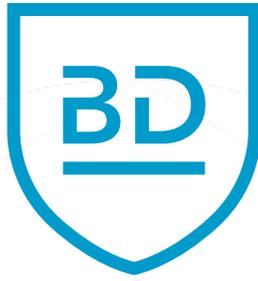
The background features a large, stylized letter 'S' shape formed by overlapping curved bands in various shades of blue and black. The text is centered within the white space of the 'S'.

BASIS SAN ANTONIO
SHAVANO CAMPUS

SENIOR PROJECTS 2021–2022



SENIOR PROJECTS & SENIOR RESEARCH 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 Diploma with Honors. 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 their 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



San Antonio SENIOR PROJECTS
Shavano Campus™

ROBERT B.

PROPERTY, PROFIT, AND STARVATION: CAPITALISM'S INABILITY TO FEED THE HUNGRY



ABSTRACT: Roughly a third of all food produced for human consumption is wasted, while around ten percent of households in wealthy countries are subject to food insecurity. Even without more efficient food production, improved distribution could drastically reduce starvation (Gustavsson, Jenny, et al., 2011 and Long, M. A., et. al., 2020). This project aims to use statistical evaluations of food scarcity to investigate the causes of world hunger. It shall argue that the profit motive—incentivizing only actions which bring maximum profit—cannot provide a meaningful solution to food insecurity. The paper will propose mutual aid as an alternate incentive system, by which members of a community provide goods and services as they are able and receive them according to their need. This project will be conducted in association with the Chicago chapter of Food Not Bombs, which has maintained an active presence throughout the pandemic to provide free and accessible meals according to the principles and methodology advocated for in the paper.

• **BASIS ADVISOR:** Kim Kinne • **ON-SITE MENTOR:** Mica Thompson • **LOCATION:** Rogers Park Food Not Bombs

ARYAMAN C.

APPLICATIONS OF ALTERED 3-D PRINTING IN FRONTIER ECONOMIES



ABSTRACT: Recent years have created worrisome times in much of the developing world. Because of automation, companies in the West are needing less low-cost labor, so they are “reshoring” production closer to their customers. Frontier economies can no longer expect to gain scale and capital by specializing in low-skilled, export-oriented industries such as textiles and consumer electronics. Will they be forced back into their slow path of development, through exporting natural resources and agricultural products? Ironically, what technology is taking away, it can also potentially give. Countries can look towards spearheading economic development through 3-D printing, requiring less physical infrastructure than conventional manufacturing. This type of additive production on a smaller scale is easier for entrepreneurs to monitor and optimize the various steps in the manufacturing process with flexibility in short supply and distribution chains of minimal inventories. My research will take place at Texas A&M University because of their growing printing lab, providing full access to dual carbon-fiber and resin. 3-D printers with an array of different architected materials. Through experimentation with a myriad of Computer-Aided Designs (CADs), I will attempt to explore a cost-effective model of production that new economies can easily adapt to. The research will extend to investigate properties of additive materials in the printers, like intelligence, thermoplastics, and lattice geometry. I expect to research an independent set of frontier countries with enough initial capital and tie in a subset of the right type of architected materials and printers to jumpstart this long-awaited development.

• **BASIS ADVISOR:** John Standifird • **ON-SITE MENTOR:** Arun Srinivasa
• **LOCATION:** Texas A&M University, College Station

CARLOS C.

AN ENVIRONMENTALLY FRIENDLY FORM OF SPACE TRAVEL



ABSTRACT: The future of engineering and physics is in space, and as we charge forward, humanity has to ensure the sustainability of space travel and the concerning environmental impacts. Current technology of space travel pollutes heavy amounts of CO₂ and sulfuric compounds that punch a hole into our atmosphere, and since rockets burn fuel in all layers of the atmosphere, their effects can last far longer than standard commercial flights. It's estimated that for every 1,000 space tourism flights, the soot released could warm Antarctica by nearly 1 degree Celsius. This asks the question, is the risk worth the reward? Are the ethics behind space travel valid for the amount of damage we will cause to our planet? This project revolves around just that, "is the risk worth the reward?" Engineering a better, environmentally-friendly form of space travel (EFSP) is based on researching and prototyping solutions on how to make rockets more environmentally friendly. This project has two main objectives. The first is understanding how and why rockets pollute the way they do and comparing/contrasting different kinds of fuels, materials, launch sequences, etc. (factors that contribute to pollution). The second half is applying my research to a physical model that would show physical representations of possible solutions. Humans will not be abandoning traditional rockets any time soon, however, I want to ensure space travel is feasible for generations to come.

• **BASIS ADVISOR:** John Standifird • **ON-SITE MENTOR:** Dr. John Taboada • **LOCATION:** Taboada Law Firm, PLLC

CHRISTOPHER C.

THE COMFORTABLE SOLUTION TO BRUXISM



ABSTRACT: Bruxism is a serious medical issue in which a person continuously clenches their teeth even when they are not aware that they do it. It is more commonly known as Sleep Bruxism as it happens when people are sleeping which may result in a loss of sleep. This is a very common condition and can lead to pain around the jaw and wearing down of one's teeth. There are also not many practical medical solutions that can address this problem in a comfortable way. Working at the Heart and Rhythm Institute of South Texas, I will conduct my research and begin my work on a prototype that addresses the issue of Bruxism. The end goal of this research is to create a comfortable, cost-efficient prototype of a headgear that minimizes the effect of Sleep Bruxism. Conducting research on prototype orientation as well as testing different materials will be key in this project. The prototype should be comfortable, but also well suited to put enough pressure on the TMJ.

• **BASIS ADVISOR:** Ray Lopez • **ON-SITE MENTOR:** Dr. Wassim Choucair
• **LOCATION:** Heart and Rhythm Institute of South Texas

POONACHA C.



AUTOMATED SYNTHESIS OF NANOSCALE CROSSBARS FOR FIXED-PRECISION ARITHMETIC

ABSTRACT: Von Neumann architecture has a significant problem, the restricted computing performance caused by constant communication between the separated control and memory units. However, in-memory computing, a revolutionary computing paradigm, poses a solution to this fundamental limitation of modern computing architectures as it allows for storage, processing, and retrieval to occur in the same unit. Methods for allowing in-memory computing to take place have been organized in the past, an example being flow-based computing. However, such methods are also reliant on the ability to synthesize nanoscale crossbars from Boolean formulas so that they can evaluate arbitrary programs. So is it possible to design a more productive, automated process of crossbar synthesis? If so, accomplishing this will serve as a promising step in the acceleration of modern computing capability, allowing for the creation of more efficient computing systems to replace traditional ones. Using in-memory computing methods, I will develop an algorithm for constructing digital memristor-based nanoscale crossbar arrays to evaluate fixed-precision arithmetic expressions proficiently using both half and full adders. The process of research includes the creation of a literature review on our topic, the exploration and implementation of a heuristically refined search algorithm using Python programming, and a research paper summarizing our findings. Success will be determined depending on whether or not our algorithm is able to synthesize a crossbar that fits our defined constraints. Our project will be conducted in correspondence with the University of Texas at San Antonio, an institute with a reputation for high-level research activity, however, our actual research and implementation process will take place virtually via online interaction.

