

UC SANTA BARBARA  
Graduate Division

# Pushing the Boundaries

Graduate Student Research at UC Santa Barbara



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# A Message from the Dean

## Dr. Carol Genetti

Anne and Michael Towbes Graduate Dean  
UC Santa Barbara Graduate Division



The theme of this year's *Impact of Graduate Education* is **Pushing the Boundaries**, a quintessential part of the graduate student experience.

In making discoveries, creating arts and technologies, and bringing new perspective and questions to our academic dialogues, graduate students push boundaries daily.

These are not only external boundaries around bodies of knowledge or creative works, but also internal boundaries as students challenge themselves, deepen their understanding, synthesize, and discover connections that were previously unseen.

This magazine brings you the voices of twenty-one graduate students from across the disciplinary spectrum. They discuss what drives them to pursue their research, their personal journeys that brought them to UCSB, and what they hope their work will accomplish. These are just twenty-one of 2,900 graduate student stories, each a unique testament to the power of graduate education to change lives and advance society.

I hope that you enjoy this snapshot of graduate education at UC Santa Barbara and that these stories bring you inspiration and hope.

# Connecting Art to Climate Change

## Lucy Holtsnider

MFA '18, Art

2017 UCSB Art of Science, Third Place

**My research at UCSB is motivated by the pursuit of both scholarly and intuitive research in the visual arts.**

My scholarly research includes the traditional accumulation of knowledge, from studying the work of artists that influence me to researching other disciplines of interest, including climate science and the natural history of California. I also practice intuitive research in which I experiment in my art studio in a non-linear way in search of new methods for making art.

This experimentation includes trying out different materials alone and in combination with each other, as well as honing my process of working. A professor gave me the advice to "do what your hands want to do," and this deceptively simple instruction often guides my intuitive choices. During my time at UCSB, I discovered the craft of hand papermaking, which I found to be a fluid conduit to this way of working.

I take my local environment and sense of place as inspiration for creating abstract compositions out of handmade paper. The collages allow me to experiment with color, texture, and layering as a way to filter through my memories and sensations related to my surroundings. My scholarly research regarding climate change and natural history strongly influences my process, even if the specifics of the science may not be accessible to the viewer of the final piece.



**Lucy Holtsnider** combines monotype prints, handmade paper, and found objects to create collages that consider climate change impacts and sense of place. In 2016, she completed *Climate Odyssey*, a year-long sailing expedition and art-science collaboration with her partner, hydrologist Zion Klos. Her work can be found in the UCSB Library Special Research Collections, University of Denver Penrose Library Special Collections, University of Utah Marriott Library Special Collections, and Colorado College Special Collections. She is a featured artist in "The Chess Club: 2018 UCSB MFA Thesis Exhibition" at the UCSB Art, Design & Architecture Museum.



# Creating a Harmonious (and Secure) Future for Humans and Computers

## Chad Spensky

Ph.D. Student, Computer Science  
Researcher, Computer Security Lab (SecLab)

**One of the toughest facets of graduate-level research is finding a project that is interesting enough to motivate you to head to work every day, knowing that it could take months or years before you realize the idea's real value.**

I am motivated to create a future where computers and humans can co-exist harmoniously and securely. Our world is becoming increasingly digitized, creating a paradigm shift that has insurmountable control over traditional analog systems.

We now have a seamless user experience where doors magically unlock, lights turn off on their own, and cars drive themselves. However, the digitization of these systems presents dire security concerns. Unlike vulnerabilities in traditional computing systems (i.e., mobile phones, laptops, or

desktop computers), these cyber systems interact with the physical world and present the risk of property damage or bodily harm if misused by an attacker. Unless these devices are properly secured, we could be heading toward a dangerous future where hackers can manipulate our information and potentially harm us.

One of my research projects aims to create a Single Device Authentication (SDA), a ubiquitous authentication solution that enables smart phones to be used to authenticate our security-critical resources like computers, homes, and automobiles. I hope to harden cyber physical systems to ensure that a software-based vulnerability will not be able to interact with the physical world in any way. For example, compromising the car's software will not let an attacker steal control.

Traditional bug-finding techniques are very hard to deploy to these systems due to their numerous hardware interactions. I hope to re-enable these bug-finding techniques to help find and patch vulnerabilities in these security-critical systems.

By developing new methods for interacting with our digital world, deploying vital defenses, and employing novel bug-finding methods for these cyber physical systems, I plan for all of us to enjoy the various conveniences of these awesome digital systems, without any fear that they may be used with ill intent.

*Chad Spensky's research interests include usable authentication, embedded systems security, novel introspection techniques, and smart card security.*

# Aligning with Our Educational Mission



## David McIntosh

Ph.D. Student, History  
2016 Graduate Student Association President

**My time here at UCSB began with a straightforward question: how did our society arrive at its current state of race relations and what small part could I—as a privileged, white male—play in helping to shift the balance of social inequalities?**

My research is part of a larger conversation that seeks a greater understanding of how contemporary identities are constructed in our multi-ethnic and multi-cultural society and, specifically, what role the historical legacies of race-based science have played in shaping public consciousness. For my part, this entails the exploration of how science has framed the anthropological other and their contact with the West through narratives contained in archaeological surveys, museum exhibits, and school textbooks. I find solace and daily motivation

in knowing that my research design aligns with UCSB's larger academic and educational missions. The university's commitment to enhancing diversity has provided me the opportunity to collaborate and engage with people from vastly different backgrounds, but who share similar sensibilities.

I am extremely proud to have the opportunity to earn a Ph.D. at UC Santa Barbara. As a first-generation college student, I appreciate the immense educational opportunities and exceptional academic resources that UCSB offers. In addition, the larger institutional vision provides the opportunity for me to pursue my passions outside of their scholarly contexts. It has been my great honor over the course of my three years here to work alongside university deans, faculty, and administrators on matters of diversity, engagement, and access for members of

historically underrepresented groups. As our campus community adapts to a changing world, I am continually inspired by my colleagues to be involved in the exciting opportunities. I seek to explore how teaching, learning, and research can draw on diverse sets of potentials and imaginations that are found here on our campus.

My endeavors here would not be possible without the continued recognition, respect, and support of the distinguished faculty and staff. I believe UCSB genuinely appreciates and acknowledges the contributions that our graduate community makes toward the realization of the university's goals, both inside and outside the classroom. So, when I'm asked, "what motivates your research at UC Santa Barbara?" my answer is the simple fact that I could not imagine being anywhere else.

**David McIntosh** is a Ph.D. student currently exploring the history of anthropology, human paleontology, and evolutionary biology. His research examines human origin narratives from a variety of sources, especially Abrahamic systems and scientific theories. He worked in information technology for 16 years before pursuing his doctorate.



