

DEPARTMENT NEWS

Perfect Chemistry: Two UTC Young Alums Land Research Fellowships

Two recent graduates of the University of Tennessee at Chattanooga's Department of Chemistry and Physics have been awarded prestigious national fellowships.

Christine Rukeyser, an Innovation in Honors student in the UTC Honors College who received a bachelor's degree in chemistry in December 2023, and Bre-Anna Willis, recipient of a bachelor's degree in chemistry in December 2022, have been selected for the National Science Foundation Graduate Research Fellowship Program (NSF GRFP)—a highly

competitive program that supports outstanding graduate students in STEM (science, technology, engineering and mathematics) fields.

Rukeyser, mentored by UTC Assistant Professor of Chemistry Meredith Barbee, will begin a Ph.D. program at Northwestern University in the fall. She is currently a post-bachelor's research associate at Oak Ridge National Laboratory.

Willis was mentored by Associate Professor of Chemistry John Lee during her time as a UTC undergraduate. She is now a Ph.D. student and graduate teaching assistant at the University of Connecticut.

According to its website, the purpose of the NSF GRFP is to help ensure the quality, vitality and diversity of the scientific and engineering workforce of the United States. The five-year fellowship provides three years of financial support, including

an annual stipend of \$37,000.

"The NSF GRFP is supporting a new generation of engaged scientists who will make their mark on the world," said Dr. Trey Straussberger, director of the UTC Office of National Scholarships. "For UTC, which serves a wide range of students, to have two former students receiving the award in one year is an amazing accomplishment and reflects the strong and engaged mentorship that faculty—in this case, the faculty in the chemistry department—provide for our undergraduates.

"When you see the results pop up that you had two different students who won, it's just a moment of joy and elation. You know that this scholarship is going to change these students' lives."



UTC chemistry alums Christine Rukeyser, left, and Bre-Anna Willis have been selected for the National Science Foundation Graduate Research Fellowship Program. Photos by Angela Foster.

Christine Rukeyser

During her time as a UTC undergraduate, Rukeyser was accepted into the Fulbright Canada Mitacs Globalink program, an international education experience under the Fulbright umbrella for U.S. students interested in traveling to Canada to undertake advanced research projects in their area of interest.

When the Knoxville, Tennessee, native won the award in 2022, she was the first UTC student in recent years in the STEM field to receive a Fulbright internship.

"Christine consistently displayed a desire to take ownership of her work and showed persistence in solving research problems," Barbee said. "Her self-motivation, organization and time management skills propelled her to success, and she aims to consistently improve her skills."

Rukeyser completed her honors thesis in Barbee's lab on stress-sensing in epoxy adhesives.

Following the honors thesis, Rukeyser completed an REU—short for Research Experience for Undergraduates—at Princeton University's Center for Complex Materials. Rukeyser worked in Professor Emily Davidson's lab, where her work focused on synthesizing degradable polymers.

"Upon returning to UTC, she rejoined my research group and began working on her GRFP proposal," Barbee said. "She was motivated to build on her work at Princeton.

"I look forward to continuing to be a mentor and eventual scientific colleague as she continues her career."



WHEN THE KNOXVILLE, TENNESSEE, NATIVE WON THE AWARD IN 2022, SHE WAS THE FIRST UTC STUDENT IN RECENT YEARS IN THE STEM FIELD TO RECEIVE A FULBRIGHT INTERNSHIP.

Willis, a native of Clarksville, Tennessee, is pursuing a Ph.D. in inorganic chemistry at the University of Connecticut—where she is a member of the Ung Research Group.

Lee called Willis an excellent experimental chemist and researcher with a highly inquisitive mind, outstanding laboratory technique and an "appropriate personality for collaborative work."

"She excelled in the laboratory component of the chemistry curriculum," Lee explained. "Laboratory work comes to her naturally.

"Her laboratory work in a short amount of time at both UTC and at the University of Connecticut (summer 2022 REU) clearly demonstrated she can translate knowledge into action."

Lee said Willis shows a passion for learning and chemistry that "is unquestionable," placing her in the "top 1%" of the undergraduate researchers he has worked with since joining the UTC faculty in 2010.

"The potential, the drive to be great and the work ethic are all there," he said, "and I have no doubt that she will continue to grow as a student and a professional during her graduate studies at UConn. Indeed, upon completion of the Advanced Inorganic Chemistry class and subsequently joining my research group, she said, 'I feel at home in this chemistry.' She took off from there.

"I am thrilled for Bre-Anna and this accomplishment."

Bre-Anna Willis



LEE SAID WILLIS SHOWS A PASSION FOR LEARNING AND CHEMISTRY THAT "IS UNQUESTIONABLE," PLACING HER IN THE "TOP 1%" OF THE UNDERGRADUATE RESEARCHERS HE HAS WORKED WITH SINCE JOINING THE UTC FACULTY IN 2010.

IN MEMORIAM

Professor Benjamin Gross



Ben Gross, left, is pictured with Irvine Grote, right, who is presenting him with a "Chemist of the Year" award from the American Chemical Society.

Professor Emeritus and former department head Benjamin Gross passed away on Dec. 20, 2023.

Gross was the older of two brothers born to parents who lived in Birchwood, TN. Ben was born on July 23, 1930. His brother Harry was born seven years later. The boys' parents were both teachers at Birchwood School which covered first grade through high school. Gross attended Birchwood School for all twelve grades. His parents, in addition to teaching, had a small farm with their primary crops being potatoes and strawberries.

