C · H · O · R · I
Children's Hospital Oakland Research Institute

UCSF Benioff Children's Hospital
Oakland

39th CHORI Summer Student Research Symposium

Friday, August 7, 2020
9 a.m.-4 p.m.

August 7, 2020

It gives me great pleasure to introduce you to the 2020 Children's Hospital Oakland Research Institute Summer Student Research Program class and abstract book. Today we are celebrating a number of firsts, the first all virtual summer training program at CHORI in 39 years, the first 'Zoomed' research symposium, and the first year to officially include collaborations with the Bio-Engineering department at UC Berkeley. However, we also are reflecting on a monumental change to our program's leadership. One month ago, we said goodbye to Dr. Bertram Lubin, the founder of the SSRP and tireless champion and advocate for underserved students. Bert looked forward to our symposium each year and delighted in the successes of our alumni. Despite our immeasurable sadness, we know Bert would want us to celebrate the accomplishments of these gifted youth and encourage them on in their science journey.

Therefore, today we celebrate the wealth of our diversity- which is represented in abundance in this summers' matriculating class. We acknowledge the importance of this diversity in science particularly at a time when our national is moved towards change. This summer's theme, 'Envision Yourself in Science', expresses our hope that each intern visualizes themselves in places of success, even when others may not have the courage to do so.

We knew this summer would be unusual – designing and crafting research studies from our living rooms was certainly a unique experience, and 3 hour long zoom calls can test anyone's ability to focus, but our students were up to the task. They overcame last minute changes to zoom schedules, internet instability, dogs barking during presentations, cats walking across keyboards, caring for family members and inflexible work schedules. Despite these challenges, our students have been incredibly resilient, a character trait that will prove invaluable in the future. I feel truly privileged and honored to have worked with these gifted youth and hope that their summer research experience offered a brief glimpse into the exciting world of biomedical research.

To our students' families, thank you for sharing your sons and daughters with us this summer, to our administration, thank you for providing unwavering support to carry on despite all the road blocks that COVID placed in our path. Most importantly, thanks to all of the CHORI, UCSF Benioff Children's Hospital Oakland, UCSF and UC Berkeley mentors and supervisors who are the backbone of the program. I appreciate their time, effort, and profound commitment to mentor these students. A very special note of appreciation also goes out to: David Killilea, Roialle Jennings, John McDonnell, and Phillip Bollinger, the core of our leadership team, as well as our guest seminar speakers for their creative efforts which made this summer's virtual program a huge success. We acknowledge the support and funding provided by the NIH, Doris Duke Charitable Foundation, the Bert Lubin Scholarship Fund and the Alex Lucas Memorial Fund.

I want to extend my very best to our CHORI summer interns who represent the creativity and hope for the future in biomedical research. I look forward with anticipation to where these young men and women will travel in their future scientific endeavors to change the face of science.

Sincerely,

Ellen B Fung

Ellen B. Fung, PhD RD CCD
Principal Investigator & Director
CHORI Summer Student Research Program

Contents

Program Advisory Members	5
2020 Program Staff	6
2020 Selection Committee Members	7
2020 Summer Students	12
Sakina Bambot	14
Ben Beernink	15
Barry Brand	16
Vivian Bui	17
Mireya Cabral-Mixco	18
Yvette Cardenas	19
Saryah Colbert	20
Eric Connelly	21
Mattias De Los Rios Rogers	22
Isabelle Faller	23
Israel Fuentes	24
Caralyn Gonzales	25
Abigail Hayes	26
Ikenna Kuba	27
Simon Le	28
Kerry Lin	29
Stephanie Martinez Contreras	30
Sarah McCarthy	31
Gabrielle Montenegro	32
Suhera Nuru	33
Cheav Lay Phat	34
Ishika Prashar	35
Rengakrishna Rengappa	36
Anna Rios	37
Erin Rosales	38
Richard Ruan	39
Dunia Saleh	40
Molly Szczech	41
Alexis Tran	42
Siem Tsegay	43
Students Presenting Elsewhere	44
This Year's Mentors	48
Notes	49

Support for the 2019 CHORI Summer Student Research Program was generously provided by the following grants and sponsors:

The National Institutes of Health (NIH)

STIMULUS: Science & Technology IMmersion for Underrepresented Learners in the US

R25 HL125451

The Doris Duke Charitable Foundation (DDCF)

Clinical Research Continuum: High School to College Program # 2016143

National Science Foundation

Award No. 1564587

Title: Scholarships for Excellence, Achievement, and Professional Competence in Science, Math, and Engineering

Awarded to: Drs. Mark Wong and Seti Sidharta

The UCSF Benioff Children's Hospital Oakland Foundation

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Summer Student Research Program Curriculum

Program Objectives:

1. *Connect with other like-minded and motivated students*
2. *Develop a basic understanding of research design and methodology*
3. *Learn to read and critically evaluate the scientific literature*
4. *Present scientific topics effectively and succinctly*
5. *Develop a professional relationship with a scientific mentor*
6. *Create a detailed scientific proposal under the guidance of your mentor*
7. *Gain a deeper understanding of careers in the biomedical sciences*

Overview

The virtual curriculum provided during the 2020 Summer Student Research Program (SSRP) will consist of both **required** and **elective** content, which will be organized through the UCSF learning management system known as CLE. In addition to the program-wide educational elements listed below, you will also be engaging in research with your individual mentor.

The **required curriculum** consists of approximately 15 hours per week. About half of the required curriculum will be provided through live Zoom sessions presented on Tuesdays & Thursdays from 2-5 pm. You are expected to be present and attentive for these live Zoom sessions. Other required content, including proposal development, safety training, and assigned training modules will happen outside of the live Zoom sessions at times of your choosing. These asynchronous activities may be accessed through links provided in the program's CLE site, and are designated by an asterisk next to their name in the required curriculum below. It is important that you organize your time to complete these assignments without falling behind. Elements of the required curriculum cannot be substituted, and all aspects must be attended for program completion.

The **elective curriculum** consists a wide range of virtual content that we have curated and believe to have value for your educational enrichment and career development. The elective curriculum will consist of both synchronous and asynchronous options, including UCSF Grand Rounds (hospital-wide presentations done by senior staff), suggested science movies, and asynchronous additional lecture videos. The individual events, including their dates and times when applicable, will be posted at the bottom of the program's CLE page.

Required Curriculum

- Safety training through UC Learning* – 5 modules
- Laboratory safety simulation module (Labster)* – 1 module
- Collaborative Institutional Training Initiative (CITI) courses* - 2 modules
- Research Methodology:
    - How to read scientific literature – 1 presentation
    - Biomedical ethics case series – 1 presentation
    - Basic biomedical statistics – 2 presentations
    - Effective presentation skills
    - Designing Clinical Research (DCR) – 3 modules
- Weekly scientific lectures – 14 lectures
- iBiology lectures* – 7 lectures
- Professional development:
    - How to make a great poster/give a flash talk
    - Career Advice: Fine tuning a resume/LinkedIn workshop
    - Careers in STEM- navigating the PhD/MD world
    - "Day in the life of a… " – 6 presentations
- Virtual lab simulation (Labster)* – 14 modules
- Research proposal development (see templates provided)
    - Research abstract: due July 6
    - Final proposal or poster presentation: due August 3
- Journal Club – 1 meeting is required out of the 6 total meetings during the summer

Elective Curriculum

- Chat with a mentor workshop series
- Grand rounds lectures at BCH-O or UCSF
- Suggested science movies or podcasts
- Suggested additional iBiology lectures

Social- Student Networking Opportunities

- SSRP alumni presentation
- Small group discussions: Interns will be divided into 5 small groups led by a returning student- and have the opportunity to discuss lecture topics.
- Social networking events

* These asynchronous activities are to be completed outside of the Tu/Th 2-5 pm online sessions, and may be accessed through links provided in the program's CLE site

Programmatic Requirements

- Abstract due: July 6 at 5:00 pm
- Personal statement due: July 13 at 5:00 pm
- Final proposal or poster due: August 3 at 5:00 pm
- Attendance at final symposium: Friday, August 7 (set aside 9 – 4 pm)
- X-train documentation (required for undergraduates funded by NIH)
- Pre / Post online survey program evaluations

Applications Used in Virtual Programming

We will be using several applications to assist with program and networking management. At program orientation, you will be provided instructions for how to download these applications and what they will be used for during the summer.

- Communications: SLACK
- Presentation: Zoom
- Feedback: Poll Everywhere
- Learning Management System: CLE (Moodle platform)

Program Contact Information

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Curriculum guru, Labster techie and speaker questions

Phillip Bollinger IT Services Lead phillip.bollinger@ucsf.edu
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John McDonnell Systems Analyst john.mcdonnell@ucsf.edu
Abstract and personal statement submissions

Elijah Goldberg Student Program Assistant goldberge@carleton.edu
CLE manager

Week 1

June 18

Ellen Fung, PhD RD CCD: “Anatomy of Clinical Research”
Christine McDonald, ScD: “Basic Principles of Biostatistics, Part 1”
Paul Harmatz, MD: “Developing Treatments for Rare Diseases”
Patricia Espinal: “Advocacy for Patients with Rare Diseases”

Week 2

June 23

Tony Muñoz: “A Day in the Life of a Basic Scientist in Training”
Nancy Noonan, PNP and Marci Moriarty, PNP: “A Background on Bone Marrow Transplantation”

June 25

Christine McDonald, ScD: “Basic Principles of Biostatistics, Part 2”
Simon Robertson: “Virtual Reality as a Pain Management Tool for Sickle Cell Disease”
Dayna Long, MD: “Health Inequalities and Social Determinants of Health”

Week 3

June 30

John McDonnell: “Wait, You Mean I Have to Talk? In Front of People??”
David Killilea, PhD: “How to Formulate a Flash Talk”

July 2

Ann Petru, MD: “Pediatric Infectious Disease”
Aaron Streets, PhD: “The Human Cell Atlas Project: a Google Maps for Biology”

Week 4

July 7

David Killilea, PhD: “Chat with a Mentor”
Jasmine Wong, PhD: “Utilizing Mice to Model Human Genetic Disease”
Theodore Roth, PhD: “A Path Towards Obtaining an MD/PhD”

July 9

David Schaffer, PhD: “Directed Evolution of New Aden-Associated Viruses for Clinical Gene Therapy”
Lorrene Ritchie, PhD RD: “Why Nutrition Matters: Conducting Research to Inform Policy”

Week 5

July 14

Kelsey Miller, MPH: “Chat with a Mentor”
Tariq Ahmad, MD: “A Day in the Life of a Pediatric Endocrinologist”

July16:

Steve Mack, PhD: “Applying Immunogenetics to Defeat COVID-19”
Carter Lebares, MD: “Getting from Bench to Bedside: How do we Change Patient Behavior?”

Week 6

July 21

Ellen Fung, PhD RD CCD: “Chat with a Mentor”
Karen Daley, MFT: “A Day in the Life of a Clinical Therapist”
Ellen Fung, PhD RD CCD and David Killilea, PhD: “Cases in Biomedical Ethics”

July 23

Sarah King, PhD: “The Long and Winding Road of Science”
Ward Hagar, MD: “How Creativity and Accident Influences Research and Discovery”

Week 7

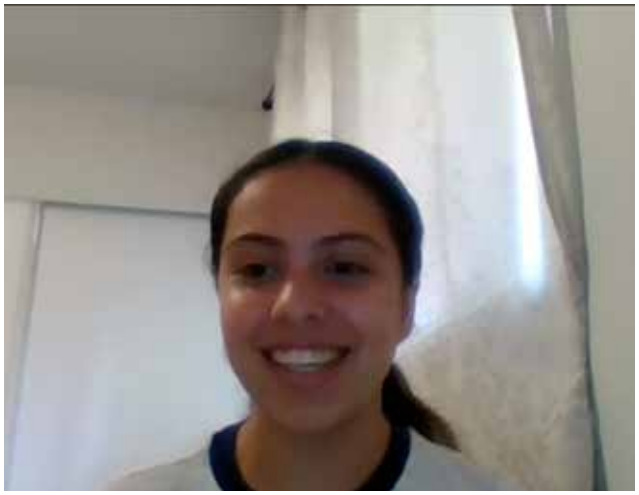
July 28

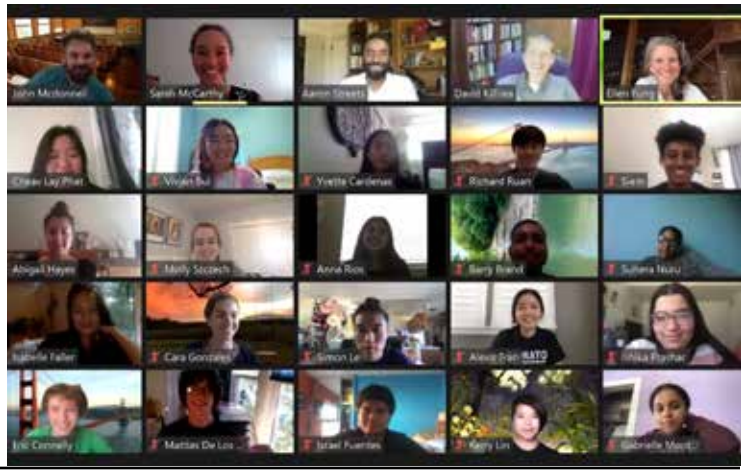
Baylee Decastro, MPP: “Chat with a Mentor”
Coleen Sabatini, MD: “My Path to Pediatric Orthopaedics and General Surgery”
Lenny Lopez, MD: “A Day in the Life of a Cardiovascular Disease Expert”

July 30

Piper Below, PhD: “Searching Big Data to Understand COVID-19 Risk”
Caroline Hastings, MD: “Niemann Pick Disease”

2020 Summer Students





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2020

envision yourself in science

Friday, August 7, 2020 | 9 a.m.-4 p.m.

