



**BASIS** ORO VALLEY

SENIOR PROJECTS 2021-2022



# SENIOR PROJECTS

At this point in their senior year, BASIS Charter School students have completed a set of four BASIS Capstone classes to earn their BASIS Honors Diploma. In addition, many students are in the process of completing the prestigious College Board's AP Capstone Diploma™, a challenging, two-year sequence of AP Seminar™ and AP Research™, plus four other AP® Exams, all of which require extensive research, writing, and oral defense. The BASIS Diploma Senior Project marks the culmination of this hard work and perseverance.

Completed in the third trimester of a student's senior year, the Senior Project is unique, self-designed, and reflective of the students' varied academic interests and passions. Regardless of the discipline —business, art, humanities, science, engineering, social work, medicine, or law — each senior must develop and explore a research question. Creating an abstract that sets the tone of the research, participating seniors must submit a project proposal, and later, orally defend their methodologies.

Under the guidance of an external advisor who is a professional in their field, as well as a faculty advisor from their school, students dedicate 10-15 hours per week to the completion of their Senior Project. To document their journey, students post weekly blog entries about their experiences, successes, and challenges as they explore their guiding question. This journaling provides a unique viewpoint on the student activities and adds a reflective layer to their research process.

Throughout the development of the Senior Project, BASIS Charter Schools support their seniors every step of the way as they develop investigative skills and their own individual scholarly pursuits. The abstracts in this publication clearly illustrate each senior's ability to apply the knowledge, and intellectual curiosity they have acquired in the classroom to professional research methods and learning. At the successful conclusion of this project, students are eligible for a BASIS Diploma with High Honors, the most distinguished accolade offered by BASIS Charter Schools.

Each member of the BASIS Charter Schools network commends our seniors for their dedication, and motivation, not only for completing this Senior Project, but for their commitment to the BASIS Charter School Curriculum. Congratulations to them on this powerful achievement, and our best wishes as they move forward on their educational journey.



Carolyn McGarvey  
Chief Executive Officer  
BASIS.ed AZ+



Peter Bezanson  
Chief Executive Officer  
BASIS.ed Texas

## JAD BADER



### DETERMINING IF WIRELESS CATHETER RADIOGRAPHY IN MICE MODELS CAN PROVIDE SUITABLE DATA CONDUCTIVE FOR NOVEL PULMONARY HYPERTENSION TREATMENT

**ABSTRACT:** Pulmonary Hypertension (PH) is a fatal disease condition that can present signs in neonates and worsens with age (for minor conditions). The typical treatment of NO<sub>2</sub> operates on the basis of the actual mechanics that the disease presents. This treatment has proven successful but may lead to side effects like increased cancer risk or problems with blood clotting. Research opportunities for high schoolers tend to model traditional internships: menial tasks, promises of experiences, and maybe just maybe, you'll label some test tubes. All just to confirm something that's already known. However, this lab offers me an opportunity to gain real experimental experience, certification, a head-start to my medical career while simultaneously navigating undiscovered scientific territory. Under the guidance of Marisela Rodriguez, I've observed markers (proteins with predictable behavior) relative to a specific protein that we believe could provide insight into a possible new cure. Myocardin is a protein that regulates healthy contractile smooth muscle (the muscles in blood vessels that squeeze to help move blood). In PH we see increased levels of diseased smooth muscle cells that we call proliferative cells (cells that multiply but don't function like smooth muscle cells should). Our hypothesis which so far has been proven correct, is that patients with PH are deficient in Myocardin (which my results have proved). Therefore, for the future we could look towards future experiments where we take the Myocardin plasmid (loop of DNA) causing diseased patients to overexpress Myocardin and hopefully have alleviated symptoms and the correct adjustment of our markers. For the distant future, perhaps a COVID-19 vaccine approach with an mRNA vaccine could prove to be a great treatment for PH.

- **BASIS ADVISOR:** Tommaso Cioni • **ON-SITE MENTOR:** Marisela Rodriguez
- **LOCATION:** Banner Medical, University of Arizona Health Sciences Lab

## CONNOR BRYANT



### A DAY IN THE LIFE OF A PARK RANGER

**ABSTRACT:** The National Parks Service has been around for over 100 years, and there are now more than 400 parks around the United States that employ over 23,000 people in various positions. The most common position is the National Park Ranger, and chances are that, if you have been to a National Park, you have interacted with these Park Rangers. However, unknown to most people, Park Rangers do more than just answer questions and lead tours. They are also actively involved in research and studies that occur in the National Parks, and they help collect data for other researchers. For my project, I worked as a Park Ranger at Saguaro National Park, assisting Don Swann, a Ranger at the Park, with the research, conservation efforts, and data collection that occurs there. Among other things, I helped pull invasive grasses, removed old barbwire fencing, and gathered various pieces of data for several different projects. Through these projects and by working alongside Mr. Swann, I was able to get a better sense of the responsibilities that a Park Ranger at Saguaro National Park has. This will help me to educate others on what Park Rangers actually do which will hopefully give people a better appreciation for Park Rangers and the National Park Service and may even encourage others to follow this career path. As a country, we value our natural resources so much, and we give lots of attention to those resources. Doesn't it then make sense to learn about and value the jobs of those who protect those resources?