# The Impact of Invasive Species in California

## Elizabeth Hiroyasu

Ph.D. Student

Bren School of Environmental Science & Management

2014 Bren School of Environmental Science & Management Fellow

**My research at UCSB focuses on invasive species, and in particular, the different ways we define a species as “invasive.”**

Invasive species are a particularly interesting problem to me as a researcher because of the variety of fields and perspectives that are needed to solve their associated problems. Invasive species impact both the economy and the ecosystems they invade in a variety of ways, including causing losses in agricultural production and driving global declines in biodiversity.

As our world becomes increasingly globalized, introductions of species into new areas are on the rise. I address the question of what

makes a species invasive from three different perspectives: ecology, social science, and management. Specifically, I ask how species differ between their native and invaded ranges, how the public defines a species as invasive (and how that impacts subsequent management decisions), and how we can use biological controls to manage invasive populations. By addressing invasive species problems from multiple disciplinary perspectives, I hope to aid in creating long-lasting and effective solutions to protect ecosystems, biodiversity, and the human environment.

In addition to the specific applied environmental questions I am currently pursuing, my research

is also deeply motivated by my passion for increasing diversity in the field of environmental science and management. My hope is that through this work, I can serve as a role model to other students and aid in diversifying the field.

A large part of my motivation to work in academia and applied science is raising awareness that scientists come from a broad range of backgrounds, and can look like anyone.

I try hard to take advantage of every opportunity to mentor and engage with students in a variety of age groups to cultivate future generations of environmental problem-solvers.

*Elizabeth Hiroyasu is interested in the ecology of invasive wild pigs in California and the implications for the communities they invade. She plans to study the population dynamics of this prolific invasive species to determine its effects across the landscape, including such sensitive natural environments as oak woodlands, riparian corridors, and native grasslands.*

# Changing the Learning Experience through Computer Coding



## Jim Gribble

Ph.D. Candidate, Education  
Emphasis in Technology

**I am motivated to push the boundary of the education field in many different ways.**

I arrived at UCSB with the intention of studying the impact of computer coding on the communication skills of children with autism.

My research team wrote an accepted paper on this topic and then joined an EduTech research group partnership between the Gevirtz Graduate School of Education (GGSE) and the UCSB Computer Science Department, and attended a collaborative exchange of ideas with CS departments in Finland. While there, I saw facial recognition software and had the idea to create a way for children with autism to

practice facial recognition in a fun way, so I flew to Finland for the summer to develop the software with the Oulu CS department.

Attending the technology course offered by my advisor, Dr. Danielle Harlow, would turn out to be a deciding moment in the path my studies would take. I leaned over to a colleague and friend named David Sañosa and said something along the lines of “wouldn’t it be cool if children could learn how to code inside virtual reality?” My jaw dropped at David’s response: “Dude! I think I can build that. We should create this.”

It is now the driving force behind my graduate research.

We were invited to collaborate with the MOXI museum and hope to pilot the technology with members of the local community. We would like them to answer some questions about their experience to further our design-based research.

We are motivated by the constructionist principles of Seymour Papert, which claim children learn best by constructing and creating, whether it be a sand castle or a theory of the universe.

My main motivation is to conduct research to encourage more ways for children to have control over their learning experiences, and to ensure teachers serve as facilitators, not dictators, in school classrooms.

**Jim Gribble** is interested in researching the impact of computer coding on the communication skills of children with autism. Before UCSB, he worked for TeachForAmerica and at schools in Chicago, London, and San Francisco. He wrote a programming curriculum based on Scratch for a school founded by Twitter’s Chief Scientist, and founded his own company dedicated to teaching children how to code. Jim taught teachers how to code in the Design Lab at the Sonoma County Office of Education.

# Lighting Up the Future for Next Generation Display Tech

## Charles Forman

Ph.D. '18, Materials  
Nakamura Group

**After experiencing several roadblocks in my graduate research, I found it easier to understand a fact I learned at the start of my PhD program: approximately 50 percent of doctoral students in Materials leave without finishing.**

Two years ago, there were significant challenges in my research project to create a special class of laser: gallium nitride (GaN)-based vertical-cavity surface-emitting lasers (VCSELs). After months with crystal growth and laser fabrication, none of my devices worked. They were basically LEDs instead of lasers. Failure analysis revealed several design flaws. I spent the next year trying to overcome each challenge.

VCSELs are desirable for their superior lasing characteristics – for example, VCSELs are key components in the iPhone X TrueDepth camera that enable Face ID to securely unlock your phone by looking at it. With unique attributes like low power consumption, high beam quality, and 2D-arraying capability, it makes sense that Apple recently invested \$390 million for R&D on VCSELs.

The most stressful aspect was having no guarantee that spending a year on these problems would lead to success, especially considering the previous experiment was

carefully-planned but still failed due to unforeseen factors. Fortunately, I find this field of laser research fascinating, with great potential for improving the world. This passion helps me find the drive to continue, despite facing setbacks.