Sakina Bambot

University of California, Berkeley

Determining the Association Between HPV and C. trachomatis Infection in the Presence of Abnormal Histopathology and Cervical Cancer.

Mentor:
Deborah Dean, MD, MPH, Sarah Theiner, BA

Funded by: National Institutes of Health

Hello, my name is Sakina Bambot, and I am a rising sophomore at UC Berkeley. I first participated in the CHORI summer program in 2018, where I became interested in learning more about the social determinants of health and the intersectionality of identity with healthcare.

This summer, I am working on a project to analyze data on the risk factors of cervical cancer in a population of Ecuadorian women. I have also had the opportunity to hear from a number of inspiring researchers and healthcare professionals who double as leaders and advocates in their communities. Through these experiences, I have gained a much better understanding of how research can be used to improve health outcomes in underserved communities as well as how science can be used to inform policy.

I would like to thank the SSRP leaders for an engaging and eye-opening experience this summer. I am also incredibly grateful to Dr. Deborah Dean and Sarah Theiner for their mentorship this summer and will undoubtedly carry the skills I have been taught into my career.

Introduction

Cervical cancer is the fourth most commonly occurring cancer in women worldwide and is primarily caused by human papillomavirus (HPV). It is highly preventable with screening and the HPV vaccine. However, many developing countries do not have access to these technologies and experience a disproportionate number of deaths as a result. In many South American countries including Ecuador, cervical cancer is the leading cause of cancer death in females. Abnormal cell proliferation in the cervix can be histologically categorized as cervical intra-epithelial neoplasia (CIN) 1, 2, and 3, which represent moderate to severe lesions, Adenocarcinoma in situ (AIS), a premalignant state, and ICC, invasive cervical cancer. Recent studies have indicated that infection due to Chlamydia trachomatis, the most common sexually transmitted infection (STI) worldwide, increases the risk of cervical cancer among women with HPV.

Objective

In a 2007 study conducted in Quito, Ecuador, women aged 17-80 years old were administered a questionnaire to evaluate possible HPV risk factors and were tested for STIs, including HPV and C. trachomatis. The objective of this project will be to analyze this data set to determine whether C. trachomatis is a cofactor with HPV in the development of cervical cancer.

Methods

The data collected in the 2007 study will be analyzed to evaluate risk factors for HPV and C. trachomatis STIs and the statistical association of each alone and together with CIN3, AIS, and ICC.

Anticipated Results

We anticipate that HPV will be significantly associated with histopathology and that C. trachomatis will increase that association.

Significance of the Project

C. trachomatis is often asymptomatic in its early stages. The relationships established by the data can help determine the extent of C. trachomatis as a risk factor for cervical cancer, as it is important to treat women promptly through actions such as early screening in order to decrease the incidences of cervical cancer.

Ben Beernink

De La Salle High School

Identification of Gonococcal Proteins to Elicit Protective Antibody Responses

Mentor:
Peter Beernink, PhD

Funded by: Volunteer

I am Ben Beernink, a rising senior at De La Salle High School. Biomedical sciences are fascinating to me because there is an unlimited amount of ways for research to benefit people all around the world. Many of these paths remain unexplored so there will always be a need for more researchers. Becoming a member of the CHORI SSRP is allowing me to explore different aspects of STEM fields by listening to lectures, reading papers, and participating in a research project. This summer I have been shown fields that I never previously considered. I've learned a lot about science and research in general from the lectures and as well from my mentor Dr. Peter Beernink as we explore proteins that have potential to be used in a vaccine for gonococcal infections. Another experience I am gaining is the benefit of a strong relationship with a mentor who wants to help me learn and progress.

Introduction

Gonorrhea is a disease that affects hundreds of millions of people worldwide, primarily as sexually transmitted infections of the reproductive and urinary tracts. With over 1000 different strains of the bacteria, not all gonorrhea strains can be treated with the same antibiotics. Most of the infections can be treated with antibiotics, but there is no effective vaccine, which is needed to control the spread of antibiotic-resistant strains.

Objective

This project is to clone 5 different gonococcal genes, purify the encoded proteins and identify which is most effective in producing protective antibodies against gonorrhea.

Methods

To begin making the antigens, we used data mining to identify 9 outer membrane proteins that were consistently expressed in 15 gonococcal strains. We amplified the genes by polymerase chain reaction (PCR) and cloned them into a TA cloning vector, pGEM-T-Easy. Next, subcloning the genes into a pET vector and transformation into an E. coli "expression" strain will enable us to produce the recombinant gonococcal proteins. These proteins will be used to immunize mice or rabbits to obtain serum antibodies for downstream immunology experiments.

Anticipated Result

I am looking forward to examining the success of the gene cloning and testing whether the proteins are produced in sufficient amounts and if they are soluble. I anticipate one of these 5 proteins will emerge as a candidate for producing gonorrhea-protective antibodies.

Significance

Gonorrhea is a widespread disease and, in the U.S. alone, over a million new cases are reported each year. It can cause serious issues such as disseminated infections and infertility. Since multiple antibiotic resistant strains have emerged, gonococcus has been called a "superbug." Therefore, this research is to identify a protein that can be used in a vaccine for gonorrhea.

Barry Brand

Xavier University

Personalized Medication Treatment for Persons with Sickle Cell Disease

Mentor:
Ward Hagar, MD

Funded by: Doris Duke Charitable Foundation

My name is Barry Brand and I am a rising junior at Xavier University of Louisiana majoring in chemistry with plans to be a pharmacologist. As far back as I can remember I have been fascinated by cells and the complexities of the human body. Growing up in a family with many health problems played a major role in creating my want to end health disparities in my community. I aspire to be an example for the youth to follow so that they can see that their own goals are attainable. This summer I had the pleasure to work with Dr. Ward to create a patient-centered algorithm to help providers use newer drugs to better care for sickle cell patients. CHORI has helped me develop skills in research and data analysis. This program has provided an intensive learning experience that has opened my interest and deepened my passion for science.

Background

Sickle cell disease medication options have increased, However, these agents have only been studied in a small number of persons with sickle cell. These medications are only reported with an overall effect size and not reported on the individual level. They also have not been studied in any combinations except with and without hydroxyurea. In order to capture as much data from each patient as possible and to determine the best individualized sickle cell care plan, we will explore using newer machine learning techniques to improve individualized care.

Hypothesis

A scalable algorithm can use accumulating data to determine which disease modifying medications for sickle cell disease will give the best individualized treatment effect.

Population

All persons with a sickling hemoglobin

Method

The literature on medical treatments for sickle cell disease will be abstracted for indications and effect sizes for medical treatments for sickle cell including hydroxyurea, L-glutamine, voxelotor, and crizanlizumab. If individualized data is lacking, then representative data sets that preserve the overall results will be generated for exploration. This data will be incorporated into an algorithm that will allow inputs of clinical features and calculations of average treatment effects and conditional treatment effects. Using the Neyman-Rubin causal model as a starting point, machine learning techniques, such as T- and S-learners will be investigated for this algorithm through KNIME or Python PANDAS. Results of these models will be evaluated by the C-for-benefit test.

Result

The expected results for this six-week project is an algorithm that can accept a few patient variables and return an individualized list of medications with an acceptable C-for-benefit value. This algorithm will be scalable with the ultimate goal of being incorporated into the patients' chart to automatically generate a personalized treatment plan.

Conclusion

The recent availability of new agents to treat sickle cell disease is an opportunity and a challenge. Devising a patient-centered algorithm to help providers use these newer agents should improve patient care and outcomes.

Vivian Bui

University of California, Berkeley

Unmasked: Perspectives on Wearing Personal Protection and Community Safety

Mentor:
Baylee Decastro, MPP

Funded by: National Institutes of Health

My name is Vivian Bui, and I am an upcoming junior at UC Berkeley studying Public Health and Global Poverty and Practice. My interests center on helping folks experiencing homelessness, which have been reinforced by my experiences as a Housing Coordinator navigating mainstream vouchers, a Health Advocate connecting community resources, a Medic providing outreach, and a Research Assistant in the Berkeley Youth-and-Social Environment Lab. My experience with CHORI consolidated my desire to pursue clinical practice and remain involved in research, which would allow me to be a clinician, an advocate, a scholar, an educator, and an innovator. I want to shape health disparity policy by advocating for folks that I care about—the folks who deal with high allostatic loads that further disease progression. I am beyond appreciative for the CHORI staff and directors who have been nothing short of remarkable. Not only was online programming seamlessly organized, but it was also sprinkled with so much practical life advice, such as how you should "study the things that bug you most." CHORI has undoubtedly helped clarify my career path.

Contributing Authors

Dayna Long, Nadia Ngom

Introduction

The nation has three crises compounding each other: A global pandemic, an awakening of racial inequality, and persisting health and housing injustice. Under the new Alameda County Masking Order, anyone over the age of 12 is required to wear a face covering at essential business. According to the language of the Order, violation or failure to comply with this order is a misdemeanor punishable by fine, imprisonment or both. The Order, according to the Alameda County Public Health Department, is critical to flattening the curve. Success in achieving this goal requires a large-scale effort to support vulnerable communities in getting access to accurate public health information as well as reusable cloth masks. The research is clear that vulnerable and marginalized communities, particularly Black, Indigenous, Latinx, other immigrant, and low-income communities, are disproportionately impacted by COVID-19 and its social and economic impacts.

Hypothesis/Objective

The objective of the research initiative is to assess mask compliance for families in vulnerable communities or experiencing homelessness. We aim to identify the barriers and facilitators to mask-wearing.

Methods

Participants will complete a self-administered survey. Potential surveys will contain questions regarding demographic information, social and political sentiments towards community safety, and current and future barriers to accessing adequate protective equipment.

Anticipated Results

Results will describe the barriers patients face in accessing mask supplies in Alameda County.

Significance of the Project

This project is a part of a larger mutual aid campaign, called the Oakland Mutual Aid Collective, aimed at supporting Oakland's most vulnerable communities as the pandemic exacerbates social and economic needs and worsens health and living conditions. We have a moral imperative and community responsibility to do our part to mitigate any unintended consequences of failing to meet the requirements of pandemic related rules and respond to urgent community needs in light of COVID-19. All of this work is in collaboration with existing efforts to address racial and cultural biases, racial health disparities and policing of Black, Indigenous, Latinx, and other communities of color, particularly through the Masking Order and public health crisis.

Mireya Cabral-Mixco

Diablo Valley College

Impact of the COVID-19 Pandemic on Adolescence Post-Prandial Glucose Levels

Mentor:
June Tester MD, MPH

Funded by: National Institutes of Health

Hello, my name is Mireya Cabral-Mixco. I recently graduated from Diablo Valley College and come fall I will be a rising junior at UC Berkeley. I am a first generation Mexican American and the first in my family to pursue a career in STEM. I have struggled with my identity all my life being I am the only person in my family not able to speak Spanish. CHORI has allowed me to feel welcomed by a science community and despite the pandemic, I have found role models with a similar face and background as myself. I am thankful for my mentor Dr. June Tester, who has allowed me virtual clinical experience with members of my community consisting of a predominate Hispanic population. This experience has solidified by understanding that speaking Spanish is not the only determinate of who I am. My passion for science will contribute to further Latinx representation in STEM.

Introduction

Glucose control in diabetics is usually estimated with the percentage of glycated hemoglobin (Hemoglobin A1c), which generally requires an in-person visit to a clinic. Due to decreased clinic visits during COVID-19, monitoring glucose levels using data collected by patients' personal glucometers is valuable. Post-prandial glucose readings are measurements recorded two hours after consuming dinner. This reading can provide insight about the patient's diet with particular insight into their glucose levels after their evening meal. Since there are restrictions on in person contact, this would also allow remote clinical assistance for managing diabetes during a systemically stressful time.

Hypothesis/Objective

In low-income households, adolescents with type 2 diabetes average post-prandial glucose levels during the stay at home order due to the COVID-19 pandemic will be higher than available data for their pre-COVID-19 measurements. After being given 12 weeks of food deliveries, their post-prandial glucose levels will be lower.

Methods

A pilot study with approximately 15 patients will be done as an extension of the Food as Medicine project. Previously-available post-prandial glucose levels from type 2 diabetic adolescents will be noted from the medical record. This data is still gathered remotely during patient visits over video rather than in person because of remote connection with glucometer technology. Pre-COVID-19 lockdown (before March 14th, 2020) will be compared to those, before and after, 12 weeks of weekly vegetable deliveries from a local farm which will start in summer 2020.

Anticipated Results

Post-prandial glucose averages during the COVID-19 lockdown will be greater than historic measurements. It is anticipated that averages during food deliveries will be lower.

Significance of the Project

According to the American Diabetes Association, 10.5% of the U.S. population has diabetes. The added socioeconomic stress of COVID-19 may lead to greater health consequences for individuals with type 2 diabetes. An interventional food study using post-prandial glucose readings can help monitor diabetic patients at home during this crisis, and information about how much variation there is in post-prandial glucose measurements will inform future research.

Yvette Cardenas

Berkeley High School

ITGA6 as a Biomarker for Breast Cancer Stem Cells

Mentor:
Mam Mboge, PhD

Funded by: CHORI Summer Student Research Program

My name is Yvette Cardenas and I am a rising senior at Berkeley High School. As a future first-generation student, I've had struggles but used them to work at my full potential and become a strong, motivated student. My parents didn't have many opportunities growing up but persevered through hardships. Their resilience inspires me to use the opportunities I'm offered and make them proud.

