Senior Projects
2023–2024

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 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 each student's 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 students' 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. The project summaries 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. 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, DC, LA

David Hubalik
Chief Executive Officer
BASIS Ed Texas

BASIS Scottsdale SENIOR PROJECTS

SIDDHARTH A.

GENOMIC BIOINFORMATICS

SUMMARY: Diabetic retinopathy (DR) is the leading risk for vision loss in working adults worldwide, affecting more than 100 million people. While risk factors such as diabetes duration, hyperglycemia, and dyslipidemia are well-acknowledged, the unifying molecular mechanisms underlying the pathogenesis of DR remain incompletely understood across different species. To bridge this gap, I conducted a comprehensive RNA-sequencing (RNA-seq) meta-analysis on retinal tissue samples from mice, rats, and humans with diabetes. This integrative bioinformatics analysis observed both conserved and species-specific transcriptional landscapes associated with DR. I hoped to see that pro-inflammatory pathways were ubiquitously activated in the retinal tissues across all examined species. However, I expected that some unique human-specific immune-metabolic signatures would not be observed in rodent models. In summary, this investigation unveiled both universal and species-specific molecular underpinnings of DR, enhancing our understanding of its complex pathobiology. I hope these findings will validate the utility of animal models in DR research and underscore the importance of human-focused studies to uncover mechanisms uniquely relevant to human pathology.

- **BASIS ADVISOR:** Ryan Yanashima • **ON-SITE MENTOR:** Sampath Rangasamy
- **LOCATION:** Translational Genomics Research Institute

ANAHITA A.

STRESS-FREE SOLUTIONS TO PREVENT COMMON CARDIOVASCULAR DISEASES IN POSTMENOPAUSAL WOMEN

SUMMARY: Family medicine best exemplifies primary care, as it is continuous, cooperative, and personal. Cardiovascular disease is the leading cause of death, taking the lives of over 800,000 individuals nationally and nearly 17.9 million individuals globally every year. At Novakovic Family Practice, primary care plays an essential role in preventing common cardiovascular diseases such as coronary heart disease, heart attacks, and strokes. Primary care requires research on each patient's risk factors. When a woman enters menopause, her risk of contracting cardiovascular disease increases as estrogen levels–which provide effective protection against heart disease–decrease. Fat buildup is more likely to occur in the arteries, causing them to become thinner. Over 60 million women in the United States (over 44%) have high blood pressure and are living with some form of heart disease. Stress is a modifiable cardiovascular disease risk factor that human behavior can control. After menopause, 70% of women develop one or more cardiovascular diseases, and an estimated 1 in 4 women may develop irregular heart rhythms in their lifetime, with stressful life events and insomnia being major contributing factors (American Heart Association). Stress can occur due to several factors, from excessive caffeine consumption to hormonal changes. I worked with participants in this study to reduce their anxiety by developing an informational brochure outlining various coping mechanisms and lifestyle changes for stress, including the 4-7-8 breathing technique.

- **BASIS ADVISOR:** Bonne de Blas • **ON-SITE MENTOR:** Zhanna Sheleg
- **LOCATION:** Novakovic Family Practice (Chandler)

MEGHANA B.

POETRY IN HEALING

SUMMARY: In poetry workshops, people study a presented poem and use it as a bridge to their own experiences. They may construct their own poems as a response, articulating their thoughts and emotions about their personal narratives, which may also inspire others to share their own stories. Poetry workshops can be used to facilitate the healing of a patient, not as a supplement for regular doctor-patient interaction, but as an adjacent service provided for the patient. This process, however, involves knowing oneself and can be terrifying for many. My Senior Project, Poetry in Healing, explores the research surrounding narrative and poetic medicine. It includes comments on literature written on the subject and my observations on several poetry workshops hosted by Dr. Rosemarie Dombrowski and other facilitators who are part of her nonprofit Revisionary Arts. It also delves into the elements of a poetry workshop, including the process through which the shared poems are chosen, how these poems are relayed to participants, and how participants are encouraged to respond and share. Finally, it recounts my experience facilitating my own poetry workshop at BASIS Scottsdale for the students in Ms. de Blas's Narrative in Medicine Capstone.

• **BASIS ADVISOR:** Bonne de Blas • **ON-SITE MENTOR:** Dr. Rosemarie Dombrowski
• **LOCATION:** Arizona State University

PURVANSH B.

