

CAROLINA CROSSTALK

FALL 2018



**Weisshursts and
Western Blots**
Research Abroad



**The Secret to
Successful Research**
*Professor Spotlight:
Dr. Woertendyke*

**GETTING
STARTED**
on undergraduate research



Founder and Co-Editor-in-Chief **Olivia Reszczynski**

Co-Editor-in-Chief **Athena Marousis**

Articles Editor **Joelle Strom**

Creative Director **Caitlyn Jennings**

Creative Director **Meredith Price**

Staff Advisor **Asheley Schryer**

Cover design by Caitlyn Jennings
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LETTER from the EDITOR



If you search the word “crosstalk” on the internet, two definitions pop up. The first, “unwanted transfer of signals between communication channels,” and the second, “casual conversation.”

“Unwanted transfer” refers to interference between electrical circuits and appears rather negative. The second definition, “casual conversation,” is one of the main goals of Carolina CrossTalk. We are opening the door for casual conversations about undergraduate research conducted at USC. So many incredible research projects in every discipline imaginable are done every day, and yet no dialogue.

When I first heard the word “crosstalk,” I was beginning to conduct research at the university as a high school student. My lab was discussing the interactions of molecules within a specific signaling pathway as we were discovering the mechanisms behind cachexia, a wasting condition that develops from cancer. I could picture the different components of the pathway shifting in space, binding to their receptors, and causing a cascade of other interactions that eventually lead to an effect.

That signaling cascade is the second goal of Carolina CrossTalk. We want to not only encourage conversation about undergraduate research at the University of South Carolina across a variety of disciplines, but we also hope to catalyze a series of effects that resonate with others and potentially even spur a career. Within these pages, we hope to provide a glimpse into the many different research experiences of students here at USC.

We thought “getting started” was an apt theme for this first issue, as a reference to getting started with this new publication, as well as getting started with a research project. Each of our writers shares his or her exact process of becoming involved in a project so that readers alike will know where to begin. Although daunting and seemingly impossible, a vision is broken down into a series of tangible steps that are tackled each week, with the help of many peers and mentors. We hope that Carolina CrossTalk provides insight into the many trials, tribulations, and successes of undergraduate researchers at USC, hopefully inspiring you to become involved in research as well.

Olivia Reszczynski
Editor-in-Chief

CONTRIBUTORS



Photo by Caitlyn Jennings



Andrew Dunton
Major: Physics + Philosophy
p. 21

If I could go anywhere in the world for 24 hours, I would visit Siberia and watch the Northern Lights. I would wander around in the winter wasteland that is Russia.



Rose Steptoe
Major: English
p. 29

If Ben & Jerry's were to make an ice-cream flavor for me, it would be called Raspberry PistachiRose. It would be vanilla ice-cream with a raspberry swirl and pistachios, but no green dye of course.



William Rivers
Major: Biochemistry
p. 13

I spent the 4th of July in Germany. We went to a park where we met a bunch of people from Germany, New Zealand, Ghana, Switzerland and Spain and we were just there belting out the national anthem.

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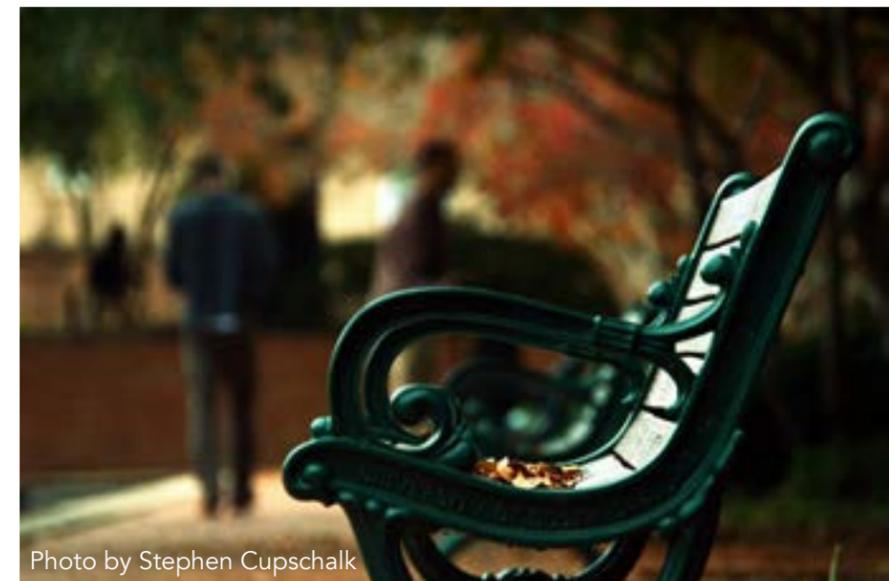


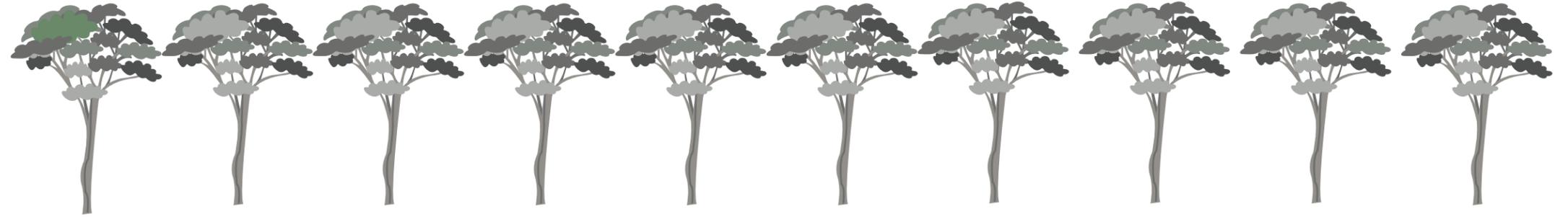
Photo by Stephen Cupschalk



WHAT'S BUGGING ETHIOPIAN FARMERS?

by Patrick McKenzie
Photos by Patrick McKenzie

Afromontane Forest 2017



32%
of the population
is undernourished

Over this last summer, I participated in a Research Experience for Undergraduates (REU) at Colby College in Maine. Essentially, REU's are prestigious, paid summer research jobs at other universities that give you the chance to work with students and professors you wouldn't otherwise meet. Last Fall, the Office of Fellowships and Scholar Programs recommended I seek out an REU because I was interested in research topics that didn't quite match any professor at USC. I applied en masse to a good 15 different programs that interested me with various combinations of essays and letters of recommendation. As the spring semester passed, I hadn't heard back from any of them, and I was getting a little bummed out. Then, as I sat on a plane preparing to depart to Cuba for spring break, I got an email of acceptance from Travis Reynolds about an REU studying sacred forests in Ethiopia. I took this as a sign of fate and slipped my acceptance email out as the plane lifted off the ground, and my summer fate was sealed.

