

## BIOLOGY/ALLIED HEALTH DEPARTMENT

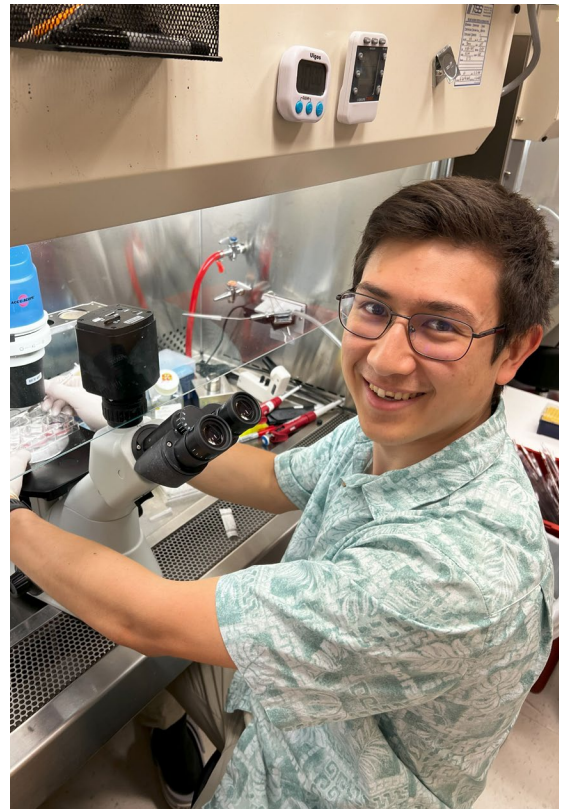
# STUDENTS IN RESEARCH

*By John Hargy, junior biophysics major*

For six months of this year, from the winter semester through the end of summer, I had the privilege of being a full-time researcher in a developmental biology lab at the University of Pennsylvania.

To begin my scientific journey, I was paired with a postdoctoral researcher to assist in his project of using human induced pluripotent stem cells (iPSCs) to grow human fetal adrenal gland cells in vitro. iPSCs are stem cells generated directly from adult cells by reprogramming them back into a pluripotent state, where they can differentiate into various cell types. These stem cells, if coaxed into the developmental trajectory toward adrenal tissue, could be potentially utilized in a cell-based therapy for treating adrenal disorders.

As part of the project, I spent considerable time in the cell culture room, carefully culturing organoids in clusters of 96. The induction process started from iPSCs and lasted approximately six weeks, with a medium change every few days. The medium consisted of a complex cocktail of various growth factors, inhibitors, and hormones. Every new set of inductions would have a slightly different medium composition to experimentally determine which compounds and concentration resulted in a closer resemblance to fetal adrenal tissue.

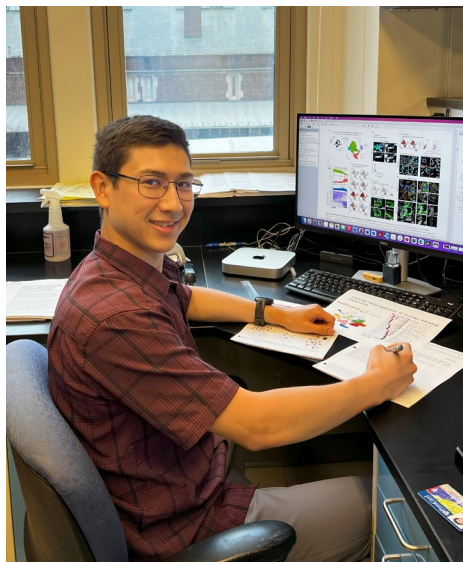


*John Hargy in wet lab.*

Since many of the genetics and mechanisms involved in adrenal gland development are unknown, my first large project was to create a cell reporter for the HSD3B2 gene, using the enhanced green fluorescent protein (EGFP) insert. EGFP emits a bright green fluorescence and, when fused to a gene of interest, allows the

**Students in Research, cont. on page 2**

Life Sciences



*John Hargy analyzing sequencing datasets.*

visualization of spatial and temporal gene expression patterns within living cells. The creation process, which takes months, taught me numerous molecular biology techniques and skills, including patience.

In addition to wet lab, I spent a portion of my time computationally

analyzing single cell sequencing datasets. Single-cell RNA sequencing (scRNA-seq) provides gene expression profiles at the individual cell level. I would use scRNA-seq data to compare the gene profiles of our lab-grown in vitro adrenal gland cells to in vivo fetal adrenal gland cells. This data provided a way to visualize where our lab-grown cells were along the fetal adrenal gland trajectory.