STUDYING THE EFFECT OF BRIGHT GALAXY COUNTS ON THE INTEGRATED BACKGROUND LIGHT LEVEL

SUMMARY: Extragalactic Background Light–also known as Integrated Background Light, IBL, or EBL–is the sum of all light emitted by every galaxy across the sky. This project aims to study the IBL in a certain small sector of the sky by compiling multiple databases of varied galaxies through ASU's ongoing 'SKYSURF' project. From these tables of information, I was able to sum up the emissions of all galaxies in this part of the sky to find the total background light for this area. Then, utilizing Python's 'Astroquery' module, I analyzed the number and density of bright galaxies. By increasing and decreasing the qualifications to be a 'bright' object, I formulated graphs comparing brightness on the x-axis to background light on the y-axis. By quantifying the slope and level of fit for the data, I was able to quantify the relative level and nature of relationship between the EBL and bright galaxies, giving us more precise information about the characteristics of bright vs. dim galaxy fields in future experiments.

• **BASIS ADVISOR:** Natasha Proctor • **ON-SITE MENTOR:** Dr. Timothy Carleton • **LOCATION:** Arizona State University

GEORGIA B.

ANALYZING THE EFFECT OF EXTREME HEAT ON HONEYBEE POPULATIONS USING DIFFERENTIAL EQUATIONS

SUMMARY: Honeybees are essential for maintaining biodiversity in ecosystems and producing crops worldwide. According to the USDA, 80% of crops benefit from pollination by honeybees and one third of the food we consume relies on bee pollination for its production. Research suggests that there are many factors contributing to the global decline of the honeybee population, such as nutritional stress from lack of flowering plants, environmental stressors such as global warming, lack of genetic variation, parasites such as Varroa mites, and diseases such as Deformed Wing Virus. For this project, I analyzed data from bee colonies at Arizona State University. Specifically, extreme heat and extreme cold have disastrous effects on colonies. In freezing weather, food becomes scarce, meaning bees must stay in their hives and form a thermoregulated cluster of bees. The queen bee will be unable to lay eggs in low temperatures. This also occurs during the summer in Arizona when temperatures rise to over 100 degrees. My project analyzes hives throughout the spring, which happens to be when the queen will lay most of the eggs. Additionally, I analyzed data from last summer, using differential equations to determine how the bees can be effectively protected as global temperatures rise.

• **BASIS ADVISOR:** Alex Covalciuc • **ON-SITE MENTOR:** Dr. Yun Kang • **LOCATION:** Arizona State University

NAIMISHA C.
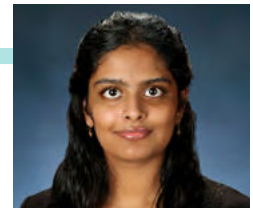
INTERNATIONAL LOBBYING IN THE UNITED STATES

SUMMARY: Interest groups, from corporations to government bodies, have always been a key part of U.S. politics. The political influence these groups wield is due, in part, to lobbyists–individuals who contact government officials directly to advance a policy initiative. With the rapid globalization associated with the late 1900s, lobbying has grown in both size and significance, as global interests–both corporate and governmental– seek influence in U.S. policy. My research aims to evaluate just how large that influence has been. My work in Arizona State University's School of Politics and Global Studies allowed me to analyze trends in foreign governmental and healthcare lobbying to see what effects they have had on U.S. policy. By studying lobbyist registrars across multiple time periods in several states, I created a comprehensive data set of the foreign lobby in the United States and analyzed trends in the presence of the international lobby in the U.S. policy making sphere. With the help of this data set, my project explores the influences of the international lobby on U.S. policy.

• **BASIS ADVISOR:** Charity Antal • **ON-SITE MENTOR:** Dr. James Strickland
• **LOCATION:** Arizona State University, School of Politics and Global Studies

NEHA K.

MARKETING STRATEGIES TO IMPROVE MEMBERSHIP SALES

SUMMARY: At Hand and Stone Massage and Facial Spa, memberships are the cornerstone for success, providing a steady and predictable source of revenue. This project aimed to identify the best sales and marketing strategies to increase the number of active members. By identifying and implementing the most effective strategies for increasing membership sales, this project aims to enhance the spa's performance and sustain its success. Through creating new promotional deals and calling suspended members-members whose payment hasn't gone through and whose benefits have been revoked, this project identified the best strategies to gain 50 active members a month, providing a blueprint for optimizing membership-driven growth strategies in the future.

