

Being Costa Rican has had an enormous impact in shaping who I am today, and as a “Tico,” I try to live my life by our national motto and phrase “Pura Vida.” It means “pure life”, but it has many significances and uses. Growing up in the U.S. as a Latino minority has made my own interpretation of this phrase a key instrument in connecting me back to my roots and guiding my interests in tropical biology. Since childhood, my family has traveled annually to Costa Rica to visit family. My favorite part of these trips was always our excursions to the national parks, which instilled in me an interest in learning about their vast ecological biodiversity. A large part of this interest was also due to the stories and teachings of my uncle who worked as a park ranger in Costa Rica for many years. My adventurous mind was filled with ambitions to work in the rainforest among the wildlife, and now, has transformed into a fascination with understanding the evolution and mechanisms which enable animals to possess plastic traits under environmental stress. **My personal background, research experiences, and passions for science education and outreach have all motivated me to pursue a Ph.D. in Ecology, Behavior, and Evolution at Boston University.**

Intellectual Merit: Studying Ecology, Behavior, and Evolution at UC San Diego as an undergraduate provided me with valuable research experiences that helped shape my intellectual interests in ecology. My first research opportunity was serving as a research assistant in Dr. Jon Shurin’s aquatic ecology lab at UC San Diego from 2013-2014. I assisted a graduate student studying the effects of environmental variability on salt marsh plant interactions. My responsibilities included setting insect traps in the field, sorting and identifying invertebrates, and setting up and sampling a common garden experiment. Through this experience I gained diverse skills in experimental design, data management, insect identification, plant research methodology, and was first exposed to studying the effects of a variable environment.

In the summer of 2014, I was awarded a \$4000 Ledell Family Undergraduate Research Scholarship in order to research mountain lake foodwebs in Yosemite National Park with the Shurin Lab. I lived and worked at the Sierra Nevada Aquatic Research Laboratory and the Sierra Nevada Research Institute for 3 months while assisting graduate students both with a mesocosm experiment and conducting field surveys of lakes. My tasks consisted of setting up large-scale experiments, collecting water chemistry data from the field, preserving samples in the lab, and other various field tasks. There, I also performed my first small independent research project on the impact of temperature on CO₂ flux from mountain lakes and found that experimental temperatures influenced pCO₂, where the highest temperature site had the highest pCO₂. Conducting my own research progressed my abilities in developing and testing environment variability-related hypotheses, collecting and analyzing my own data, and presenting my findings in a report submitted to my university and funding sources.

After my field research experience in Yosemite, I was eager to continue working in field-research biology. Because of my Costa Rican heritage and lifelong interest in tropical ecology, I desired to conduct research in the rainforests of Central America. **In the summer of 2015 I applied and was awarded an NSF Research Experience for Undergraduates (REU) fellowship to work at the Smithsonian Tropical Research Institute (STRI) in Gamboa, Panama¹.** I worked on an independent research project in Dr. Karen Warkentin’s lab on adaptive plasticity of red-eyed treefrog (*Agalychnis callidryas*) embryo behavior. Specifically, I (i) recorded and analyzed macrovideo of hatching performance to measure developmental changes, (ii) used flooding experiments to quantify rates of hatching complications across development and (iii) designed and conducted original phototaxis and photoperiod experiments to determine if visual (light) cues play a role in hatching direction and timing.

¹Smithsonian Tropical Research Institute. “BRANDON GUELL_REU STRI Intern”. Online video clip. YouTube. YouTube, 18 Nov 2015.

I found that red-eyed treefrog embryos use light cues to orient hatching direction when flooded and to time ‘spontaneous’ hatching. I also found that hatching performance improves developmentally and rates of hatching complications decrease, so hatching attempts are more likely to lead to fatal complications in younger embryos. My involvement in this REU further developed my skills in formulating research questions, designing unique experiments and equipment to answer my questions, and analyzing data using R statistical software. It also introduced me to scientific photography and videography, as well as using custom-engineered tools for data collection and analysis. I gained invaluable experience through presenting my findings in formal settings at both the 2015 STRI Intern Symposium in Panama City, Panama and at the 2016 Society for Integrative and Comparative Biology international conference in Portland, Oregon^{2,3} for which I received a \$1000 BIO-OCE REU travel scholarship. **My work is currently being drafted and submitted for publication**^{4,5,6}.

In an effort to expand my research experiences in an array of ecological systems, I undertook an independent research project in Dr. Carolyn Kurle’s lab at UCSD in collaboration with the National Oceanic and Atmospheric Administration’s (NOAA) Marine Mammal Lab (MML) studying the changes in foraging ecology and behavior in northern fur seal pups (*Callorhinus ursinus*; NFS) on the Pribilof Islands. In late summer of 2015, I collected whisker, blood, muscle, liver, stomach, milk, intestine, and fecal samples from animals taken during the subsistence harvest on St. George Island. I am currently performing stable isotope analysis (SIA) on the tissues in order to determine whether pups forage for prey to supplement milk consumption and whether pup weaning periods can be determined using SIA and stomach content analyses. I also assisted with the annual flipper tagging of pups for survival and population estimates, as well as the satellite tagging of pups and adults for geospatial foraging data. Partaking in this research has introduced me to new biochemical and telemetry techniques, gave me extensive animal handling experience, and strengthened my abilities to perform independent research, especially in data analysis and communicating my work through presentations and publications. **I am presenting this work at the 2016 Western Society of Naturalist Conference in Monterey, CA this November, and at the 2017 Society for Integrative and Comparative Biology international conference in New Orleans, Louisiana in January. I am also currently working on a manuscript for publication of my findings.**