My interest in science began in Biology class as a high school freshman, and further expanded through my participation in the Biotech Academy as a junior. This summer, alongside my mentor, I am researching stem cells' significance in breast cancer, specifically their identification through surface markers.

CHORI has exposed me more in depth to scientific research and careers in the science field. While in CHORI, I'll gain valuable knowledge and skills on various topics that I aspire to use and positively impact my community.

Contributing Authors

Meenakshi Pamula, Mina Bissell, PhD

Introduction

Cancer stem cells (CSCs) are a subpopulation of cells that have been identified in tumors to have properties of proliferation and differentiation. These are thought to arise from mutations in normal stem cells and have been implicated in tumor initiation, increased malignancy, and chemoresistance. Surface markers have been used to identify and isolate CSCs. Previous studies have identified CD49f/ITGA6/α6 Inetgrin, as a surface marker that is upregulated in breast cancer stem cells (BCSCs). ITGA6 is a transmembrane glycoprotein that maintains cell-cell adhesion and is associated with decreased survival in breast cancer patients. This molecular marker is found in more than 30 populations of normal stem cells and multiple CSCs. It was shown that the knockdown of CD49f causes mammosphere-derived cells to lose their ability to grow as mammospheres and repeals their tumorigenicity in mice. Together, these studies suggest that CD49f plays an important role in the growth and survival of CSCs, and therefore is a potential therapeutic target.

Our aim is to validate ITGA6 as a surface marker of CSCs and to gain further insight into the role it plays in breast cancer development.

Hypothesis

We hypothesize that ITGA6 is essential for breast cancer development.

Methods

Data mining to determine the expression level of ITGA6 in the different breast cancer subtypes and correlate to patient survival
Confirm our findings in our 3D cell culture model using qPCR, western blotting, immunofluorescence, and flow cytometry
Target ITGA6 expression and function

Anticipated Results

Validate ITGA6 as a positive marker for BCSCs
BCSCs will upregulate ITGA6 when compared to non-malignant breast cells
Increased ITGA6 levels will contribute to the malignant phenotype of BCSCs
Inhibition of ITGA6 will repeal tumorigenesis in BCSCs and will be associated with an increase in relapse-free survival

Significance of the Project

By validating the existence of CD49f and identifying the role it plays in oncogenesis and cancer progression, we can expand our knowledge on the factors that regulate malignancy. Additionally, this information can help develop possible therapies that specifically target CSCs and consequently aid in prolonging the life of breast cancer patients.

Saryah Colbert

University of Califonrnia, San Diego

Increase in Food Insecurity During the Time of Coronavirus in the Bay Area

Mentor:
Dayna Long, MD

Funded by: National Institutes of Health

Greetings, my name is Saryah Colbert and I'm a first generation college student. Being from an underrepresented background in science, a woman, and minority has presented unique challenges, but has also brought vast opportunities. My current education at UC San Diego as a PreMed Global Health major is the first stepping stool to the levels of success I aspire to accomplish in my near future. After receiving my Bachelor of Science degree at UCSD, I intend to attain my MD. I want to become a Pediatrician and open my own practice in my hometown Oakland, Ca. This summer, I had the pleasure of working alongside my wonderful mentor, Dr. Dayna Long.

With the help of herself, and staff at the UCSF Benioff Children's Hospital Oakland primary care clinic, I will have conducted a research study that will investigate food insecurity's effects on patient's health pre and post Covid-19.

The CHORI SSRP connects students like me to medical professionals, and the training from this program offers so many informative tools needed for graduate education, and life as a biologist in the near future. I would like to thank Dr. Long, the CHORI staff and faculty, and the Claremont Primary Care Clinic staff for supporting me through this journey.

Contributing Authors

Rigoberto Del Toro, MpH, Artanesha Jackson, MSW, Marina Franco

Introduction

The increasing cost of living in the Bay Area has left families with little to no money left for food, because most of it goes towards housing. During the coronavirus, with an increase in food and housing instability and unemployed families, the demand for food is increasing, while the funds to supply it decreases. Luckily, the primary care clinic at UCSF Benioff Children's Hospital Oakland addresses food insecurity through their farm food delivery program. "Food insecurity continues to be a major challenge in the U.S. , affecting 49 million individuals" (Whittle et al, 2015). This study will address the impact the clinic food delivery program has on patient families, investigating the food insecurity impacts on health locally pre and post covid.

Objective

This study aims to insure families' access to dairy, meat, produce, and will evaluate the food delivery program's impact on providing resources and bettering the health of food insecure communities.

Methods

This is a mixed-method study using both qualitative and quantitative data. Data collected from this study will be composed of feedback from family questionnaires. The questionnaire serves to interview 21 patient families of the primary care clinic and asks questions measuring food stability and what they enjoyed from the farm food boxes within the last 6 months.

Anticipated Results

I expect a great outcome of this study to be full of feedback of a high percentage of families having their needs met receiving resources from the food delivery program.

Significance of the Project/Conclusion

Ramifications and financial devastations during covid are huge. How do we get food to families that need it? Within the primary care clinic, families are being signed up for food stamps, connected to food banks, and handed food bags while in clinic, and now more recently having food delivered to their homes. Within the health center, 95% of families are families of color and 92% of those families are on medicaid. To qualify for medicaid, you have to be at or below the poverty level. This work is meaningful because the food delivery system significantly benefits families lacking nutritional resources amidst a global pandemic.

Keywords

food insecurity, food desert, covid, coronavirus

Eric Connelly

San Ramon Valley High School

The Effectiveness of Vitamin D Supplementation on Bone Health in Thalassemia Patients

Mentor:
Ashutosh Lal, MD

Funded by: Doris Duke Charitable Foundation

I'm a rising senior at San Ramon Valley High School in the Bay Area. Whether it was taking the lead during my first squid dissection in 5th grade or standing in front of a sign that read "I will be the next Nobel Laureate in…" with a whiteboard that read "Medicen," I've always been attracted to science. That interest was enhanced after an injury that forced me to spend countless hours in physical therapy where I learned more about the science of human health. CHORI SSRP gave me the opportunity to cultivate my interests with virtual labs, fascinating STEM speakers, and the ability to collaborate with incredible students and faculty. With the help of my mentor, Dr. Ashutosh Lal, I was able to expand my interests in bone health and research vitamin D treatment on Thalassemia patients. Thank you to Dr. Lal for the incredible guidance and support, my parents, and my grandparents, Francisco and Margaret De Osuna, for inspiring me to pursue a future career in pediatrics assisting underserved communities.

Introduction/Background

Thalassemia is a category of genetic disorders that causes a decrease in hemoglobin production. Mutations in globin genes produce anemia and lead to an expansion of bone marrow that causes an imbalance in bone remodeling. This imbalance promotes processes that stretch, thin, and weaken the bone. Patients rely on regular blood transfusions to make up for lower hemoglobin levels, leading to iron overload that inhibits osteoblast activity and expands osteoclast presence. Subsequent restricted physical strength, activity, and thus outdoor exposure are other risks for osteopenia and fractures, which highlights Vitamin D insufficiency as a risk factor in furthering lower bone mass in patients with thalassemia. Vitamin D is critical to helping the body absorb calcium required to build bone and regulate other metabolic processes.

Hypothesis/Objective

The objective of this study is to determine whether long term exposure to Vitamin D supplementation reduces the detrimental effects of low bone mineral density found in patients with thalassemia.

Methods

This is a longitudinal review of de-identified information collected from patients treated at various chronological points at UCSF Benioff Children's Hospital Oakland (BCHO), comparing the differing levels of vitamin D and bone health measurements. We will use DXA (dual-energy x-ray absorptiometry) scans as a tool in measuring bone mineral density and information from serum 25-hydroxy Vitamin D concentrations.

Anticipated Results

It is anticipated that thalassemia patients treated previously at UCSF BCHO with Vitamin D supplementation will overtime exhibit greater levels of bone mineral density compared to patients who did not have a long term previous history of Vitamin D treatment.

Significance of Project

This project is essential to evaluating the success of Vitamin D treatment in inhibiting the negative effects of thalassemia on bone health. It will suggest new ways to treat osteopenia in patients with thalassemia earlier to limit the contribution of poor bone health to long-term morbidities.

Mattias De Los Rios Rogers

Berkeley High School

Sensing and Signaling ER Stress by Dopaminergic and Serotonergic Neurons

Mentor:
Ryo Higuchi-Sanabria, PhD

Funded by: CHORI Summer Student Research Program

I am a rising senior at Berkeley High School, and I plan on majoring in biology. This program has given me an amazing opportunity to develop as a scientist and work in research. I've always been drawn towards science; one of my earliest memories about my interest in the subject was my fascination with the book The Elements by Theodore Gray which I got in third grade. Around the same time, I found the Periodic Table of Elements YouTube channel where I discovered just how much you can learn on YouTube. Since then I have continued seeking out science and learning all I can about it. Getting to work with my mentor Dr. Higuchi-Sanabria this summer and learning about cutting edge biology through my lab and the CHORI SSRP program has allowed me to take my passion for science to a new level, and I could see it becoming a career I love.

Contributing Authors

Naame Kelet

Introduction

The endoplasmic reticulum (ER) is responsible for the production of most of the cells' proteins and lipids. Mechanisms exist to maintain ER homeostasis, such as the unfolded protein response of the ER (UPR^{ER}). In the presence of ER stress IRE-1 induces translation of XBP-1, the UPR^{ER}'s master transcription factor, to promote ER proteostasis and lipid metabolism. Universal expression of *xbp-1s* increases ER stress resistance but has negligable effect on lifespan in the absence of ER stress. Neuronal *xbp-1s* overexpression, however, both extends lifespan and promotes ER stress resistance because neurons can activate the UPR^{ER} in the periphery (non-neuronal cells) through cell-nonautonomous signaling. This activation depends on serotonergic neurons to induce the chaperone response and dopaminergic neurons which induce the lipid metabolism response though both responses rely on XBP-1 signaling.

Hypothesis/Objective

We hypothesize that serotonin and dopamine signaling cause major remodeling of the genetic program of the peripheral tissue to allow for one transcriptional program, XBP-1 signaling, to elicit two unique responses.

Methods

To test the possibility that cofactors of XBP-1 differentiate the responses, we will run co-immunoprecipitation (co-IP) on cells distally activated by dopaminergic and serotonergic neurons. To test the alternative possibility that chromatin remodeling differentiates the responses, we will run ATAC-seq to observe overall chromatin structure along with ChIP-seq to identify which parts of the DNA XBP-1 is binding to on cells distally activated by dopaminergic and serotonergic neurons.

Anticipated Results

Two potential hypotheses exist that allow for a single transcription factor to elicit two divergent responses. First, there are additional transcriptional regulators that work in concert with XBP-1 and are differentially recruited based on which neurotransmitter signal is received. Alternatively, serotonin and dopamine signaling cause chromatin remodeling allowing XBP-1 to bind to specific sites.

Significance of the Project

This work has significant implications in the field of aging research. It will allow for a deeper understanding of the UPR^{ER} which could lead to possible therapeutics to improve health span.

Isabelle Faller

Santa Clara University

Unaffiliated Patient Study

Mentor:
Marsha Treadwell, Olivia Chen

Funded by: Volunteer

My name is Isabelle Faller and I am a rising senior at Santa Clara University, majoring in psychology and minoring in public health. Growing up I was fortunate to be surrounded by passionate and driven health care workers. Seeing the sacrifices that they made imbued me with the desire to focus my life around helping others. I am aspiring to work in the mental health field and pursue a PsyD or Clinical PhD, and hope to center my career around underserved and underrepresented populations.

This summer I have the honor of working with Dr. Marsha Treadwell and Olivia Chen. Through their mentorship I have been able to explore complex questions surrounding why some people living with sickle cell disease become unaffiliated from specialty care. I will conduct a qualitative analysis of how stigma may play a role in unaffiliation. Thank you to CHORI and my team for this amazing experience.

Introduction

The Unaffiliated Patient Study seeks to identify and address barriers to quality care for individuals with sickle cell disease (SCD). "Unaffiliated Patients" are those who have not received SCD specialty care in over one year. For my project, I am focusing on how stigma may contribute to unaffiliation. Stigma associated with structural racism has long existed in SCD care in the U.S., as this disease primarily affects African Americans. The intense pain episodes that are the hallmark of SCD are debilitating and require extremely strong painkillers, resulting in stigmatization as patients may be viewed as drug-seeking. These types of stigma as well as others may contribute to individuals with SCD deciding to distance themselves from the healthcare system.

Hypothesis/Objective

We expect that different types of stigma affect decisions of individuals with SCD to engage with the healthcare system.

Methods

This study will enroll 10 adults (ages 18-45 years), with confirmed diagnosis of SCD who meet the criteria for unaffiliation. Participants will be recruited through community-based organizations, provider referrals and from a SCD registry. We will conduct qualitative interviews and use lifetime narrative charts2 wherein participants describe major life events surrounding their care, categorized into positive, negative, and neutral events. These charts will be imported into a qualitative analysis software, Nvivo. We will use thematic content analysis to examine the role of stigma in patient decision making regarding engagement in SCD care, including prevalence and types of stigma.

Anticipated Results

We anticipate that our results will show that experience of stigma is instrumental in causing patients to disengage from care, as well as discouraging them from reengaging with care. We anticipate that types of stigma reported will be derived from challenges in receiving care, lack of support from family and/or community, and internalized attitudes.