Doing this kind of intellectual work was deeply rewarding on a personal level, because my efforts in the lab contributed to the body of knowledge. The work was humbling, as well, since every day I would be reminded of the awesome majesty of God. It is impossible to conceive of a universe without a Creator responsible for the sheer complexity of life here on Earth.

For me, research is the perfect intersection between the academic

rigor of classes and real-world applicability. In research, I engaged with science in its raw form and gained an understanding of how to frame hypotheses, conduct experiments, and analyze data. The symbiotic relationship between academic coursework and practical research experience has significantly enhanced my educational journey.

Even with modern technological advancements, we have only a fraction of the possible knowledge about human biology. Modern medicine is ineffective for numerous diseases, offering palliative rather than curative interventions. The most important and significant discoveries are still waiting to be made. I encourage everyone to engage in a summer of research; it will prove to be a transformative experience.

## STUDENTS IN SERVICE

*By Emmanuel Izquierdo, sophomore biomedical major*

As the plane descended in Beirut, Lebanon, I felt a rush of excitement. I was nervous to live and serve in a place where I knew no one. Once I stepped outside the airport, I felt like I was in a new world, where the people spoke a different language and carried themselves differently.

During my time here, I have learned so much and been exposed to many new things. I had never taught a class in my life, and now I find myself teaching English to Syrian refugees through an Adventist nonprofit organization called Winners.

The first few days were very challenging, and a few students even told me that they didn't want me here. This

was discouraging, but I began praying a lot for my students and specifically about the classes. I felt extremely unqualified and worried that they weren't learning English well. During challenging moments, when I feel insufficient, I have always clung to 2 Corinthians 12:9 (NKJV), which says, "And He said to me, 'My grace is sufficient for you, for My strength is made perfect in weakness.' Therefore most gladly I will rather boast in my infirmities, that the power of Christ may rest upon me."

This verse reminds me that despite my weakness, Christ's strength can be shown! As classes have progressed, the students have started warming up to me and showing a lot of love. They began turning in their work with notes of

appreciation and small tokens of gratitude, such as picking flowers before they come to class and sharing them with me. This has been an answer to prayer, and whenever these kids express love to me, I feel like it's also God showing me love and letting me know that He is there for me no matter what.



*Emmanuel Izquierdo with a student.*

**Students in Service, cont. on page 3**

Another new thing I have been exposed to is the Islamic religion. During my first night here, I was awakened at 4:30 a.m. by what sounded like a man singing into a megaphone in the distance. It was loud enough to be heard in the whole town. That was the first of five daily prayers at the mosques. I was amazed at the dedication of the people and the fact that they wake up so early EVERY DAY to pray. This, of course, made me think about my prayer life. On some days I find myself praying only before meals or when I am in situations that remind me to pray. What's sad to me is that the people I am supposed to be sharing Jesus with seem to be more dedicated to God than I am. This has opened my eyes and encouraged me to put more effort into my relationship with God. I now ask Him to give me the desire to seek diligently and serve Him wholeheartedly. I trust



Lebanese children in Beirut, Lebanon.

in the promise found in Ezekiel 36:26 (NKJV), which says, "I will give you a new heart and put a new spirit within you; I will take the heart of stone out of your flesh and give you a heart of flesh."

I have been immensely blessed

here so far, and I am more than excited to see what God is going to do in my life during the rest of my time here in Lebanon.

## INSIGHTS From the Professor

By David Nelsen, PhD

For those of us who love the smaller things of biology, late summer and early fall are wonderful times of the year, when many arthropod species are out and are easier to find and identify. This is true for one of my favorite groups of arthropods: spiders. Last fall (2022), I used my Sabbatical to begin a new multiyear research project. I joined a few other researchers to track the spread of a giant Asian spider, *Trichonephila clavata*, also known as the Jorō spider. This spider is native to Asia and is found in Japan, South Korea, Taiwan, China, and Nepal.

In the United States of America, it was first observed in 2014 in Braselton/Hoschton, Georgia. It has since spread throughout much



Students engaged in spider research.

of northern Georgia and is regularly seen in neighboring states, including Tennessee, South Carolina, and North Carolina. It has even established a breeding population as

far north as Baltimore, Maryland. Maybe you have heard about or seen this spider, as its spread has garnered regional and national attention from

**Insights, cont. on page 4**



*Jorō spider snagging an insect.*

news outlets such as NBC and USA Today, among others.