His father died the week before Gross started college in 1948 at the then-University of Chattanooga, now UTC. When he entered college, Gross knew he wanted to be a chemist. The first year of college, he lived with an aunt in north Chattanooga and worked part-time at a tar company in town.

Dr. Irvine Grote provided significant portions of his chemistry instruction. Professor Grote recognized in Gross a highly motivated and talented young man. Grote urged Gross to go to graduate school. He did and was able to secure a National Science Foundation (NSF) grant to help fund his advanced studies at the University of Tennessee at Knoxville. He completed M.S. and Ph.D. degrees in organic chemistry in four years.

After completing his Ph.D., Gross wanted to return to the Chattanooga area where he grew up and to be nearby to help his mother. He obtained a job at Chattem Drug and Chemical Company where his mentor, Grote, worked part-time as a consultant. Grote was employed as a professor at the University of Chattanooga

and served as head of the Chemistry Department. Grote often traveled, and when he was out of town, he had a standing arrangement for Gross to cover teaching duties.

Helen Bellamy, a UC chemistry major, first encountered Gross when he provided instruction in a course during one of the times that Grote was out of town. After graduation, Helen taught chemistry at Notre Dame High School. Later she worked full-time at Chattem. Gross worked for eight years as the chief research chemist at Chattem. Gross and Bellamy got to know each other while both were employed at Chattem.

The year 1964 was a busy one for Ben and Helen. The two started building a house in May, got married in July (they later raised two sons) and Gross started a new job teaching at the University in August. Gross started his academic career as an associate professor and as head of the department.

Gross was at the University of Chattanooga in 1969 when it and a predominantly Black junior college affiliated with the state system to create the University of Tennessee at Chattanooga, the UTC of today. Gross recognized the importance of this transition to provide increased financial support for infrastructure and classroom and lab instruction and to provide enhanced educational opportunities for students in Chattanooga and surrounding areas.

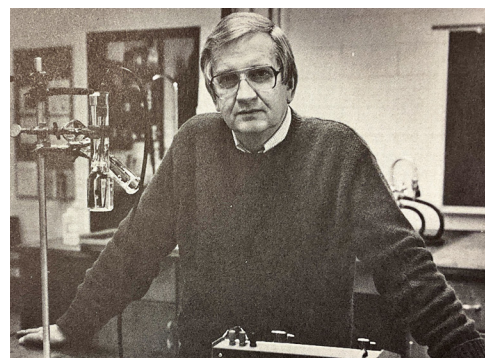
One of Gross's proudest accomplishments was assisting in the transformation of Chattanooga from its national designation as the "Dirtiest City in America" to the environmentally oriented city that it is today. In the early 1970s, the mayor of Chattanooga appointed a committee to deal with the air pollution and particulate matter that plagued Chattanooga. This problem was due to both the location of Chattanooga in a natural bowl surrounded by mountains and ridges and also its important but polluting industrial output. This committee worked tirelessly to help push the local industry to clean up.

One time, Gross accidentally left his briefcase filled with papers to grade on the top of his car when he headed home from the University. A man later appeared at their door with the briefcase. He came in and sat down. He was thanked profusely but showed no signs of leaving until he was offered a suitable reward. After the reward was secured, the man immediately left. At

that point, Gross could turn to his grading.

Among other honors, Gross was twice selected to represent the University of Tennessee as a UT National Alumni Association Teaching Award recipient. Each year two faculty were selected from each UT campus for this high honor. Another recognition of Gross's teaching ability was that when Lamar Alexander, former governor of Tennessee, became president of the UT System, it was Gross's organic chemistry class that he attended as part of his listening and learning tour of UT campuses including UTC.

Gross retired at age 70. He passed in 2023 shortly before his 93rd birthday. Gross and his wife Helen were married for 59 years. Although Gross is no longer with us, his influence and spirit live on in our now enlarged Department of Chemistry and Physics. He was key to expanding the department through his hires in the 1970s and 1980s and increasing the number of students. Ben always displayed care for students and faculty, recognized and encouraged the role of student and faculty research, and was keen to provide the best science education possible.



Dr. Ben Gross pictured in the lab at UTC.



The UTC chemistry department faculty in 1986, while Dr. Gross was department head. Gross was the head when most of the people in this photo were hired. Back row, L to R: Professor Mebane, Professor Lynch, Professor Grant, Professor Rybolt, Laboratory Technician Jimmie Narramore, Professor Kutz, and Professor Waddell. Front row, L to R: Professor McNeely, Professor Gross, Sharon Rose, and Professor Meyer.

Chemical Company Has UTC Molecules All Over It

Pick a shampoo or conditioner from Walmart. Any Walmart.

Even though the Colonial Chemical name is not on the label, there's a good chance the molecules are from the South Pittsburg, Tennessee-based company, which is home to 16 current University of Tennessee at Chattanooga graduates—nine of them with undergraduate degrees in chemistry or chemical engineering.

In 2021, when UTC needed to replace an aging device called an ultra-performance liquid chromatography-tandem with mass spectrometer (UPLC-MS), an expensive apparatus for analyzing molecules, Colonial Chemical chipped in \$55,000 of the estimated \$170,000 cost.

The device determines what molecules and their concentration are in samples provided by Colonial Chemical, which specializes in developing surfactants most common in detergents, shampoos and soap. Those molecules are then sold to manufacturing companies.