Significance of the Project

This project aims to identify stigma-related barriers to that influence decision-making regarding SCD care. Affiliation with SCD specialty care is important so that patients can receive preventative services and thereby reduce morbidity and mortality. Our results will inform implementation of interventions, e.g., provider education, community workshops and resilience training for patients.

Israel Fuentes

St Joseph Notre Dame High School

The Increase in Household Food Insecurity Due to the COVID-19 Pandemic

Mentor:
June Tester, MD MPH

Funded by: Doris Duke Charitable Foundation / Achieve

My name is Israel Fuentes-Juarez and I am currently a rising senior at Saint Joseph Notre Dame High School. Science has always played a predominantly large role in my life, as it continues to motivate me towards a career in medicine. Being a part of the CHORI program, has allowed me to explore and learn the impact that community-based research can have in the scientific and local community. I've been able to get this perspective through participating in the **Food as Medicine** research study. With the help of my mentor, Dr. June Tester, I've learned that the medical field is broad and does not only consist of careers in a hospital. Health educators, physicians, community members etc., serve as advocates towards a more sustainable and equitable future for millions of individuals. Revealing and addressing health disparities, I've gained inside knowledge of the ever-shifting medical field. As I complete my summer project, I feel confident that I'm supporting underrepresented communities facing food insecurity. With such said, I'd like to thank the donors, my research team, Dr. Tester, and the CHORI Program for allowing me to have an opportunity of a lifetime to help foster change.

Introduction

Food security, as defined by the United Nations, is that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life. Food insecurity is known to fluctuate due to a variety of socioeconomic factors. New research has shown that due to the current COVID-19 pandemic, many households across the United States are experiencing food insecurity at greater levels similar to other economic recessions, like in 2008.

Hypothesis/Objective

My objective is to assess changes in reported food insecurity among a population of around 60 low-income families who received food deliveries in 2019 through early 2020 and are having long-term follow-up in the summer of 2020. I hypothesize that food insecurity will have increased in these families due to unemployment and increased economic insecurity.

Methods

Surveys will be collected remotely from participants that received food deliveries as part of a longitudinal randomized controlled study. Participants will complete their answers using an online platform (RedCap) using the same gold-standard tool utilized at pre- and post- intervention. This USDA tool includes up to 18 items regarding household food security, and people are categorized as having "High", "Marginal", "Low", or "Very Low" Food Security. (These last two categories of "low/very low" food security are known as "food insecurity").

Anticipated Results

It's expected that food security in low-income families will increase after COVID-19 due to many socioeconomic factors. In particular, we think that a greater portion of people will be experiencing more severe degrees of food insecurity. We also anticipate that there will be worsening in their reported dietary measures, such as frequency of eating vegetables.

Significance of the Project

This study is significant because it is important to highlight the effect COVID-19 has had on the American population. Economic uncertainty has become prevalent and with massive unemployment, more American face food security. This relates to the general population of Americans, especially Latino and African-American communities.

Caralyn Gonzales

University of California, Berkeley

Determination of Hemolysis Thresholds that Inflate Plasma and Serum Mineral Concentrations

Mentor:
David Killilea, PhD

Funded by: National Institutes of Health

My name is Caralyn, I am originally from Eagle, Idaho, and I have spent the last four years studying Chemical Biology at UC Berkeley. Since I was old enough to study the bugs and birds around my family's farm, I have been fascinated by the ways that life orchestrates itself in the natural world. As a scientist, I will pursue a PhD in how chemistry explains and shapes biology and where we can use these natural technologies to improve the health and wellbeing of our communities.

My project this summer with David Killilea, PhD is focused on investigating the thresholds of hemolysis, the rupture of red blood cells into plasma, on the viability of plasma as a source of information about nutrition. In locations where people are facing malnutrition, the information to be gained from studying nutritionally essential minerals is crucial to getting practical solutions and life-saving resources to them. This summer I have learned just how compassionate and creative scientists and doctors can be about the problems people face every day. I am excited to move into a career with them leading the way and I have to give a special thanks to my mentor David who embodies a passionate scientist and has shown the importance of embracing your natural spunk!

Contributing Authors

Kathy Schultz, MS

Introduction

Patients and researchers all over the world rely on testing of blood plasma and serum samples to measure markers of human health. Due to the prevalence of this method of testing, it is vital to have standardized measures of blood sample quality, as many markers of interest can be affected by hemolysis, or the rupture of red blood cells, from poor sample processing. Nutritional minerals that are essential for normal growth, healthy pregnancy, and immune function are often measured from plasma and serum, but do not have established thresholds of hemolysis.

Objective

To identify a threshold of hemolysis which significantly elevates the concentration of Ca, Cu, Mg, K, Na, Mn, and Fe in human blood plasma and serum.

Methods

This project will take three main approaches – theoretical, experimental, and correlations to field samples. For theoretical, the effective thresholds were estimated using standard hematological variables and clinical reference ranges for mineral content. This was compared to the mineral concentrations by direct spectroscopy in experimental data collected from an in vitro study and tested in serum samples from a large population survey in Ghana.

Anticipated Results

Robust hemolysis thresholds will be generated for each nutritional mineral, and, if successful, all three methods will agree on a threshold for percent hemolysis and grams of hemoglobin per liter RBC volume. The thresholds for Ca, Cu, Mg, K, Na, Mn, and Fe may be adopted by different standards committees and organizations as evidence-based limits for hemolysis. We will also develop a functional color matching scale for field phlebotomists.

Significance of the Project

According to WHO and the Gates Foundation, malnutrition contributes to 45% of childhood deaths in developing countries. The project has wide reaching implicational for the standards of hematological research and the care of those suffering from malnutrition all over the world. Many charitable organizations seek to help these populations by distributing food and supplements, so accurate mineral measurements are necessary to determine if their interventions are beneficial.

Abigail Hayes

Berkshire School

Impact of Telehealth on Care for Transgender Youth During a Pandemic

Mentor:
Janet Y Lee, MD MPH MAS

Funded by: Doris Duke Charitable Foundation

My name is Abby Hayes and I am a rising senior at Berkshire School in Sheffield, Massachusetts. I have always wanted to help others and during my freshman year, I discovered a love of biology and began considering a career in medicine. The CHORI program has taught me more about the reality of the medical field, introduced me to new interests, and solidified my goal of becoming a physician. I am so grateful to have been a part of this amazing program. I would like to thank my mentor, Dr. Janet Lee, for teaching me so many things this summer and allowing me to work with her to research the impact that the SARS-CoV-2 pandemic has had on access to care for transgender and gender diverse youth.

Introduction

The UCSF Child and Adolescent Gender Center (CAGC) is a multidisciplinary program offering comprehensive care to transgender and gender diverse (TGD) youth. Although access is improving, many families must travel to metropolitan centers for care. Telehealth, the use of telecommunications to support health-related services, has been available at the CAGC since 2018. However, the CAGC transitioned completely to telehealth in March 2020 due to the SARS-CoV-2 pandemic.

Objective

Our objective was to investigate the impact of the pandemic on the number of completed visits per provider clinic at the CAGC.

Methods

This was a retrospective review of de-identified scheduling and medical records. CAGC provider schedules from March 2020-June 2020 were compared with schedules from March 2019-June 2019 to accommodate seasonality of appointments. The primary outcome was the number of completed visits per provider clinic. Basic demographic information was collected, including age at visit, sex designated at birth, gender identity, and race/ethnicity. A completed visit was defined as one 30 minute slot. Since new patients were allotted 60 minute slots, they counted as two visits. Additional analyses described the proportion of new patients per provider clinic, time from referral, and distance traveled.

Anticipated Results

We will describe the impact of the pandemic on completed visits per provider clinic, and expect to show increased or equal capacity to provide care compared to the pre-pandemic time.

Significance of the Project

It is important for medical centers to maintain access to care for TGD youth during the pandemic. Although access to care for TGD youth is increasing, most multidisciplinary care centers are concentrated in metropolitan areas, disadvantaging those in rural areas. Telehealth has the potential to increase access to care for all TGD youth, and has enabled CAGC to continue providing care to TGD youth despite shelter-in-place orders. While this study will describe the effect telehealth has had on access to gender-affirming care during the pandemic, our findings may inform how we use telehealth to provide care for TGD youth after the pandemic.

Ikenna Kuba

University of California, Santa Cruz

ALIGN(An Individualized Pain Plan with Patient & Provider Access for Emergency Department care of SIckle Cell Disease) Sickle Cell Disease Emergency Department project

Mentor:
Marsha Treadwell, MD, Ashley Fraser

Funded by: National Institutes of Health

My name is Ikenna Kuba. I am from Lagos, Nigeria, currently residing in San Jose. I am a rising Junior majoring in Human Biology at UC Santa Cruz. I am applying to nursing school to pursue a career as a Certified Registered Nurse Anesthetist after graduation. As a boy raised in rural Nigeria, it was difficult to envision myself with a future in healthcare as I did not have access to the necessary resources to equip me for the journey. However, being surrounded by a community of people with health challenges and limited access to health care, compelled me to want to give back to those in need. I therefore intend to one day start a clinic in my home country. This summer, I hope to gain solid health services research experience and learn more about eliminating disparities and improving emergency department care for individuals with sickle cell disease.

Introduction

Sickle cell disease (SCD) is an inherited red blood cell disorder affecting about 100,000 in the United States, predominantly African Americans. Individuals with SCD often experience acute painful events (vaso-occlusive episodes - VOEs), too severe to manage at home, leading them to seek care in emergency departments (EDs). Individuals with SCD express dissatisfaction with ED visits due to negative experiences including long wait times and stigmatization as “drug seekers”, resulting in poor VOE management and lower overall quality of care.1 Previous research with pediatric patients with SCD found that use of individualized pain plans (IPPs) improved patient satisfaction with ED care. However, similar studies have not been conducted among adolescents and adults.2

Hypothesis/Objective

We will examine factors associated with the effectiveness of individualized pain plans (IPPs) in the ED for adolescents and adults with SCD, as measured by patient satisfaction and quality of care

.

Methods

Adolescents and adults (ages 15 - 45 years, any confirmed SCD diagnosis) enrolled in the Sickle Cell Disease Implementation Consortium who visit a UCSF ED (n=20) using their IPPs, will be surveyed regarding (1) their satisfaction with their IPP based on rating aspects of the ED visit and (2) their perceived quality of care. Additional systems level variables such as total ED visits, time to first dose of pain medicine, readmission rates and accessing of and adherence to the IPP by the provider will also be analyzed. Individuals will be interviewed to identify which factors influence satisfaction such as IPP helpfulness, challenges, and overall experience of visits.

Anticipated Results

We expect the use of IPPs to be effective in increasing patient satisfaction and perceived quality of care, and in improving VOE management.

Significance of the Project

Given frequent dissatisfaction on the part of patients with SCD seeking ED care, and mis-management of their severe pain episodes, there is need for an intervention to improve ED care quality. This study will provide vital evidence regarding factors that influence patient satisfaction with IPPs as well as the impact of IPPs on VOE management, addressing our ultimate goal to improve quality of life and quality of care.

Simon Le

University of California, Berkeley

Physical Activity in Thalassemia Patients

Mentor:
Tariq Ahmad, MD

Funded by: National Institutes of Health

My name is Simon Le and I am from Hayward, California. I am a rising sophomore at the University of California, Berkeley and I am studying Molecular and Cellular Biology with a minor in Nutritional Sciences. The aspect of STEM that I am interested in is being able to study biological concepts and then apply them to improve the lives of people and see positive results. This summer, with Dr. Taric Ahmad, an endocrinologist at UCSF Benioff Children's Hospital. The research project consists of assessing the nutritional and physically active conditions of thalassemia patients and identifying trends in order to educate patients and improve quality of life. What I have gotten out of this summer's SSRP is that there are an incredible amount of opportunities in the STEM/medical field. Your journey is not always linear, but your passions will lead you to your destination.

Introduction

Thalassemia is a rare genetic blood disorder in which the body produces an irregular form of he-moglobin. This disorder leads to a large loss of red blood cells, leading to anemia. Anemia is when the body fails to produce enough healthy blood cells to carry oxygen to the tissues. Symptoms of thalassemia include iron overload, increased risk of infections, bone deformities, spleen complica-tions, and fatigue. Treatments include constant blood transfusions in order to remove iron from the body, bone marrow transplants, medications, supplements, and possible spleen/gallbladder remov-al surgeries. Previously published studies have shown lower exercise levels corresponding to a lower quality of life with thalassemia patients.

Objective

The objective of this research is to find nutrition and physical activity trends that can be tied to low-er pain levels recorded in the patient surveys. Through these findings, we can create diet and exer-cise goals to improve quality of life for thalassemia patients.

Methods

This is an observational study, where I will obtain data from surveys of patients and their families with thalassemia regarding pain, physical activity, and nutrition. Through the data I will analyze the results and find trends from the questions asked.

Anticipated Results

I expect that patients that have a nutritious diet and exercise regularly have lower levels of pain. This can be associated with them taking better care of themselves and therefore having lower levels of pain recorded.

Significance of the Project

Through analyzing the data gathered from the surveys, we can get a better understanding of the lifestyles of patients with thalassemia. We are able to find positive and negative trends that affect their quality of life. We can use these trends to better inform current and future thalas-semia patients in order to promote a better lifestyle with the disorder.