Although I was originally supposed to be in Ethiopia for part of the summer doing on-the-ground ecology research, civil unrest in the country changed those plans. Instead, the ten of us in the REU created our own distinct projects

that were feasible from Waterville, Maine. We had a good mix of social science and natural science projects, with mine falling somewhere between the two. Continuing off a project from the previous year, I decided to study the impacts of forest cover on pest damage of surrounding agriculture in the Amhara region of Ethiopia. Over time, that project narrowed to focus only on maize, teff, and horse beans: three of the most important crops in the region. My day to day work generally involved a mixture of GIS (basically fancy Google Earth) and statistics, combining satellite imagery and household survey data to generalize results. The most striking difference between the research I do at USC and my REU was that my project in the REU was all mine; I created the project, decided my priorities, and did all of the work.

I was also struck by the potential impact of my project. I had gone from studying the evolution of algae (an interesting but not particularly useful subject) to doing research with the real, concrete potential to save lives. With 32% of its population undernourished, Ethiopia suffers from serious food insecurity, and pest damage is an important contributor to that insecurity. Agriculture is also a centerpiece of the Ethiopian economy, accounting for 35.8% of the country's

GDP. Further, only 4.2% of the country today is Afromontane forest, reduced from 40% in the early 1900s. With native forests quickly dwindling and successful agriculture so essential, my research is particularly valuable. Through my research, I have found differential impacts of forest cover on pest damage by crop type, meaning that maize planted near forests suffers more than teff or horse beans. This allows prescriptive measures to be taken by educating farmers on what crops are best to plant near the forests, a task that can be taken on by our partners in the TREE Foundation.

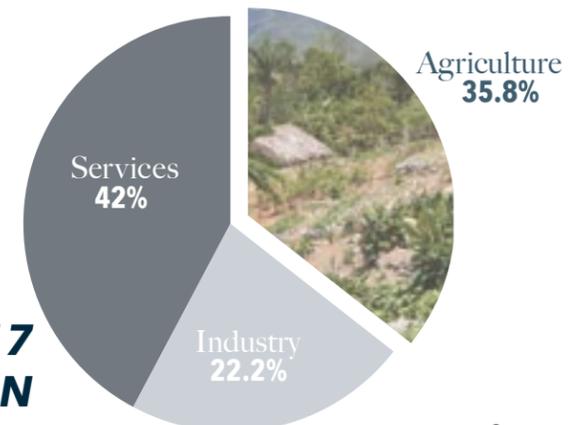
My favorite moment was compiling and presenting my research at the California Academy of Sciences. On the one hand, the free trip to San Francisco for the week was obviously fun. However, it was the chance to explain the results and implications of my research to both scientists and families that really made the experience meaningful for me. It was an incredible chance to talk on an equal level with actual scientists and pique the interests of children in science and conservation, both

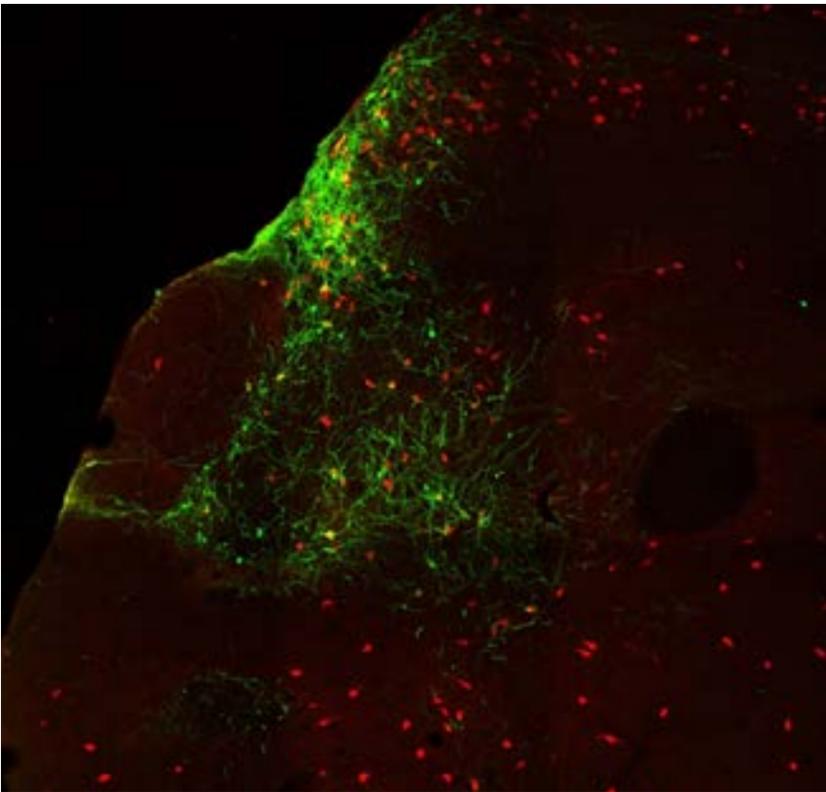
of which were satisfying in different ways. In terms of what I learned, I really didn't know anything about Ethiopia before I started my REU. Thankfully, during my program we received supplemental classes on the language, history, and culture of Ethiopia. Now I know it is an amazing place, and it is one of the destinations on my travel bucket list.

When I found out I wasn't going to Ethiopia, I was expecting to have to work a boring desk job for summer. However, what I found was meaningful, impactful work that was distinctly mine and that has the potential to make a difference on a global scale. Through my REU, I made incredible friends, was compensated for my research, and got to explore the Northeastern U.S., which I had never even visited before. All in all, I strongly encourage my fellow USC students to seek out an REU of their own for the chance to spend a summer researching something that is not only of interest to them, but could potentially have profound global impacts.