- **BASIS ADVISOR:** Tommaso Cioni • **ON-SITE MENTOR:** Don Swann, Biologist • **LOCATION:** Saguaro National Park

## CANELLA CARO



### THE PROCESS OF PRODUCING AN ALBUM

**ABSTRACT:** Music serves many purposes beyond entertainment. It can lift someone's mood and function as a coping mechanism for when someone is feeling down, anxious, or irritated. Music brings a sense of comfort--for centuries people have used music to tell stories and describe common experiences such as falling in love or going to war. I sought to tell my own stories and hoped someone else could find comfort in my work, as I have found comfort in music throughout my life. As the final product of my senior project, I have been working on a small album (otherwise known as an EP) of four songs. During the past few months, I have learned so much about composing music, songwriting, and sound engineering. I have also become well acquainted with the many different aspects of music production and have grown more confident in my abilities as a musician. I have primarily been writing and producing the EP from home, using equipment from my father's music room as well as my own instruments. In addition to my individual work, I have been interning as an assistant for Caleb, a sound engineer, at Monterey Court (a small music venue in Tucson). At this internship, I have learned how to manage the sound for live performances, communicate with musicians, and adapt to sudden technical difficulties. I ultimately plan to release the EP on multiple music streaming platforms (such as Spotify and Soundcloud) once I finish the recording process.

- **BASIS ADVISOR:** Philip Skorokhodov • **ON-SITE MENTOR:** Greg Haver/Caleb Hathawon
- **LOCATION:** Monterey Court Care and Music Venue

## EMMELINE CLOSE



### THE PINE OVERCOAT: THE PROCESS OF MAKING AND CREATING A DEMO GRAPHIC NOVEL

**ABSTRACT:** In the world of art, graphic novels are an exciting and relatively new addition. Although not seen as immediately important, graphic novels have the amazing ability to incorporate the visual aid of pictures with text, combining two ancient forms of artistry. Graphic novels tie back to how civilizations themselves were created and that heritage is fascinating to me. I created my own "demo" or "sample" of a historical, horror graphic novel. I contributed to the understanding of how graphic novels are made. In addition, using storytelling within my "demo" graphic novel, I contributed awareness to relevant topics in today's society. I worked with Joseph Long at the University of Arizona, learning more about art in a business and academic setting and aiding the department in their work involving the use of art. The use of my graphic art tablet, stylus, and laptop was invaluable and helped to create a fully finished and colored "demo" or "sample" graphic novel with an original and provocative story by the end of the given weekly schedule. Combining drawing and writing elements together, the end product was an intriguing reflection of my artistic style, outsider information, and knowledge: a unique blend to create a unique product.

- **BASIS ADVISOR:** Annalisa Ard • **ON-SITE MENTOR:** Joseph Long • **LOCATION:** University of Arizona

## IMAN DIN

### TAKING PICTURES OF ALZHEIMER'S DISEASE USING SPECIALIZED MRI TECHNIQUES



**ABSTRACT:** An estimated 5.5 million Americans suffer from dementia caused by Alzheimer's and a devastating 20% of them are misdiagnosed. Alzheimer's is difficult to diagnose because its symptoms overlap with other neurodegenerative diseases, such as benign brain tumors and Parkinson's. Current treatments for Alzheimer's require early diagnosis since they are only prevention methods and there is no known cure. MRI scanning is a potential solution to this issue because they are noninvasive and can produce detailed images, but current MRI techniques aren't yet advanced enough to map the microstructural changes of early-stage Alzheimer's. In an effort to address this, I worked with the Hutchinson lab at the University of Arizona to research non-traditional, specialized MRI techniques and their ability to map Alzheimer's pathology to find new MRI markers for Alzheimer's Disease. My main role had been researching and reviewing papers on these specialized techniques for my analysis at the end of the project. If microstructural differences are detected with my analysis, this research could serve as evidence for the merit of specialized MRI techniques in detecting Alzheimer's Disease and the merit of further research on the topic. Extensive research is required to implement a treatment for Alzheimer's Disease and exploring different avenues for early detection of the disease, such as MRI scanning, is necessary to accomplish this.