Kerry Lin

University of California, Davis

Effects of Removing Ribosomal Protein L41 and the Importance of Ribosomopathies

Mentor:
Andrew Modzelewski, PhD

Funded by: National Institutes of Health

Hey! My name is Kerry Lin and I am from San Leandro. I am a rising sophomore at UC Davis studying Cell Biology and I am fortunate to participate in the CHORI program for a second summer! I enjoy looking at tissues under the microscope and I am interested in anatomic pathology. This year, I am working with Dr. Andrew Modzelewski on ribosomal mutations and infertility.

I am absolutely grateful to the CHORI team for the amazing virtual experience as it would mark another milestone in my path to STEM. I had lots of fun learning valuable insights from various professionals in the medical field. I would also like to thank my mentor for taking the time to guide me this summer!

Background

Ribosomes are highly conserved molecular machines responsible for all protein synthesis and consist of a 40S and 60S subunit. When mutations occur in ribosome biogenesis or ribosomal proteins, ribosomopathies—diseases associated with the ribosome—can arise. Previous work in the He Lab identified RPL41 and found that the removal of this small peptide sequence causes infertility in females and subfertility in male mice. The ovary is a reproductive organ responsible for female gamete production and is nurtured by follicles. The reproductive system is regulated by hormones, chemical messengers transported through the bloodstream. Among different organ systems, there is cross-talk: communication between organs through signaling factors which includes oocytes that produce hormones to ensure a successful pregnancy. In an earlier study, we observed that ovaries, where RPL41 were knocked out, did not share morphological features with wild-types which suggest that oogenesis has been compromised.

Objective

To analyze how the structural integrity of ovaries are affected by the deletion of RPL41 through histological and immunohistochemical methods and determine if infertility is caused by a hormonal imbalance by analyzing blood hormone concentrations.

Methods

Formalin-fixed, paraffin-embedded tissue are generated to examine the morphology of ovaries. Immunohistochemistry allows us to detect our desired antigen through antibody-antibody interactions. We will measure the area of the ovaries through ImageJ and quantify the number of follicular stages. Additionally, blood hormone levels will be monitored over twenty days with an enzyme-linked immunosorbent assay.

Anticipated Results

We expect the structure of knockout and heterozygous ovaries to differ from wild-types. As the morphology is highly disrupted, we expect its hormone signaling capacity to be compromised, therefore the blood hormone levels in knockout mice are anticipated to deviate from the standard values obtained from wild-type hormone concentrations.

Significance of the Project

Preliminary data indicate that RPL41 in mice is homologous with yeast which reveals its evolutionary importance in the conservation of individual ribosomal components. This study is significant because it is widely believed that ribosomal mutations would result in death but ribosomopathies are highly overlooked and difficult to study. By furthering our understanding of ribosomopathies, it would be an important addition to novel therapeutic strategies.

Stephanie Martinez Contreras

Contra Costa College

Comparison of Liver Iron Concentration Assessment in Transfusion Dependent Anemias by MRI Relaxometry and SQUID Biosusceptometry

Mentor:
Marcela Weyhmiller, PhD; Kelsey Miller, MPH

Funded by: National Science Foundation

Hello, my name is Stephanie Martinez Contreras and I'm a student at Contra Costa College majoring in Chemical Engineering. As a first-generation high school graduate and college attendee, I struggled academically in finding my purpose. I broke the chain after I had my daughter and returned to college. By taking charge of my academics and exploring my interests in chemistry, I saw the connection of how I could impact my community through engineering.

This summer I've had the pleasure to work with Dr. Marcela Weyhmiller and Mrs. Kelsey Miller in the Iron Overload Program. My research is a comparison study between the SQUID-Ferritometer, a non-invasive device that quantifies liver iron concentration in patients at risk for iron overload, with MRI. As part of the SSRP community, I've have built a strong relationship with my mentors, learned the importance of clinical research, and the positive impact it makes in patients' lives.

Contributing Author

Roland Fischer, PhD

Introduction

Patients who depend on regular blood transfusions can accumulate toxic levels of iron which must be removed with chelation therapy. Frequent monitoring of iron concentration is necessary to safely remove iron. Serum ferritin is the most common method used to monitor iron concentration world-wide however it only loosely correlates with body iron. Iron concentration can be quantified with relaxometry, Magnetic Resonance Imaging (MRI), and biosusceptomety, Superconducting QUantum Interference Device (SQUID), techniques.

MRI is a device which acquires detailed imaging of patients' tissues and organs. Using special software, iron concentration can be indirectly measured in any tissue. However, very young patients must be sedated and intubated to stop breathing during the scan.

The SQUID biosusceptometer, Model 5700 Ferritometer (Tristan Technologies, Inc.), is an investigational device dedicated to non-invasively measuring liver iron concentration (LIC) in patients as young as 2.

Hypothesis

LIC measurements made with both techniques will be highly correlated in patients with transfusion dependent anemias.

Methods

Transfusion dependent patients who received a SQUID and a pancreas iron measurement with MRI (1.5T Phillips Intera, software version 3.2.3.2) within 4 months of each other between 2014 - 2020 at UCSF BCHO will be enrolled. LIC will be analyzed from the abdominal MRI gradient-echo sequences and compared to LIC measured with the SQUID. The correlation of the two measures will be analyzed by linear regression, with results reported as r2 and p-values.

Anticipated Results

We expect to establish that these two methods of determining LIC are both effective, with results highly correlated.

Significance of the Project

Iron overload is a global health issue, however no dedicated device is commercially available for accurate and non-invasive quantification of body iron. While MRI is widely available, the techniques and software to measure iron are limited to a few centers. SQUID is a dedicated device and non-invasive for pediatric populations, however it is expensive and limited to a few centers around the world. The results of this research will be used for an FDA approval for the SQUID and pave the pathway for the development of other biosusceptomety devices which will expand accessibility across the world.

Sarah McCarthy

Stanford University

Antigen Discovery for Prevention of Gonococcal Disease

Mentor:
Peter Beernink, PhD

Funded by: National Institutes of Health

My name is Sarah McCarthy. I grew up in Alameda, CA. I completed my freshman year of college at Laney College and in the fall, I am transferring to Stanford University as a sophomore where I plan to study biochemistry.

I am fascinated by human biology and disease which is why my long-term career goal is to become a physician scientist. I want to work at the intersection of science and medicine to help bring new scientific innovations into patient care. This summer, I had the wonderful opportunity to work with Dr. Peter Beernink to identify antigens for the prevention of gonococcal disease. I gained confidence in my ability to succeed in STEM and new skills to better equip me to reach my goals by participating in the lecture series, journal clubs, and lab activities.

I would like to thank Dr. Peter Beernink, the SSRP staff, and the NIH for giving me the privilege to partake in this enriching internship.

Introduction

Gonorrhea is a sexually transmitted disease caused by the gram-negative bacterium *Neisseria gonorrhoeae* (Ng). With over 78 million cases each year worldwide, gonococcal infection is a major global health problem. Individuals with gonorrhea can be asymptomatic which contributes to the wide spread of gonorrhea. Untreated gonorrhea can lead to cervicitis in females and urethritis in males. After recovering from gonorrhea, individuals do not develop immunity to future infections. Currently, the only treatment option for gonococcal infection is antibiotics. However, many strains of Ng have developed antibiotic resistance. As a result, there is an urgent need for a gonococcal vaccine. In order to develop a vaccine, we need to identify antigens that produce antibodies that protect against most Ng strains. Since there are few Ng protein vaccine candidates, our research focused on identifying novel conserved Ng proteins to subsequently develop antibodies against gonococcal infection.

Objective

We aimed to identify Ng protein antigens that elicit protective antibody responses against gonococcal infection.

Methods

We used bioinformatics to identify antigens with constitutive expression in Ng coupled with localization in the outer membrane. We amplified our genes of interest, including NGO1492 and NGO1780, using polymerase chain reaction (PCR). Subsequently, we performed gene cloning in *E. coli* to produce plasmids to generate our Ng proteins of interest. We will utilize Western blotting to compare the expression levels of our proteins. The proteins with the highest expression will be purified. Finally, mice/rabbits will be immunized with our purified Ng proteins to obtain antibodies against these Ng proteins.

Anticipated Results

We expect to identify which proteins have the highest expression and solubility using Western blotting. These proteins will be purified and used to immunize mice/rabbits to test their ability to elicit protective immunity.

Significance of the Project

N. gonorrhoeae infects millions of people each year. Currently, the only treatment regimen for *N. gonorrhoeae* infection is antibiotics, but many strains of *N. gonorrhoeae* have developed resistance to antibiotics; thus, we may run out of treatment options without a vaccine.

Gabrielle Montenegro

Macalester College

Pre-treatment Bone Measures in Early-Pubertal Transgender and Gender Diverse Youth

Mentor:
Janet Y. Lee, MD, MPH, MAS

Funded by: National Institutes of Health

Hello, my name is Gabrielle Montenegro. I am a first generation college student from Berkeley, CA, attending Macalester College on a QuestBridge National College Match Scholarship. I am a rising sophomore with an intended major in Biochemistry. Growing up in a chaotic household, I discovered my passion for caretaking. I became fascinated with anatomy and biology while taking courses at Berkeley High. However, my love for medicine and science is truly rooted in the death of my grandmother to cancer. These experiences led me to seek a career in medicine where I will get to care for patients and conduct research on illness.

This summer I researched bone health in transgender and gender diverse youth. I am beyond thankful to the CHORI staff and specifically my mentor, Dr. Janet Y. Lee, for the immense amount of knowledge and experience I have gained in clinical research and will surely use in my future career--possibly to help improve transgender healthcare.

Introduction

The development of undesired secondary sexual characteristics can worsen gender dysphoria in transgender and gender diverse (TGD) individuals. Gonadotropin-releasing hormone agonists (GnRHa) pause puberty until gender-affirming sex hormones are initiated. Studies in late-pubertal TGD youth have described low bone mineral density (BMD) prior to GnRHa, with continued impairment following several years of gender-affirming sex hormones. A study in early-pubertal TGD youth has also shown low BMD prior to GnRHa. Dual-energy X-ray absorptiometry (DXA) is standard for assessing BMD.

Objective

Our objective was to characterize pre-treatment bone measures in early-pubertal TGD youth.

Methods

This was a cross-sectional analysis of a prospectively-enrolled observational study. Eligible participants (n=10) were in Tanner Stage 2-3 of puberty prior to GnRHa. DXA (Hologic) quantified areal BMD (aBMD) at the total body less head, lumbar spine, hip, and forearm. BMD Z-scores by DXA were adjusted for height and for bone age. Demographic data, dietary calcium intake and physical activity assessments, pubertal status, vitamin D levels, anthropometrics, and bone age radiographs were collected.

Anticipated Results

We anticipate that aBMD Z-scores (primary outcome) will be lower in the early pubertal transfeminine youth, and that additional data collected on determinants of bone health may provide information on reasons behind impaired BMD.

Significance of the Project

Low BMD prior to gender-affirming medical therapy has been described in TGD youth. This study provides further insight to low BMD in early-pubertal TGD youth by describing bone measures using DXA. This prospective study also assessed important determinants of bone health such as vitamin D status, dietary calcium intake, and weight-bearing exercise. Our focus on early-pubertal TGD youth would allow potential interventions to be started earlier if low BMD is found. For instance, an increase in weight-bearing exercise or dietary calcium intake could improve BMD over time.

Suhera Nuru

Berkeley High School

Investigating the Role of AMP-Activated Protein Kinase in Triple-Negative Breast Cancer

Mentor:
Mam Mboge, PhD

Funded by: CHORI Summer Student Research Program

My name is Suhera Nuru, I am a rising senior at Berkeley High School. I remember being fascinated by my STEM courses in middle school and high school. It was not until I took a biotech class in my junior year, where I was introduced to the field of research. This experience inspired me to learn more about research, and one day become a scientist. This summer, under the guidance of my mentor, Dr. Mam Mboge, I researched possible ways of targeting and treating triple-negative breast cancer. This experience revealed a new avenue of research that I had not been introduced to.

Additionally, the various speakers that CHORI brought in further inspired me to pursue research as a career. They introduced me to numerous paths and opportunities that are available in this field. Finally, I would like to thank my mentors Dr. Mam Mboge and Lilian Hernandez, for their support this summer.

Contributing Authors

Lilian Hernandez, Mina Bissell, PhD

Introduction

According to the American Cancer Society, one in eight women will develop breast cancer in their lifetime. Triple-negative breast cancer (TNBC) is the most aggressive breast cancer subtype, characterized by the lack of targetable receptors: estrogen, progesterone, and human epidermal growth factor. Similar to most solid tumors, TNBC upregulates glucose metabolism for energy production, contributing to their malignant phenotype. This metabolic process is often inhibited by AMP-activated protein kinase (AMPK) under nutrient-rich conditions. AMPK is a known tumor suppressor and has been shown to suppress many growth and proliferation pathways, including mTORC1. Further studies also shed light on the effects of metformin (a mTORC1 inhibitor) on increasing AMPK levels in intact cells and in vivo. Treatment with metformin resulted in decreased proliferation, oncogenic signaling, and induced apoptosis in breast cancer cells. Therefore, the goal of our study is to determine the role that AMPK plays in TNBC.

Hypothesis

Metformin mediated activation of AMPK will suppress the malignant phenotype of TNBC cells.

Methods

We will use data mining techniques to compare AMPK expression levels in the different breast cancer subtypes and correlate our findings to patient survival.
Determine the effects of Metformin treatment in TNBC cells compared to nonmalignant controls or non-TNBC cells using western blot analysis and confocal microscopy.
Observe the phenotypic consequences of AMPK activation in TNBCs using phase-contrast microscopy and cell proliferation/death assays.