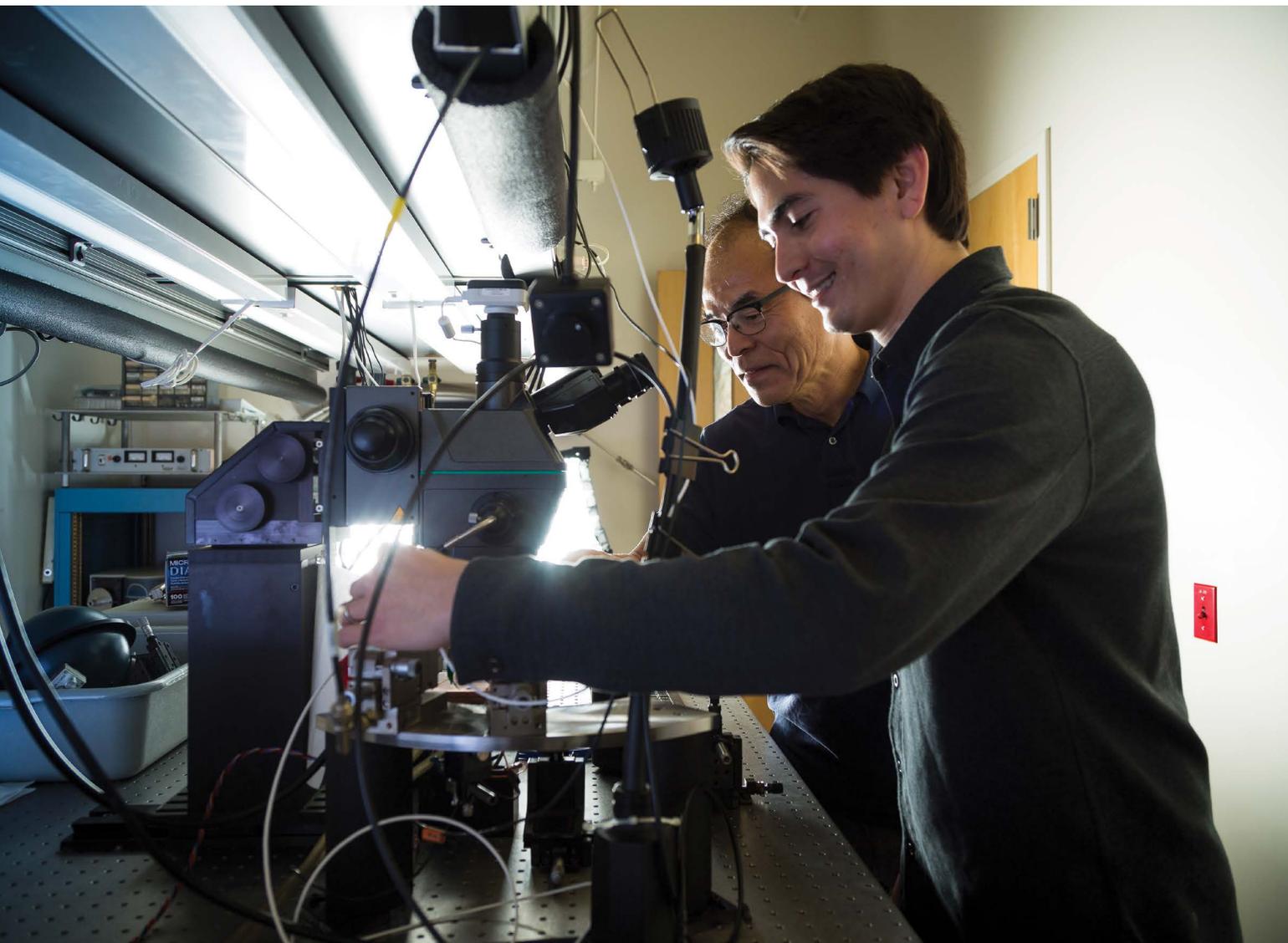
However, the market is limited to VCSELs that emit red or infrared (invisible) light. Creating blue and green VCSELs would open up a whole world of untapped applications in illumination, sensing, and display technology. This is possible using GaN – the same material that Dr. Shuji Nakamura used to invent the blue LED, leading to his 2014 Nobel Prize. His invention revolutionized illumination technology with energy-saving white LED lightbulbs. That was just the beginning. In the future, LEDs will be replaced by laser-based lightbulbs that use a blue laser coupled with a yellow phosphor to create white light.

Actually, the future has already arrived – laser-based white headlights can already be found on the Audi R8 LMX, the BMW i8, and the new BMW 7 Series. Solid-state illumination is especially exciting because it enables LiFi wireless networks that are more than 100 times faster than WiFi. Conventional edge-emitting lasers can be modulated over 100× faster than LEDs, but VCSELs can be modulated even faster.



The small size and low power consumption of blue/green VCSELs is particularly promising for next-generation display technology, such as near-eye displays for virtual and augmented reality. The great potential of these devices helped give me motivation to continue performing experiments to solve each problem, and it finally led to success – demonstrating the world’s first continuous-wave nonpolar GaN VCSELs.

**Charles Forman** works on GaN laser research under the supervision of Nobel Prize Laureate Dr. Shuji Nakamura. His main research goal was recently achieved: the first continuous-wave lasing for a nonpolar GaN vertical-cavity surface-emitting laser. Charles filed three patents together with his lab colleague Jared Kearns. Both Charles and Jared received the 2017 SSLEEC Outstanding Graduate Researcher Award.





# Networking in Style between Italy and Germany

## Sophia Quach McCabe

Ph.D. Candidate, History of Art & Architecture  
2016 Venetian Research Program Grant for Individual Scholars,  
The Gladys Kriebel Delmas Foundation

**My research is motivated by a desire to discover something new in order to better understand today's world.**

My work on the late 16th-century German artist Hans Rottenhammer, known for his religious and mythological paintings on copper panels, will help develop new ways of understanding the connections between art, commerce, and social networks in the early modern world.

Through my findings in archival collections, my use of digital tools in mapping markets and networks, and my close study of paintings and drawings, I seek to enrich the study of art and its connectivity to economics and people across

cultures. I'm especially fascinated by how Rottenhammer's international commercial achievements parallel today's immigrant success stories. I relate to the challenges faced by Rottenhammer, through my own experiences as a refugee and immigrant, growing up in America in the aftermath of the Vietnam War. Rottenhammer was, after all, a foreigner, who developed a career and started a family while living and working in Venice.

I've recently recognized the dearth of diversity among scholars of Renaissance art. This has further motivated my research and the completion of my dissertation. As a first generation Ph.D. candidate, I feel a strong responsibility to

contribute to the knowledge exchange of the Renaissance. During my years as a teaching assistant at UCSB, I've encouraged students from many different backgrounds to think critically about art. While living in Germany and Italy during a recent two-year research period, I met and worked with scholars and curators from around the world who welcomed me into their communities.

My journey at UCSB has not been without the occasional pitfall. With the help and support of my advisors and my dissertation committee, I'm proud to say I've contributed to my chosen field and, more importantly, to the culture of learning.

*Sophia Quach McCabe's dissertation "Hans Rottenhammer in Venice: Networking in Style between Italy and Germany" concerns paintings on copper panels, cultural exchange, and the relationship between art, commerce, and networks in the late sixteenth and early seventeenth centuries. Supported by the Fulbright Program, she has done research in Germany where she also served as a fellow at Wolfenbüttel's Herzog August Bibliothek. She also received awards from the Gladys Kriebel Delmas Foundation's Venetian Program, and the Albert and Elaine Borchard European Studies Fellowship. Sophia received her B.S. in Chemical Engineering from The Ohio State University, and spent several years working globally as a marketing manager.*

# Addressing the Cultures of Health in Latinx Communities



## Mario Espinoza

Ph.D. Student, Sociology  
Mentor, ONDAS Student Center  
2018 UCSB Grad Slam Presenter

**My research at UC Santa Barbara is motivated by my intersectional identity as a HIV-positive, queer Chicana individual with indigenous cultural roots.**

I am a product of first generation Mexican-immigrant parents.

My background has shown me the importance of addressing the cultures of health that exist in Latinx families and queer communities.

Growing up, my family did not go to the doctor routinely. We only went if we absolutely had to—like if one of us got cut really badly or broke an arm—or to be with a relative during their last moments.

Regarding sexual health, talking about sex was taboo, so discussions of sexual diseases and prevention never happened as an adolescent. My parents were hesitant about consenting for sexual education.

As a queer man of color, I needed to educate myself and others on HIV/AIDS awareness and prevention, especially after my diagnosis in 2011.

Before graduate school, I worked at a nonprofit called the Access Support Network as the HIV-testing Coordinator. This allowed me to address the gaps in education and prevention outreach in Latinx communities. Many barriers exist to inhibit Latinx families access to important health resources, including stigma, fear, and cultural taboos. I also founded the Know Your Status program, which uses community programming to address HIV/AIDS stigma.

