, not speaking English and without knowing anyone here. This journey started in a little town in the Republic of Côte d'Ivoire, and I never imagined that it would have led me to a PhD.

Pierre celebrated his successful defense with his mentor, Dr. Lori O'Brien, and his fellow labmates.

What was your most memorable experience in CBP?

My most memorable experiences are the ones I made with all the friends, mentors, and amazing people I have met here at UNC and in CBP. These interactions with everyone and the community we developed made this journey so memorable.

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

My hope is to continue to grow and improve as a scientist and in life. In my next position, I will be continuing research and making scientific discoveries at the University of Pennsylvania in the Laboratory of Dr. Alex Hughes, where I will be studying tissue engineering and renal development.

Congratulations Dr. David Rocco

What was your research hypothesis or goal?

My research goal was to investigate the role of RAPGEF2, a previously uncharacterized RAP-GEF in platelets, in RAP1-mediated integrin activation in platelets, and how RAPGEF2 contributes to hemostasis and thrombosis.

What were the major findings from your PhD research?

We found that RAPGEF2 is indeed important for RAP1-mediated integrin activation, and that RAPGEF2 operates downstream of G13-coupled receptors. We also found that RAPGEF2 is important for hemostasis and thrombosis under arterial shear conditions.

What are you most proud of from your graduate career?

I am most proud of my overall growth throughout my graduate career. During my time in graduate school, I learned a lot about myself in terms of both my shortcomings and strengths. Looking back, I am very proud of the improvements I've made and habits I've developed both as a scientist and in general.

What was your most memorable experience in CBP?

It's hard not to say passing my defense, but if I had to choose something else it would have to be the 2023 CBP Research Retreat at the NC Museum of Art.

David Rocco defended his PhD research in Dr. Wolfgang Bergmeier's lab on April 6, 2026.

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

Right now, I am pursuing potential postdoc positions in the triangle area as I will be staying here for the next few years. What I plan on doing after that is still uncertain.

Congratulations Dr. Garrett Sessions

What was your research hypothesis or goal?

The overall goal of my research was to better understand the spatial and temporal dynamics of senescence induction. More specifically, how senescence emerges following DNA damage to healthy cells across long periods of time, how senescent cells influence their healthy neighbors through secreted factors, and how the burden of senescent cells accumulates in an age-related disease such as osteoarthritis.

What were the major findings from your PhD research?

I found that there is significant heterogeneity in how senescence arises from healthy cells. Only a small fraction of all senescent cells express the factors which negatively influence their healthy neighbors. Additionally, there is an increased senescence burden in female synovial fibroblasts in osteoarthritis. This increased senescence burden could help explain why females are more likely to develop OA.

What are you most proud of from your graduate career?

I had the privilege of training several undergraduate students during my time as a graduate student. One of them is now working on her own PhD, another is currently writing up an amazing publication based on her post-bac work, and the third is set to graduate this year. All three are on course to be excellent scientists and I couldn't be more proud of them.

Garrett Sessions defended his PhD research in Dr. Jeremy Purvis's lab on March 16, 2026.

What was your most memorable experience in CBP?

I've always loved public speaking, so the FUSION seminar talks have always been a lot of fun for me. I always looked forward to the chance to present my work.

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

I want to stay in academia and run my own lab, here at UNC if it works out that way! My next step on the path to that goal will be a postdoc with Mohanish Deshmukh studying cellular senescence in the brain!

Welcome

Madison Bunce

Mentor: Rob Dowen, PhD

Maddie Fuller

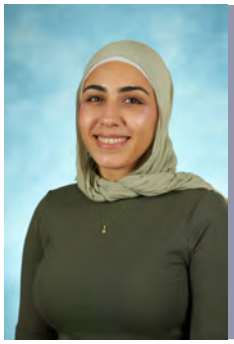
Mentor: Natasha Snider, PhD

Sophie Kiehl

Mentor: Todd Cohen, PhD

Hailey Dodson

Mentor: Heather McCauley, PhD

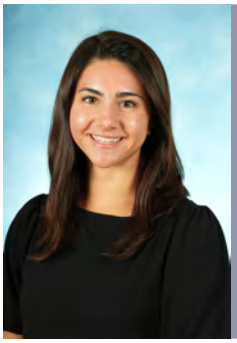


Zena Khaled

Mentor: Wolfgang Bergmeier, PhD

Joseph Lee

Mentor: Adam Gracz, PhD



Kaylia Edwards

Mentor: Samuel Young, PhD

Brian Khov

Mentor: Janice Hwang, MD, MHS

Lindsay Sheft

Mentor: Jessica Thaxton, PhD

Paris Kiehl

Mentor: Owen Fenton, PhD

Chase Solomon

Mentor: Qingyun Liu, PhD

New CBP Curriculum Students!