WITH NATIVE FORESTS QUICKLY DWINDLING AND SUCCESSFUL AGRICULTURE SO ESSENTIAL, MY RESEARCH IS PARTICULARLY VALUABLE.

ETHIOPIA'S 2017 GDP COMPOSITION





NO REASON TO BE AFRAID:

PTSD Research Explores Psychological Disorders

by Mallory Long

Photos by Mallory Long

My whole life I have always been fascinated with the notion that our brain is the very essence of our being. The idea that this complex interconnected mass of circuits is the driving force behind our ability to experience life continuously amazes me. I enrolled at the University of South Carolina to pursue a degree in experimental psychology, as I sought to better understand the brain. My courses, focusing on neuropsychiatric disorders, provided me with enlightening explanations, which kindled my interests in learning the more detailed mechanisms of these disorders at the biological and molecular level. Many of my courses did not have the time to go into that level of detail, so I sought out research that would provide me with explanations that I wanted.

I initially felt overwhelmed because, like many undergraduates, I had no idea where to start. I had asked a few of my friends who were already involved in research how they got started and they told me they emailed a professor they had for a previous course. Unfortunately, my previous professors that I contacted were not currently taking students, so I was still stuck on where to

start. Overwhelmed, yet still determined to get involved in research, I heard from other students about the Office of Undergraduate Research and the Getting Started workshop available to students. After attending a workshop, I finally found some direction with how to get involved. The Getting Started workshop provided me with a database comprised of all of the faculty members on campus who are currently conducting research. That is how I found a list of faculty members I knew I wanted to contact. After emailing this list of professors, a week later I had an interview. I was so excited for the consideration and the opportunity to talk to the professor, yet I was plagued with the thought of not being good enough. After all, I had little-to-no previous research experience, and I knew close to nothing about the intricacies of the research the lab was conducting. The moment that I sat down in front of the professor for the interview, all of my worries washed away. It didn't seem to matter that I hadn't had previous lab experience, or that I didn't know everything about the research topic of the lab. What seemed to matter the most to him was that I

was genuinely interested in research and I had a desire to learn more about the brain.

Following the interview, I was fortunate to have been accepted to work in the laboratory of Dr. David Mott. The Mott lab aims to investigate the underlying mechanisms involved in Post-Traumatic Stress Disorder (PTSD) as well as other fear and emotional disorders. Fear is an essential emotion used to shape behavior for survival, but too much fear can begin to interfere with a person's life. PTSD is a psychological psychiatric disorder that has the potential to develop in a person who has experienced a traumatic event, such as a car wreck, assault, or near-death experience. PTSD can be characterized by recurring episodes of fear and anxiety as well as recurrent flashbacks. Unfortunately, like many psychological psychiatric disorders, there are a number of complexities involved in the diagnosis and treatment of PTSD. The development of new therapies for fear disorders, such as PTSD, benefits from an understanding of the fear circuits of the brain that underlie the disorder. I was immediately captivated by the opportunity to learn more about the disorders in a way other than sitting in the classroom. In an effort to devote more time and resources to my research, I applied, and was awarded, the Magellan Scholar Grant, a competitive research funding opportunity offered here at USC. Under the guidance of Dr. Mott, I developed my own project investigating the neuronal circuitry of cortical and subcortical brain regions involved in fear. My research project aims to navigate and analyze the anatomical connectivity of a number of brain regions involved in fear processing.

The amygdala is commonly known as the emotional processing center of the brain, it receives input from a number of various brain regions, where it is then modulated, and then relayed elsewhere. By investigating the connections of different brain regions into the amygdala, we can begin to observe and further analyze if there are any differences in the circuitry between a control, and a PTSD model. This can help to potentially isolate exactly where the deficits of PTSD are occurring. I am able to define the anatomical connectivity between

these brain regions by using a technique called anterograde tract tracing. With this technique, mice are injected into a specified brain region with a genetically modified virus that encodes a fluorescent protein which expresses green under a microscope. The virus works by infecting neurons in the injected brain region, where the fluorescent protein is then transported down the processes of the cell, thus defining the axonal pathways from one brain region to the next. So far, I have observed the neuronal pathways from the prelimbic cortex, the thalamus, the hippocampus, and the basal forebrain, brain regions that each play a unique role in processing of the emotion fear. The prelimbic cortex is responsible for providing the amygdala information involving higher order cognitive processes such as goal-directed behaviors and decision making. The hippocampus is associated with aspects of memory and encoding of contextual information. The thalamus receives, interprets, and delivers sensory information to the amygdala. The basal forebrain sends cholinergic projections to the amygdala which in turn modulate the output response through acetylcholine, a neurotransmitter that plays an essential role in learning and memory. Collectively, the information sent from these brain regions plays a cardinal role in the experience of fear.

My work identifying these projection pathways is only a small portion of the overall goal for my lab. My findings provide an anatomical basis for more experiments to be done analyzing the functional significance of how acetylcholine modulates these incoming pathways by using a technique called electrophysiology. Furthermore, investigations are also being conducted in order to observe the various cell types that these brain regions project onto and how acetylcholine differentially regulates the physiological responses of each interneuron subtype. A detailed understanding of the anatomy and functionality of the fear circuit will provide groundbreaking information needed to advance therapeutic research for emotional disorders, like PTSD.