Our team set out to address three questions in our first year of the project. First, we wanted to respond to what we felt was inappropriate coverage of this species in the media. Several news outlets used headlines such as: “Large, Parachuting Spiders Could Soon Invade the East Coast, Study Finds” (for an online article by Margaret Osborne in *Smithsonian Magazine*). That same week, *USA Today* columnist Rex Huppke posted an article with this sensational headline: “Giant spiders are invading the East Coast! This is not a drill! Evacuate to Toledo! Now!” Its subhead continued: “The East Coast faces an invasion of 3-inch Joro spiders that can parachute from the sky. It’s clearly time for everyone to move to the Midwest.”

We wrote an article published in the journal *Biological Invasions* that summarized the current state

of knowledge on this species within the United States, highlighted the many unknowns that still needed to be investigated, and called for a more data-driven approach to reporting on this species.

Second, we started to survey areas that are inhabited by Jorōs as well as areas where they have never been reported, to determine where these spiders are located, how abundant they are, and how Jorōs are affecting the presence and abundance of native spiders. Professor Aaron Corbit, a biology professor at Southern, joined the team on this project, and we were able to visit 103 locations. In addition, Professor Corbit and I started to take Data Science courses offered by the School of Computing at Southern. As part of these courses, we created models to predict places within North America that Jorōs would find habitable. We combined the surveys with our models, and recently our efforts have been accepted for publication in the journal *Ecology and Evolution*.

While working on the first two projects, we made extensive use of a database called iNaturalist. This web-based application allows users to upload images of any species they see—plants, fungi, or animals. iNaturalist applies a machine learning algorithm to suggest identifications for what each user has observed. We call this citizen science data, as it comes from anyone with any level of knowledge. As we added to the database and utilized its contained data, we noticed that people interacted with the Jorōs differently than with other spider species. We used this opportunity to

investigate how and why these differences may occur. We have already submitted this project for publication and are currently undergoing peer review.

Through all of this, I have come to several realizations. First, it has been a great experience to work with colleagues from other universities and to show them—and others, through our publications—that Southern is a place where discoveries are being made. We offer our students the opportunity to practice what they have learned, network with specialists from across the nation, and better understand how science works (its strengths and limitations).

Second, it reminded me what it means to be a lifelong learner. Our learning is never complete; as we progress throughout our lives, we must continue to learn, be willing to change, and realize how our understanding of the world changes. This should humble us! It should drive us to the ultimate Source of knowledge and help us recognize that we won’t have all the answers, but we can have eternity to figure them out.

Last, I am thrilled to share this experience with our students. If we don’t use our research to help them, we are missing a huge opportunity to affect their lives in lasting ways. I know of no better way to understand the strengths and limitations of science than to participate in its practice. In a world that looks to science to solve all of our problems, we can help the next generation form an appropriate conception of what science can and can’t do. Science is incredible, but it isn’t a replacement for knowledge of the Creator.

# DEPARTMENT HAPPENINGS

By Joyce Azevedo, PhD

A great group of 15 students came to campus a week before SmartStart for the summer BIOS program, which immerses students in the rigors of university-level biology. This weeklong intensive experience is designed to help General Biology students better anticipate the demands of the course and how best to study the material for success.

Alumni Homecoming Weekend 2023 featured three biology-infused nature walks/hikes. The first, a BioBlitz bird walk that took participants across campus, began at Hickman Science Center at 7:30 a.m. on Sabbath, October 28. An additional two hikes were held later that day on the Sabbath Trail, atop Bauxite Ridge. Former students joined Professor David Nelsen for an outdoor worship experience or engaged in botany discovery with Professor Ben Thornton. Professor Dias also led students that day in outreach downtown Chattanooga with a booth by the American Art Museum and walking



Students participating in downtown Chattanooga outreach with Professor Dias.

bridge. Students conducted blood pressure and blood glucose checks for the community, and shared 245 magazines! This will become a monthly event.

Biology professors contributed to the recently published book *Design and Catastrophe – 51 Scientists Explore Evidence in Nature*. Professor Nelsen penned two chapters: “Design, Spiders” and “Integrated Wholes.” Research Professor Lucinda Hill

Spencer wrote a chapter titled “The Amazing Gift of Hearing.”

Professor Nelsen’s Jorō spider research has gained much local attention, with two recent articles in the *Chattanooga Times Free Press*, a story in *Clemson News*, and a televised news story on the NBC affiliate in Greenville, South Carolina. Professor Nelsen also gave a recent Jorō spider presentation at the Chattanooga Engineers Club.