- **BASIS ADVISOR:** Amanda Guido • **ON-SITE MENTOR:** Professor Sumit Jha
- **LOCATION:** University of Texas at San Antonio

BRADEN D.



SURVIVAL OF THE BUSINESS: HOW COMPANIES SURVIVED THE COVID 19 PANDEMIC

ABSTRACT: During the COVID-19 pandemic 34% of small businesses closed which left 23 million people without a paycheck. In one of the largest economic collapses in over a century business owners had to adapt and change with the new world they had to succeed in. I hope my research will yield a guide to how companies survived the pandemic and the lessons they have learned through these difficult circumstances. I will be covering a wide variety of industries, businesses, and even covering the companies that did not survive the pandemic. This research will be based on personal testimonies from up to 11 different business owners/high ranking employees. These people come from all over San Antonio with their own personal experiences with the trying economic times. It will cover the food industry, supply chains, human services such as salons and therapists, manufacturing companies, and the auto industry. I will hold interviews to better understand how they maneuvered through this recession, and what they wished they did differently. This project will produce an in depth guide to survive future issues with our economy and act as a base for my own accumulation of knowledge in the business world.

- **BASIS ADVISOR:** Ray Lopez • **ON-SITE MENTOR:** Lauren Graff and Jon Hart • **LOCATION:** Jon Hart Designs

KRISHNA E.



MEDULLOBLASTOMA: THE STUDY OF THE MARCH1 ONCOGENE

ABSTRACT: Medulloblastoma-the most common pediatric brain cancer-is an embryonal tumor stemming from our cerebellum, a structure involved in almost all physical movement. As it pervades, it can have lasting impacts on a child's way of life including paralysis, seizures, and motor control deficits. There are several oncogenes offsetting its growth, however, my research at the Greehey Children's Cancer Research Institute involves isolating the MARCH1 gene (novel in this realm of cancer) to analyze how it spurs on the pathogenesis of MB. MARCH1 has been seen to mediate ubiquitination- a process involved in protein degradation and cell signaling pathways. In other cancer types(hepatocellular carcinoma and ovarian), researchers concluded the cancer cells exhibited an overexpression of MARCH1. Through various experiments including but not limited to apoptosis assays, RNA and protein isolation/quantification, cell cycle assays, colony formation, and western blotting, we will hopefully attain data proving beneficial to those suffering with this illness.

- **BASIS ADVISOR:** Julia Villarreal • **ON-SITE MENTOR:** Paneerdoss Subbarayalu
- **LOCATION:** University of Texas Health Science Center at San Antonio

JACK G.



INVESTIGATING THE DEVELOPMENT AND USE OF DRONES IN COMBATING CLIMATE CHANGE

ABSTRACT: With the increased demand for creative solutions to problems posed by climate change, young students interested in engineering and design are faced with applying what they are passionate about to pressing, real-life dilemmas. Because of my natural inclination for physics and my interest in aeronautics and mechanical engineering, I will be exploring the use of drone technology in combating climate change, in various respects. Drones are currently being used to quickly replant fire-ravaged forests, monitor ecological fluctuations more efficiently than traditional methods, and track and relay critical information on endangered wildlife. Over the course of my project, I will 3D model a rough prototype drone of my own design equipped with a universal socket capable of accommodating various payloads, each to address a different problem facing the environment. Working with me is a long-time family friend of ours who is a mechanical engineer at the Southwest Research Institute, where they use a software called Creo to design their professional, custom designs. After learning how to use Creo on my own with the help of my advisor, additional research will be conducted on the financial feasibility, necessary changes, current employment, moral concerns, and sustainability issues that face developments in drone technology.

- **BASIS ADVISOR:** John Standifird • **ON-SITE MENTOR:** Shane Siebenaler • **LOCATION:** Southwest Research Institute

SAMANTHA G.

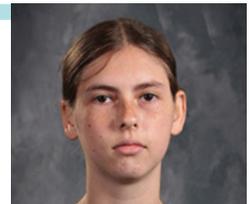


AN ACCESSIBLE EXTERNAL REMEDY FOR BRUXISM AND TMJ

ABSTRACT: Symptoms are important markers for recognizing and diagnosing issues. When people are asymptomatic they often don't opt for or need treatment. It follows that many treatments for diseases or disorders are meant to treat symptoms instead of causes. However, some long-term treatments can eventually start to cause more harm than good. Therefore, it is important to identify and target the causes of illnesses. The goal of this project is to further investigate why some treatment plans target symptoms instead of causes and how doctors decide the best road of action. The final presentation will outline the process it takes to assess and treat patient symptoms and highlight different doctors' opinions on finding causes. At Heart and Rhythm I will witness firsthand Dr. Choucair treating patients, and I can keep track of patterns in how treatments are formed.

- **BASIS ADVISOR:** Debby Hermann • **ON-SITE MENTOR:** Dr. Wassim Choucair
- **LOCATION:** Heart and Rhythm Institute of South Texas

TAMARA G.



THE UNDERREPRESENTATION OF WOMEN IN STEM AND WAYS TO REMEDIATE IT

ABSTRACT: Historically, women have been absent from the scientific narrative. Despite significant progress, the underrepresentation of women in STEM still persists to this day. The challenges women face in STEM are complex and structurally ingrained in our society. Gender stereotypes, lack of female role models, imposter syndrome combined with wage and career growth gaps all act as barriers limiting women entering STEM fields. It is crucial to systematically work on eliminating these factors to create meaningful change in our society. By removing these enormous challenges, numerous women would no longer have to fight to gain a foothold in STEM and could instead diversify perspectives in their fields. The purpose of my project is twofold. Initially, I will gather data from fellow students in my community to gain a more niche understanding of their STEM experience. After identifying specific, local challenges I will seek out female participants for a STEM outreach program. By working closely with UT Health San Antonio, I will strive to provide a hands-on opportunity, encouraging exploration in the fields of STEM to aid in the gradual removal of the deep-rooted female underrepresentation in STEM.