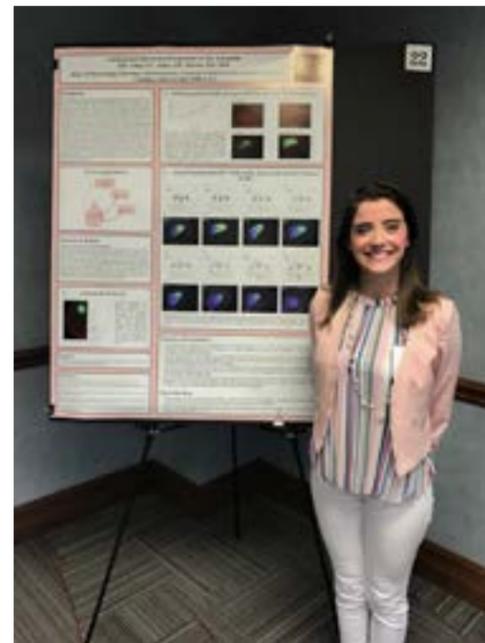
Though, at times, my work can seem

meticulous, there are plenty of moments that make it worth the many hours it demands. One of the requirements for being awarded the Magellan Scholar is presenting at the annual spring showcase, Discover USC, sponsored by the university. I was nervous to present in front of such a large crowd, but I was so excited to have the opportunity to share what I had been working on over the past year with the community. Without a doubt, one of my favorite experiences thus far from my involvement in research has been presenting at Discover USC. I quickly learned that there was no reason to be nervous, and I fell in love with being able to share my work with people who were genuinely interested in learning about my research. To top it all off, I was awarded a prize for my presentation! Being able to converse about science excited me and moved me to seek other outlets to do so. Moreover, through the Office of Undergraduate Research, I was awarded a position to do just that. I currently serve as a Magellan Ambassador, a leadership position awarded to students who conduct research at the university. Through this position, I present seminars to other undergraduate students in order to encourage and inspire others to get involved with research.

Overall, research has had such a substantial impact on my life and has enabled me to discover my passion for scientific research and outreach, as well as redirect my career goals in a different, more fitting, direction for my life. For as long as I can remember, it had always been my dream to become a medical doctor, but my career goals were quickly re-evaluated after getting involved in research. Pursuing a career in neuroscience research, rather than medicine, became an irrevocable commitment after working in a laboratory. I quickly realized that I loved everything about research and that I could not see myself in any other career field. Experiencing the opportunity to integrate and apply scientific understanding of anatomical structure, neural function, in order to treat neurological disorders solidified my decision to dedicate my life to aiding in our pursuit to better understand the brain. This coming fall I will be attending graduate school in order to pursue a doctoral degree in neuroscience. I am very thankful for my undergraduate research experiences as they have provided me with many opportunities as well as illuminate the path for a new and exciting direction for my future.

 **Get started with undergraduate research**

Below: Mallory presenting her research at Discover USC



GET INVOLVED

RESEARCHERS

who want to write about their research experience

WRITERS

looking to write about the research experience of others

EDITORS

who want to assist with the editing process

DESIGNERS

who want to help design the next issue

Like what you see in our first issue?

Email carolinacrosstalk@gmail.com to get involved!
Please include your name, major, year + what you want to assist with in your email.



Weisswursts & Western Blots

by William Rivers

Photos by William Rivers



“

The whole process of going to Munich for research was a really cool experience not only for the research but also for the ability to travel around Germany and Europe. Most of my favorite experiences this summer came from those adventures and misadventures in the mountains around Munich and exploring the cities I found myself in.

There are lots of ways to get involved with research. You might have a burning question you want answered, or maybe you simply jump on board with a professor's existing project in a field in which you are interested. Personally, I have worked on a couple of professors' projects and I found them all in slightly different ways. The most unique one I found by combing through the database of fellowships that the Office of Fellowships and Scholar Programs maintains on their website. The program is called DAAD Rise, and it provides a stipend for students from the United States, Canada, or the United Kingdom to spend 10-12 weeks at a top tier German institution conducting research. The Deutscher Akademischer Austauschdienst (German Academic Exchange Program) provides a list of internships, delivers the students' applications to the graduate students in charge of the research, and ultimately picks which students receive internships and where. I applied to and was placed into the lab of Dr. Dejana Mokranjac in the Physiological Chemistry Department of Ludwig-Maximilian University in Munich to work with a doctoral student named Umut Günsel. In a sentence, I joined their project to help biochemically and structurally characterize the TIM23 mitochondrial protein translocase.

The vast majority of mitochondrial proteins are synthesized in the cytosol and need to be imported into the organelle. TIM23 is a protein complex responsible for transferring proteins into the mitochondrial matrix or into the inner membrane. Because about 70% of mitochondrial proteins utilize this pathway to enter the mitochondria, it is essential for function of the mitochondria and its breakdown has severe negative effects on mitochondrial function and cell viability. Therefore, having a greater understanding of how the complex works not only provides a molecular insight

into a fundamental cellular process but may also help understanding the cellular and biochemical basis of human disorders.

My role in the project was to analyze the dynamics and local environment of Tim23's N-terminal region during protein import. To do this we created 11 yeast mutants that each encoded a molecule called Benzoylphenylalanine (Bpa) in a different position of Tim23's N-terminal region. Bpa is a synthetic, photoreactive amino acid that covalently bonds nearby molecules when it is irradiated with UV light. The products of such reaction are called crosslinks. We then grew the yeasts, irradiated them, isolated the proteins from the cells, separated them by SDS-PAGE, and did a Western Blot analysis with Tim23 antibodies to visualize Tim23 and its crosslinks. SDS-PAGE separates proteins based on size, and the Western Blot tags Tim23 using Tim23-specific antibodies so we can see where on the gel it and its crosslinks are located.

The Tim23 versions with a Bpa incorporated at an amino acid position near another molecule appear at a different location on the gel from where Tim23 is normally located because the bond between the molecule and Tim23 combines their sizes. Therefore, the analysis allows us to identify which amino acid positions in Tim23 are near another molecule by looking for these shifts in protein size and identifying where we incorporated the Bpa for that mutant. The next step is identifying the molecules each mutant bound, since the identity and characteristics of these molecules may give insight into the mechanism of protein import.

Overall, the Bpa molecule was one of the most interesting things I learned about from this research. I hadn't ever worked with a synthetic amino acid before, considered how



they might be incorporated into a protein, or thought about them ever outside of class. After working with Bpa for a summer, it seems applicable to a lot of other research projects and really just expanded my knowledge of general techniques that can be used when studying proteins. As a side note, knowing about it also helped me on a test in which the professor asked us how a certain mechanism might be explored experimentally. I am also glad that I got the chance to learn more about protein analysis. At USC, I spent a lot of time manipulating *E. coli* and yeast genetics, but prior to this experiment was never able to work with the proteins we were creating due to issues in the mutation process. Understanding how to introduce mutant genes is useful, but mostly for the sake of producing protein mutants.