Career Exploration & Development

Insights into the Non-profit Sector

Interviewed by Zachary Williamson, PhD

Many scientists build their careers and positively impact human health and society outside of academia. Here is a discussion with one in the non-profit sector.

I recently sat down with my wife, Caroline Smith, who is the Senior Director of Foundation and Scientific Partnerships at The V Foundation for Cancer Research to talk about what career development advice she has for current students. Smith received her PhD from the University of Kentucky in Jessica Blackburn's lab where she studied a protein phosphatase's role in pediatric leukemia.

How do you use your scientific training from your PhD in your role?

I use my scientific training a lot, not so much the specific protein I studied, but more so the types of work I did. I review certain grants that come into the V Foundation, depending on how comfortable I am with the specific research field. I also use my scientific training to communicate the scientific importance and relevant scientific needs to grant donors in lay terms. I use my scientific training to access scientific studies during the granting process. All our grantees submit annual progress reports, and I review them as a part of the post-award process to check their research progress and spending of V Foundation grant funds. I would not be able to do this without my PhD training.

How do you use the non-science skills you developed during your PhD in your current role?

I use critical thinking all the time. Anytime someone from the fundraising team comes to me with a new donor opportunity, I try to figure out the puzzle of how best to apply their donation so it is granted effectively within the V Foundation. It's a lot like planning an experiment. That to me is what's fun, I'm constantly being creative and finding new solutions to problems. I also spend a lot of time managing relationships. In your PhD, you are managing the relationship with your PI and other lab members, and maybe sometimes a collaborator. In my position, I manage relationships with our fundraising teams, other foundations, and partners and donors. Just like a scientific collaboration I am trying to figure out how we can meet in the middle and work together to get the best outcome.

Caroline and Zach at Rupp Arena in Lexington, KY after her Doctoral Hooding Ceremony in May 2023.

Was there a critical moment during your PhD training that helped you land your first position?

I did an internship at the Office of Foundations and Corporate Philanthropy in the 4th year of my PhD. My PI had a connection in this office and brought it up during one of our monthly "Career Development" lunches. I did this internship for about six months, balancing the 6-8 hours a week in the Philanthropy Office with the normal load of being a 4th year graduate student, and my PI not only gave me the space to do it but encouraged me along the way. After the first six months, my PI encouraged me to negotiate a paid position if I wanted to keep working there, which I did for an additional six months. That year of experience was so crucial when I applied and interviewed for my current position; it really set me apart from the other candidates.

Caroline stands mid-court at Madison Square Garden before the 2025 Jimmy V Classic.

What advice do you have for current PhD students?

Find good advocates. For my career, I knew I needed solid references. I was lucky my PI was supportive, but I had a large team of advocates from the Cancer Center Career Development and Education offices and my internship mentor. Another note is, once you figure out the career you want, research the types of jobs that exist in that field. I learned about the Health Research Alliance, a member organization of medical research non-profits, while I was still a student. I did many informational interviews with so many people whose jobs and careers interested me. These were all cold calls, and no one ever turned me down.

Throughout graduate school I tried to tell myself that earning my PhD was not an end but a beginning. I did not go to graduate school just to have a PhD; I went to pursue my career, and I needed a PhD to get there. This helped me see beyond my defense day and kept me motivated despite the difficulties of graduate school.

A fun anecdote about my current position is that the V Foundation was always my top career choice. I always wanted to work there. When I defended, there was an opening at the V Foundation for a coordinator-level position that required a bachelor's degree and minimal experience. I was overqualified, but I applied anyway. I got rejected for that job, but a few days later the hiring manager for my current position reached out and said, "I saw your materials and I think you would be great for this other position we're posting." Just put yourself out there. The worst someone can say is no, and if they do there's always someone else who will say yes.

This interview has been edited for length and clarity.

Congratulations

to the inaugural cohort of the

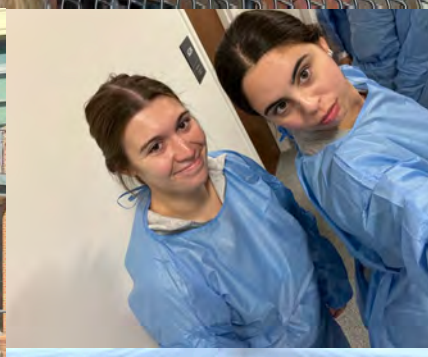
Cell Biology and Physiology Biomedical Master's Program

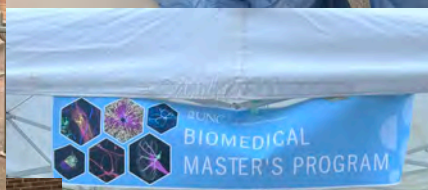
Commencement Ceremony
May 8, 2026, 2:00 - 4:00 pm, MBRB 2204








BIOMEDICAL
MASTER'S PROGRAM







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

bit.ly/3EBrzN5

@unc-cbp

@UNC_CBP

@UNC_CBP