Anticipated Results

AMPK expression will be lower in TNBCs and thus correlate with decreased survival.
Metformin treatment will induce AMPK expression/pathway activation in TNBC cells.
AMPK upregulation in TNBC cells will suppress their malignant phenotype.

Significance of the Project

Not only is TNBC considered one of the most aggressive types of breast cancer, but it is also known to develop resistance to commonly used chemotherapies. This leads to disease progression and poor patient outcomes. Through the activation of AMPK, one can suppress specific pathways that can result in inhibiting/suppressing the malignant phenotype. Therefore, determining the role that AMPK plays in cancer will be crucial in elucidating the mechanisms that regulate tumorigenesis and cancer progression. Ultimately, this research can aid in the identification of novel therapeutics that effectively target TNBCs.

Cheav Lay Phat

Univeristy of Pennsylvania

Impact of Significant Figures in a Child's Life on Childhood Trauma

Mentor:
Christine Schudel, MSW, MPH

Funded by: National Institutes of Health

Hello, I am Cheav Lay Phat, and I am a rising sophomore at the University of Pennsylvania. I will be pursuing a major in Neuroscience, aspiring to become a clinical neurologist. I am passionate about mental health, especially with communities of color, because I want to be part of the field that defies conventions and shares treatments to destroy the life sentence of isolation after diagnosis in patients who suffer a mental illness.

This summer, I had the opportunity to propose my own research through the CHORI Summer Research Program. I was able to formally investigate my curiosities and transform them into a proposal that I could share with others. This summer, I explored the impact of the number of significant adult figures in a child's life on childhood trauma. I am thankful for my mentor, Christine Schudel, for guiding and assisting me through this whole process.

Contributing Authors

Christine Schudel

Introduction

The wellbeing and maintenance of a child's mental health are often understudied because the consequences of damaging it are not immediately visible. A developing child is not only growing physically but mentally, so impactful stressors can impair their emotional wellbeing. Trauma is one such stressor that can cause intense psychological stress reactions. PTSD, a traumatic stress response, can develop, especially if it involves interpersonal violence. PTSD results in severe damage to the developing mind of a child, increasing risk for behavioral health disorders like anxiety and depression. Although it is known that not all traumas are equally likely to result in PTSD, the risk is significantly higher when trauma is experienced during childhood. One study found that more than 2/3 of people reported experiencing a traumatic event by the age of 16. Differences in responses may be due to protective factors, variables that reduce the likelihood of an individual to experience trauma or develop a traumatic stress response, mitigating the effects of trauma by positively influencing their interpretation and ability to process it. An important external protective factor associated with health outcomes is a child having a strong relationship with an adult. However, it is not well understood how the relationship between an adult and a child works in the context of trauma.

Hypothesis

The number of significant figures in a child's life is negatively correlated to a child's self-reported PEARL score and is a key factor in mitigating childhood trauma.

Methods

Patients scheduled for a behavioral health visit will be recruited and separated into two groups: (1) those with a positive ACEs/PEARL score and no previous or current diagnosis of PTSD and (2) those with a positive ACEs score and a previous or current diagnosis of PTSD. Each participant will complete a trauma screener, and participants in each group will be recruited for in-depth qualitative interviews to illuminate how significant adult figures may mitigate childhood trauma and the development of PTSD and if the number of significant adult figures increase this mitigating effect. Qualitative and quantitative data analysis will be conducted.

Anticipated Results

A statistically significant negative correlation between the number of significant adults in a child's life and a child's self-reported PEARL score will be found. Additionally, there will be a greater understanding of the relationship between significant adult figures and a child in the context of trauma.

Significance of the Project

This study will improve our current understanding of the role of significant adult figures in a child's life may play in the context of childhood trauma, improving frameworks for systemic interventions.

Ishika Prashar

University of California, Berkeley

Identifying Shared HLA Associations with Type-1-Diabetes in Non-European Populations

Mentor:
Steve Mack, PhD

Funded by: Doris Duke Charitable Foundation

Hello! My name is Ishika Prashar and I'm an incoming sophomore at UC Berkeley studying computer science and cognitive science. I am interested in the intersection between technology and medicine and enjoy learning from an interdisciplinary perspective. My motivation to pursue STEM has always been from my mother. I saw how hard she worked when we first immigrated to the US to become a nurse. Seeing how rewarding her work has been, I also want to follow in her footsteps and pursue a career where I can help others.

This is the second time I have participated in CHORI, and this summer has been especially unique due to the pandemic. I'm so thankful for all that I've learned from this program and everyone who is working behind the scenes to make this a meaningful remote experience. Thanks to Dr. Steve Mack, I've learned so much about HLA genes and immunogenetic analytic tools. I've had the chance to attend lab meetings, learn about the work other researchers are doing, and get meaningful feedback and mentorship. From this experience, I can confidently envision myself in medicine and hope to continue seeking research opportunities.

Introduction

The human leukocyte antigen (HLA) genes encode cell-surface proteins that present intra-cellular peptides for inspection by T-cells, forming the basis of the vertebrate adaptive immune system. When this system malfunctions, healthy tissue can be incorrectly recognized as foreign, resulting in autoimmune disease. Type-1-diabetes (T1D) is a childhood disease with the highest prevalence in Europe, although it is observed in non-European populations. T1D is an autoimmune reaction against pancreatic islet cells, which result in the loss of insulin production. Specific HLA alleles are strongly associated with the susceptibility and resistance to T1D. Data from epidemiological studies shows that the incidence of T1D has been increasing by 2-5% world wide. Research on HLA association with T1Ds has mainly focused on European populations; predisposing HLA alleles identified in these studies include DRB1*03 and DRB1*04 and their associated DQB1*02 and DQB1*03:02 alleles. Although studies of HLA association with T1D have been performed outside of Europe, it remains to be determined whether T1D patients outside of Europe share predisposing HLA alleles with European T1D patients, or if specific alleles that are not common in Europe predispose to T1D in the rest of the world.

Objective

Identify patterns of association between HLA alleles and T1D in published studies performed in non-European populations.

Methods

Conduct a meta-analysis of non-European HLA T1D studies to determine if specific HLA alleles are consistently associated with T1D in non-European populations, and if these alleles differ from those that predispose to T1D in European populations. Perform analyses utilizing R Studio by using extant meta analytic packages (e.g., dmetar). Include studies which meet the predeveloped inclusion criteria of T1D in populations from India, Africa, South America, and the Middle East to determine if there are any commonalities that may remain statistically significant across larger sample sizes. A second step would be to stratify across each subcontinental region to see if there are shared associations within each region.

Anticipated Results

We expect to find some common HLA alleles in non-European T1D patients that differ from the well known predisposing European alleles.

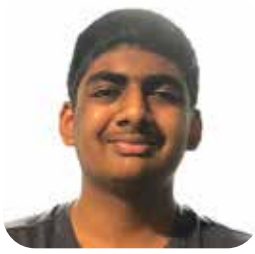
Significance

This information could be used to develop population-specific HLA diagnostic tests to identify children who are at-risk for developing T1D. If high-risk subjects can be identified at birth via an HLA typing test, intervention and insulin therapy can begin before they suffer any of the negative effects of type one diabetes.

Rengakrishna Rengappa

Leland High School

Qualitative Assessment of Utilization of DXA Scans in High-Risk Pediatric Celiac Disease Populations



Mentor:
Mala Setty, MD

Funded by: Doris Duke Charitable Foundation

My name is Renga Rengappa. I am a rising senior at Leland High School. Since I was little, I have always wanted to be a doctor, especially after I was diagnosed with Ulcerative Colitis. I want to be a pediatric GI so that I can help other children like me.

I joined CHORI this year to further my knowledge of how medical research is conducted and to gain clinical experience. It has been awesome so far! The many lectures have taught me a lot about the applications of science, and I even gained some virtual lab experience!

This summer, I am thankful to be working with Dr. Mala Setty on a study to determine the correlating factors between IBD and Bone Mineral Density in pediatric patients, which has immensely furthered my clinical knowledge of these diseases.

Introduction

Celiac Disease (CeD), an autoimmune disorder, affects an estimated 1% of US adults (~3 million) in the US and is rising in the pediatric population. CeD has been correlated with a lower Bone Mineral Density (BMD). BMD can be measured through a Dual-energy X-ray absorptiometry, or DXA scan. Low BMD is defined as two standard deviations (SD) below the mean (Z score), which is associated with an increased susceptibility to pathologic fractures. In a recent meta-analysis, the risk of fracture in CeD patients was 30% greater than in the general population (Heikkila, et al.). There is limited consensus on which specific factors contribute to low BMD, thus screening in CeD patients has not been standardized. Though bone accrual is maximal during childhood, Pediatric CeD patients are not usually screened. Moreover, there are patients who have comorbid disorders with CeD, who have an increased risk of developing bone-related issues later in life.

Objective

Our Primary Objective is to determine the utilization of DXA scans in high risk CeD populations.

Methods

An analysis of medical records of pediatric CeD patients at BCHO, who had positive Celiac antigens or positive biopsy, was conducted with respect to age, sex, comorbid disorders, and presence of DXA scans (with associated scan data) on record.

Anticipated Results

We expect to see a higher statistical association between patients that have comorbid disorders and those who get DXA scans, as those patients are at a higher risk of bone-related issues later in life. However, we still expect to see a low statistical association between CeD pediatric patients and having a DXA scan.

Significance of the Project

This study is significant as it will review certain factors that may correlate between our pediatric CeD patients and DXA scans. This study would give more credence to the fact that standardized guidelines for DXA scans in high risk populations, such as pediatric CeD patients, is a necessity in order to prevent the possible decline of a patient's bone health during maturation. Also, the results of this study would demonstrate the need for the development of interventions to compel more of these patients to undergo a DXA to monitor their bone health, as well as demonstrate to physicians the helpfulness of soliciting DXA as a precaution.

Anna Rios

University of California, Berkeley

Milk Type Intake and Child Adiposity Levels

Mentor:
Lorrene Ritchie, PhD RD

Funded by: National Institutes of Health

My name is Anna Rios and I am from Williams, a small town in Northern California. I'm a rising junior at UC Berkeley, intending to graduate with a degree in Molecular and Cell Biology. Although a great part of my studies consists of understanding processes unseen by the bare eye, I am most interested in how this knowledge can be applied to solve existing problems and prevent potential problems relating to public health. This summer, I had the pleasure of working with Dr. Lorrene Ritchie and Dr. Anisha Patel, alongside the wonderful staff at the Nutrition Policy Institute, to develop a research proposal dedicated to investigating the effects of milk type on child adiposity and development. CHORI SSRP has taught me the value of sharing ideas with a diverse range of scientists to develop innovative approaches that can tackle the challenges our world faces.

Contributing Authors

Marisa Tsai, Danielle Lee, Anisha Patel

Introduction

Milk contains calcium and vitamin D that are essential for child growth. While health officials recommend higher fat (3.25%) whole, unflavored milk before age 2 to promote brain development, a transition to lower fat (1% or non-fat) milk after age 2 is recommended for obesity and chronic disease prevention. Non-dairy alternatives nutritionally equivalent to cow's milk are also options for children who need special diets. While lower fat intake is hypothesized to be healthier, recent cross-sectional studies have found an inverse association between continued whole milk intake and child adiposity. Further, early diet influences gut microbiota composition which is associated with obesity.

Objective

This study will employ a randomized controlled trial to examine how milk type affects BMI and adiposity levels in children ages 1 to 3. A secondary aim is to investigate impacts of dairy versus plant-based milks on the gut microbiome.

Methods

Families with infants will be recruited from pediatric clinics. At age 12 months, children will be randomly assigned to receive one of five milk types (whole cow's milk, 1% cow's milk, organic whole cow's milk, organic 1% cow's milk, or soy milk) for 2 years. Milk will be delivered to each child's home bimonthly and parents will be contacted routinely throughout the study. BMI, blood lipids, gut microbiome, and child cognitive development will be measured at ages 1, 2, and 3 years.

Anticipated Results

Compared to children drinking 1% milk, children drinking whole milk will have smaller increases in BMI; children drinking 1% milk or soy milk compared to whole milk will have lower total and LDL cholesterol; and gut microbiota composition and diversity will vary between all groups.

Significance of the Project

The prevalence of child obesity in the U.S. is at an all-time high of 14% among children ages 2 to 5, with percentages increasing with age.4 Obesity in young children is a precursor to adolescent and adult obesity.5 This study can inform what could be a simple intervention to prevent obesity: changing the type of milk recommended to young children.

Erin Rosales

University of California, San Diego

Health Disparities in Pediatric Orthopedic Surgical Care in the United States, A Scoping Review

Mentor:
Coleen S. Sabatini, MD, MPH

Funded by: National Institutes of Health

Hello, my name is Erin Rosales! I recently graduated from UC San Diego with a B.S. Human Biology and am working towards my second degree, B.S. Global Health. I am passionate about helping people of all backgrounds, including underserved and marginalized populations. With my dual degree, I aspire to specialize in pediatrics and help reduce disparities in healthcare. My next endeavor is applying for Master's Entry Nursing Programs to pursue my dream of becoming a pediatric nurse practitioner at UCSF!

I am grateful for my mentor match, Dr. Coleen Sabatini who is incredibly supportive of my career goals. Dr. Sabatini connected me with her nurse to introduce me to the innumerable aspects of patient care at BCHO. This connection provided me with invaluable insight into the nursing profession.Thank you to the SSRP team for a phenomenal internship - I am honored to be a part of the program!