Surfactants—soaps, in Colonial's case—are chemical compounds that decrease the surface tension or interfacial tension between two liquids, a liquid and a gas, or a liquid and a solid. Surfactants function as emulsifiers, wetting agents, detergents, foaming agents or dispersants.

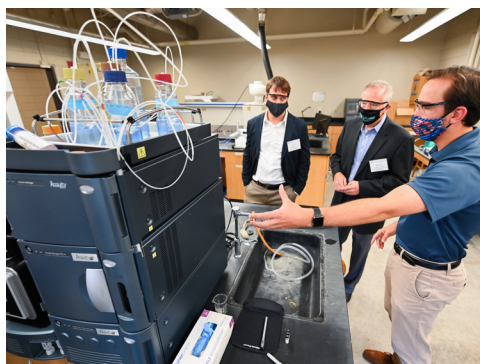
"Colonial has been a great partner for the chemistry program," said Dr. Gretchen Potts, head of UTC's biology, geology and environmental science department and UC Foundation professor. "Several of our graduates are employees, and they have collaborated on analyses with Dr. [Steven] Symes," a UTC chemistry professor. "The connections from that relationship resulted in financial support for the purchase of a new UPLC-MS. The instrument is an excellent tool for analysis and as an undergraduate program, chemistry is fortunate to have it available in our labs for use by our students and faculty."

Among Colonial Chemical's UTC graduates are Jason Santola (2005 chemistry), Andrew Lawrence (1995 master's in psychology: industrial/organization), Paul Moreland (2017 biology), Megan Blevins (2016 chemistry,



UTC alum Kacee Hedrick, front center, who graduated with a bachelor's degree in chemical engineering in 2020, leads a group of UTC chemistry faculty and students on a tour at Colonial Chemical in South Pittsburg, Tennessee. Photo by Angela Foster.

2019 chemical engineering), Kacee Hedrick (2020 chemical engineering), Katie Fox (2020 human resource management), Zechariah Avello (2016 chemistry), Carmen O'Hagan (2017 communication), Madison Holt (2017 chemistry: biochemistry), Derek Phillips



Zack Avello, Colonial Chemical's analytical chemist manager in the research and development lab at UTC Chemistry alum, gives a tour of the UPLC-MS in Grote Hall.

(1999 psychology), Robin Williams (2018 business administration: finance), Corey Barker (2016 chemistry), Krista Carson (2021 chemistry), Molly McEnery (2014 chemistry), Jordan Taylor (2020 chemistry) and Hunter Lowery (2021 biology).

Symes said the UPLC-MS is a powerful instrument with various applications, including allowing Erlanger Health System doctors to analyze metabolites in the bloodstream for early cancer detection.

"We need a sensitive instrument like this," Symes said. "Students get research

training on an industry workhorse instrument, and a drug-testing lab uses this for athletes. Students learn the ins and outs and how to set it up."

When chemistry professor Dr. Keenan Dungey, who heads the chemistry and physics department, came to UTC four years ago, he found a spectrometer that was 15 years old and required frequent cobbling.

The new device is "huge for us as a smaller department," Dungey said, adding that the technology can also be used for environmental analyses, such as tracing pollutants and impurities.

In Summer 2023, Colonial Chemical hosted the Summer Undergraduate Research Program for a tour of their facilities. Current students were able to meet alumni from the department and learn about their job roles.

Zack Avello, Colonial Chemical's analytical chemist manager in the research and development lab, graduated from UTC in 2016 and moved to Memphis before returning to the area and taking a job at Colonial Chemical through a Potts connection.

"There are plenty of us who came from UTC. It's a nice feeder system that produces awesome students. That relationship is very important to us," Avello said.

Dr. Robert Coots retired from Colonial in 2019 after nearly 20 years and now teaches a general chemistry lab at UTC.

He said the UTC relationship with Colonial bloomed through university contacts with professors like Drs. Doug



UTC Chemistry and Physics students in the Summer Undergraduate Research Program (URP) tour Colonial Chemical.

Kutz and current faculty member Thomas R. Rybolt, whose wife played against Coots and his wife in a local tennis league.

Among the UTC graduates at Colonial are O'Hagan, a regional sales manager and a 2017 communication graduate responsible for Colonial sales in eight northwestern states. Last year, she was

president of the Marion County Chamber of Commerce at age 25.

Coots noted that among UTC's graduates, Avello runs the analytics in the R&D lab, Santola is head of quality control and McEnergy was an intern and now heads the formulations group.

"Those are the kind of things Colonial benefits from and that we hope to continue," Coots said.

Dr. Lucas Moore, vice president of research and development at Colonial Chemical, said the 16 UTC (he's from the University of Alabama) graduates work in his department and in engineering, human resources, quality control, purchasing, sales and safety—"across the whole company. ... We use UTC's UPLC mass spectrometer. It's very expensive. It doesn't make sense for us to have one, so we pay a rental fee" for the one it helped buy UTC. "We can make new molecules and sell these products to companies

that make shampoos, detergents, conditioners, etcetera."

Coots said Colonial's fingerprints can be found universally. "Surfactants are Colonial's main products and they have a lot of them." He explained that "surfactants" is a contraction for the term surface active agents. "Surfactants are used for any product in cleaning of any kind, anywhere from the gamut of cleaning airplanes to shampoo or cleaning chicken plants. They also are very helpful in metal lubricants for activities like cutting, drilling and forming metal. They cut down on friction."