- **BASIS ADVISOR:** Alex Covalciuc • **ON-SITE MENTOR:** Ghuncha Gul
- **LOCATION:** Hand and Stone Massage and Facial Spa

HARINI K.

EFFECTIVENESS OF LEARNING STRATEGIES: VIDEO INSTRUCTION OR TEXT INSTRUCTION

SUMMARY: It has been shown in various studies that there are effective reading strategies that elementary children and secondary readers should employ to improve comprehension of text. Strategies such as self-explanation, which includes paraphrasing, are beneficial for reading comprehension. There are four methods of generating a paraphrase: using synonyms, restructuring, splitting, and combining sentences. Creating synonyms for words that are in the sentence is one strategy to generate a paraphrase. Restructuring the order of phrases is another valid strategy. Additionally, readers may split a sentence into two separate ones or combine two separate sentences into one singular sentence. However, there is a gap in understanding why strategies are useful and actually pushing students to implement these strategies when they read on their own. Undergraduate students at a large midwestern university completed a study on paraphrasing. The sample group was randomly assigned to two different conditions: one text instruction of a video script, and one instructional video that was five minutes long. Participants were tasked to generate 50 paraphrases based on the strategies they just learned. These paraphrases were human scored on a rubric that was previously validated. These paraphrase quality scores were compared between both experimental groups to see if they were statistically different. This project investigates the most favorable method of teaching students these effective reading strategies, as we know that these are skills students must learn.

- **BASIS ADVISOR:** Ryan Carey • **ON-SITE MENTOR:** Dr. Tracy Arner • **LOCATION:** Arizona State University

SUJAY K.

SCALING COMPANIES THROUGH VENTURE CAPITAL

SUMMARY: This Senior Project explores the operational complexities within the venture capital (VC) sector, focusing on Auteur VC, a new VC firm focused on being the first check to AZ founders. VC is pivotal in driving innovation and growth by funding promising startups, yet it faces challenges like efficient information management and strategic decision-making. This project addresses these issues by developing systematic tools aimed at enhancing the operational efficiency of venture capital firms. These systems, designed to serve as a single source of truth, are critical in streamlining processes and providing accurate insights for investment decisions. By implementing these tools at Auteur VC, the project offers a unique opportunity to study and improve upon the existing methodologies in venture capital operations. The anticipated outcome is a set of refined, integrative systems that not only facilitate the firm's day-to-day activities but also provide a deeper understanding of the nuanced decision-making processes in the venture capital world.

• **BASIS ADVISOR:** Dana Johnson • **ON-SITE MENTOR:** Phillip Pipkins • **LOCATION:** Auteur VC

TANISHA K.

ACCESSIBILITY OF MATERNAL FETAL MEDICINE CLINICS IN ARIZONA

SUMMARY: High-risk pregnancies pose distinct challenges that demand specialized medical attention to ensure optimal outcomes for both the mother and the fetus. This project seeks to explore the availability of emergency maternal fetal medical care for individuals with high-risk pregnancies. Collaborating with Dr. Krunal Patel, one of only doctors in Arizona at a private emergency maternal fetal medicine practice, I aimed to understand the difficulties faced by patients in accessing crucial medical care during pregnancy. Through an examination of the accessibility of emergency maternal fetal medical care, the project aims to uncover potential barriers that impede timely and effective intervention. By contributing to targeted interventions and measures to enhance accessibility, the findings of this project may ultimately help reduce healthcare outcome disparities in high-risk pregnancies. Partnering with a maternal fetal medicine specialist allows for a comprehensive analysis of challenges faced by patients and healthcare professionals, paving the way for well-informed recommendations to improve the overall standard of emergency care for high-risk pregnancies. The study's results may contribute to the broader discourse on maternal and fetal health, influencing policy development, medical education, and the overall enhancement of healthcare services for pregnant individuals confronting high-risk conditions.

• **BASIS ADVISOR:** Ryan Carey • **ON-SITE MENTOR:** Dr. Krunal Patel
• **LOCATION:** HonorHealth John C. Lincoln Medical Center

SHREYANK M.