These unique experiences have given me distinct depth in researching immigrant communities at risk for HIV/AIDS. Knowing that health access is simply unequal for immigrant communities motivates me to continue my work on ways

HIV/AIDS health care can be transformed to better advocate and maintain health for marginalized groups. To better understand the contemporary tensions over HIV/AIDS healthcare issues in the United States, I analyzed archival data from the Aids Coalition To Unleash Power (ACT UP) Oral History Project.

My master's thesis describes the ways that ACT UP pursued health rights for people living with HIV/AIDS while facing repression and violence from multiple institutions. Despite institutional barriers, advocates were able to effectively garner attention and support through strategic activism and collaborations between laypersons and professionals. I am inspired by these activists and HIV-positive individuals, and I am motivated to go further in my research.

**Mario Espinoza's** research focuses on the sociology of health, law, HIV education, social movements, disproportionality of criminal sentencing, race, class, and gender. He founded the program Know Your Status in San Luis Obispo to alleviate stigma from the HIV-positive community by hosting special talks and providing free access to on-site HIV testing for college students.



# Uncovering the Mechanisms Behind “Halide Perovskites”

## Doug Fabini

Ph.D. '18, Materials  
Seshadri Group

**Solar cells, which convert sunlight directly to electricity, are a promising technology that meet our energy needs without producing climate-altering carbon dioxide emissions.**

My research seeks to understand the chemistry and atomic structure of a promising new family of materials known as “halide perovskites.” These materials make cheap, efficient solar cells, but their workings are poorly understood, and significant practical challenges currently prevent their use. The thin layers of these materials in a solar cell degrade quickly, and the best performing materials contain the toxic element lead, posing significant environmental risks.

We are trying to understand the relationship between the chemistry, the structure, and the resulting properties. We hope to design and discover new materials that mimic

the performance of the halide perovskites but don't suffer from instability or toxicity.

The arrangement of atoms in a substance has an enormous influence on the properties of the substance. With this in mind, we are using sophisticated tools including X-ray and neutron scattering, nuclear magnetic resonance spectroscopy, and quantum mechanical simulations to build a detailed understanding of the behavior of atoms, molecules, and electrons in halide perovskites.

The high efficiency of halide perovskite solar cells is particularly mystifying because these materials are quite different from the conventional “semiconductor” materials used in solar cells and other electronics with respect to which elements they're made of, how they're made, and how they appear to function. Conventional

semiconductors are produced at great expense from high-purity ingredients on specialized equipment in large, industrial foundries because impurities and imperfections in the final material are extremely detrimental to performance. Halide perovskites can be prepared by a first-year grad student in a standard chemistry laboratory. This results in many impurities and imperfections, yet performance is relatively unaffected. We are seeking to unravel the origins of this remarkable behavior using a host of experimental and theoretical approaches.

If we can understand why the halide perovskites are so unexpectedly good at what they do, we can design and discover lead-free alternatives, as well as apply this insight in other areas of materials science and chemistry.

*At the Ram Seshadri Group, **Doug Fabini** focuses on functional inorganic materials. He participated in the UCSB Grad Slam competition and won the 2016 Best Student Speaker Award at the UCSB Chemical Sciences Seminar.*

# Doing Dignity Work



## Rosie Bermudez

Ph.D. Candidate, Chicana and Chicano Studies  
2017 Woodrow Wilson Women's Studies Fellow  
2017 Ford Fellow

As a Chicana from a working poor family, my lived experiences with generational poverty, addiction, incarceration, death, and, more importantly, strength, resilience, and determination, have shaped my commitment to research, teaching, and service in higher education.

My parents, both born in Los Angeles, did not complete their high school education because of their impoverishment. As a youth, I did not have models of academic success. I only had my father's example of alcoholism, incarceration, and premature death.

By the time I was in the eighth grade, these experiences, coupled with other personally difficult matters, had resulted in self-destructive behavior leading to my expulsion from the Los Angeles Unified School District and introduction to the juvenile

justice system. Fortunately, I was blessed with the support and encouragement of teachers at the continuation high school I would graduate from a few years later in South Central Los Angeles, and later by several key professors during my time here at UCSB.

My lived experiences coupled with the necessary mentorship that I have received throughout my academic trajectory serve as the foundation to the motivation behind my research. As a first-generation college student of color, I recognize the significance of providing the necessary academic and personal tools for success in the academy. Likewise, I am explicitly conscious of the need to create room for new historical subjects who come from marginalized communities such as my own.

My research on Alicia Escalante and the East Los Angeles Welfare Rights Organization is rooted in my experience of witnessing the

indignities that my mother had to endure as a single mother on welfare. By paying attention to historical subjects and histories that have been cast to the dustbins, we can find an abundance of untapped knowledge, strength, and lessons that have the potential to serve us today as we continue to grapple with multiple forms of oppression and inequality.

My research is also inspired by the generations of youth of color who have yet to see themselves or their communities represented in the history they are reading and learning about in the university classroom.

I am committed to centering these histories in my scholarship and in the classroom, to creating access to higher education for those who have been historically marginalized in our society, and to nurturing future generations of students like me. We have so much to offer this ever-shifting world.

**Rosie Bermudez** is a Chicana and Chicano Studies Ph.D. candidate. Her dissertation "Doing Dignity Work: Alicia Escalante and the East Los Angeles Welfare Rights Organization, 1967-1974" focuses on the human dignity struggles waged by single Chicana welfare mothers in East Los Angeles at the confluence of multiple social movements. She was instrumental in acquiring Escalante's personal archive for the UCSB Library.

# Developing Non-Invasive Therapies For Diabetics

## Kelly Ibsen

Ph.D. '18, Chemical Engineering  
Researcher, Daugherty Lab

**My graduate research at UCSB is motivated by a personal desire to improve the quality of the lives of children with Type 1 diabetes (T1D).**

When my daughter was diagnosed with diabetes, she became one of more than 1 million children and adults in the United States who must inject themselves with insulin because their bodies have stopped making it. Without insulin, sugar levels in the blood rise, causing life-threatening issues. T1D is a frustrating disease that takes over your life, complicating food choices and requiring dose calculations for multiple insulin shots daily to keep blood sugar levels stable, something the rest of us never have to think about.

The mental burden is staggering for an adult, much less a child and even greater for those who suffer from needle phobia, a common fear. Injected insulin also has a less predictable effect on blood glucose

levels than insulin produced by the body. The shot that worked to control the carbs in yesterday's lunch may not work today -- or, it may work too well, making the blood sugar go low, a dangerous condition that can lead to death without immediate intervention.

Trying to keep blood levels in check can become a vicious cycle: eating to treat low blood sugar results in going high, and taking too much insulin to treat the high means going low again. Rinse and repeat. Food becomes a tool, a danger, and sometimes the enemy.