Contributing Authors

Tyler Kelly

Introduction

Health disparities exist at all levels of health care and affect people of all ages, including children. There are numerous factors which influence disparities in health, including race, ethnicity, gender, sexual orientation and socioeconomic status. Individuals who experience these inequities have higher rates of disease and mortality; therefore, the elimination of health disparities is essential to achieving optimal health for all communities. While there are articles that explore health determinants within specific surgical specialities or surgical procedures, there has not yet been a comprehensive literature review of health disparities within pediatric orthopaedics and trauma.

Hypothesis/Objective

To conduct a qualitative scoping review of health disparities within pediatric orthopaedic and trauma surgery, in the United States.

Methods

A scoping review was conducted to map literature for our topic, health disparities in pediatric orthopaedic and trauma surgery. Medical Subject Headings (MeSH) search terms were identified, including descriptors and synonyms, to search databases for medical literature pertaining to our topic. A systematic review software, DistillerSR, was used to configure and manage available literature for our scoping review. Four levels of screening were developed and utilized for our review, respectively: title and abstract review, full text review, secondary screening and data extraction. The data and analyses from articles which passed all levels of screening were included in the final scoping review analysis.

Anticipated Results

We anticipate that our scoping review will include the review of hundreds of articles, with inclusion of fewer that meet criteria, which we will then extract data from to consolidate into a summary of the literature on health disparities in pediatric orthopaedic and trauma surgery in the United States.

Significance of the Project

As a result of this project, evidence and data from existing literature on health disparities in pediatric orthopaedics and trauma surgery will be compiled into a single manuscript, synthesizing evidence from existing literature on health disparities within these fields. This review will identify various health disparities that exist for pediatric surgical patients and better equip pediatric surgical specialists to advocate for their patients and improve surgical outcomes in children. Further, a scoping review will help identify knowledge gaps in the available literature and provide future research directions in this field.

Richard Ruan

University of California, Berkeley

Mobile App Supporting Medication Plan Adherence in DeLIVER Care Van Hepatitis C Patients

Mentor:
Jennifer Price, MD

Funded by: National Institutes of Health

Hi! My name is Richard Ruan and I'm a rising junior at UC Berkeley studying Bioengineering. An encounter with breast cancer in my family and a love for biology fuels my dedication to pursuing a career as a physician-scientist. My personal growth throughout my undergraduate experience has made me extremely passionate about research topics like stem cell biology, regenerative medicine, disease pathology, and immunotherapy. But in addition, my identities, including my low-income background and connections to the LGBT+ community, motivate me to make an impact in community-oriented public health initiatives.

I am extremely grateful to my mentor Dr. Jennifer Price for giving me the amazing opportunity to see her clinical work firsthand in the field of hepatology, allowing me to shadow her in her meetings for both the DeLIVER Care Van and in clinical research. And I'm thankful for the amazing program the CHORI team has created.

Introduction

Hepatitis C virus (HCV) is an infection that affects the liver. The disease exists as either an acute or chronic condition, and untreated chronic Hepatitis C usually leads to more severe liver conditions. According to the CDC, people who inject drugs and certain socioeconomic groups are at the highest risk for infection. However, these groups continue to face obstacles barring them from the testing resources of conventional healthcare environments. According to a study conducted by the End Hep C SF initiative, the prevalence of HCV in San Francisco is significantly higher than the national level, and it's estimated that 12,000 residents live with active virus. To address this, the DeLIVER Care Van from UCSF offers accessible HCV screening and treatment to the sites and populations that need them the most.

Hypothesis/Objective

We aim to develop an app that helps the HCV patients of the DeLIVER Care Van with adherence to their treatment plans, which involve daily medication for 8-12 weeks. The app will provide timed interactive notifications reminding the patient to take their medication, and automated communication with the clinician regarding treatment plan completion.

Methods

The functions needed will be implemented in a web app that can be installed on android devices, and will require memory associated with a selected medication plan and responses to previous notifications. In addition, notifications for van visits will also be provided, and the app will include a short compilation of potentially necessary resources regarding patient health and HCV treatment. Summary data will be de-identified.

Anticipated Results

We anticipate seeing improvement of treatment plan completion on time, and fewer missed visits and medication refill pick-up.

Significance of the Project

Through this app, the DeLIVER Care van will be able to provide more integrated patient care and assistance for treatment plan completion. The functionality would support the van's mission of providing accessible care for HCV to underserved populations, and the features can be easily translated to other similar initiatives and clinical studies.

Dunia Saleh

Oakland High School

A systematic Review of the Importance of Nutrition for Patients with Thalassemia

Mentor:
Ellen B. Fung, PhD; Elijah Goldberg

Funded by: Doris Duke Charitable Foundation

My name is Dunia Saleh. I'm a rising senior at Oakland High School. During my previous experiences with UCSF Children's hospital, I had the opportunity to shadow surgeons. In that experience, I realized exactly what I hoped to be—a surgeon. The dedication to achieve, build strength, and ignite passion resonated with me. I want to help others and challenge what seems invincible, just as I saw one surgery save one patient. After all, what excites me most about medicine is that it helps people overcome what was invincible. The medical field and community, determined by both hope and hard work, reflects my own core values that will be a part of my journey.

Being a part of CHORI has allowed me to visualize myself in the medical field. Having the opportunity to share these passions with colleagues who have similar interests shows me that no matter my background, I can pursue a medical trajectory. This summer, I have the oppurtunity of working alongside Dr.Ellen Fung and Elijah Goldberg exploring the important role of nutrition for patients with thalassemia. Lastly, I would like to thank my mentors Dr. Ellen Fung and Elijah Goldberg for all their time and guidance this summer!

Introduction

Thalassemia (Thal) is an inherited blood disease where the body cannot produce enough hemoglobin. This causes anemia that may require regular blood transfusions to sustain life. Ironically, iron from the transfusions can accumulate in the body and become toxic. The body cannot excrete the extra iron fast enough, so it continues to build up primarily in the liver, pancreas, endocrine organs and the heart. Iron overload in these tissues leads to liver damage, diabetes, hypogonadism and heart failure. Historically, clinical care has focused on optimizing transfusion schedules and reducing iron overload related co-morbidities. With medical advancements, patients are living longer. As a result, the role of nutrition for optimizing health in patients with Thal has captivated the attention of health care professionals and scientists.

Objective

To conduct a systematic review of previously published research studies focused on the importance of nutrition for patients with Thal.

Methods

Original research published in English between 1990-2020 will be abstracted using the search tools: Pubmed, Embase, and Medline. The following keywords will be used to identify relevant studies: thalassemia, nutrition, diet, calcium, copper, zinc, vitamins C, D & E. Non-original research studies (meta-analyses, reviews, letters to the editor) or papers focused on other hemoglobinopathies will be excluded from the review. Anticipated Results: This review will focus on nutritional adequacy of both macro and micronutrients for patients with Thal. It is anticipated that patients with Thal will have the greatest risk of deficiency in water-soluble vitamins and minerals with antioxidant capacities due to inadequate intake and increased requirements.

Significance

Nutritional deficiencies are common in patients with thalassemia and are often associated with inadequate growth, poor immune function, decreased bone mineralization and increased risk of diabetes. This review will be the first to summarize all original research on this topic, and thereby highlighting the important role nutrition plays in optimizing health of patients with thalassemia. Results will aid clinicians in creating a targeted nutrition evaluation and supplementation plan for their patients with Thal.

Molly Szczech

University of Pennsylvania

Biomarkers Collagen X and cGMP as a Predictor of Efficacy of Vosoritide in MPS

Mentor:
Jacqueline Madden, PNP

Funded by: National Institutes of Health

Hello! My name is Molly Szczech and I am a nursing student at the University of Pennsylvania. I am from the Bay Area, and hope to come back and pursue a masters in nursing after graduation. I have always been interested in medicine, and after spending time as a patient in hospitals and clinics in high school, I fell in love with nursing. Going into college I thought I wanted to focus only on clinical work, however as I soon discovered my passion for research, and this program has helped me envision this as part of my career. This summer I have had the incredible opportunity to work with Jacqueline Madden to write a proposal to collect biomarkers Collagen X and cGMP from people with MPS, in order to gather more evidence to support starting a clinical trial of Vosoritide. Thank you to all the CHORI staff for your support!

Contributing Authors

Ellen Fung, PhD and Paul Harmatz, MD

Introduction

Mucopolysaccharidoses (MPS) are a group of diseases caused by a shortage of enzymes that break down glycosaminoglycans (GAGS). Without these enzymes, GAGs accumulate leading to dysfunction in multiple systems including orthopedic, which causes shortening of long bones due to distorted growth plates and inflammation.

Current treatments focus on enzyme replacement therapy, which increases the growth rate in children with MPS, however adult height is still affected. There are no therapies that focus solely on bone growth in MPS and growth hormones are ineffective. Children with achondroplasia (ACH) also experience shortened long bones and are unaffected by growth hormone.

Vosoritide, a C-type natriuretic peptide analog, is a positive regulator of endochondral ossification shown to increase bone growth in children with ACH. Collagen X and cGMP have been used as biomarkers for Vosoritide efficacy in ACH clinical trials. If similar biochemical abnormalities in Collagen X and cGMP were found in MPS and ACH, this data would support a trial of Vosoritide in MPS.

Objective

The objective of this project is to collect blood and urine samples to test for Collagen X and cGMP to predict the potential effectiveness of Vosoritide in promoting bone growth for children with MPS.

Methods

This study will collect a one time sample of blood and urine from patients with MPS I, II, IV and VI. These samples will be tested for Collagen X and cGMP.

Anticipated Results

Levels of Collagen X and cGMP in people with MPS are expected to be lower than average, consistent with delayed long bone growth due to decreased endochondral ossification. This data will present a case for the effectiveness of Vosoritide in children with MPS.

Significance of the Project

People with MPS have significant growth impairments that are associated with sleep apnea, reduced pulmonary capacity, and joint pain that result in decreases in quality of life assessments. With Vosoritide, people with ACH have seen significant growth increases with minimal side effects. Vosoritide has the potential to increase quality of life for subjects with MPS, and the results of this study will help predict its capabilities.

Alexis Tran

Ann Sobrato High School

The role of TMEM55B in Regulating Hepatic Mitochondria

Mentor:
Yuanyuan Qin, PhD, Marisa Medina, PhD

Funded by: CHORI Summer Student Research Program

My name is Alexis and I'm a rising high school senior from Morgan Hill. I've always had an inherent fascination with biology, but my interest in medicine and pharmacology began last summer during a research experience in drug development where I designed a novel inhibitor targeting a phosphatase found in a fungal pathogen. Inspired to develop my growing passions and build on my research background, I pursued an opportunity with CHORI SSRP to further explore the horizons of medicine.

My greatest discovery this summer was that I loved research and it translates to real-world impact. I learned that it is inherently fraught with challenges and uncertainty, but nevertheless, I loved the process, the interdependent collaboration, and the sense of accomplishment that came with the results. I would like to thank Drs. Yuanyuan Qin and Marisa Medina for guiding me through the process and serving as incredible mentors.

Introduction

Mitochondria are organelles responsible for generating energy through the oxidation of fatty acids. Alterations in mitochondrial function are associated with a variety of human pathologies including nonalcoholic fatty liver disease. Recently, our lab found that the knockdown of transmembrane protein 55b (TMEM55B) caused increased staining of autophagosomes and lysosomes, reduced mitochondrial oxygen consumption rates, and impaired fatty acid oxidation in both HepG2 cells and murine primary hepatocytes. Mitochondria can be degraded through a process called mitophagy, a form of selective autophagy. Thus, our project seeks to determine if TMEM55B impacts mitochondrial function through mitophagy.

Hypothesis

TMEM55B knockdown impairs mitochondrial function via increased mitophagy.

Methods

We will transfect HepG2 cells with siRNAs targeting TMEM55B and a non-targeting control to test the effects of TMEM55B knockdown. Differences in mitochondrial density will be quantified in two ways: 1) staining cells with MitoGreen to label mitochondria, and DAPI to label nuclei, with the MitoGreen/DAPI ratio compared, and 2) using qPCR to quantify the mitochondrial DNA/genomic DNA ratio. Mitochondrial oxidative phosphorylation complex (OXPHOS) protein levels will be quantified by western blot. To detect mitochondrial membrane potential, cells will be stained with tetramethylrhodamine ethyl ester, with fluorescence quantified by flow cytometry. To monitor mitophagy, cells will be transfected with Mito-mCherry-GFP and examined under the Keyence 710 microscope. Under neutral pH, both mCherry and GFP will fluoresce, while the acidic lysosomal environment quenches the GFP fluorescence. Thus, the red:green ratio indicates the amount of mitophagy. For comparisons, we will use ANOVA with Tukey's post hoc test. P-values <0.05 are considered statistically significant.

Anticipated Results

We anticipate that TMEM55B knockdown increases mitophagy, leading to decreased mitochondria density, membrane potential, and OXPHOS protein levels.

Significance of the Project

Mitochondrial dysfunction causes several rare monogenic disorders and has been implicated in many common metabolic, cardiovascular, neurodegenerative, and neuromuscular diseases. The successful completion of this study will elucidate novel pathways of mitochondrial regulation, and thus may provide insight to new therapeutic and preventive strategies.

Siem Tsegay

St Joseph Notre Dame High School

Evaluation of the TM6SF2 E167K Variant in the Development of Hepatic Steatosis

Mentor:
Antonio Munoz and Marisa W. Medina, PhD

Funded by: Doris Duke Charitable Foundation / Achieve

Hello, my name is Siem Tsegay, and I am a rising senior at Saint Joseph Notre Dame High School. Ever since I can remember, medicine has always been a big interest of mine. In medicine, you learn diseases and the sophisticated systems within our body. Eventually, you'll get the opportunity to impact a human life by finding a cure for some of the deadliest diseases that exist. This is what makes medicine so appealing to me. My experience with CHORI has allowed me to explore multiple careers in the medical fields through the different lectures and time spent with my mentors discussing my project. At this program, I also learned that a career in gene therapy might be for me after a presentation done by David V. Schaffer. I would like to thank the CHORI Summer Program and specifically my mentors, Antonio and Dr. Medina, for providing me with this phenomenal experience.