- **BASIS ADVISOR:** JennaLynn Hunnicutt • **ON-SITE MENTOR:** Kristi Kilpadi
- **LOCATION:** University of Texas Health Science Center at San Antonio, Dolph Briscoe Library

AHMAD H.



A GUIDE TO COMBATTING COVID CAR PRICES

ABSTRACT: On average, Americans keep their cars for 8.4 years before purchasing a new car. Many get rid of their cars for a number of reasons ranging from innovations in safety technology to maintaining an image. Many Americans don't realize the environmental impact buying a new car has. Large sedans and small SUVs create about 17 tons of carbon before it even hits the road. If car owners kept their cars for an extra year, global carbon footprint would decrease by 1% (about 30.7 million tons). Besides the environmental impact, there is also an economic factor to keep in mind. Due to the chip shortage caused by COVID-19, the price of cars has skyrocketed. Both new and used cars have risen an estimated 15% compared to pre-covid markets. The goal of this project is to explore how buying a cheap car and fixing it up is more economically practical and how it could help the environment. The project will go in depth on what needs to go into fixing up an old cheap car and compare the cost to both a similar and identical car on the used market to show the audience how much money we saved.

• **BASIS ADVISOR:** Adrian Gallegos • **ON-SITE MENTOR:** Mohammad Hassan • **LOCATION:** Lackland Auto Repair

ANSH J.



EXAMINING AND ECONOMIZING SOIL CONDITIONS AND FOUNDATIONS FOR CIVIL AND GEOTECHNICAL PROJECTS

ABSTRACT: Asphalt optimization is the unique study and analysis of different aggregates necessary to create suitable and adaptable road conditions in varying environments. With the several other conditions in which roads and streets exist as well as the rapidly changing climate conditions, the need to better understand asphalt optimization is at an all-time high. This project will document and note my journey through better understanding the factors required to produce optimal asphalts through the process of aggregate mixing and volumetric analyses. The project will be conducted at Terracon Consultants Inc.'s geotechnical and asphalt laboratories, where the assistance of materials professionals will be consistently provided. Through viewing mixing procedures and later on taking part in the execution of the mixing process, I will be able to visualize the specific variables acting upon the process. The goal will be to create a stable, economical, and constructable hot asphalt mix design applicable across the board, factoring in variables like weather and vehicle weight. Furthermore, this project hopes to add to the continued research into the fields of asphalt mix design and aggregate mixing in order for there to be increased resources, specifically digitally, available for other researchers to utilize.

• **BASIS ADVISOR:** Alexander Decker • **ON-SITE MENTOR:** Yatish Jakatimath and Yash Menaria
• **LOCATION:** Terracon Consultants Inc.

MARGARET J.

GEOMETRIC AND DOSIMETRIC EVALUATION OF DEEP LEARNING SEGMENTATION IN RADIATION ONCOLOGY



ABSTRACT: During treatment planning for cancer patients undergoing radiation therapy, physicians must contour patient organs to determine whether treatment will affect those organs. This process is not only time-consuming but also subjective due to interobserver variability. AI software has the potential to speed up this part of the planning process, which may have implications for expediting patient treatment. Similarly, the standardization of contouring may improve data quality for future research or clinical trials, as well as minimize interobserver variability. This project takes place at the University of Texas Health Science Center at San Antonio, which provides access to the necessary anonymized patient contours, as well as to the AI contouring software being tested. AI contouring software can provide contours to compare with physician-made contours. Statistical tests to analyze this data can determine whether there is a significant difference between the two categories of contours in terms of organ volume, planned treatment dosage, and dosimetric organ objectives. This research looks to provide necessary insight into the validity of AI contouring software, potentially impacting timely patient treatment and the efficacy of future research.

- **BASIS ADVISOR:** Sarah Chavez • **ON-SITE MENTOR:** Dr. Sartori Stathakis
- **LOCATION:** University of Texas Health Science Center at San Antonio

AYUSH K.

BUILDING A WEB APP TO INCREASE ACCESS TO RESOURCES ON HEARING LOSS



ABSTRACT: In recent years, hearing loss has become a complete area of study, with scientists and researchers publishing new information on the subject and companies building new products to help improve an individual's hearing. Although this is true, there remains a significant gap, which is that learning about hearing loss from an individual's perspective can be difficult and time-consuming. Specifically, there are no sources that provide the following features:

1. A "catalog" of hearing-related products across all company manufacturers to allow individuals to determine which product is best for them in term of hearing loss and budget.
2. A resource page for introducing people to hearing loss, the types of hearing loss, the next steps for people who are deaf, etc.
3. A list of certified audiologists and ENT (ear, nose, throat) doctors so that people can easily find clinics where they can get further medical support.

Accessing information through the world-wide-web has also become easier to do in recent years through building better technologies and software solutions. Using websites, different parties can communicate information and interact with users. For the senior project, I plan on building a web application that will include the three features mentioned above using a JavaScript tech stack (a set of tools used to implement a solution). The ideal outcome of this project is to build a web app that will have the three features mentioned above, and to test the solution by having the target audience (deaf individuals and families) assess if the solution does make researching hearing loss feasible.

- **BASIS ADVISOR:** Tim Theis • **ON-SITE MENTOR:** Jon Garica and Roger Mayer • **LOCATION:** Geekdom

KYRA K.

2020-2021 THROUGH THE LENS OF INDEPENDENT BOOKSTORES



ABSTRACT: The past two years have consisted of the virus and quarantine, an increase in activism movements, and one of the most heated elections in recent history. Of all the companies affected by the pandemic, independent businesses have no doubt been hit the hardest, with a significant number of them having to temporarily close. Independent bookstore owners, especially, were impacted in more ways than one. While they too experienced closures, they have the unique experience of being first hand witnesses to the priorities and interests of their communities. As stated, 2020 and 2021 were marked by the resurgence of the Black Lives Matter movement, an increase in Asian hate crimes, and the tension of the election. Many bookstore owners took note of significant fluctuations in sale trends as the public was drawn to educate themselves on different current issues. Awareness of the way independent bookstores have been affected by the past two years would allow for an increase in publicity for their businesses and important acknowledgements of how communities responded to modern-day political and social changes, emphasizing the effectiveness of certain movements. This project will be conducted with an instructor of film production at Alamo Arts Academy with the goal of creating a short documentary presenting the research I've gathered. Through interviews with bookstore owners, while taking into account their community demographics, and background research from previous years, I aim to show the impact and importance of the historical events of 2020 and 2021 through the unique eyes of independent bookstores.