Working with NFS led to a newfound love for marine mammal science and provided me with a new network of scientists at the MML with whom I found mentorship and kinship. **Moreover, it reinforced my interest in addressing developmental questions that focus on changes in behavior and ecology.** I returned to the Pribilof Islands in 2016 to aid in the biannual shearing of newborn NFS pups. I assisted in the collection of dead pups, the recaptures of tagged adults for survival information, and in scat, spew, and carcass collections. I learned about long term experimental methodology from NFS production, population, and mortality estimates as well as extraneous data collection methods. I believe my experiences working with treefrogs in the rainforests of Central America and with fur seals on sub-arctic islands in the Bering Sea share a coherent intellectual framework at the intersection of ecology, behavior, and development. This is where I see my future research.

²Güell, BA & KM Warkentin, 2016. When and where to hatch? Red-eyed treefrog embryos use light cues. *Integr Comp Biol*, 56: E290-E290. ³Jung, J, SJ Kim, BA Güell, KL Cohen, & KM Warkentin, 2016. Ontogeny of escape hatching in red-eyed treefrogs: onset of response to flooding and attack cues. *Integr Comp Biol*, 56: E310-E310.

⁴Güell, B.A. & K.M. Warkentin. When and where to hatch: red-eyed treefrog embryos use light cues. Manuscript in draft. ⁵Warkentin, K.M., J. Cuccaro Diaz, B.A. Güell, J. Jung, S.J. Kim & K.L. Cohen. Developmental onset of the escape-hatching response in red-eyed treefrogs depends on cue type. Near-final manuscript for submission to *Animal Behavior* ⁶Warkentin, K.M., B.A. Güell & J. Cuccaro Diaz. Ontogeny of hatching performance in red-eyed treefrogs. Manuscript in draft.

Broader Impacts and Future Goals: I have benefitted immensely from working in foreign locations alongside a variety of cultures and local communities. In 2015, I led a field trip for the K-8 elementary school students of St. George Island, Alaska to the NFS rookeries where we observed and studied the biodiversity of their island. I was able to share my experiences about working with their charismatic fur seal neighbors, which are a crucial part of the local Aleut culture and history. In Panama, I worked and interacted closely with students from all across Europe and the U.S., as well as Central and South America. I also participated in an outreach video made by Thomas Vacanti, a high school teacher from New York, which highlighted my experiences and involvement in research aimed to inspire and encourage high school students interested in STEM fields⁷. **These international collaborative and outreach opportunities were rewarding; they helped refine my interests in outreach to underrepresented minorities, and provided me with insight on how scientific research can impact societies like the Aleut and Panamanian communities.**

In addition to outreach, I have been extensively involved in science education and teaching throughout my collegiate career. I served as a teaching assistant at UCSD for 2 years and taught various biology courses including Animal Behavior and Communication, Human Impact on the Environment, Organismic and Evolutionary Biology, and Biodiversity. As an assistant teacher, I was responsible for teaching course material in weekly small discussion groups; writing, grading, and administering quizzes and exams, and fostering a learning environment that enabled my students to succeed. My teaching experiences allowed me to gain a deeper understanding of the education system and have helped make me a more multifaceted scholar. In addition to teaching at UC San Diego, I also assisted in teaching private Spanish classes in multiple K-12 elementary and junior high schools in Long Beach, CA where I was tasked with helping prepare lessons and facilitate instruction. **As a Latino, I have always been grateful for the ability to communicate and express myself in multiple languages, and I am eager to transfer these skills to my graduate schooling, education, and outreach goals as a professional scholar and research scientist working in Central America.**

I have a strong desire to continue my graduate studies in tropical ecology with Dr. Karen Warkentin at Boston University (BU), specifically in examining the evolution and mechanisms of phenotypic plasticity in phyllomedusine treefrog embryos. As an underrepresented minority pursuing a career in science myself, I have firm intentions of taking on leadership and mentorship roles for diverse and underrepresented undergraduate students as research assistants. In addition, I aspire to become involved in outreach programs at BU such as “Biobugs” – this program exposes high school students to a university research atmosphere in a fun and engaging manner, using activities in ecology, anatomy, and forensic science to develop important research experiences in the STEM fields. I also intend to develop multilingual online outreach projects through webpages that offer the public *accurate* and useful information on my study species, in the hopes of countering some common misconceptions about these charismatic and appealing treefrogs. Most notably, my heritage motivates me to incorporate my research with bilingual/bicultural outreach opportunities. I plan on establishing authentic K-12 outreach programs for students in Costa Rica, Panama, and marginalized Latino students in Boston, integrating some of my work into their curriculums in the hopes of stimulating interests in STEM fields. I am confident that the skills and experiences I have acquired have prepared me to work internationally with students and professionals at STRI in Panama and other facilities throughout Central America. Receiving this NFS graduate research fellowship would greatly benefit me as I strive to incorporate my background, passions, and research and teaching experiences into a career devoted to scientific development, science education, mentorship, and outreach.

⁷Mrvacanti. “Brandon Guell Full Interview.” Online video clip. YouTube. YouTube, 1 March 2016.