Moore sums up Colonial's commercial influence. "When you go to Walmart or Costco, you won't see Colonial's name on the products, but we're in soaps, conditioners, personal care wipes, car wash detergents, oil and gas agents, paint emulsifiers," he said.



STAFF PROFILES

Dr. Heather Riley

Dr. Heather Riley joined UTC in July of 2023 as the chemistry lab coordinator. They received their B.S. in chemistry from Cedar Crest College and their M.S. and Ph.D. from Iowa State University in organic chemistry and chemistry (chemical education). Before joining us at UTC, Riley was a full-time professor at Des Moines Area Community College in Iowa. After moving to Tennessee with their son to be closer to their chosen family, Riley then spent two semesters teaching at Cleveland State Community College. When not at work, Riley enjoys spending time with their son and family.



Zuan Xu

Zuan Xu joined the department in February 2024 as an accounting specialist. She holds a bachelor's degree in accounting from Dalton State College and is currently pursuing an Master of Accounting degree at UTC's Gary W. Rollins College of Business. Her primary objective is to ensure accurate transaction recording, demonstrating proficiency in reconciling accounts and utilizing accounting software such as SAP to facilitate departmental operations. Outside of work, Zuan enjoys cooking and walking her dog.

30 Years of Westbrook

For 30 years, the Westbrook Scholarship Program has helped first-year chemistry and physics students at the University of Tennessee at Chattanooga complete their degrees.

The scholarship provides \$14,000 over four years to eligible incoming freshmen in the UTC Department of Chemistry and Physics.

The scholarship was established in 1993 by UTC alumnus Howard L. Westbrook ('38), a Chattanooga native who attended Central High School and went on to work as a chemist for the Shell Oil company for 30 years.

Westbrook passed away in 2016, but his lasting legacy at UTC is embodied in these 2023 Westbrook Scholarship recipients.

2023 Recipients: Kylie Flores, Noah Wyatt, Savana Lawrence, Billy Hansen, Abigail Hurst, and Aidan Harrison.

STUDENT SUCCESS

Zayda Dominick

Zayda Dominick has some advice for first-year college students about getting involved in undergraduate research: Don't wait. Try it.

"I guess I never really thought of myself as the voice of research, nor did I ever think I'd end up in this situation at all. My whole thing was to try everything," said Dominick, a sophomore biochemistry major at the University of Tennessee at Chattanooga. "I had an inclination that I thought it would be cool, so I simply was like, 'Let's try it, and if it's not cool, move on to something else.'

"I tried it and realized how much I absolutely loved it."

In late October, Dominick and 13 other UTC undergraduates, accompanied by faculty from the Department of Chemistry and Physics, had the opportunity to present the results of their research at the Southeastern Regional Meeting of the American Chemical Society—known as SERMACS—in Durham, North Carolina.

Dominick, who presented research



Zayda Dominick in the biochemistry research lab.

she began during her freshman year titled "Understanding how NtrZ affects NtrY in *Caulobacter crescentus*," received an undergraduate poster award.

Her faculty mentor is UTC Assistant Professor of Biochemistry Benjamin Stein.

"Zayda's great. She came in as a freshman excited for research knowing she wanted to venture into the scientific

unknown. She has since really been dedicated and already has an experimental mindset," Stein said.

"She put a lot of work into making a really beautiful poster to present her data. It definitely paid off."

Dominick explained that bacteria was the focus of the research, as she studied how they respond to different environmental changes.

"There are specific proteins involved in that," she said, "so certain proteins will regulate responses. I just study the mechanisms of how those proteins work together to cause a response."

Dominick, who said her plans include pursuing a Doctorate of Medicine and Philosophy (MD-PhD) dual doctoral degree for physician-scientists, was asked what excited her about this type of research.

"The central dogma of chemistry is structure equals function," she said, "so I love studying how the structures of these proteins actually drive certain functions and mechanisms. It drives survival and how all these things can change and create a living organism, so I like that a lot."

STUDENT SUCCESS

Nehemiah Antoine

Nehemiah Antoine was the recipient of the Outstanding Senior Award and the Service Award at the Department of Chemistry and Physics awards banquet.

Antoine's four-page resume is filled top to bottom with his chemistry-related endeavors.

A Ringgold, Georgia, native, Antoine chose UTC because of his love for the city, he said.

His original plan was biology and eventually medical school.

"After doing research and taking more chemistry courses here, I found I actually have a very strong passion for chemistry."

Still wanting to incorporate his interest in medicine, Antoine focused much of his research on medicinal chemistry.

"I was always fascinated by the human body and ways to improve it," he said, "so I wanted to tailor my love for medicine along with my love for chemistry."

"I'm interested in the chemistry of drugs. I want to improve the drugs that are out there in the market and make them better and maybe even cure some diseases."

Antoine is a twice-published

researcher, which is something Dr. Keenan Dungey, head of the UTC Department of Chemistry and Physics and professor of chemistry, called "very impressive" for an undergraduate student.

Antoine's undergraduate departmental honors thesis is included in those publications, which he finished as a junior—another exemplary feat, according to Dungey.

"I didn't think I was going to get publications as an undergrad," Antoine said. "I thought that was more expected for graduate students. But really, it's because of my professor. My research professor pushed me to work hard and accomplish a lot."