As I watched my daughter struggle with the all-consuming work of living with diabetes, it wasn't enough for me to just help her each day. I wanted to change her future. I had been doing research as a chemical engineer for decades, but didn't have the biological training needed to work in diabetes research, so I decided to go to graduate school.

I specifically chose UCSB's Chemical Engineering program for its commitment to biologically-based research and the opportunity to participate in the Center for Bioengineering's special emphasis program. My advisors Patrick Daugherty and Sami Mitragotri have helped me find and study important issues in diabetes, including improving diagnostic tools and developing non-invasive insulin delivery therapies.

I felt helpless after my daughter's diagnosis. Now, I feel armed with the tools to make a difference in the lives of diabetics. There have been amazing breakthroughs in diabetes treatment, from the discovery of insulin therapy by Drs. Banting and Best in the 1920s, to the recent development of artificial pancreas systems that will significantly improve a diabetic's quality of life. There is so much more to do. I am ready to join the ranks.



**Kelly Ibsen** worked for several years before pursuing her Ph.D. in Chemical Engineering at UCSB. As a finalist at the 2017 UCSB Grad Slam competition, she presented on her research into a class of ionic liquids that can penetrate skin with minimal irritation while enabling the transport of large molecules through the skin and into the bloodstream.



# A Transnational History of the North American West

## Laura Hooton

Ph.D. '18, History

2017 Interdisciplinary Humanities Center Pre-Doctoral Fellowship

2016/2017 Brython Davis Graduate Fellowship

2016 UCSB Dean's Prize Teaching Fellowship

**I research and teach about race and ethnicity, especially social movements, migration and immigration, and the intersection of borderlands history and Black Studies.**

My dissertation is about the history of an African American agricultural community in Baja California in the early twentieth century that sought to change racism in the United States from just south of the U.S.-Mexico border. When I began this research project, I was motivated by my interest in discussing how people fight for and dream of

equality and justice for themselves and their communities, and drawing connections between the past and present. In my time at UCSB, my research has been impacted by my students and my teaching.

My research questions, especially the connections between race, citizenship, and identity in North America, at first relied on my experiences working with Black Studies and borderlands history scholars at UCSB who encouraged me to think deeply and widely about these topics. As I began to engage with students as a

teacher, students' genuine interest in understanding their own place in our society and in the larger world pushed me to more clearly articulate how identity, especially race and ethnicity, informs our history and our present-day society.

Ultimately, I hope to become a faculty member focused on teaching and research about race and ethnicity. UCSB has encouraged and strengthened my passion for both parts of the university professor position.

***Laura Hooton** recently graduated with a Ph.D. from the Department of History with an interdisciplinary emphasis in Black Studies. She is currently the Postdoctoral Fellow in American History and Diversity Studies in the Department of History at the United States Military Academy at West Point. Her first monograph focuses on Little Liberia, an African American agricultural community in Baja California in the early 20th century, as well as its larger place in the United States, Mexico, and Baja California History, Black Studies, and social movements.*

# Creating and Understanding Micro-LED Displays



## David Hwang

Ph.D. '18, Materials Science & Engineering  
Researcher, DenBaars Group

**Displays are a critical part of mobile and portable electronic devices like smartphones, smart watches, and smart glasses.**

Emerging technologies such as virtual reality (VR) and augmented reality (AR) will allow for seamless ways for people to access information. VR/AR displays require small form and flexible factors, ultra-high resolutions, and high energy efficiencies.

Today's display technologies do not meet all these requirements. A display is essentially made of red, green, and blue (RGB) pixels. The two current technologies used in consumer products are liquid crystal displays (LCDs) and organic light-emitting diode (OLED) displays. These technologies suffer from issues with low efficiencies, low brightness, and rigid form factors.

My research is focused on creating and understanding a third type of display that is still in its infancy: micro-LED display. The core of the micro-LED display is its light source, which is made of inorganic LEDs. Micro-LEDs are promising as they may reach high brightness, high energy efficiencies, and long lifetimes. To reach high resolution, ultrasmall micro-LEDs with dimensions smaller than 20 micro-m are needed (for comparison, human hair is about 50-100 micro-m thick).

A major challenge in creating micro-LED displays is the shrinking of LEDs. The LEDs in typical LED lightbulbs are on the order of 0.1 1 mm<sup>2</sup>-inch area. Micro-LEDs are 100,000 times smaller in area.

This decrease in size causes many issues in micro-LED fabrication, energy efficiency, and handling.

Research in Professor Steven P. DenBaars' group and the Solid State Lighting and Energy Efficiency Center (SSLEEC) is being done to clarify the reasons behind performance drops as micro-LEDs decrease in size. Recent work has shown that micro-LED efficiencies drop by about 20 to 30 percent when decreasing their size. By understanding the root cause of the drop in efficiencies, new device designs can be created. Along with the efficiency drop, assembling red, green, and blue micro-LEDs next to each other is no longer trivial.

This issue of mass transfer arises because there is no existing robotic machinery capable of handling these tiny devices. Other work in SSLEEC is related to developing a mass transfer technique to enable micro-LED assembly.

**David Hwang's** UCSB research pushes the boundaries of optoelectronics and technology. He is developing methods to fabricate high-brightness and high-efficiency electronic displays using GaN micro-LEDs. He has conducted independent research on III-nitride metalorganic chemical vapor deposition (MOCVD) growth and nanofabrication. David was a finalist in the 2016 UCSB Grad Slam competition.



# Proteins and Pathways that Potentially Regulate the Aging Process

## Dominique Houston

M.A. Candidate, Molecular, Cellular, and Developmental Biology  
Researcher, Denise Montell Lab  
2017 UCSB Grad Slam Finalist

**The general answer to what motivates my graduate school research is the same that almost all graduate students would give: curiosity.**

Most graduate students would also acknowledge that it takes a pinch of insanity to take on the daunting task of attempting to answer questions that no one really has the answers to. While rewarding, research can also be frustrating.

My research project seeks to identify new proteins and pathways that are potentially involved in regulating the aging process by studying a protective trait in the fruit fly (*Drosophila melanogaster*), called Diapause. My advisor Denise Montell presented this project to me while working as a lab technician in essentially the following form: "There's this interesting process

in flies called Diapause, where they basically don't age for several months during winter periods. Wouldn't it be cool if we could figure out how this works, and see if we can apply some of the principles involved to preventing tissue degeneration seen during aging?" I was instantly hooked!

After scouring through countless research articles about Diapause and the aging process, I knew that I wanted to get a more "hands-on" experience; or rather, I realized that I might as well be getting a degree for all of this work I was doing. So I applied for the master's program in MCDB and was accepted! From that moment on, I began life as a graduate student.

As no one else in the lab was currently working on this project, I had to start from the ground

up. This was probably the most difficult thing I've ever had to do, and what I would consider to be my greatest accomplishment in graduate school. With the help of postdoctoral researcher Sreesankar Easwaran, I began to put together an experimental design and teach myself things I had never before thought I could ever learn.