• **BASIS ADVISOR:** Kim Kinne • **ON-SITE MENTOR:** Jenny Lawson • **LOCATION:** Nowhere Bookshop

PRANAVKRISHNA K.

A COMPARATIVE STUDY OF TWO GROWTH FACTORS ON TUMOR ORGANOID GROWTH



ABSTRACT: According to statistics from the International Agency for Research on Cancer (IARC), there will be 27.5 million new cancer cases and 16.3 million cancer deaths around the world by 2040. Due to tumor heterogeneity in patients, standard treatment methods, such as surgery, chemotherapy, or radiation, are ineffective for most of the patient population. The forefront of cancer treatment is now precision (or personalized) medicine which is a way healthcare providers can provide specific therapeutics for their patients based on a person's genetics and disease. Organoids, in-vitro 3D culture models that can replicate the diverse genetic and molecular landscape of cancer, have opened up avenues for the development of novel cancer therapies. Additionally, organoids can be quickly grown with high efficiency from patient-derived tumor tissue, which allows for more specific drug testing with these models. At the NEXT Oncology Biobank, my project seeks to discover more effective methods of tumor organoid cultivation. Specifically, I will refine the cancer organoid culture protocol by testing the effectiveness of epidermal growth factor (EGF) on the time to harvest (TTH) and take rate of a cancer line. Each of the organoid cultures grown in the lab will be separated into two different treatment types. For every individual patient or PDX tissue sample, one column of wells (untreated) will have the normal growth media without the EGF, while the other column of wells (treated) will have the media with the EGF added. After cultivation, I will look at the samples to observe tumor cell growth and decide whether to resuspend, pass/cryo, or leave the sample alone to grow some more. By adding in epidermal growth factor to the regular growth media, I will hopefully allow the treated sample to proliferate at an expanded rate and further enable more quality drug experimentation with organoids.

• **BASIS ADVISOR:** JennaLynn Hunnicutt • **ON-SITE MENTOR:** Megan Groves • **LOCATION:** NEXT Oncology Biobank

ANANYA L.



MENTAL HEALTH, TAUGHT BY TEENS, FOR TEENS

ABSTRACT: According to the CDC, mental health is defined as someone's condition in regards to their emotional, psychological, and social well-being. With the increasing usage of social media and the onset of the pandemic, teenagers' mental health has been significantly affected. Comparisons are constantly being made, self-deprecation is extremely recurrent, and the feeling of not being good enough is as common as ever. With proper education and validation of mental health, we may be able to reduce the high-stress levels that teenagers face, over time decreasing anxiety, depression, suicide, and crime rates in the world. This project will be in conjunction with the student-led nonprofit organization, The Purple Hydrangea Project, to create an online mental health course for teenagers. This course will educate people about mental health statistics, mental illnesses, self-care tips, resources, etc., normalizing the prioritization and sharing of one's own mental health. My goal in creating this online course is to aid those who are struggling with their mental health, raise awareness on this topic, and help to eliminate the stigma around this overlooked issue.

- **BASIS ADVISOR:** Sarah Chavez • **ON-SITE MENTOR:** Madeleine Salem
- **LOCATION:** The Purple Hydrangea Project at Stanford University

ROSARIO L.



A CONFIDENCE AND SELF-ESTEEM BUILDER: THE LONG-TERM EFFECTS OF MARTIAL ARTS IN THE HUMAN EXPERIENCE

ABSTRACT: Do martial arts actually help as much as it seems to? Or maybe you never thought about it again after you took a few karate classes as a kid and didn't like it. There is data from 1893 that explores the benefits of martial arts. I will research the benefits of training under a martial art, the discipline, integrity, and respect instilled, with a belt, age, and knowledge style ranking on individuals. The benefits of training have proven to be physically and mentally beneficial to cognitive, social, and personal drive abilities. I can personally attest to these statements as I have trained under two martial arts for more than twelve years. The importance of knowing the benefits of a realistic training system that could instill self-control and respect to children, a means of overcoming a sexual-assault-related experience, teach awareness and defense could be the difference between life-or-death, or simply a learning point in a child's life. I plan to discover the benefits to mentality, mindset, social and cognitive abilities while teaching mental strength and power in defense for self and others, in men, women, children, and sexual assault survivors, by researching accredited scientific studies and conducting research of my own. At the U.S. Taekwondo Center, supervised by Master Tai Nyguen, I will teach children and adult Taekwondo classes, participate at other dojos and share surveys to answer my questions and educate on the benefits of training, enlighten those who have negative opinions on martial arts, and debunk the general stigma of martial arts.

- **BASIS ADVISOR:** Nelly Rovira • **ON-SITE MENTOR:** Tai Nguyen • **LOCATION:** U.S. Taekwondo Center

KENDRA M.



BEHIND THE SCENES OF CREATING AN ENVIRONMENTALLY SUSTAINABLE BUSINESS

ABSTRACT: For my senior project, I am discovering what it takes to start a business that is not only successful but also is environmentally sustainable. Many businesses accumulate an abundant amount of waste from their products that add to the pollution and amount of trash on our planet. This project is significant because it teaches others and myself what it will take to make small changes in one's business plan to help better the environment. This includes everything from decomposing plastic bags, using recyclable materials, and even selling seeds so that one could plant them. My project will be conducted in Quito, Ecuador. There, I will be working with Xorbet, a small ice cream business, whose main objective is promoting environmental sustainability through its products. I hope to discover what exactly goes behind creating a business from scratch that focuses on using materials that will either decompose or could be re-used; and instilling a change in our society to help impact our future generations' quality of life.

• **BASIS ADVISOR:** Tim Theis • **ON-SITE MENTOR:** Emily Yerovi • **LOCATION:** Quito, Ecuador

PRATEEK M.



OPTIMIZING CYBERSECURITY PROCEDURES ACROSS COMPANY DEPARTMENTS

ABSTRACT: As technology advances at ever-growing rates, cybersecurity is becoming even more important and necessary. Ranging from simple phishing scams to complicated SQL injections and dedicated hacking software, the safety of information on the Internet has never been more in question. Improving cybersecurity procedures is not as simple as adding more precautions. Combining necessary counter-measures can open up new avenues for attack. Thus, using software like ESET that allows one to mix and match defense mechanisms to create specific sets is a boon in today's digital world. By using these sets across multiple testing periods, it is possible to create an optimal set of procedures for each specific company and operation. At Walkingspree, that is exactly what I hope to do. By crafting basic sets at the beginning of every week and testing them until the weekend, I can create lists of known vulnerabilities and strengths. By compiling and analyzing these lists and comparing them to the target areas asked by Walkingspree, I will optimize all of the security procedures in place so that all sensitive data remains secure even as times evolve.