Antoine's accomplishments include receiving the Tom Rybolt and Richard X. Zhang Undergraduate Research Chemistry Scholarship, working as a teaching assistant (TA) in various labs, serving as president of the UTC Chemistry Club, and presenting research results at meetings in San Juan, Puerto Rico and Long Beach, California.

When he won the outstanding senior award, he said, "I thought that one was probably the best

I've ever received. Not only do you need to make really good grades in chemistry, but you also have to be very involved in the department.

"I believe this award really does represent the fact that grades are only half the battle. There are also many other things you could do with your major and to show your love for it."

On top of academic diligence, Dungey said Antoine's kindness helped him stand out.

"That's who he is," Dungey said. "He's always the most positive person. If I ever need a boost to feel good, I just say 'Hi' to Nehemiah."



STUDENT SUCCESS

Olivia Ziemer

At a recent conference for undergraduate women physics majors, University of Tennessee at Chattanooga sophomore Olivia Ziemer initially found herself in awe, as “I’ve never been in a room of that many women in STEM (science, technology, engineering and math) in my life, which was awesome.”

She also awed the judges, returning to UTC with first prize in the poster competition.

During the weekend of Jan. 19-21, Ziemer—accompanied by physics majors Emery Rutledge and April Horn and UC Foundation Professor of Physics Tatiana Allen—attended the American Physical Society Conference for Undergraduate Women in Physics at Georgia Institute of Technology in Atlanta.

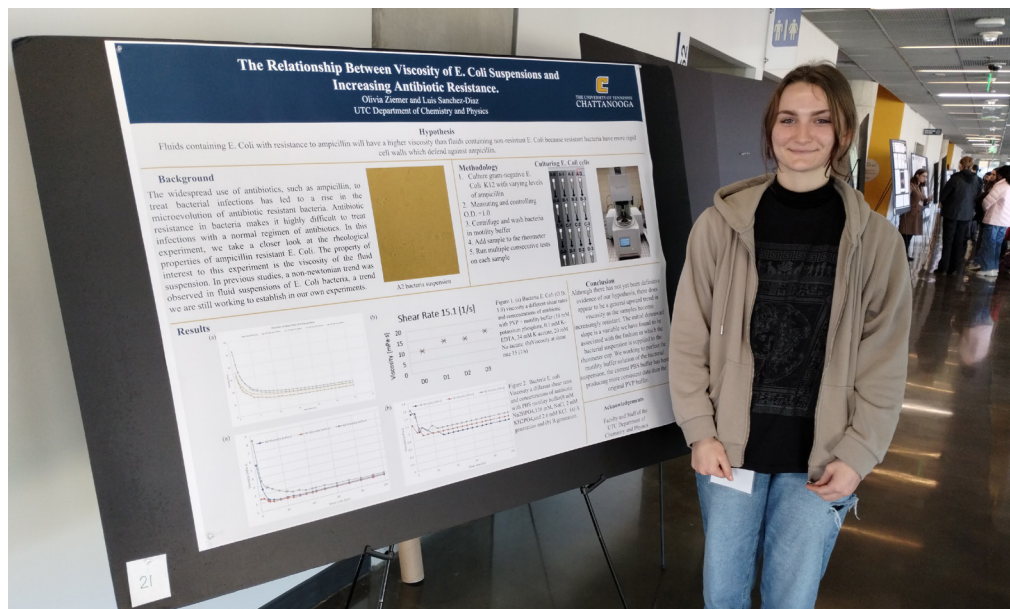
The goal of the conference, known as CUWiP, is to support female undergraduate physics majors by giving them access to professional conferences while participating in workshops on different topics—such as graduate school opportunities and how to be successful in the physics profession.

The three-day conference had more than 200 attendees and included visits to the Georgia Tech and Emory University laboratories.

Ziemer, a biophysics major and Brock Scholar in the UTC Honors College, presented a poster she started working on during her freshman year titled “The Relationship Between Viscosity of E. Coli Suspensions and Increasing Antibiotic Resistance.” The poster resulted from her year-long research with her faculty advisor, Assistant Professor Luis Sanchez-Diaz.

“It felt really good to be acknowledged for my effort,” said Ziemer, acknowledging that she was not expecting first prize.

“I was very surprised because Dr. Allen



UTC sophomore Olivia Ziemer stands in front of her poster, which received first prize at the recent Conference for Undergraduate Women in Physics at Georgia Institute of Technology. Photo courtesy of Dr. Tatiana Allen.

had suggested the day before that I try to win when giving my presentation,” she said with a laugh. “I was like, ‘I’m not super competitive. I don’t want to make myself nervous.’”

“It’s kind of a weird step to go from presenting research and speeches from a lab and bouncing ideas off of your advisor to presenting it to people you didn’t know.”

She called the poster a great way to start working “on your scientific vocabulary” and making it accessible to people “who have no idea what you’re doing.”

The research centered on the property of the E. coli bacteria. “As they become ampicillin resistant, cells become more rigid,” she explained, and her work included collecting microscopy data to see how a single cell’s rigidity translates to the viscosity of an entire population.

Originally from Tigard, Oregon, Ziemer and her family moved twice during her

high school years—first to the Charlotte, North Carolina, suburbs and then to the Chattanooga area. She completed her senior year as a dual enrollment student at Chattanooga State Community College before enrolling at UTC.