It's amazing how graduate school and research in particular takes you so far out of your comfort zones, and really tests your capabilities of adapting to new and evolving situations.

I believe that this plays a huge role in what motivates my graduate school research, because despite its many set-backs and failures, the opportunity for discovery and innovation is so overwhelmingly inspirational that you persist.

*Dominique Houston's graduate school research at UCSB is focused on the impact of the environment on ovarian development. Working with her research colleagues at the Montell Lab, she focuses on uncovering how flies integrate environmental cues into reproductive development. Dominique participated as a finalist at the 2017 UCSB Grad Slam competition with her talk titled "DID I PAUSE? DIAPAUSE: A Story of Suspended Animation."*

# The Paradoxes of Golden Lilies



## Fang He

Ph.D. '18, History

2017 UCSB Graduate Division Dissertation Fellowship

2016 UCSB Grad Slam Semifinalist

2015 James D. Kline Fund for International Studies Award

**My dissertation centers on the roles of visibility and the racialized body to understand American inclusion and exclusion. It investigates the politics of Chinese footbinding in American discourse and in the enforcement of American immigration laws against the Chinese in the late 19th and early 20th centuries.**

It was not until I took history classes in college that I discovered a piece of myself in historical thinking. History captivates me every time it puts the social and cultural "norms" I took for granted into perspective and challenges me to reconsider the artificial boundaries that rule our imagination about the possibilities of individual, local, and global transformation.

However, it was not an easy decision for me to choose to pursue

a Ph.D. in History in the United States. Most Chinese students are coming here to study in STEM fields, which in general have better funding and job prospects. People questioned and are still questioning my "impractical" decision. In those moments of soul-searching, I came to realize how much I hoped to step outside my comfort zone, to meet people with different points of view, and to learn firsthand about the United States. I chose to listen to my inner voice. I love intellectual stimulation. I am willing to spend my time and effort on something that truly excites me. To me, this is the most practical choice.

My journey of graduate study at UCSB has reinforced how worthwhile this effort is. Everything is part of learning and growth. The more I realize that current challenges of the world are deeply rooted in the past, the more I desire to tell stories that

led us to today yet have been fading away from collective memory. As a woman of color, I gained deeper insights into the racialization of minority groups. I seek to reclaim the significance of the pasts that have often been relegated to marginal roles in traditional narratives of U.S. history. I aspire to denaturalize conventionally-held knowledge about race, gender, class, national identity, and the body on the both sides of the Pacific.

I love the quote from the American poet Robert Frost, "I took the one (road) less traveled by. And that has made all the difference." This is a journey in which the lines between research and life, challenges and rewards blur. I am here not just for the degree, but for the person I hope to become. Pulling my research sources into focus, I have rediscovered myself.

**Fang He's** dissertation is titled *"The Paradoxes of Golden Lilies: Bodies, Admissibility, and American Empire in Enforcing Chinese Exclusion Laws."* She published a book chapter *"Golden Lilies Across the Pacific: Footbinding and the American Enforcement of Chinese Exclusion Laws"* in *Gendering the Trans-Pacific World* (Brill, 2017).

# Synergy and Structure in Linguistics

## Joseph Brooks

Ph.D. Candidate, Linguistics

2015 Dean's Fellowship Award

Co-Organizer, New Adventures with Indigenous Languages

**Since 2012, I have conducted research in a village in Papua New Guinea (PNG).**

Two main languages are spoken there including the traditional language, Chini, which is actively used by about 50 people.

Some aspects of the research are hard. There are no modern comforts in the village, and the risk of mosquito-borne illnesses is ever-present. In addition to the practical challenges are certain social complexities. As a white man from the United States, the immense privilege I am afforded in my home society increases by several magnitudes in PNG.

While these and other complexities cannot be understated, several motivational factors keep me going back to PNG and keep me focused on making the work meaningful to me and to the people I work with.

The underlying research question that led me to PNG in the

first place is what it takes to understand—and at a deep level — the workings of a language as distant from and as historically unrelated to my own as Chini is by several unknown tens of thousands of years.

The linguistics department at UCSB trains students like me in the study of how different languages work, how they develop over time, and how they are used by the people who speak them. What I find exciting about this approach is that those questions become more apparent when we are equipped with the right tools and training.

The questions are fundamentally empirical, resolvable to the data from recordings of language as people use it in their day-to-day lives. Linguistic analysis based on this data involves interacting with what other linguists have learned and have continued to learn in their own research contexts.

I am motivated by the synergy between the broader linguistics

academic world and all the 'bottom-up' insights gained by other linguists. What also motivates me is learning how different languages can be from one another, often in ways linguists would not have imagined.

Part of good linguistic research involves not just an unquestioning application of particular analytic principles, but also studying another language and culture in its own terms. This can mean discarding long-held approaches or assumptions about the universality of a linguistic category or structure.

For example, most languages in the world have number systems (marked on nouns, verbs, and/or other types of words) where the categories 'singular' and 'plural' are distinguished — very similar to what we have in English.

The category 'singular' is often assumed to be universal across human languages. Yet in Chini, the number opposition



found throughout the grammar distinguishes not 'one' (singular) versus 'two or more' (plural), but rather 'relatively few' versus 'relatively many.' Just from this previously undocumented and undescribed language, we learned that something we thought all languages have is not in fact universal. Human languages are more diverse in their categories than we knew previously.

This gets me to my over-arching motivation, which is the intellectual process of trying to see the world through someone else's perspective. What I think I know about the Chini language and culture is always at risk of being

too much a product of my own perspective. Learning what aspects of my own approach that I need to rethink, deconstruct, or discard altogether keeps me going — even though it is fairly humbling!

When I do the work to understand local peoples' world views, epistemologies, and ideologies (including about their languages), I become more able to see the pitfalls of my outsider perspective.

This in turn allows me to gain a more intimate and true-to-life understanding of the people I work with. It is truly rewarding work and I cannot imagine doing anything else.

**Joseph Brooks** is focused on documenting the Chini language spoken in Papua New Guinea. His approach to linguistics is based on the analysis of connected speech data, with the goal of understanding linguistic structure, its development over time, and how structures are used by speakers. His research seeks to answer questions as part of a broader cultural-historical context where genealogical developments and contact have affected linguistic structure at all levels.



# Improving Farming in Kenya with Smart Tech

## Natasha Krell

Ph.D. Student, Geography  
Researcher, UCSB Caylor Lab  
Fulbright Awardee, Kenya

**My work is motivated by the question of how farmers, particularly in Sub-Saharan Africa, will continue to deal with a changing climate.**

We are seeing more variability in rainfall and higher temperatures which create challenges for households dependent on rainfed agriculture for their livelihood. Smallholder farmers, particularly women farmers, are vulnerable because they have relatively few assets to fall back on when the rains fail or when floods wash away their seeds.