• **BASIS ADVISOR:** Amanda Guido • **ON-SITE MENTOR:** Patrick Asher • **LOCATION:** Walkingspree

YASHAS M.



**INTERGOVERNMENTAL RELATIONS IN THE 21ST CENTURY:
REVISITING STATE PREEMPTION**

ABSTRACT: As political polarization remains on the rise, state-local conflicts have become as common and consequential as federal-state conflicts. With these state-local conflicts cropping up very frequently, policy tools that expressly prohibit local jurisdictions from passing legislation on certain issues (preemption actions) have become increasingly popular. Without any empirical reasoning, the existing research on this ripe field usually assumes preemption is wholly a republican party tool used against local governments. Drawing on a variety of primary and secondary sources, we develop an original data set of over 300 observations of instances of preemption over several issue areas such as municipal broadband, paid sick leave, minimum wage, and antidiscrimination ordinances in order to test conventional wisdom that preemption becomes more likely if the state is more Republican. More broadly, the contribution of this project to the federalism research field is attempting to 'modernize' research to accurately describe the 21st century.

- **BASIS ADVISOR:** Denise Scott • **ON-SITE MENTOR:** Dr. Brandon Metroka
- **LOCATION:** Political Science Department at the University of the Incarnate Word

ETHAN P.



**AFFORDABLE HOUSING: CONTEXTUALIZING THE RELATIONSHIP
BETWEEN HOUSING AND EDUCATIONAL ACHIEVEMENT**

ABSTRACT: Affordable housing – an all encompassing term referring to any development that involves generating affordability for individuals who fall at varying levels of the income ladder – has long been associated with positive externalities. With the increasing concern over the nature of the housing market and the tremendous decrease in housing affordability in recent years, it is of paramount importance that society find new ways to develop quality housing options that render beneficial outcomes to both tenants and the community at-large. Focusing on the state of Texas, this project will document my time at Streamline Advisory Partners, where I work with the Senior Analyst and other members of the firm to address the impact of affordable housing, and will evaluate the effectiveness of these developments in creating measurable change in educational achievement. The ideal outcome of this project is to derive a quantifiable relationship between various housing programs, both state and federal, and educational achievement to isolate the most potent solution for addressing the needs of underserved communities. Furthermore, this research attempts to construct a projection for the change in housing demand over the coming decades and propose reforms for both the public and private sector to best meet the needs of the growing population.

- **BASIS ADVISOR:** Alexander Decker • **ON-SITE MENTOR:** Karsten Lowe • **LOCATION:** Streamline Advisory Partners

MANSI P.

THE EFFECT OF K18 MONOMER AND K18 FILLER ON MECHANICAL, ESTHETIC, AND ANTIMICROBIAL PROPERTIES OF 3D-PRINTED DENTURE MATERIAL



ABSTRACT: There are approximately 40 million Americans that use dentures. The recent introduction of 3D-printed dentures can potentially increase the speed of denture production and lower its cost. Conventional dentures are made of polymethyl methacrylate (PMMA), but 3D-printed dentures are made of proprietary polymer blends that may or may not include PMMA. One major disadvantage of conventional dentures is its susceptibility to microbial colonization and denture stomatitis: inflammation, redness, and irritation of the oral tissue caused primarily by *Candida Albicans* (oral fungi). K18 Quaternary Ammonium Silane-containing PMMA (K18-PMMA) and K18-containing filler have been shown to have biocidal properties against multiple oral bacteria/fungus, including *Candida Albicans*. The purpose of this project is to study the effects of K18-PMMA and K18-filler on the mechanical, esthetic, printing, and antimicrobial properties of 3D-printed antimicrobial denture materials. Under the guidance of Dr. Kyumin Whang at the UT Health Science Center at San Antonio, 3D printed denture materials with different K18-PMMA, and K18-filler loadings will be fabricated and tested for mechanical (3-point bend test), esthetic (digital colorimetry, color, and color stability), printing (print accuracy) and antimicrobial (ring inhibition test) properties. The development of an antimicrobial denture base will improve not only the patients' oral health, but also their overall quality of life, especially for those suffering from denture stomatitis.

- **BASIS ADVISOR:** JennaLynn Hunnicutt • **ON-SITE MENTOR:** Dr. Kyumin Whang
- **LOCATION:** University of Texas Health Science Center at San Antonio

ADAM R.

LAND USE AND ECONOMICS



ABSTRACT: As investors and capital markets pivot to sustainable investment strategies, a growing number of companies and governments have added a net-zero pledge to their long-term strategies. Net-zero entails an entity not adding greenhouse gas (GHG) emissions to the atmosphere, ending that entity's impact on the carbon cycle imbalance and the accumulation of GHG. Currently, over a fifth of the 2000 largest public firms have made this commitment. For firms with emissions inherent to their supply, like airlines and oil companies, simply halting the emission-causing areas of their business is not an option. This dilemma has spawned a carbon market, a type of marketplace where buyers purchase credits from entities that promise to cut their emissions or store carbon, offsetting the buyer's own emissions. In some jurisdictions, the market is imposed by the government in a non-voluntary system. However, the bulk of my research will focus on voluntary carbon markets, which are spawned by the economy and firms that choose to participate. Voluntary carbon markets introduce the possibility of capitalist, market-based institutions adequately addressing emission concerns, a prospect facing heavy scrutiny by those advocating for more interventionist alternatives. The Carbon Equilibrium will assess this potential in three core objectives including, determining the necessity of a carbon market in emission mitigation, predicting the equilibrium price of carbon in a voluntary carbon market, and evaluating a firm's incentive to implement a net zero strategy. Research for the project will be conducted with input from Dr. Jason Sawyer, an Associate Professor and Research Scientist at the King Ranch Institute for Ranch Management in partnership with East Foundation. Dr. Sawyer's insight into carbon markets, specifically his research on the potential for landowners and the agriculture industry to participate in carbon markets, will help guide my analysis. The results of each investigation will be used to address other questions, including whether the United States needs to make the carbon market non-voluntary to reduce emissions. Other research not pertaining to the primary objectives will be conducted to support the relevancy of the topic and provide further context.