The whole process of going to Munich for research was a really cool experience not only for the research but also for the ability to travel around Germany and Europe. Most of my favorite experiences this summer came from those adventures and misadventures in the mountains around Munich and exploring the cities I found myself in. However, my all-time favorite moments were when I got the opportunity to spend time with the other students, graduate and undergraduate, in the department and German language course. I enjoyed learning more about them, where they came from, and their cultures. Since we were in Munich, several of these moments were in the world famous beer gardens which didn't hurt either.

Coming into the experience I was really nervous for a lot of different reasons. First was that I did not



speaking any German and I was concerned that it would make daily life difficult. I was also worried that I would not really understand a lot of the project or that I would mess up the research. These fears turned out to be relatively unfounded. A lot of the people in Germany, especially the younger population, speak English at least at a conversational level, and everyone in the Physiological Chemistry Department spoke fluently. The few times I faced a language barrier were when I was traveling to smaller, less touristy towns or outside of Germany. In terms of research, a lot of the work that I did was similar to work that I had already done here at USC and it was relatively easy to apply what I already understood to a new project. However, there were several new techniques and ideas to work with, especially since it was my first time working with protein analysis. While I took some time to really understand the new processes, my lab mates were really patient with me and helped walk me through everything that was new. Overall, it was a great experience and I would recommend anyone interested in research to reach out to the Office of Fellowships and Scholar Programs to talk about applying to DAAD Rise or at least to the Office of Undergraduate Research to start looking at getting involved in research here at USC.

[!\[\]\(f80254b170d0ecdc443847276e625120_img.jpg\) **Learn more about DAAD Rise**](#)

YOUR CELLS GET STRESSED TOO

by Joelle Strom

Just like most college students, cells undergo stress on a daily basis. While students race to meet deadlines for papers or cram for the next midterm, the stressors for cells are slightly different. Some of these factors include oxidative stress, caused by an overload of highly reactive free radicals; endoplasmic reticulum stress, brought on by an accumulation of incorrectly folded proteins; or infection by a virus or bacterium. In all types of stress, the cell shuts down normal activity. From here, there are two options: the cell can either remove the stressor or sacrifice itself through programmed cell death, or apoptosis.

Dr. Rekha Patel studies the way cells respond to stress at a molecular level. She studies the proteins involved in the stress response, as the cell communicates with itself to decide whether to stand and fight or surrender. Early in her research career, she was investigating double-stranded RNA-activated protein kinase (PKR). At the time, it was thought that PKR mainly functioned in response to viral infections, due to the fact that it is activated by the unique genetic material carried by viruses. There were

indications, however, that PKR functioned during other types of stress. Dr. Patel sought to find the molecules that would activate PKR in the absence of a virus, and discovered a protein that activates PKR, called PACT. This was a groundbreaking discovery, as it opened the door to many other investigations about the role of PACT and PKR in the cell stress response, including a project about dystonia.

Dystonia is a neuromuscular disease characterized by involuntary muscle contractions, leading to abnormal movement and posture. Genetic studies had found that some dystonia patients had mutations in PACT. When Dr. Patel learned about this, she had already been studying PACT for 15 years and was excited to apply her research to a human disease. When I joined her lab, I began working on a project investigating how these mutations in PACT alter its activity and lead to dystonia symptoms. My introduction to this project came about seemingly by chance. I was meeting with my genetics professor to ask for a letter of recommendation for a summer research program, and during the conversation, I

mentioned that cellular signaling pathways fascinated me. Based on this interest, my professor suggested I reach out to Dr. Patel. Fortunately, she had space in her lab for a new undergraduate student and I had taken enough biology courses to keep up with the theoretical basis for her research.

I began working in Dr. Patel's lab in the fall semester of 2016, at the beginning of my sophomore year. I wasn't quite sure what to expect on that first day. I didn't know what my responsibilities would be, or whether I would be successful. Thankfully I was eased into the research process: my first assignment was to read papers published by the Patel Lab to understand the background theory for the current project. I then began to help with the day-to-day procedures, first learning by watching, then by performing an experiment under supervision, and finally being given a task to complete independently. I have learned more in the past year and a half than I could have imagined, including many important molecular biology and cell culture techniques. Most recently I have begun running Western blots, which identify the

presence of specific proteins in tissue samples. This is a complicated, costly procedure, and it was a satisfying moment when I successfully ran my first Western from start to finish. Although these skills are indispensable for a future career in this field, my favorite part of joining the lab has been meeting the other graduate and undergraduate students I work with on a daily basis. Everyone has been welcoming and supportive, and I have enjoyed the conversations we have during the downtime that inevitably occurs with biological experiments. When I presented at Discover USC this past spring, they coached me as I practiced, and I felt so prepared that I easily overcame my nerves and had an exhilarating experience. My time in Dr. Patel's lab has made me feel like a member of the research community and has taught me a lot about dealing with stress (the cellular kind, of course).

RADON AND REALIZATION

by Andrew Dunton

When I first came to USC, I had a general plan for my future and no idea how to carry it out. I knew I needed research experience to appeal to graduate schools, establish myself in my field of study, and generally gain expertise on what I'd be doing for the rest of my life.

Fortunately, the physics department here at USC has plenty of professors open to helping students discover the research opportunities available to them. The first step is simply reaching out. For me this came in the form of attending one of the weekly department colloquia held in the Physical Science College. It was the first meeting of the semester, so the purpose of the colloquium was for faculty and students to make introductions. As each of the professors stood up and mentioned what sub-discipline they worked in, I listened for a topic that appealed to me. I wanted something space-

related, but not hardcore space, like observational astronomy. I needed some nice atomic physics mixed in, but not pure mathematics, since I had no intention of being a theorist. A man sitting near me stood up and announced that he was Dr. Guiseppe, and his work involved experimental particle astrophysics. Perfect. After the colloquium was over, I introduced myself, and asked if he'd be open to letting me work with him. He was, but asked me to wait until after I had taken a few more lab courses for my major. I stayed connected to him throughout my freshman year, getting acquainted with the skills and knowledge I'd need, and began working with him my sophomore year.