Where I work in Kenya and Zambia, farmers are experiencing the effects of climate change, and they have contributed little to the problem.

On the bright side, services such as crop insurance and technological advancements to deliver information about seasonal forecasts or threats such as pest or disease outbreaks are on the rise. As farmers and communities gain access to these sorts of information, they can improve their resilience or ability to bounce back when crises occur.

However, there is still a lot we do not know about farmers' agricultural management and decision-making. There are also significant barriers that prevent farmers from accessing novel information streams that can improve their yield and livelihood.

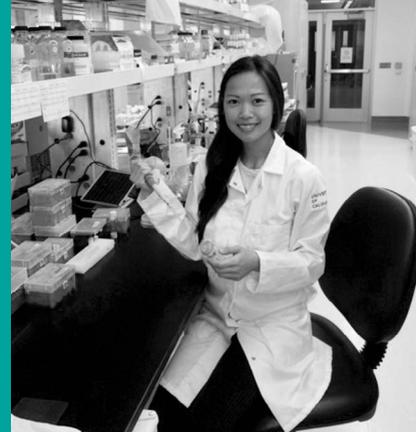
At UCSB, I have the opportunity to travel to my field sites to survey farmers about their management

practices through both household-level surveys as well as real-time Short Message Service (SMS) surveys. With SMS surveys we can get information about how farmers' decisions change throughout the growing or rainy season. We pair this information with environmental data collected by weather stations that provide us with a sense of how the local environment is changing around farmlands.

Putting these environmental and social datasets together allows us to ask questions about how the natural environment and the social environment affect farmers' decisions and also how the social environment affects farmers' decisions and, in turn, yields.

***Natasha Krell** researches socio-hydrological systems, the use of Information Communication Technologies for climate smart agricultural development, and climate variability impacts on smallholder farmers in Sub-Saharan Africa. Her work couples novel environmental sensors with SMS-based surveys to understand farmer decision-making in southern Zambia and central Kenya. She is a Fulbright Fellow conducting research on the gendered determinants of mobile phone use and adoption of communities at the foothills of Mount Kenya. She works closely with international partners at the Zambian Agricultural Research Institute, Kenya's Mpala Research Center, and Karatina University.*

# Defining Receptors and Signaling Pathways



## Nicole Leung

Ph.D. Student, Biomolecular Science and Engineering  
Graduate Student Researcher, Craig Montell Lab

**I am driven by my passion for basic science discoveries, mentoring students, and science communication.**

As a fifth-year Ph.D. student in the Biomolecular Science and Engineering program in the Craig Montell Lab, I aim to define the receptors and signaling pathways that allow animals to sense environments and guide behavior.

I focus on a protein found mainly in the eye called opsin and its surprising roles outside of the eye. For over a century, opsins were thought to function exclusively in light sensation. In recent years, our lab has shown these light-sensitive opsins are also important for other sensory modalities, such as temperature sensation and circadian rhythm.

My work uncovers a new role of opsins in bitter taste sensation, revealing first evidence for opsins in chemosensation. Opsins represent a new class of polymodal sensory receptors.

The light-independent roles of mammalian opsins are largely unexplored and have broader impacts for human physiology and medicine. Our lab uses *Drosophila melanogaster*, the fruit fly, as a model organism to study sensory neurobiology. The fruit fly allows us to approach basic science questions with molecular biology techniques, as well as with genetics and electrophysiology. Recent published work by others shows the presence of opsins in human taste receptor cells. I am currently conducting a screen of bitter compounds to identify those that activate human opsins using cell culture.

In addition to working at the lab, I am dedicated to teaching and mentoring. The most rewarding experience is serving as a mentor for the UCSB Research Mentorship Program for high school students interested in research. The caliber, dedication, and positive energy of these students is inspiring, and it brings me great joy to share my passion for science and research

with them. I mentored a total of four students through the program and I hope that I inspired them as my mentors have inspired me.

I am also passionate about science communication. I enjoyed presenting my research at scientific conferences and feel it is important to engage with the public about my lab work. I participated in the 2016 UCSB Grad Slam and represented UCSB at the UC-wide competition. I also submitted a piece to the UCSB Art of Science competition in 2017 titled, "Neuronas o árboles?," showcasing neuronal projections in the tongue of a fruit fly. I feel mentoring and communication are vital parts of my training to become an independent scientist. I am thankful for the many opportunities at UCSB to be a better researcher, mentor, and advocate.

**Nicole Leung** is a researcher at the the Craig Montell Lab. She was the 2016 UCSB Grad Slam champion, and won the Art of Science competition with her lab colleague Tyler Ogunmowo.



# Collective Social Empowerment, Environmental Connection, and Food System Change

## Michelle Oyewole

Ph.D. Candidate, Geography  
Graduate Student Researcher, Broom Center for Demography  
2016-2017 Kennedy/Graves Awardee  
2015 NSF Graduate Research Fellow

**In my four and a half years of study at UCSB, my motivation has always been related to having people who are supporting me, and a project that is interesting and personally meaningful.**

Currently, I am inspired by working on social, racial, food, and environmental justice issues surrounding school gardens in Brooklyn, New York.

I have been motivated by my current Ph.D. committee, my community of student advocates, my inspiring partner, family, and friends outside of this institution. I'm motivated by the young people of color in middle and high schools I've worked with who are itching to create a better future and are seeking a means to do so. I am

motivated by the potential of school gardens to provide collective social empowerment, food system change, environmental connection, self-love, and self-efficacy for people of color.

I'm interested in the potential of gardens to help find solutions, in partnership with organizations and communities, to injustices like the prison industrial complex and uneven environmental degradation.

I am motivated by a love for the earth and how it makes me feel when I am rooted in an understanding of the interconnection between the organisms on our planet. I am motivated because my methods of study—social justice, social science, and biogeochemistry—help me deepen this wisdom while simultaneously working to transform

broken systems. I am motivated by the fight to liberate people of color and other marginalized communities from mindsets or institutions that do not serve them.

I am motivated because the projects I have been involved with, academically and otherwise, have been steps in the direction of a future that is exciting to me.

I feel fortunate to be working on a personally meaningful Ph.D. and to be involved with a campus community working to change social inequality in academia and society, and with a community that is interested in solving environmental issues in the face of climate change with tremendous thoughtfulness and creativity.

*Michelle Oyewole is a doctoral candidate in the UCSB Geography Department. Her research examines social and environmental outcomes of school gardening, with a focus on varying effects in neighborhoods of different racial, ethnic, and socioeconomic composition. She was a finalist in the 2014 UCSB Grad Slam.*

# Patterns of Health



## Amy Anderson

Ph.D. Student, Anthropology  
Graduate Student Fellow, Broom Center for Demography

### We all know that the experiences of a lifetime become written into our bodies.

From wrinkles to methylated DNA to our skeletons, our lives shape us as we live them.