Introduction

Non-Alcoholic Fatty Liver Disease (NAFLD) is the most common form of liver disease in the US, and is initiated by accumulation of fat in the liver (hepatic steatosis). In some individuals, simple steatosis progresses into non-alcoholic steatohepatitis (NASH), cirrhosis and ultimately hepatocellular carcinoma. NAFLD has several known genetic risk factors, including a coding variant (E167K) in the transmembrane 6 superfamily 2 (TM6SF2) gene, which was found to be strongly associated with NAFLD risk through genome-wide association, cellular and murine studies. This project's aim is to test whether the E167K variant alone is sufficient to cause increased intracellular lipid accumulation.

Hypothesis

Gene editing the TM6SF2 E167K variant to the non-risk allele will reduce intracellular lipids, while introducing the risk allele in a non-carrier will cause greater intracellular lipid accumulation.

Methods

Two iPSC lines will be identified, one from an individual diagnosed with NAFLD carrying E167K, and one from an individual without NAFLD who does not carry E167K. CRISPR/Cas9 will be used to revert E167K back to the non-risk allele, or to introduce the E167K allele in a non-carrier cell line. Briefly, cells will be transfected with the Cas9-sgRNA ribonucleoprotein complex targeting TM6SF2, along with a template containing a fragment of TM6SF2 to enable homology directed repair. Sequence verified edited lines will be incubated with BSA conjugated oleate for 24 hours, stained with Nile Red (a neutral lipid dye), and fatty acid accumulation measured via fluorescence microscopy. Measurements will be performed in triplicate and edited vs. unedited lines compared.

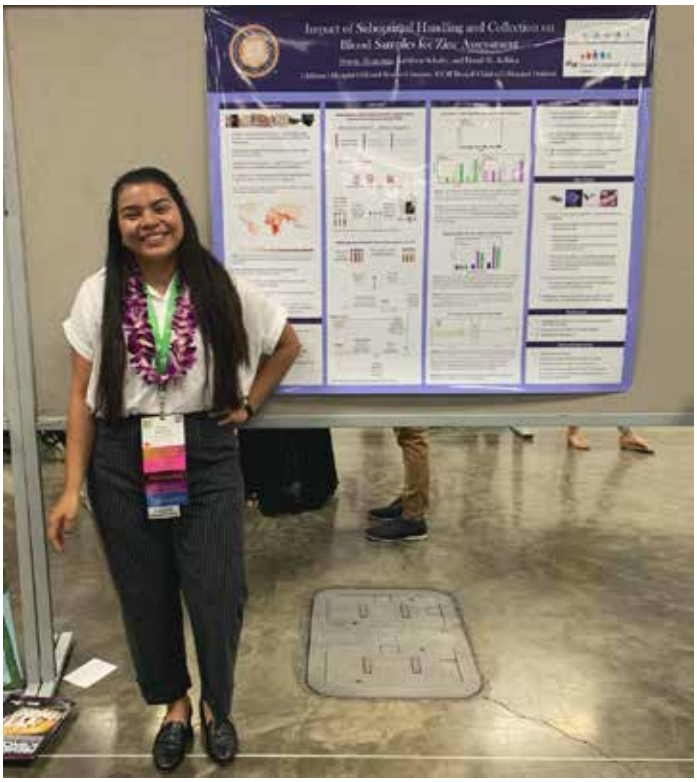
Anticipated Results

iPSC lines with the E167K allele will have higher levels of intracellular lipids compared to non-carrier lines.

Significance of the Project

Understanding this key mechanism of NAFLD is paramount for the development of new treatments. This study will demonstrate that the E167K variant is sufficient to cause excess accumulation of intracellular lipids, improving our understanding of the relationship between TM6SF2 E167K and the development of hepatic steatosis.

Students Presenting Elsewhere



Bonny Alvarenga, SSRP Alumni 2018

SACNAS – The National Diversity in STEM Conference

Honolulu, HI, October/November 2019

Attending the SACNAS Diversity in STEM conference was an invaluable and extremely validating experience. I was able to present my research to professionals in the nutrition sector and I was encouraged to pursue PhD and MD/PhD programs. It was very empowering to hear professionals from diverse backgrounds share their journeys in research and to experience the blend of culture and research. Additionally, it was very helpful to talk to graduate school representatives and graduate students about the opportunities available at their institutions and the application process. I am very thankful to CHORI for helping fund this opportunity and I hope to attend this conference in the future as a graduate student.

Students Presenting Elsewhere

Eric Garcia, SSRP Alumni 2017/18

SACNAS – The National Diversity in STEM Conference

Honolulu, HI, October/November 2019

Attending the SACNAS conference was an incredible experience - the opportunity to network with dozens of biotechnology companies and top graduate programs was invaluable. I'm currently in contact with several potential employers and summer internship programs, and have never so confident in my decision to attend graduate school. SACNAS made me particularly grateful for CHORI, through which I was able to complete two summers of clinical hematology and basic neuroscience research, and mentor high school SSRP students as well. Without CHORI, I would not have been nearly as inspired to pursue science research, and I really can't emphasize how much this program has helped support me throughout my education.

Students Presenting Elsewhere

Troy Coaston, SSRP Alumni 2019

Academic Surgical Congress

Orlando, FL, February 2020

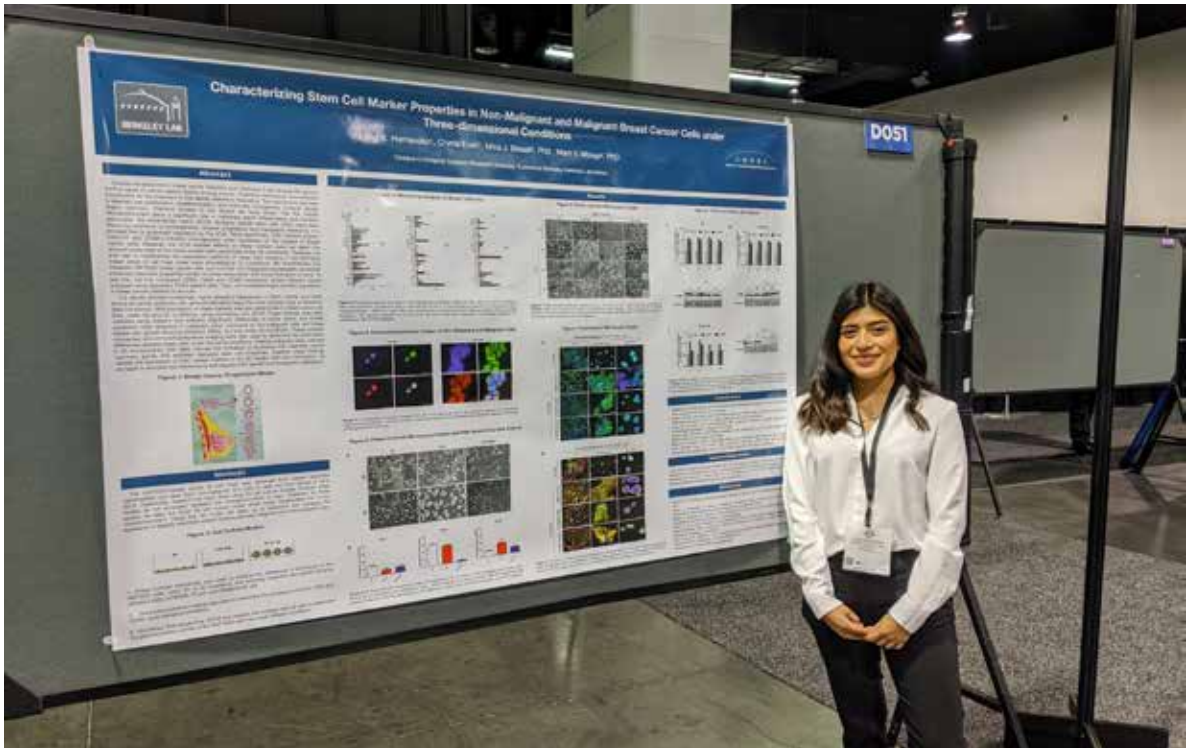
My experience at the 15th Annual Academic Surgical Congress was extraordinary. While I've been involved with research for years in college, Dr. Carter Lebares, the mentor I was paired with during the CHORI Summer Student Research program, was the first mentor I've had that has really pushed me to present my data, as such, this was my first experience presenting at a conference.

Other than the CHORI symposium, I had never presented my data to an audience before, this fact, coupled with my status as one of the only undergraduates at the conference, made presenting a nerve-racking experience. When I first got up to the podium, I could barely speak, I fumbled through my introductory slide and feared what would come next. Then a blessing in disguise occurred, technical difficulties with my presentation. I got to return to my seat while the tech support staff sorted out the issue. While I was sitting down, Dr. Lebares reminded me to take a deep breath and remember all the hours I spent practicing. My mind wandered to my experience presenting at the CHORI symposium and I felt ready to try again when they called my name to present once more. This time, I felt ready, and when I started, the words came to me easily and the presentation flew by. The review card I received at the end of the session featured high marks of praise, my second attempt passed with flying colors.

The rest of the conference was informative. I learned about everything from how surgical robots work to gun control laws in other countries. I met a variety of surgeons and learned a great deal about the profession. It seemed like everywhere I turned there was something new to see and more things to learn.

My time at the Academic Surgical Conference helped me to grow as a presenter and as an academic. I expanded my comfort-zone by presenting in front of an audience of doctors and surgeons and learned about how to explain information clearly to a large group. I also was able to meet new people and learn about a broad range of topics. My time at the conference will be a part of me forever as a rewarding and enriching experience. Thank you to the CHORI program and to Dr. Lebares for giving me this opportunity

Students Presenting Elsewhere



Lilian Hernandez, SSRP Alumni 2019

Annual Biomedical Research Conference for Minority Students

Anaheim, CA, November 2019

ABRCMS is one of the largest conferences for underrepresented minorities in STEM, as a first generation Latina scientist attending this meeting was a very exciting and motivational experience. I had the opportunity to network with a lot of students and scientists, it was very inspiring to talk to them and hear about their career goals and plans not only in the research field but also in the medical field. I presented my work on validating stem cell marker properties in non-malignant and malignant breast cancer cells under three-dimensional conditions. Furthermore, I had the opportunity to attend sessions on stem cell and cancer biology research which allowed me to further confirm my interest in cancer biology research. I am very excited to continue my journey in research and work towards becoming a physician-scientist in the future to further research to help patients.

I am very grateful to CHORI and my mentor Dr. Mam Mboge for their ongoing support in helping me to attend this meeting and in my future endeavours in research and medicine.

This Year's Mentors

Andrew Modelewski, PhD	Molecular Cell Biology	UC Berkeley
Antonio Munoz, MS	Center for Cardiovascular Disease	CHORI
Ash Lal, MD	Hematology	BCHO
Baylee DeCastro, MPP	Center for Community Health and Engagement	UCSF/BCHO
Christine Schudel, MSW MPH	Pediatrics, Primary Care Clinics	BCHO
Coleen Sabatini, MD MPH	Orthopedics	BCHO/UCSF
Danielle Lee, MPH RD	Nutrition Policy Institute	UC Berkeley
David Killilea, PhD	Center for Nutrition & Metabolism	CHORI
Dayna Long, MD	Pediatrics, Primary Care Clinics	BCHO
Deborah Dean, MD MPH	Center for Immunobiology & Vaccine Development	CHORI
Ellen Fung, PhD RD	Bone Density Clinic	CHORI
Jacqueline Madden, PNP	Gastroenterology	CHORI
Janet Y Lee, MD MPH MAS	Endocrinology	UCSF
Jennifer Price, MD PhD	Hepatology	UCSF
June Tester, MD MPH	Pediatrics	BCHO
Lorrene Ritchie, PhD RD	Nutrition Policy Institute	UC Berkeley
Mala Setty, MD	Gastroenterology	BCHO
Mam Mboge, PhD	Molecular Cell Biology & Bioengineering	LBNL
Marcela Weyhmiller, PhD	Iron Measurement Program	CHORI
Marisa Medina, PhD	Center for Cardiovascular Disease	CHORI
Marsha Treadwell, PhD	Psychology	BCHO/UCSF
Mindy Benson, PNP	Pediatrics, Primary Care Clinics	BCHO
Peter Beernick, PhD	Center for Immunobiology & Vaccine Development	CHORI
Ryo Sanabria-Higuchi, PhD	Molecular Cell Biology	UC Berkeley
Steve Mack, PhD	Center for Genetics	CHORI
Tariq Ahmad, MD	Endocrinology	BCHO
Ward Hagar, MD	Hematology	BCHO
Yuanyuan Qin, PhD	Center for Cardiovascular Disease	CHORI

Key to Locations

BCHO	UCSF Benioff Children's Hospital Oakland
CHORI	Children's Hospital Oakland Research Institute
LBNL	Lawrence Berkeley National Laboratory
UC ANR	University of California, Agriculture and Natural Resources
UCB	University of California, Berkeley
UCSF	University of California, San Francisco

Notes

Notes

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Children's Hospital Oakland Research Institute

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www.childrenshospitaloakland.org