The project I work on with Dr. Guiseppe is a spinoff of the MAJORANA neutrinoless double-beta decay experiment. That experiment, to briefly encapsulate, is at the forefront of where experimental

nuclear physics meets theoretical astrophysics. It's the search for a unique nuclear reaction which, if found, would be evidence of a Majorana fermion, a particle which is its own antiparticle. Majorana fermions are the best guess for the mechanism that caused the asymmetry between matter and antimatter in the universe. There is an abundance of matter over antimatter, which doesn't make sense given our current models; there ought to be an equal amount of antimatter, and we even have a conservation law called CP-symmetry which requires that this be the case. Since it isn't, there ought to be Majorana fermions or something which accomplishes the same effect. These sorts of particles, and others like them, are thought to be the key to a more comprehensive grasp of how matter works and why the universe is the way it is.

Alas, I am but a humble undergraduate. I do not get to work on the big, important MAJORANA experiment (which is just a block of metal surrounded by detectors a few thousand feet underground). What Dr. Guiseppe and I do is optimize the larger experiment as best we can. During the first run of the MAJORANA experiment, unexpectedly high levels of radon (a radioactive gas present everywhere on earth) interference were detected. In order to have a better chance of detecting the elusive neutrinoless double-beta decay, we need to minimize all interference as best we can. We study how radon deposits on various materials in various conditions, and how best to remove it. I work on the deposition of radon, and a fellow undergraduate I work with tries to remove it.

Physics is a very code-intensive occupation, and I had little prior knowledge of most coding languages. I spent this summer writing and running code in Unix, Root, and C; as a result, I have acquired new skills in coding in these languages, something that should be of great benefit to me in my later career.

My research has an effect on the larger project in that we are gaining a new and better

understanding of the interrelationship between radon and various materials, as well as how radon reacts under certain conditions. With this knowledge, the MAJORANA apparatus deep underground can be prepared in such a way that exposure to radon is minimized, and radon's interference with the experiment is lessened. That's the hope, at any rate.

I'd say my favorite moments of this work are also the most frustrating ones. One thing you're not told about experimental science is that the vast majority of your time is spent trying to figure out what went wrong. This isn't a typical lab class with lab manuals and expected results; this is you experimenting in a small room full of acid and radon pretending you know what's going on. Your sealed box full of radioactive gas might leak. If my experience is anything like the norm, it will leak many times. Your vacuum pump will break, your data-collecting program will fail in three different ways, and you'll have to invent an equation to describe a particular sort of phenomenon which nobody else has bothered looking at before. It's simultaneously maddening and exciting, and all of it happens with the hope that one day your work will be tangentially involved in the next breakthrough in physics.

Going into this project, I expected a lot of pedantic work. I was right. But it wasn't as uniformly pedantic as I anticipated – I've spent many weeks doing something completely novel, something I never expected to be doing. Sometimes there's a big payoff at the end, like your graphs (finally) showing you something coherent, and sometimes it all fizzles out and nothing changes. I don't regret doing this in the slightest, and I'd encourage anyone with a passing interest in doing work in their particular field to step up and go for it. There is an ineffable feeling of being part of something bigger than yourself or anything you could hope to accomplish on your own.

PROFESSOR

SPOTLIGHT

The Secret to Successful Research: Dr. Woertendyke sits down with CrossTalk to reveal her professional research project

by Athena Marousis
Photo by Stephen Cupschalk

Dr. Gretchen Woertendyke is an associate professor in the English department of USC, as well as the author of *Hemispheric Regionalism: Romance and the Geography of Genre*. She is currently working on her second book, which she describes as a project focused on secrecy as different flashpoints, particularly in moments of heightened circulation, in American history. For Dr. Woertendyke, a secret is more than just something that is kept hidden. Rather, "secrecy is this sort of set of protocols and processes and behaviors and networks more than it is about the secret itself." Her project focuses on four branches of secrecy in American history: secret societies such as the Freemasons or the KKK, scandal fiction in the early nineteenth century, slave narratives, and our contemporary culture of secrecy. Her research has led her to discover intriguing parallels between the ways in which current and older societies handle matters of public interest. She explains that in the early nineteenth century, newspapers and media outlets took on a writing style of commodifying secrets. They would report on a crime that was

publically known to have been a true event, but they would do so in a manner that reframed the story into a secret narrative. And while this was not necessarily a new technique, it effectively increased popularity and intrigue.

This window into previous reporting styles stands to reveal something about our modern attitude of public versus private life. With social media ever present in our contemporary culture of secrecy, Dr. Woertendyke describes the current climate quite nicely: it is a "confused arena" where public and private are overlapping, and there is this tension of how people are representing themselves. There is this appearance of heightened exhibitionism, but the reality of whether or not something is actually revealed is questionable.

Dr. Woertendyke explained that she was not initially familiar with secret histories, and that she came upon them while conducting research for her first book. The text that sparked her interest in secrecy was Leonara Sansay's *Secret History; or, the Horrors of Santo Domingo*.

"I became fascinated by it, and the more

fascinated I became I thought, 'oh, I have to include this in my project' ... the more research I did on secret histories, the more I realized it was just too big ... but I knew I wanted to return to it."

Such is the nature of research, particularly in the humanities. Undergraduates, graduates, and scholars alike begin pursuing one topic, only to be swept up by a new one entirely. This lack of rigidity is the very thing that gives the humanities its appeal. "It was cool and it was

“The bigger the project, the more open you have to be to letting the research guide you.”

unexpected" Dr. Woertendyke explained. "You have to be willing to follow the strands."

Her advice for undergraduate students looking to get involved in humanities research: find a faculty member you work well with. Humanities research can take different forms, from students working on their first novels, to engaging in critical analysis essay writing on a particular topic or time period. She also noted that Magellan scholarships are available to students with faculty members sponsoring their project. This type of research is frequently characterized by substantial interaction between professor and student, or fellow colleagues. The process is hardly ever formulaic. It involves reading, rereading, writing, and rewriting, and many times, simply talking it through.

As far as the differences go between

seasoned humanities scholars and student researchers, Dr. Woertendyke says, "we know our own idiosyncrasies better." She explains that everyone's process is different. Regardless of how the words end up on paper, the process in general is a long one that requires commitment. The goal of such a commitment is ultimately publication.