“I’m really happy that I came here because the physics department is small and very tight-knit, which is great,” she said. “I love the size and the community, and I know all of my professors on a first-name basis.”

Ziemer, Rutledge and Horn are all members of the UTC chapter of the Society of Physics Students (SPS). Ziemer serves as the student organization’s secretary for the 2023-24 academic year.

The CUWiP trip was sponsored by the Physics and Astronomy Gift Fund and the UTC Office for Undergraduate Research and Creative Endeavor (URaCE).



Baker Garrison

“My first semester here, I had no idea about undergraduate research, but I took a scientific communications class that opened my eyes to all the research going on at UTC. That really intrigued me, so I went around and talked to all the professors and eventually settled with Dr. Steven Symes on the project I’m working on now. It is an untargeted metabolomics project, where we are essentially trying to develop a new test for endometrial cancer that is far less invasive

than the current testing methods. Survival rates are directly related to how early you catch the cancer, and hopefully this test will allow cancer to be caught earlier.

The professors are wonderful and there’s a great sense of community within our department. It’s a smaller department than many schools, so you get one-on-one time with professors, have access to instrumentation that you might not have at other schools, and due to the small size, you get to use it all. It feels like I’m doing something good for the world.”



ALUMNI SPOTLIGHTS

Dr. Marian Axente

Dr. Marian Axente graduated from UTC with a bachelor of science degree in physics in 2007. He earned a doctoral degree in medical physics from Virginia Commonwealth University in 2012. He is currently an assistant professor of radiation oncology at the Emory School of Medicine in Atlanta, specializing in therapeutic medical physics. Axente spoke with current UTC students at a spring 2024 SPS (Society of Physics Students) meeting.

His advice for current students: "In my

sophomore year I was introduced to the field of medical physics by a local clinical physicist working at Erlanger Hospital. From that moment, it was a long journey of me adopting the field as a career. Grab hold of all opportunities to learn from those that come and give back to young learners. We do so because we care. Make those moments meaningful for them and for yourselves by paying attention and scouring their expertise in any means possible!"



Jeffrey Duke

Jeffrey Duke graduated from UTC in 1986 magna cum laude with a bachelor of science degree in chemistry. He worked for 15 years as an analytical chemist for Monsanto Ag in St. Louis, MO.

In 2002, he graduated with a J.D. from the St. Louis University School of Law. He is now in private practice as the owner and managing member of Duke Legal, LLC. He is licensed to practice law in Missouri and Tennessee and lives in the Chattanooga area.

His top advice to students? "Never assume where your foundational degree will take you!"

Duke fondly remembers how accessible

his professors, Drs. Gross, Mebane, Waddell, Kutz, Lynch, Grant and Rybolt were. Other key memories are his 8 a.m. advanced inorganic lecture with Dr. Grant with its ferrocene lab and ACS final exam, being scolded by Dr. Kutz on the first day of pchem I for answering a question in British units rather than metric, solving the Schrödinger equation in pchem II for the hydrogen atom, watching the space shuttle Challenger explosion in the library, Dr. Gross's distinctive voice and enthusiasm and his research advisor Dr. Mebane getting one of the earliest Macintosh Computers.

Summer Research

Summer 2024 marks the 38th annual Undergraduate Research Program.

Last year in Summer 2023, 23 students participated. During the school year, 60 students earned credit for research and one student completed a departmental honors thesis.

Jackson Ricketts

(Josh Hamblen, mentor)

"Simulation and Analysis of Charged Particle Activity and Detector Efficiency for the Nab Experiment"



ALUMNI SPOTLIGHTS

UTC Chemistry Grad Caitlyn Randolph's Research Wins National Recognition

University of Tennessee at Chattanooga graduate Dr. Caitlin Randolph is the winner of one of academia's most prestigious and highly competitive fellowships for researchers within chemical sciences and instrumentation, and she attributes the win to UTC.

In 2016, Randolph graduated from UTC with degrees in biochemistry and applied mathematics. Four years later, she completed a Ph.D. in analytical chemistry at Purdue University in West Lafayette, Indiana. In 2022, as a Purdue-based researcher, she won the Arnold O. Beckman Postdoctoral Fellowship in Chemical Instrumentation.

As a member of the 2022 class of Beckman fellows, Randolph is among 14 exceptional researchers across the country who are receiving more than \$4.3 million in funding over three years.

And for her, it all goes back to her time at UTC.

"UTC provided a rich learning environment for me. I had direct interaction with all my professors, allowing me to learn from them firsthand, creating more of a mentor/mentee relationship as opposed to a teacher/student one," she said.

Randolph was awarded the Beckman fellowship for her research on new analytical tools to enhance the understanding of fatty compounds known as lipids in neurodegenerative diseases including Alzheimer's disease.

Among the various functions of lipids in the body are moving and storing energy, absorbing vitamins and making hormones.

When Randolph visited UTC in May 2023 to deliver the keynote presentation for the Department of Chemistry and Physics' annual summer Undergraduate Research Program, she discussed her continuing research into tools to better understand lipids.

Together with her Purdue colleagues, Randolph is working to further develop these tools for use in analysis of single cells. Doing so would enhance understanding of the role of lipids in biological processes while also



answering fundamental questions of lipid diversity within individual human cells.

As a UTC student, Randolph worked on research with UC Foundation Professor of Chemistry Steven Symes. Their collaborations began when she was a freshman and continued until she graduated.