- **BASIS ADVISOR:** Denise Scott • **ON-SITE MENTOR:** Jason Sawyer • **LOCATION:** East Foundation

THOMAS R.

THE COST EFFECTIVENESS OF 3D PRINT-MILLS



ABSTRACT: 3D printers are an important piece of technology for the future. They serve the purpose of bringing digital concepts into the physical world with low-skill effort, allowing cheap mass production of useful objects, and speeding up product development with fast prototypes. Recently, the 3D print mill has emerged as a unique printer concept with infinite z-axis. This has the potential to bridge the gap between hobbyist and industrial printer capabilities, but the cost of the currently available printer mills is too high for many to afford. What is the cheapest way to make a print mill without sacrificing the functionality or durability of the machine itself? Are 3D Print-Mills cost-effective machines for creating small-scale manufacturing lines? The purpose of my project is to answer these questions by researching and creating my own 3D print mill. I will be working with my brother who works at Alcon in Fort Worth. His group has extensive experience with building motorized systems for manufacturing and using industrial-grade 3D printers for creating prototypes. I plan to use spare parts I have laying around and purchase the cheapest yet most durable parts I can find. Learning how to fix printers and design with 3D CAD software is not only fun and educational, it is also linked with my desired career. I'm interested in working in the 3D house printing industry, which is why I chose this project to be a stepping stone for me to better understand the mechanical, electrical, and programming aspects that are needed to 3D print.

• **BASIS ADVISOR:** Tim Theis • **ON-SITE MENTOR:** Arthur Raiford • **LOCATION:** Alcon

GERMAN S.

MUSIC: THE SOUNDS THAT INFLUENCE PERFORMANCE



ABSTRACT: Music: The Sounds That Influence Performance is a project dedicated to the analysis and exploration of the effects music has on the human brain. Specifically, it explores the potential benefits or disadvantages music can have on one's performance. Music and the effect it has on our brains is so often overlooked as most people see it as merely a form of entertainment. Music is so much more than that, it is science, a science that can have a real, lasting impact on our performance and our behavior. The findings collected from this project will add knowledge to our collective understanding of the effects music can have on us. Furthermore, it will expand the knowledge of a field so few have tapped into and potentially give rise to other questions that can be explored by future investigators in this field. This project is primarily taking place in two facilities. One will be on campus while the other will be off campus. The participants will be asked to participate in the experiment, after which they will consensually fill out a survey relaying their experiences. This experiment will ideally result in information that will answer the question: "How does music influence our performance?"

• **BASIS ADVISOR:** Chris Jordan • **ON-SITE MENTOR:** Carlos Sanchez • **LOCATION:** Carlos Sanchez Studio

RAJAKRISHNAN S.



RESEARCH ON NUCLEAR WASTE MANAGEMENT: EFFECTS AND PROPOSALS

ABSTRACT: With nuclear energy having the highest capacity factor out of any power solution yet, at 92.5% (an efficiency to time-dependent relation), it is seen to be the future of carbon-free energy, yet it is latently harmful, producing waste ranging from EW (exempt waste) to HLW (high-level waste). This radioactive material can range in half-lives of about 30 years like Cesium or 24,000 years like Strontium and also range from alpha to gamma emitters. This is an important field of research due to the known health risks this has on human life and its potential to be the next source of our energy, yet there are trade-offs with it that we have to minimize if we have a chance to use this process at all for the next thousands of years to come. I plan to do an analysis on the viability and possibility of different methods of nuclear waste management in terms of long-term complexities and the possibility of integration. I will be doing this project virtually, with my offsite advisor's help, a retired executive director at the Center for Nuclear Waste Regulatory Analyses, Southwest Research Institute. This topic is primarily theoretical so my approach to understanding and diving into this topic will come from my own ability to access and mathematically model data regarding the topic. I hope to analyze the different methods and metrics in which complexities could arise and to estimate the plausibility of nuclear energy.

• **BASIS ADVISOR:** Lyle Koonce • **ON-SITE MENTOR:** Budhi Sagar • **LOCATION:** Virtual

STEVEN S.



ECONOMIC HISTORY: HOW THE PANDEMIC HAS AFFECTED VARIOUS MUTUAL FUNDS AND WHAT SOCIAL FACTORS THROUGHOUT HISTORY HAVE AFFECTED THEIR SIZE AND PERFORMANCE

ABSTRACT: Investment funds growth is closely tied to events in the United States and internationally at the time. Investment funds growth is highly dependent on the economy as they grow in price when the different stocks, which are tied to the economy, within them go up in price. The main type of investment fund I will be looking at is mutual funds which pools money from many investors and invests the money in securities such as stocks, bonds, and short-term debt. With the increasing prevalence of globally impacting events such as the COVID-19 pandemic, it is important to fully understand how different types of investment funds are affected by these events in order to allow investors to make informed and long-term decisions in these funds. This project will document my time at EIP where I will analyze past data on investments funds particularly during the Coronavirus Pandemic and other significant economic events. The Coronavirus Pandemic is what I will primarily focus on researching because the many side factors caused by the pandemic such as decreased social interaction, and home stability have had profound effects on the economy. It is important to compare the effects of the pandemic to years past to get a clear picture of what exactly is causing the economic downturn, and how to better improve the economy. The ideal outcome of this project is to gain a better understanding of how global events can affect the growth of the different funds.

• **BASIS ADVISOR:** Julia Cottle • **ON-SITE MENTOR:** Lisa Sacerdote • **LOCATION:** EIP San Antonio

SURAN S.



DEVELOPING A NOVEL WEARABLE ELECTROCHEMICAL SWEAT SENSOR FOR PATIENTS WITH CHRONIC KIDNEY DISEASE (CKD)

ABSTRACT: Chronic kidney disease hinders the kidneys' ability to filter blood and, in most cases, results in renal failure. The resulting buildup of toxic waste products forces patients to depend on blood dialysis machines, committing them to time-consuming dialysis appointments for the rest of their life. This project aims to mitigate this problem by designing an at-home, point-of-care, wearable biosensor that detects the biomarker urea from sweat. This helps determine how often patients need to get their blood filtered, saving them time and money. Previous literature suggests a correlation between the level of urea in sweat and blood. For this project, an electrochemical sweat sensor will be developed utilizing a 3D-printed sensor case housing a sensing cell matrix with urease enzyme and a reference cell matrix without any enzyme. The voltage produced when urea reacts with urease enzyme is said to be directly proportional to the amount of urea. The overall goal is that the sweat sensor will be able to detect the concentration of urea present in samples of simulated sweat offering patients a real-time glimpse into their current blood health status.