"So much of what we do is thinking and reading and sitting with ideas before they're even visible to anyone else, which is a frustrating part of the job and the process because we're always up against the perception that we don't do enough as it is, which is to say that people don't really understand ... just the kind of labor that goes into intellectual work." For Dr. Woertendyke, it's about more than just the literature. It's about, "using what I do and what I know that I can do well, and making it have some impact beyond my own scholarship ... I'm very interested in having that kind of conversation, not one that's just based in the nineteenth century, but one that's current."



by Lindsey Guerin

Like most people, I know that smoking is bad for you. As a fairly educated person, I was surprised when at least five people at my internship this summer had to leave a long meeting to go take a smoke break. These were smart people. They were neuroscientists at MIT, there's no way they didn't know that smoking was a bad idea; yet they still did it. They did it because, somewhere along the way, they became addicted to smoking, or more specifically, the nicotine in cigarettes. This addiction and the withdrawal people experience when they try to quit smoking is what I am researching. Our lab is trying to understand what causes the withdrawal symptoms that people experience, and what can be done to prevent them.

I started working in Dr. Jill Turner's lab in the College of Pharmacy my sophomore year, and honestly,

I didn't have a crazy passion for nicotine addiction research before I started. I thought the brain was really cool and that's what initially drove my involvement into undergraduate research. I had this interest but I didn't really know what to do with it so I decided to talk to my professors and advisors. Not surprising to any professor reading this, I received a lot of good advice. The one thing that they kept suggesting was that I join a lab and begin doing research. They said that real life experience is pivotal when studying neuroscience, class lectures and labs were not going to cut it. So, that's what I did, or tried to do. The problem was, before I could get started in any lab, I needed to find one to take me on. Not knowing where to start, and being slightly afraid of emails, I went to a workshop hosted by the Office of Undergraduate Research.

They helped me find people doing neuroscience research and send out my first email. That email resulted in a meeting with Dr. Turner, whose lab I'm still working in today.

Sometimes the scariest part of doing something is actually getting started. For me this was definitely the case. I had obviously never worked in a lab and it seemed safe to assume it was going to be very different than my waitressing job. In all the best ways, it was. Initially, I spent most of my time training. I had to learn all the techniques that I had heard about in my classes. Starting from square one meant I had to learn how to pipette correctly, when to wear gloves, and how to keep a good lab notebook, amongst other things. I then learned actual lab protocols like qPCR and western blots, which we use to look at the amount of a gene or protein in cells. A lot of what happens in your body daily is the result of slight changes in specific molecules, and withdrawal is no different. If nicotine goes into your brain and increases the amount of one protein it can throw off the whole carefully calibrated system. Take that nicotine away after your brain has just recalibrated, and it's messed up all over again. All this messing around is bound to have some consequences, including the anxiety people feel during withdrawal. As a result, we're interested in what changes on a molecular level during nicotine addiction and withdrawal. Some of the ways I use qPCR and western blots are to try and figure out what's changing. I've also learned other valuable lab skills, like working with the mice we use for our experiments and making brain slices, which allows me to design other experiments to look at the same general questions.

Research isn't just about spending time at

the bench pipetting. What I'm learning wasn't discovered decades ago by some old guy. When I finish an experiment, even just for a few minutes, I'm the only person who knows what I just learned. I think that's pretty cool. What started as a vague interest in the brain has developed into a love for research, in large part due to the great experience and lab that I've had. College is crazy because you rarely end up where you planned. I had never even considered attending graduate school when I started in the lab but now I'm applying to schools to spend another six years conducting more research. Now, even though I'm definitely not looking forward to graduation, I think I'm more prepared for my next step because of everything I've learned while I was here as a student at the University of South Carolina.

“When I finish an experiment, even just for a few minutes, I'm the only person who knows what I just learned.”

THE BEGINNING OF MY

WITHDRAWAL



RAD(51D) SCIENCE

by Claire Chabot

Photo by Stephen Cupschalk

I came into USC thinking I wanted to do one thing with my life but soon switched to something completely different, in part because of the research I began in Spring 2016. If you are looking to get into research, my advice is to join a major-specific club as a way to meet a potential research mentor. During meetings for the Carolina Association of Pre-Pharmacy Students (CAPPS), presenters would come to discuss the various job opportunities in the field of pharmacy. It was in January of 2016 that Dr. Doug Pittman was scheduled to present on his research in pharmacogenomics. Although I had been interested in this topic for some time, I was still fascinated when he talked about his research linking chromosome integrity and potential chemotherapy targets in ovarian cancer genes.

The future of personalized medicine drew me in. Once the meeting was over, I went right up to Dr. Pittman and asked if I could swing by sometime to see his lab. A week later, he gave me a tour of the lab, where I also met Dr. Nicole Reilly (then graduate student and one of my future mentors). I asked if it might be possible for me to come and work on a research project as an undergraduate. After discussing how many hours I would commit a week and other specifics, my training started! I've never considered myself to be an especially direct individual but I am truly glad that I took the risk in asking Dr. Pittman for an undergraduate research position. After all, I had nothing to lose; the worst-case scenario would have led to me continuing my search for a research position in other labs.

I soon found out that research requires patience, a lot of it. When I began in the lab I didn't believe it when Dr. Pittman told me that research was "99% troubleshooting." I thought he was joking until the entirety of the spring semester was spent trying to figure out why nothing was working despite my careful execution of established protocols. In the beginning, most of my time was spent shadowing Dr. Reilly to learn new techniques and having weekly conversations with Dr. Pittman about the theoretical background behind his research. It was difficult not being able to dive right into a project but I understood why once I became somewhat independent with my own project. Now I finally feel confident laying out my weekly plan, presenting my own data, and fully understanding the other projects in the lab. Looking back it is satisfying to realize how much I have grown.