"My time with Dr. Symes was integral to my development as a scientist—and a person. He patiently taught me the 'ins and outs' of proper lab procedures; how to critically think through research problems and execute research projects," Randolph said. "He instilled a passion for academic research in me, fostering a love for exploring the unknown.

"He was instrumental in building my self-confidence while also giving me the proper space to fail—something that is often overlooked in scientific training. He taught me to not fear failure, but to even embrace it, as much learning can happen from what we perceive as failure."

Symes said he feels "fortunate to have worked with such a bright and dedicated individual."

"She worked on a variety of projects in my lab," he said. "Caitlin mastered complex analytical techniques such as liquid chromatography-mass spectrometry and scanning electron microscopy. She gave several presentations at regional and national conferences that were always well-received and generated much interest."

E MOCS GIVE DAY

OCTOBER 1, 2024

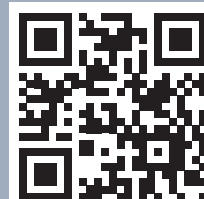
The third annual one-day fundraising effort known as Mocs Give Day was organized in October 2023. The generosity of our donors was amazing! We raised \$5,025. The funds were used to support student conference travel and programs at the Clarence T. Jones Observatory. This year, Mocs Give Day will be on October 1.

MocsGiveDay.utc.edu

GIVE TODAY!

SHARE YOUR ALUMNI NEWS

Please send your news to share on our social media or in the next edition of *Mocs Matter*.
alumni.utc.edu/update



FACULTY SPOTLIGHT

Quantum Leap: UTC connected to EPB Quantum NetworkSM

In 2022, UTC started an institutional initiative in quantum information science and technology with a goal of establishing a program known for excellence in education, innovation and economic development enabled by quantum technology.

"The effort develops cross-disciplinary teams that perform applied research and development and deliver an effective education program of great value to students and individuals already in the workforce," said UTC Vice Chancellor for Research Reinhold Mann. "Of particular interest are use cases of the technology in advanced energy systems and in smart city applications."

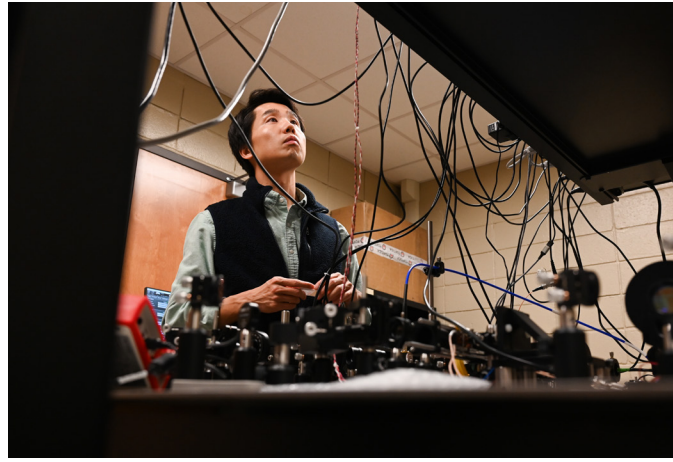
The initiative engages departments and programs in STEM disciplines (science, technology, engineering and math) and non-STEM disciplines—communications, sociology, economics, entrepreneurship and more—and it will advance collaborations with partners in Chattanooga, in academia and industry.

Quantum optics expert and UTC assistant professor of physics Dr. Tian Li joined UTC in 2022 because of the University's strategic focus on quantum science and creating "quantum opportunities." Prior to UTC, Li was an associate research scientist in the Institute for Quantum Science and Engineering and the Department of Biological and Agricultural Engineering at Texas A&M University.

"My research interests lie primarily in the area of experimental quantum information science and engineering," Li said. "I use atomic vapor as well as nonlinear optical crystals to generate quantum correlations and entanglement for quantum information, quantum communication and quantum sensing investigations."

Li was raised in a middle-class family in the city of Urumchi, China, where both parents were engineers. He was a track and field athlete from junior high to his junior year in college before graduating from Beijing Normal University with a bachelor's in physics. He earned a master's from University of Nevada and his doctorate from the University of Maryland.

When he's not teaching students or in the lab advancing the frontiers of quantum optics, he's trying to master the acoustic guitar and



Assistant Professor of Physics Tian Li works in the UTC Quantum Physics lab (photo credit: Angela Foster).

with his wife, Xingchen Wang, enjoying time with their 4-year-old son, Noah.

"Among all the physics subfields, quantum physics is the most fascinating one to me," he said. "Quantum physics provides the most accurate description of the world around us; it has provided a way to synthesize and simplify the many seemingly disparate processes we encounter. Quantum technologies are transforming communication, computing, information processing and sensing. I would like to extend the impact of these technologies so that they can be beneficial to the general public as well.

"I'm honored to be part of the campuswide Quantum Initiative. Together, we can make UTC a quantum hub in the southeastern part of the United States," he said.

Quantum sensing, he explained in a prior interview, "is basically measurement using photons" — particles of light. "We use photons to do the sensing, and quantum sensing is the field of study that uses quantum states of light to develop highly sensitive detectors to measure physical properties such as absorption, temperature, magnetic fields, chemical fields and so on," Li said. "I made my decision to come to Chattanooga because the quantum initiative here is one of the strategic plans the whole school [UTC] is trying to push, a place for quantum opportunities," he said. "I'm really impressed by the scenery of the city; it's a good place to live and raise a family. I'm extremely happy I made this decision."