- **BASIS ADVISOR:** JennaLynn Hunnicutt • **ON-SITE MENTOR:** Leon Bunegin
- **LOCATION:** Vascular Perfusion Solutions, Inc.

NAPAT T.



APPLICATIONS OF HYDRAULIC HYBRIDS

ABSTRACT: Energy efficiency is a pressing issue in combating global warming and energy expenditure. However, the applications of Hydraulic Hybrids can expand our advancement in more efficient and productive alternative energy sources. As such, governments around the world and significant amounts of energy industries are carefully examining possible solutions to develop more efficient-energy power, turning away from harmful fossil fuels. One such solution is Hydraulic Hybrids which are vehicles that utilize pressurized fluid power, along with a conventional internal combustion engine to attain better fuel economy and reductions in harmful emissions. By exploring alternative energy sources and researching the technology behind Hydraulic Hybrids, I can determine possible solutions to exploiting energy consumption and possible refined transportation. It is crucial to start conducting research in a local public university library such as the UTSA library where background information on fluid dynamics and energy sources can be critical to understanding efficient-energy power. Understanding Hydraulic Hybrids can lead to reducing energy consumption as the technology behind the innovation can regulate a continuous energy system that can reduce the amount of energy used to power the vehicle. In addition, using more developed technology can lead to a reduction in harmful fossil fuel emissions given that it can reduce our dependence on oil resulting in a cleaner environment. The ideal outcome of this project is to gain an understanding of Hydraulic Hybrid systems and further explore if this innovative technology can help reduce energy or result in a cleaner environment, reducing the impact of climate change.

- **BASIS ADVISOR:** Tim Theis • **ON-SITE MENTOR:** Daniel Pineda
- **LOCATION:** University of Texas at San Antonio, John Piesse Library

ANA W.

METHYLCYCLOPENTADIENYL MANGANESE TRICARBONYL (MMT) DEPOSIT MITIGATION



ABSTRACT: As of 1996, the use of tetraethyl lead in pump gas was eliminated after the Clean Air Act due to its harmful effects to the health of the population but its use as an octane enhancer had to be replaced. Recent research has proved Methylcyclopentadienyl Manganese Tricarbonyl (MMT), an organometallic compound, to be the most effective octane booster and anti-knock additive to replace lead additive's role in fuel. While effective in these aspects, MMT deposits are built up on the engine components including the spark plugs and cylinder heads which adversely affects the engine's performance. When MMT is burned in gas, manganese particles are formed which are what make up the deposits. The development of a fuel additive, a PEA-detergent, to minimize or eliminate the manganese deposits is imperative and is what I plan to research and work towards during my senior project with VP Racing Fuels, particularly in aviation fuel. The Clean Air Act only dissolved the use of lead additives in pump gas for automotive vehicles, not aircrafts. To more effectively counteract the harm on the population due to tetraethyl lead fuel additives, MMT will be revolutionary for aviation fuel after the development of an additive that counteracts the manganese deposits. I am continuing this research and work towards a prototype in the lab at VP Racing Fuels Fulfillment Center as the company is working with the FAA to develop an unleaded aviation fuel using MMT and additives to deter the manganese deposits.

• **BASIS ADVISOR:** John Standifird • **ON-SITE MENTOR:** Mark Walls • **LOCATION:** VP Racing Fuels World Headquarters

ELIJAH W.

USING CONVOLUTIONAL NEURAL NETWORKS FOR OPTIMAL POSITIONING OF ROADSIDE UNITS



ABSTRACT: Smart cities are a broad field that have been recently gaining traction in research. One topic that has been the subject of research and is beginning to appear on consumer markets is intelligent transportation systems (ITS). ITS are vehicle communication networks and infrastructures that can improve the safety and efficiency of travel. As ITS become more common on roadways, infrastructures like Roadside Units (RSUs) are needed to support them. RSUs pass information between vehicles, improving the safety and efficiency of the system. The placement of RSUs greatly affects the efficiency of the infrastructure. However, no research has been done for using AI for this purpose. Thus, the aim of my work is to develop a convolutional neural network (CNN) to determine optimal RSU positions to minimize signal interferences from the environment and improve vehicle safety. My research will be conducted at the Autonomous Control Engineering Lab at the UTSA, which has a variety of projects about robotics and neural networks. The first step of my project is to substantially manipulate data by preprocessing the heterogeneous dataset of the RSU coordinates via Numpy and Pandas. Then, that is extracted, normalized, shuffled, and split to create training and testing datasets. Next, a CNN using a Keras Sequential model that is systematized with Conv2D, MaxPooling2D, Flatten, Dense, and Dropout layers; an Adam optimizer; and a sparse categorical cross-entropy loss function is created. Ultimately, my goal is to show that CNNs are a valid method to determine RSU placements.

• **BASIS ADVISOR:** Amanda Guido • **ON-SITE MENTOR:** Sean Ackels
• **LOCATION:** University of Texas at San Antonio, John Piesse Library

JOSHUA W.



CLINICS OR WRISTS: APPLE WATCH EKGs OR EVENT MONITORS?

ABSTRACT: Technology is constantly evolving all around us. Whether it be for the medical field or civilian use, technology is continuously impacting our society. With the recent developments of the Apple Watch EKG, this project aims to compare how effective Apple Watches are in identifying cardiac arrhythmias compared to traditional event monitors, and also explore the benefits and disadvantages of civilian access to medical technology. While there is no doubt using a wrist accessory to measure cardiac disturbances is more convenient than carrying a bulky event monitor, this project will investigate just how effective these watches are. Apple Watch EKGs would be revolutionary in the medical field for quickly identifying any cardiac arrhythmias present in a person. The Heart and Rhythm Institute of South Texas has numerous patients who qualify and have consented to participate in this program which serves to identify any irregular heartbeats using both devices. By investigating how effective these devices are in identifying arrhythmias and the social aspect of civilian access to this technology, this project can establish how beneficial these Apple Watch EKGs really are. The outcome of this project will aid in identifying the limitations of these cardiac devices and identify how beneficial civilian possession of EKGs really are to society.

- **BASIS ADVISOR:** Ray Lopez • **ON-SITE MENTOR:** Dr. Wassim Choucair
- **LOCATION:** Heart and Rhythm Institute of South Texas

MICHAEL X.