The main focus of the Pittman lab's research is an ovarian cancer susceptibility gene: Rad51D. My specific project mainly involves cloning a Green Fluorescent Protein (GFP) to different Rad51D constructs. I enjoy this project not only because cloning is fun, but also because it serves an important purpose. For starters, one in seventy-three women will develop ovarian cancer and many of their tumors will have mutations in known DNA repair genes such as BRCA1, BRCA2, or RAD51D. The RAD51D gene is essential for cell division, repairing DNA damage, and maintaining genome integrity. These changes increase sensitivity to DNA damage, which previous studies have shown may correlate to RAD51D-deficient patient sensitivity to chemotherapy. I have hypothesized that these RAD51D mutations disrupt RAD51D nuclear localization since improper localization of RAD51D generally causes an increase in DNA damage and subsequent cell death. One long-

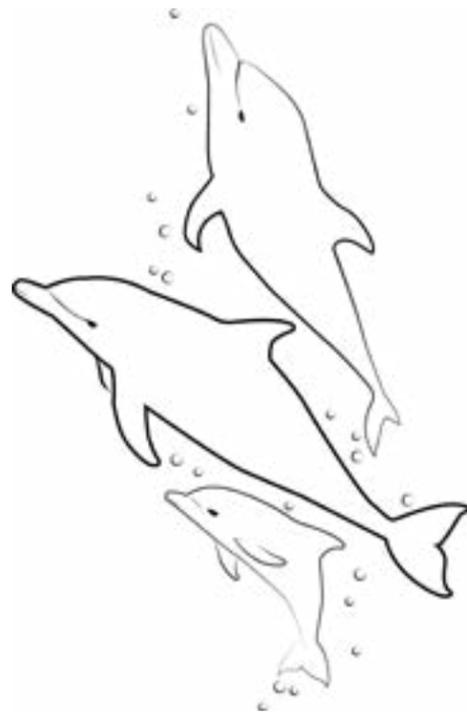
term goal of this project is to provide insight into how the RAD51D mutations may benefit the fifty percent of ovarian cancer RAD51D-proficient patients by increasing their sensitivity to chemotherapy. If the mutated regions on the RAD51D protein are required for nuclear localization, they can provide a potential target site to block RAD51D function and sensitize cells to chemotherapeutic agents.

I can easily pinpoint some of my favorite moments from the two years I have worked in the Pittman lab. During the process of testing my hypothesis, I generated the fusion between RAD51D and GFP that allows the detection of RAD51D localization. When I finally saw my cells fluorescing under a microscope after about a year of work it was such a thrilling experience, especially after all the pesky troubleshooting it took to get those results. In fact, I was so proud of the work I did that I transformed it into an art project for the Honors College Artists in Residence program that will be on display throughout 2018. Some of my other favourite moments have been earning the Magellan and SURF grants after trading drafts between Dr. Pittman and Dr. Reilly for what seemed like an interminable amount of time.

My experience in the Pittman lab has given me so much confidence, not only in my own potential as a scientist, but also in more practical abilities such as presenting at conferences such as Discovery Day and the National Conference for Undergraduate Research (NCUR). The impact of the Pittman lab has been powerful enough to inspire me to switch my major to biochemistry with a pre-med focus. Throughout your time in college you never know who you are going to meet or how it will shape what you will become, but sometimes it just helps to put yourself out there and try.

PART OF THE PUZZLE

by Rose Steptoe



Archiving the Catalogs of the Real Life “Lone Woman”

When coming into college as a freshman, I knew that I wanted to do research. I didn't know with who, on what, or even in which subject, but I knew that doing research was an opportunity I had to take advantage of. My high school's STEM program exposed me to the research process that I could explore at USC, and that piqued my interest as I was entering college. However, once freshman year began, I switched my major from Print Journalism to English (and eventually added a second major in History), which may not seem conducive to the stereotypical idea of conducting research in a lab setting. However, I was still determined to pursue research, and during my spring semester I went to the Office of Undergraduate Research for some guidance. At a workshop, I was told there was one professor who was looking for an undergraduate to help her with research on the children's novel *Island of the Blue Dolphins* by Scott O'Dell. From there my research process began. I met with my mentor Dr. Schwebel, talked about our individual goals for the project, and joined the eight other undergraduates that were involved with the project at the time.

My research with Dr. Schwebel is about much, much more than *Island of the Blue Dolphins*. The children's novel is based on the true story of a Nicoleña woman left alone on San Nicolas Island off the coast of California from 1835-53. The main goal of our research has been to create an archive that catalogs the story of this “lone woman.” Her story was widely circulated throughout the 19th century, and the archive contains documents relating to it. The archive is made in conjunction with the National Park Service, and serves as a means of critical analysis of the children's novel and of the mythic representation of Native Americans.

When I first began working on the project, I helped transcribe historical documents for the archive, and made the transcriptions website-ready through a version of coding called Text Encoding Initiative. While that work was more nuts-and-bolts, I have recently been writing historical annotations to accompany the documents. This has involved a lot of research through the library, as well as time spent drafting with my mentor. The goal of the annotations is to allow users to click on the available notes and

be provided with explanations of the person, place, or group in the archive. Each explanation elaborates on the way in which the information is related to the Lone Woman's story. This process has involved frequent meetings with my mentor to discuss research strategies, reliable sources, and the method of writing public history.

Island of the Blue Dolphins lives on today in most public schools in elementary-level curriculum. The archive facilitates further research on the ideas presented in the children's novel by compiling all relevant information about the history of the real-life Lone Woman. The archive works to demythologize the historical and fictional account presented around the Nicoleño Native Americans who once lived on San Nicolas Island. It marks all documents on the website with instances of tropes such as the “vanishing Indian” or the “noble savage.” The archive also helps contextualize the story of the Lone Woman within the broader history of the California Channel Islands, the native peoples of California, and the state's overall history in the 19th century.

Working with the documents on the archive has been an interesting experience on its own. The story of Lone Woman is influenced by many historical factors; each new document I read

was like fitting a new piece of the puzzle into place. It was interesting, if not ironic, to read all the misinformation circulated about the Lone Woman's story throughout the 19th century considering that one hundred years later “fake news” is still a matter of concern.

For me, some of the greatest assets I have acquired from my research are the friends I have made and my relationship with my mentor. When I imagined what research in the humanities might look like, I definitely imagined a one-on-one sort of experience. Instead, I've had the pleasure of working with many other undergraduates, a graduate student, and, of course, my mentor who I know I can look to for advice on issues outside of our research. I've had the opportunity to meet up with my fellow researchers to work on the archive, take classes with them, view a screening of a documentary about our research topic, and present our archive at Discovery Day. Although I had no idea what my research would originally entail when I began freshman year, I was pleasantly surprised that it meant also building lasting relationships with other students and my mentor.

“Each new document ... was like fitting a new piece of the puzzle into place”

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