In 2024, the Quantum Initiative achieved a major milestone when The University of Tennessee at Chattanooga became the first academic institution to be connected to EPB Quantum NetworkSM powered by

Qubitekk. In late 2022, EPB and Qubitekk jointly launched the nation's first industry-led, commercially available quantum network for running equipment and applications in an established fiber optic environment. UTC is connected to the network via a node within a quantum technology laboratory on campus and Li has been an essential part.

"We appreciate the collaborative relationship with EPB and Qubitekk leading to this extraordinary

milestone in the development of our education and research programs," said UTC Chancellor Steven R. Angle.

EPB CEO and President David Wade cited the importance to the company of UTC's involvement.

"Having UTC connected to EPB Quantum Network is integral to our strategy to prepare our community with the education they need to be successful in the quantum age," Wade said. "Amazing work is being done in universities across the country and here at UTC. Having a path to move research from academia and into practical application is possible with a quantum-prepared workforce like the one we're developing in Chattanooga. This could put our city at the forefront when quantum companies consider where to locate their operations."

Qubitekk Co-Founder, President and CTO Dr. Duncan Earl added, "Having a node on EPB Quantum Network makes UTC the first university in the country with access to a commercially managed quantum network, exclusively available in Chattanooga. Moreover, UTC's quantum node allows them to continue growing their quantum program and establishing R&D collaborations with quantum players from around the country."

UTC's quantum technology lab is in the University's Multidisciplinary Research Building on East ML King Boulevard, co-located with activities of the UTC Research Institute, Interdisciplinary Geospatial Technology Lab and doctoral program in computational science.

"We are excited about making use of the EPB network to advance experiential learning in quantum technology, including quantum sensing applications," said Li.

FACULTY SPOTLIGHT

Less Painful, Less Scary: UTC Researchers Looking For Better Way To Screen For Cancer

Screening for endometrial cancer, a type of cancer that begins in the uterine wall, can be an invasive, uncomfortable and frightening experience for many women. Two professors and their colleagues at the University of Tennessee at Chattanooga are trying to make the procedure much simpler and less scary.

UC Foundation Professor Steven Symes in the Department of Chemistry and Physics and UC Foundation Professor Sean Richards in the Department of Biology, Geology and Environmental Science are testing whether blood samples can be used to screen for endometrial cancer.

The research team included Baker Garrison before he graduated in May 2024 with a bachelors in chemistry. Dr. Kris Amrhein, who graduated in 2017 from UTC with bachelor's degrees in biochemistry and biology, also is a team member; he earned a master's and Ph.D. in analytical chemistry from the University of Memphis.

Detecting endometrial cancer requires an invasive biopsy in which a small tube is inserted through the cervix into the uterus and a tissue sample is taken from the uterine lining. The sample is then examined under a microscope. The new test only would require blood being drawn and run through a spectrometer. Computer software will then indicate whether there are blood-borne indicators of possible cancer. If so, further tests will be recommended.

Symes stresses that the experimental endometrial cancer test does not provide a positive indication of the disease. "We're not diagnosing cancer," Symes said. "If you're positive on our screening test, that means much more significant follow-up is needed."

When it hasn't spread outside the uterus, endometrial cancer's five-year survival rate is 96%, according to the American Cancer Society.

For the research, blood comes from patients at Erlanger Hospital. The samples

include patients who have cancer and those who don't, Symes said. Samples aren't labeled, he said, so there is no indication whether it's healthy or unhealthy blood.

The screening process has been shown to be accurate through research conducted by Dr. Jacopo Troisi, a professor in the Department of Chemistry and Biology at the University of Salerno in Italy and CEO of Theoreo Srl, a research company. But those results must be duplicated elsewhere to validate their findings, Symes said.

At UTC, no actual blood samples have been used at this point. The focus right now is on calibrating the equipment used to run the tests. It's different than what was used in the Italian research, Symes said, so getting the same results from different equipment will solidify the validity of the technological process and the results—a necessary step in the overall research.

Once confirmed as accurate, test results from blood samples can be used to determine whether other factors—such as eating habits, genetics and environmental conditions—may influence the presence of cancer.

"If there's really something there, and it's really due to just human biochemistry, there may be factors that change things a little bit," Symes said.

Over the years, through his collaborations with Erlanger doctors in his toxicology research, Richards has collected some of the blood samples used in the research. He also developed the questionnaires that patient volunteers are



Professor Steven Symes and Baker Garrison '24 are part of a faculty and student team testing whether blood samples can be used to screen for endometrial cancer. Photo by Angela Foster.


asked to fill out.

Once substances indicate the possible presence of cancer, Richards said he wants to trace backward to see if there are any reasons why these patterns crop up. "We can then go back and say, 'OK, this pathway is associated with exposure to this metal or this pesticide,' and then we start looking back on the woman's history," Richards said. "We need to know what their lifestyle's like. Do they smoke? How many children they've had and so forth."

Ultimately, tests similar to the ones used for endometrial cancer may be developed to screen for many types of cancers, Richards said. "We could screen them once a year, twice a year, three times a year through blood or saliva or urine, something very easy to collect and say, 'You're showing biological markers that cancer is developing,' and this is without going in and taking tissue samples," he said. "If it's something very simple, then we can increase the screening rate and we can get more women in there."

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