Several biology faculty presented during the Biblical Foundations in Faith and Learning meetings held in June on Southern’s campus. After the event, during an Alaskan cruise for the participants and spouses, each faculty presented a peer-review paper based on the theme “Exploring Biblical Foundations in Biology.” Professor Nelsen’s paper laid the groundwork for understanding how worldview is important to our students. Professor Keith



Pickleball Tournament winners with Professor Bishop.

**Dept. Happenings, cont. on page 6**

Snyder's paper focused on practical applications of Biblical Foundations that we use in our Southern classes. Professor Aaron Corbit focused on ecology as a single practical application of Biblical Foundations that affect the whole world.

Professor Thornton taught Summer Field Ecology 2023 to a great group of 15 students. They had a very memorable 17-day experience exploring numerous ecological habitats and wildlife interactions in Costa Rica. Professor Thornton is looking forward to Summer 2024, when he will again explore the diversity of Costa Rica teaching Summer Field Ecology.

Professor Corbit was invited to present the evidence for creation on a new TV show called "Hope at Night," which aired October 17 on the Hope Channel.

Allied Health Club sponsored a successful Team Pickleball Tournament on a recent Saturday night in October. Twenty mixed teams competed for the first-place

medal and gift cards. The event was a rounding success, drawing many spectators, so it is likely to become an annual event.

Professor Snyder's faculty sabbatical is scheduled for the Winter 2024 semester, and Professor Joyce Azevedo will begin her sabbatical in the Fall 2024 semester. In general, these much-needed sabbaticals are available every seven years for faculty with terminal degrees in their field and are intended for scholarly work projects or other previously approved endeavors that improve the ability of the professor to teach and/or do research. Professor Snyder will be working on two different research papers and finishing up details for the governance restructuring that has taken place in faculty senate over the past two years.

Professor Snyder's Entomology class has discovered the negative side of "no-till" farming, which has been practiced locally over the past several years. Insect numbers are down considerably, and a butterfly expert



Rahn scholarship recipients with Dr. Rahn Shaw (Emily Rojas-right).



Field Ecology students and Mrs. Thornton at Arenal Volcano, Costa Rica.

has suggested they may be down 80% or more. Since insects are at the base of the food chain, this doesn't bode well for local creatures depending on insect food.

Professor Ann Foster is scheduled for a well-earned retirement beginning the summer of 2024; by then, she will have taught at Southern for 28 years. An active search process for a new biology professor is underway.

We are grateful and blessed that one of our majors, Emily Rojas, is a recent recipient of an endowment scholarship. Along with other scholarship recipients and their department deans or chairs, Emily attended a recent luncheon with Professor Snyder, department chair, and met alumnus Rahn Shaw, MD, who initiated one of Southern's largest scholarship endowments.

# SOUTHERN BIOLOGY

By Ben Thornton, PhD

I am so excited to share this with you. (No, I am not trying to sell you anything.) A few years ago, the Biology/Allied Health Department designed a Southern Biology flag. These flags have literally traveled all over the world with our students and graduates.

Thanks to my good friend Seig Mayer, and in partnership with Southern Arboretum, we are now able to send out, as requested, Southern Biology flags to alumni and friends as they help us spread the influence of Southern Biology

far and wide. As our students and graduates travel to and serve in far-off lands, Southern Biology goes with them, and with the flags go hope, friendship, service, companionship, warmth, and acceptance. We are Southern



David Callender and Gabriel Brown (2022 Student Missionaries) on Mt. Kilimanjaro.



Field Ecology students and Mrs. Thornton at Rio Celeste, Costa Rica.



Professor Thornton at Wadi Musa, Jordan.

Southern Biology, cont. on page 8



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Biology, a department that is changing the world for good! Join us in carrying the Southern Biology flag to your next destination.

Currently, I have a backlog of Southern Biology posts to make, so keep coming back to see where Southern Biology flags will

show up next. This is only the beginning. Thank you for being a part of spreading Southern Biology around the world!

## HOW YOU CAN SPREAD SOUTHERN BIOLOGY

Partner with us in spreading Southern Biology by emailing me (benthornton@southern.edu) to request a Southern Biology flag to take with you on your next adventure—even if that adventure is just around the corner from where

you live. Take a photo of yourself with the Southern Biology flag, then send it to us with your name, the event pictured, the date your photo was taken, and the location with GPS coordinates. We will post your adventure as we track the travels of

our Southern Biology graduates, teachers, and current students. We will need the GPS coordinates for each photo. Since some photo apps strip this information, you may need to submit the coordinates in the email when you send us the photo.

**You can use the URL or QR code below to access Southern Biology Around the World**

<https://www.southern.edu/arboretum/flag/indexBiology>