THE INFLUENCE OF INCOME AND ORIGIN ON THE PERCEPTION AND PUNISHMENT SEVERITY OF DEFENDANTS ACCUSED OF A CRIME

SUMMARY: Being in an environment where the slightest misjudgment may alter a person's life, courtrooms must ensure that biases are reduced to a minimum and that preconceived notions are left aside from their judgments. This project was inspired by Kennedy and Tripodi (2015), who examined the attitudes of social work students towards death penalty sentences, using a series of case studies. The type of crime, age, and mitigating factors for the nine scenarios were manipulated. Overall, student responses favored lifetime imprisonment over death penalty sentences. Consequently, my research question was adapted from this case study and focused on determining the effect of mitigating factors, i.e., income and prior convictions, on the perception of specific crimes. I conducted my experiment using Google Forms, randomly assigning the participants to one of four experimental groups. I measured dependent variables using the Perception of Criminal Defendants Scale (PCDS), a set of nine items using a 6-point semantic differential rating scale, and a 10-point rating scale to measure punishment severity. I found that income affected perception and punishment severity, such that the high income condition had a more negative perception than the low income condition, and prior convictions had a more negative perception than the no conviction condition. Consistent with my hypothesis, the high income and prior conviction scenario had more negative perceptions and more severe punishment compared to the other scenarios. However, in future studies and discussions, I will be investigating how the context of a crime shapes an individual's perception of a defendant, and impacts what punishment is deemed appropriate.

• **BASIS ADVISOR:** Brandon Hermann • **ON-SITE MENTOR:** Dr. Lisa Worthy
• **LOCATION:** Glendale Community College

NADIA N.

ENHANCING USER EXPERIENCE IN LIBRARY SPACES

SUMMARY: Increasing user satisfaction is essential in increasing the success of a product. User experience (UX) design is the process of enhancing a product's user experience by evaluating human behavior and preferences. In this project, I performed user experience research on the Scottsdale Public Library website with Mr. Anup Viswanathan, the general manager of Toyota Boshoku America, Inc., as my external mentor. In order to successfully improve the website's design, I predicted hypothetical examples of bad UX, and also observed other library websites around the nation as a source for comparison. My main purpose for this project was to explore how a human-centric designer works and thinks when tasked to redesign a product. While I learned a lot from researching UX design, participant responses also played a crucial role in pointing out improvement features I failed to recognize. After analyzing my data, I started on my final product, the design prototype of the Scottsdale Public Library website. In the end, this project highlights the importance of user input on design and illustrates how websites are improved every year.

• **BASIS ADVISOR:** Mitra Sahu • **ON-SITE MENTOR:** Anup Viswanthan • **LOCATION:** Toyota Boshuku America, Inc.

ALISTAIR P.

NEUROINFORMATICS: COMPUTATIONALLY MODELING HIGH-FREQUENCY OSCILLATIONS IN THE OLFACTORY BULB

SUMMARY: In the past few years, ketamine has become popularized as an acute treatment for drug-resistant depression. While a ketamine nasal spray became FDA approved in 2019 for depression treatment, not much is known about why it helps or its long-term efficacy. One possible mechanism for ketamine's antidepressant effect is its effect on brain waves, particularly the increase in high-frequency oscillations (in the 130–180 Hz range) associated with low doses of ketamine. The olfactory bulb, a key region in processing smell, plays an important role in coordinating oscillations across the brain, particularly the limbic system. It has been shown to be a likely source of the high-frequency oscillations seen with ketamine, and in turn the antidepressant effect. Using a realistic computational model of the mouse olfactory bulb, I worked with a graduate student to replicate the effects of ketamine on high-frequency oscillations by modifying NMDA receptors, revealing the cellular mechanism. Apart from working with the graduate student, I worked on the neuroinformatics side, further developing the olfactory bulb model, the BlenderNEURON software, and documentation for each.

• **BASIS ADVISOR:** Dr. Merissa Remus • **ON-SITE MENTOR:** Dr. Sharon Crook • **LOCATION:** Arizona State University

ERIC P.

OPTIMIZING INTERACTIVE UNIVERSITY ADMISSIONS TOOLS TO DRIVE CONVERSIONS

SUMMARY: Through this research project, I explored how chatbots can be implemented into a real world scenario: university admissions. As the cost of labor and complexity of institution computer systems increase, the need for digital customer service tools is imperative. Through this project, I explored how to implement these models into a user-friendly chatbot. The organization I worked with to conduct this project had previously attempted a similar project, but former iterations of this bot proved unnecessarily complex and were never published. My goal was to make a new version that was more user friendly.

• **BASIS ADVISOR:** Natasha Proctor • **ON-SITE MENTOR:** Jonette Pettyjohn
• **LOCATION:** Sonoran University of Health Sciences

ABHINAV R.