- **BASIS ADVISOR:** Dallin Bundy • **ON-SITE MENTOR:** Courtney Comrie
- **LOCATION:** University of Arizona, College of Engineering

## CAMI LEE

### THEATER OF THE MINDS: A PODCAST ABOUT THE WORLD'S STORIES



**ABSTRACT:** We are stuck in a European mindset. Whether that be the fault of Tolkien who brought European legends to common use or even earlier the fault of colonizers who took the culture away from the people they conquered, the result remains the same: There is still a whole other world to explore. With the help of the creators of the Vocal Fries Podcast, I found these stories and conveyed them in my podcast, Infamous Fables. I have always loved the auditory medium as a way to convey stories from all reaches of life, and I have moved that love into a wonderful podcast of my own. The road has been tough, sure, but the result has blown even me away. I got to talk to people from their native countries, podcasters who have studied stories their whole life, and even my past history teacher who lived in Africa for 20 years. I came into this project hoping to discover new methods of storytelling and how different cultures convey their ideas through art, but I also learned how to connect with people all over the world through the stories they share. Not only have I learned these things, but I have also gotten the opportunity to share my experiences with others through my eight-episode podcast each one featuring a different person I interviewed— and my website, chock-full of the research I did along the way. I am proud of the work that I have done that both introduced me to the podcasting world and spread the stories of these cultures to a full audience.

- **BASIS ADVISOR:** Kolb Ettenger • **ON-SITE MENTOR:** Megan Figueroa • **LOCATION:** University of Arizona

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## DORIA LUKASIK

### THE CULTURE AND HISTORY BEHIND ARIZONA'S NATIONAL PARKS AND MONUMENTS



**ABSTRACT:** There is no shortage of National Parks in Arizona. The state hosts four each with their different environments and ecosystems. The landscapes in these parks have seen everything from the Conquistadores to the Civil War to the modern day. Much of this history, such as if the rock faces were formed by moving tectonic plates or rivers and what animals and plants live there, has been written and researched, but there is much still to learn about the parks themselves. I am interested in this because of my love of the outdoors as well as my interest in learning more about the park's culture. The outdoors and nature to me are my happy place. It is where I can connect to myself and get away from the hustle and bustle of daily life. My goal was to delve into how the National Park Service is trying to broaden its visitor population whilst also trying to protect and maintain what Saguaro National Park is already doing well and stands for. I did this through the help of my internship mentor, Ms. Melanie Rawlins, a Park Ranger herself who oversees the school fieldtrip programs at Saguaro National Park, as well as with the help of various Park Rangers that specialize in various park subjects, and by reading various studies and documents. These park subjects include park maintenance, trail upkeep, and the park's ecosystems. For my final product I set up a white board at the Visitors Center. I had two questions written on the board regarding what visitors enjoyed about the park and what didn't they enjoy about the park. I was hoping to get from this a sense of what Saguaro National Park was doing well and what they could improve on. I am hoping this research will help visitors to these parks understand more about what the National Park Service does and help the Saguaro National Park team understand a bit more about what the visitors want out of their experience.

- **BASIS ADVISOR:** Ms. Jacklyn Deppmeier • **ON-SITE MENTOR:** Ms. Melanie Rawlins
- **LOCATION:** Saguaro National Park (West)

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## MASON MOORE

### THE PHYSICAL, MENTAL, AND SPIRITUAL EFFECTS OF TAKING A MARTIAL ART POST-QUARANTINE



**ABSTRACT:** With quarantine, lockdowns, and isolation prevalent throughout the last year and a half, it is no surprise that people's physical and mental health has worsened. The CDC claims that these measures lead to increased stress and anxiety as well as feelings of loneliness and isolation. The research journal Obesity reported significant increases in sedentary leisure behaviors, declines in physical activity, and increases in anxiety and weight gain. The CDC recommends taking breaks from watching and reading news stories, connecting with others, unwinding, and exercise to combat such problems. What if there was another way? In order to maintain my sanity during quarantine, I took to learning a new craft every day. From lockpicking to chess, I found that occupying one's mind with an objective was extraordinarily beneficial to my mental health. Eventually, I fell down the rabbit hole of watching martial arts videos on the internet. Unable to get any practical experience and actual practice, I decided to join a martial arts academy once businesses started reopening. After some research, I decided to attend Daimyo's Brazilian Jiu Jitsu where I learned from expert, black-belt instructors (Crisantos Rivera and others). This project aimed to explore the effects of taking a martial art and determine whether or not martial arts classes could be employed as an instrument to combat the negative effects of living in a pandemic. To determine the effects of taking a martial art, I analyzed prior research and studies which, combined with my own personal experience in Brazilian Jiu Jitsu, allowed me to conclude that the practice of a martial art is extremely beneficial to one's mind, body, and spirit. Furthermore, I concluded that martial arts should be implemented and encouraged at every opportunity in this post-pandemic era as a means to improving people's physical and mental health. My final product is a research paper detailing how I arrived at said conclusion, including information from my own experience as well as a meta-analysis of prior research and experimentation in the field.

- **BASIS ADVISOR:** Adrienne Fluitt • **ON-SITE MENTOR:** Crisantos Rivera • **LOCATION:** Daimyo Brazilian Jiu Jitsu



# Oro Valley

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