There is a literal 'bare bones' story to be told about each life. Bones are our support structures. They tell only our most chronic aches, long-kept habits, and sharpest traumas.

As an undergraduate, I was captivated first by the organic beauty of our internal architecture, and then by the questions that bones could be made to answer.

There are stories to be told, if we have the cipher, of personal frailty and resilience, of how nations rise and fall, of how the landscapes people changed altered us in return.

I am a Ph.D. student in anthropology, and my work is at the intersection of human biology and bioarchaeology. I am interested in patterns of health that play out across time and space, from the cells of a single tissue to the disease ecology of entire populations.

My main research looks at how disease affects the skeleton, and my dissertation will focus on skeletal indicators of anemia in both living populations and archaeological human remains. Towards the end of my undergraduate studies I found myself starting to ask questions that couldn't be answered by archaeological skeletal remains alone. There is so much we don't know about how our lived experiences impact our skeletons. It's astonishing to realize how much there is left to uncover about the human body, let alone the rest

of the universe. I followed my questions into a graduate program that focuses on human evolution, with an adviser who was willing to bet on a student without a background in biology. From talking to human biologists, physicians, and bioarchaeologists, I discovered that, though all three specialties are dedicated to understanding human health and disease, they take different approaches and ask disparate questions. I am carving out a niche for myself as a translator among allied disciplines.

Every person who ever lived had a skeleton. By triangulating data from existing medical data sets, translational research, and archaeological sites, we can expand the edges of the known universe a little further, or, at least, create a slightly more complete owner's manual for the human body.

**Amy Anderson** is a graduate student in Integrated Anthropological Sciences. Her research focuses on the skeletal biology of disease and nutrition in living and past populations. Her current research is an analysis of anemia and its risk factors in the Tsimane people of lowland Bolivia. She is also interested in ecological immunology and skeletal variation over the life course as it relates to pathogen load and nutritional status, particularly in diseases that present salient public health challenges with a traceable history in the archaeological record, such as tuberculosis. She holds a B.A. in archaeology and classics from the University of North Carolina at Chapel Hill.

# I, Thou and the American AIDS Play

## Eric Jorgensen

Ph.D. '18, Theatre and Dance

UCSB Doctoral Scholars Fellow

2018 Commencement Student Speaker

**My dissertation explores the corpus of American drama and performance written about and in response to the HIV/AIDS pandemic. Three pieces of my life came together and led me to my research area.**

I am an actor. And like so many other theater artists, I discovered a piece of my soul in the theater. It is a place of action, escape, and transformation. I truly believe that the American theater consistently and powerfully challenges society to be better than it is. Plays from the past are documents of how we lived then. New plays are mirrors for the way we live now. And anyone who steps foot in the theater is a participant. Theater practice and theater scholarship make each other stronger. In studying the cultural impact of American AIDS performance, I have come closer to understanding why theater practice is always relevant.

I have worked in international humanitarian aid. For nine years, I was a part of the financial and administrative team of Médecins Sans Frontières (MSF)/Doctors Without Borders. I traveled to places I never dreamed my professional training would take me. Among these were HIV clinical projects in Kenya, South Sudan, and Uzbekistan. I saw firsthand how one of the finest organizations in the world tackles medical emergencies that are often forgotten – or are presumed to be in the past. The AIDS crisis is not over.

I live with HIV. That does not mean the same thing it once did. I have a full life ahead of me. But with my hopeful prognosis comes an obligation to remember those who died. The theater is a place where their stories are remembered and told.

The American AIDS plays matter. They provide unique and powerful ways of understanding the pandemic. They represent the best of humanity and demonstrate how art can survive the worst of times. I am proud that my research allows me to take part in their caretaking.



**Eric Jorgensen**'s research focuses on the corpus of American drama written about and in response to the HIV/AIDS pandemic. He was inducted as a distinguished member in the UCSB chapter of the National Society of Collegiate Scholars, and received the 2017 Dean's Prize Teaching Fellowship for the Division of Humanities and Fine Arts. He was the featured student speaker at the 2018 Graduate Division Commencement Ceremony and was runner-up at the 2017 UCSB Grad Slam.

# The Impact of Giving to Graduate Education

We hope you enjoyed this insight into the research and lives of twenty-one outstanding scholars at UC Santa Barbara.

Together with nearly 3,000 other graduate students, they are essential to UCSB's overall excellence and our mission as a leading research and teaching institution. Outstanding graduate students attract stellar faculty and contribute creativity and an entrepreneurial spirit that form the backbone of our research programs. They serve as mentors and teachers for our undergraduates, and they go on to leadership positions in California, the United States, and the world in fields from academia and government to art, engineering, and the sciences.

Alumni and friends of UC Santa Barbara have an opportunity to impact research and scholarship – and above all, the lives of students – by supporting graduate fellowships and programs. Britta Schumacher, recipient of the Emil Steck, Jr., Graduate Fellowship, and Chryss Yost, who received the Satomi Family Fellowship, are just two of the many students who benefit from gifts to graduate fellowships, research funds, and program support.

We hope you will continue or join with others to support students like the ones highlighted in this magazine by making a gift to the Graduate Fellowship Fund, the Dean's Fund, or the Graduate Research Fund the next time you receive a letter, e-mail, or phone call from UCSB. You may want to consider starting a named graduate fellowship in honor of your family or an important individual in your life. Or, as you plan your will, please think about including UCSB graduate students among those who benefit from your generosity.

If you would like to discuss how you can make a difference for our students, we would love to hear from you!



## **Julie Karbula**

Assistant Dean of Development

[julie.karbula@ucsb.edu](mailto:julie.karbula@ucsb.edu)

805-893-2190



"It has been great to learn the reasons that we do what we do here -- to actually see it backed up with science and research across institutions and over time. I want to be able to build strong programs that are based on tested theories, on strong research, and that can accommodate and serve a broader range of students more effectively. I would like to thank the UCSB Graduate Division and the Satomi family."

## **Chryss Yost**

Ph.D. '18, Education  
Santa Barbara Poet Laureate (2013-2015)  
Author, Mouth & Fruit  
Co-Editor, Gundpowder Press  
Founder, Shoreline Voices Project  
2018 Satomi Family Fellowship Awardee

"With support from the Emil Steck, Jr., Fellowship, I was able to spend my summer abroad in the Kilombero Valley, the heartland of smallholder agriculture in south-central Tanzania. My research team and I completed over 200 household questionnaires in three villages. We asked questions about environmental perceptions, migratory behavior, and agricultural practices, to begin understanding their social, political, and environmental dynamics. This research would not have been possible without the Steck Graduate Fellowship. I am beyond thankful for the opportunity that this fellowship has provided -- and will continue to provide -- graduate students like me in the future."

## **Britta Schumacher**

M.A. '18, Geography  
Emil Steck, Jr., Fellowship





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