ANALYZING MULTIMODAL INTEGRATION OF OLFACTORY AND TOUCH IN HONEYBEES

SUMMARY: In this research project, I looked at the integration of multiple sensory modalities in the honeybee. This means that multiple different senses come together to increase the amount of information an organism has about a stimulus, allowing it to react accordingly; examples would be the integration between smell and taste, or sight and hearing. In the project, I studied the integration between smell and touch. Odors could only reach a bee's antennae via the wind, so there would be a touch component to any olfactory response. Two major questions I had were how are smell and touch integrated with the honeybee's olfactory system, and what advantage does that give the bee when sensing an olfactory stimulus? To study this, I took electrophysiological recordings within the honeybee antennal lobe (roughly equivalent to the human olfactory bulb) where I could expose the bee to different combinations of odor concentration and airspeed. If there was integration occurring here, I would expect to see an interaction between the two sensory modalities reflected by the spiking pattern on the graph. The hypothesis was that the touch component makes the olfactory response shorter, but more sensitive to changes in the odor. After this, I studied how this changes at different levels of processing, such as directly within the antenna or the mushroom bodies, which helped me understand where the integration is occurring and allowed me to trace the processing pathway from stimulus to behavior.

• **BASIS ADVISOR:** David Glosser • **ON-SITE MENTOR:** Hong Lei • **LOCATION:** Arizona State University

MUGI S.
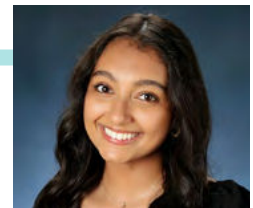
CONSEQUENCES OF INEFFECTIVE STERILIZATION IN DENTISTRY

SUMMARY: This Senior Project addresses a critical aspect of oral medicine by diving into the repercussions of negligence in proper sterilization practices with the context of dental malpractice. Dental malpractice concerning ineffective sterilization poses severe and dangerous risks to patients. This type of malpractice encompasses incorrectly sterilized instruments, incorrectly sterilized patient procedural rooms, and the improper use of personal protective equipment. This project sheds light on the importance of effective sterilization practices and its potential complications in this crucial aspect of oral healthcare. I have conducted this research alongside Dr. Nigam at Sapphire Dental Care, where numerous dental procedures involving various instrumental tools are performed daily. By examining the intricacies of the sterilization process at this dental facility, specifically hand-on experience with sterilizing rooms and tools, the project aimed to contribute valuable insights into the challenges and consequences associated with improper sterilization standards.

• **BASIS ADVISOR:** Sergio Garcia • **ON-SITE MENTOR:** Dr. Sanjay Nigam • **LOCATION:** Kierland Dental Arts

AIDEN T.

RETROFITTING FOR A WALKABLE PHOENIX

SUMMARY: In recent years, I have developed a great interest in urban design and architecture, specifically in the idea of ìretrofittingî cities to improve quality of life. Learning about these fields has always been a personal endeavor–one only accessible through online lectures on very basic principles. This was until I experienced first hand the strength of close-knit neighborhood communities in the Alphabet City of Manhattan–reclaiming areas to set up community gardens, bike lanes, food pantries, and most importantly educating other communities on the need for strong local bonds. I am particularly drawn to these efforts because I believe it is an accessible and easy-to-implement solution to many modern issues. Growing up, I have always lived at least 20 minutes from my friends' complexes–completely detached from their community. Additionally, the 20-minute stretch was filled exclusively with retail spaces and barren neighborhoods–barely the spaces in which middle schoolers enjoy spending time with each other. If this area was not only made smaller and less sprawling, but also filled with plazas and gardens to allow communities to form, my 20 minutes could be spent biking to friends' houses waving to familiar faces. I would enjoy views of a teeming community, instead of driving by copy-pasted housing units positioned back to back with no semblance of neighborly love or community in the slightest. These are the communities I want to create for future generations–ones intentionally designed to allow for new faces to cross paths and familiar ones to gather, improving the value and enjoyment of every life it lovingly houses.

• **BASIS ADVISOR:** Dr. Merissa Remus • **ON-SITE MENTOR:** Daren Petrucci • **LOCATION:** A-I-R inc.