CRITICAL POINTS FOR BUCKLING IN BLOOD VESSELS

ABSTRACT: In the human body, arteries are blood vessels that carry oxygen away from our heart and into the tissues. Arteries are vital for human function, and any disease or detrimental condition that affects them carries fatal implications. For instance, one major cause of failing arteries is calcification, where the build-up of calcium in bloodstream can harden the arteries, increasing the risk of coronary artery disease. In my project, I hope to experiment with different "buckling points," the forces at which hardened arteries can soften and break. By modeling different buckling points for different arteries of different species, I hope that I can verify and create computer simulations and algorithms that detail these different breaking points, which would help scientists understand the fundamentals behind arteries and their biomechanical structure.

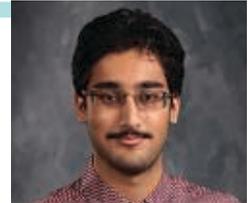
- **BASIS ADVISOR:** John Standifird • **ON-SITE MENTOR:** Dr. Hai-Chao Han
- **LOCATION:** University of Texas Health Science Center at San Antonio





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MOEEZ A.



STRESS SPILLOVER: EXAMINING THE IMPACT OF PEER AND FAMILY STRESSORS ON COLLEGE STUDENTS' ACADEMIC STRESS LEVELS

ABSTRACT: Stress is one of the main causes of mental health concerns in college undergraduates. The American Psychological Association reported that 41.2% of college students suffer from some form of anxiety. Understanding the causes of high academic stress levels is vital to helping students deal with stress problems. The influence of spillover from family and peer stressors on academic stress levels is one important perspective to look at the issue. Spillover refers to how experiences in one context influence another. Understanding how stressors associated with peers and family influence academic stress levels can give a clearer picture into the role they play in high academic stress levels. This project will document my work with UTSA in order to ensure that my project will follow proper ethical procedures. The actual research will be conducted independently by me and not by the university for legal reasons, but UTSA will be a fitting place to discuss and analyze my research to ensure it is implemented accurately. I plan to send out a survey to former BASIS alumni who are now college undergraduates. The survey will consist of questionnaires that will examine academic stress levels of the students, as well as the extent of how the peer and family stressors spillover into their academics. The ideal outcome of my survey is to find a concrete link between spillover and high academic stress levels. This will allow a clear picture into how much spillover really impacts academic stress in college undergraduates.

- **BASIS ADVISOR:** Rosemary Everts • **ON-SITE MENTOR:** Raymond Swisher
- **LOCATION:** University of Texas at San Antonio

ALESSANDRA F.



EFFECTS OF PARAFFINS ON PSORIASIS

ABSTRACT: Paraffin is a derivative of mineral oil, which can be found in many petroleum-based products and is used in various sectors. The use of paraffin within skincare has been an ongoing debate within the dermatology community, as it has contrasting effects for different skin types. This project aims to test the efficiency of paraffin for psoriasis-skin types, which are generally more dry and flaky. This research is significant, as topical treatments are the main form of treatment for psoriasis, regardless of the type of psoriasis an individual may have. The project is being conducted through a meta-analysis, but there is an offsite internship to supplement the online research. The internship is a good way to gain experience in the field of dermatology, as the site is a place where routine facials are done, and many skin care products are used and sold by experts. As for the project itself, the research will be conducted via meta-analysis, which is using existing data found in online research bases to draw conclusions from real statistics. I expect to find that paraffin is an effective psoriasis topical treatment, as it has been used for other skin topical treatments.

- **BASIS ADVISOR:** Mark Petrie • **ON-SITE MENTOR:** Tanya Rollins • **LOCATION:** Hello Lovely

ABIGAIL H.



A PREDICTIVE TRAFFIC SAFETY ANALYSIS OF THE PROPOSED DIVERGING DIAMOND INTERCHANGE AT THE INTERSECTION OF LOOP 1604 @ FM 2696 (BLANCO ROAD)

ABSTRACT: In the world of intersection and interchange design, there are a few unique alternatives to the typical four-way stop or traffic light. One such alternate interchange is the diverging diamond interchange (DDI), which is praised for its ability to handle large left-turn volumes of traffic and reduce congestion. The Texas Department of Transportation has proposed the construction of a DDI at the interchange between Loop 1604 and Blanco Rd in San Antonio and conducted an extensive analysis on the improvements the interchange will make to traffic congestion in the area. However, current research lacks a significant safety evaluation and the changes to crash statistics the new interchange might create at this location. By analyzing past traffic crash statistics and applying crash modification factors, a numerical value representative of the changes in crash frequency and type, I can predict the expected crash frequencies of the new DDI. Working with TxDOT engineers, I can use a comparative analysis to assess the safety benefits or risks of the proposed design change and determine if it is an appropriate change from the perspective of safety improvement. A prediction of fewer crashes after the construction of the DDI will support the change while more crashes would oppose it. With my findings, I hope to support or contradict the decision to construct a DDI at this interchange and other proposed DDI locations across the country.

- **BASIS ADVISOR:** Tim Theis • **ON-SITE MENTOR:** Dale Picha
- **LOCATION:** Texas Department of Transportation, San Antonio District

TEJSAI Y.



DIETARY NUTRIENTS EFFECTS ON C-REACTIVE PROTEINS

ABSTRACT: In general public health standards, healthy eating is classified as fitting the US food department guidelines. Some people, however, have different diets which they utilize to provide important nutritional vitamins and values such as fiber. In turn, fiber helps produce c-reactive proteins, a key protein in maintaining the body's immune functions. To increase the likelihood of receiving c-reactive proteins and higher fiber nutritional counts, multiple diets must be looked at to understand whether or not the US recommended diet is truly what is best for the endocrine and immune system, which help maintain homeostasis and healthy living in the body impacting humans in a very positive way. The Greehey's bioinformatic research institute will help me conduct research on c-reactive proteins in specific and their relation to fiber which can further be analyzed with the measurement of different diets. Since the lab already conducts cutting edge research on all types of proteins, the research I shall conduct will fit in nicely with the rest of the ongoing research. By working in these labs, the fellow student researchers and I can look at different foods prevalent in the Mediterranean diet and American House diet to analyze the fiber values of each food, searching for the correlation of c-reactive proteins to fiber. In doing so, the results will allow me to find the exact portion and ratio of protein and fiber in exact values, so I can help advance the public health agenda of keeping people at the peak of their healthiness.

- **BASIS ADVISOR:** Mark Petrie • **ON-SITE MENTOR:** Dr. Luiz Penalva
- **LOCATION:** UT Health San Antonio - Children's Cancer Research Institute



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