SRIVARUN V.
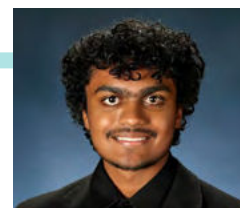
ULTRAFAST LASER TECHNIQUES TO DO ELECTRONIC-SPECTROSCOPY, ADDITIONALLY MATHEMATICALLY MODELING HHG PROCESSES

SUMMARY: High-speed cameras have revolutionized our ability to observe processes occurring on timescales beyond human perception, such as those in the order of milliseconds to microseconds. However, to delve into even faster phenomena, like the motion of electrons operating at attosecond timescales, attosecond laser pulses are indispensable. This project explores the compression of long pulses from a Ytterbium (Yb) laser using two distinct methods: gas-filled hollow-core fiber (HCF), and multi-plate compression (MPC). Through comprehensive analysis, the advantages and drawbacks of each approach were evaluated. Preliminary findings suggest that while the HCF method facilitates greater pulse compression at higher energies, the MPC approach offers superior stability and ease of implementation. Additionally, the development of a robust beam monitoring and readjustment system within the lab was crucial to ensuring the accuracy and reliability of experimental results.

• **BASIS ADVISOR:** Paul McClernon • **ON-SITE MENTOR:** Arvinder Sandhu
• **LOCATION:** University of Arizona, Department of Physics

ANDREW Y.

COMPUTER AIDED DIAGNOSIS USING IMAGE SEGMENTATION AND STABLE DIFFUSION FOR HIGHER ACCURACY THAN GROUND ZERO AND STANDARD DIAGNOSIS

SUMMARY: Machine learning (ML) models interpret and diagnose medical images, specifically chest X-rays. They can detect respiratory diseases, locate abnormalities, and provide specific information through image segmentation. One specific type of ML model is called convolutional neural networks, or CNNs for short. Different ML models use image classification, object detection, and segmentation to identify chest diseases, with newer architectures such as CNNs and vision transformers producing precise and efficient models for medical diagnosis. The early 2010s used neural networks for image classification, but today, more complex CNN architectures such as vision transformer models, data augmentation, unsupervised learning models, and transfer learning are used to effectively train models for medical diagnosis, particularly for chest X-rays (CXRs). In recent years, top-performing models for examining NIH chest X-ray datasets include ResNet-101, VGG-16, VGG-19, and SqueezeNet, with an accuracy score ranging between 90.7% and 94.3%. A more state-of-the-art model, called a diffusion model, is used to learn a lot of detail and images through denoising and noising the image, allowing the model to evaluate the chest X-ray images pixel by pixel to predict the specific category (disease) it belongs to. What makes them interesting is its ability to provide a more complex understanding of chest X-ray diseases with the generation of more realistic and RGB images. My method combines RoentGen model (stable diffusion model) and DenseNet-121 Classifier model to diagnose atelectasis, cardiomegaly, consolidation, Edema, P. Effusion using RoentGen model feature extraction and convolution neural network. This combination model is evaluated against vision autoencoder models, transfer learning models, and traditional diagnosis (radiologist interpretations, clinical assessments, and laboratory tests) based on quantitative metrics and qualitative evaluation to identify specific features of diseases. With the help of CheXpert Validation Dataset, NIH Chest X-ray 14 dataset, and RoentGen chest X-ray datasets, I will be able to evaluate whether this model is significantly more effective than SOTA models and traditional diagnosis used today for future use in treating chest and cardiovascular diseases.

• BASIS ADVISOR: Natasha Proctor **• ON-SITE MENTOR:** Jianming Liang **• LOCATION:** Arizona State University

HETAL N.

DRIVING CANCER THERAPY: CAR-NK CELLS

SUMMARY: Among the emerging fields of oncological research for leukemia, CAR-NK cell therapy has shown promising potential. This therapy harnesses the innate power of the body's immune system and involves engineering natural killer (NK) cells to target and destroy cancer cells more effectively. Its development marks a significant leap from conventional treatments. There is a need for comparative studies that directly assess CAR-NK cell therapy against other immunotherapies and standard treatment modalities to determine its relative advantages and limitations. Therefore, this project aims to answer the question, 'How can CAR-NK cell therapy be optimized and integrated into multimodal treatment approaches for hematologic malignancies?' This will help guide clinicians in making informed decisions about incorporating CAR-NK cell therapy into comprehensive treatment plans for leukemia patients.

• **BASIS ADVISOR:** Shannon James • **ON-SITE MENTOR:** Dr. Rizwan Romee
• **LOCATION:** Dana-Farber Cancer Institute, Romee Lab