FACES OF SCIENCE

CHORI Summer Student Research Program 2018

FRIDAY, AUGUST 10, 2018

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

UCSF Benioff Children's Hospitals
Oakland | San Francisco

UCSF Benioff Children's Hospital Oakland

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Children's Hospital Oakland Research Institute

August 10, 2018

Welcome to the 37th Annual CHORI Summer Student Research Symposium! We are here to applaud the future leaders of biomedical research. We are also here to celebrate the wealth of our diversity- which is represented in abundance in this summers' matriculating class and is the theme of this years' program, the many 'Faces of Science'. Our students originate from around the globe including: Guatemala, Iran, England, Mexico and India. Despite their diverse racial and socio-economic backgrounds, all these trainees have one common goal- they are considering careers in biomedical research and other health care fields. Over the past 9 weeks, these young students have been exploring challenging basic, clinical and ethical questions. Today's oral and poster presentations constitute the conclusion of the program that has featured a rigorous mentored guided research project and educational curriculum.

This summer's program has been unique in that students have overcome many obstacles to achieve their goals. Some students were placed in research assignments that required lengthy commutes from their home yet made it to their internship on time, others were uprooted from hometowns thousands of miles a way to enter the program. A number of students struggled to balance daily caregiving of family members, still others offered emotional support to family members held in immigration detention centers. Despite these challenges, students have been incredibly strong and resilient, a character trait that will prove invaluable as they continue on in their educational journey.

We invite you to join these inquisitive young minds as they share what they have explored this summer, topics ranging from the effects of aging on neural stem cell behavior, real time monitoring of hemoglobin S levels in sickle cell patients, optimal delivery routes for chemotherapy agents, beverage policies and their effects on obesity in child care settings, to examining potential barriers for the treatment of Hepatitis C. Please mingle and chat with the all the students during the poster session, as well as the research scientists and physicians who served as mentors for the trainees. We feel truly privileged and honored to have the trainees in our organization and hope that their summer research experience offered a brief glimpse into the exciting world of biomedical research.

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. We appreciate their time, effort, and profound commitment to mentor these students. A very special note of appreciation also goes out to: David Killilea, Roialle Luckett, John McDonnell, and Phillip Bollinger, as well as Kathy Schultz, Jennifer Beckstead, Shar Rauch, Susan Camel, Christian Leiva, Peter Chin-Hong, Lily Mirels and all CHORI and BCHO staff, guest seminar speakers and other friends of the CHORI Summer Program for their effort and time, which made this summer's program a huge success. We acknowledge the support and funding provided by the NIH, DDCF, CIRM, and the Alex Lucas Memorial Fund and other Anonymous donors. We wish the trainees all the very best in their future scientific endeavors; please keep in touch as we are always anxious to hear what are alumni are up to!

Sincerely,

Bertram H. Lubin MD

Bertram Lubin, MD
Associate Dean of Pediatric Health, UCSF
Principal Investigator
Co-Director CHORI Summer Program

Ellen B Fung

Ellen B. Fung, PhD RD CCD
Associate Scientist, CHORI
Principal Investigator
Co-Director CHORI Summer Program

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2018
CHORI Summer Student Research Program Curriculum

Administrative Orientation: June 11, 9:30-1:00 pm
Location: CHORI Little Theatre
Catered continental breakfast will be served at 9:00 am and bag lunch will be provided

- Introductions, computer access, badging, CHORI tour

Safety Training: June 11, 1:00 – 4:00 pm
Location: CHORI Little Theatre
Mandatory safety training with CHORI Safety Officer, Miriam Fang. Students are required to complete this training BEFORE beginning their projects. (*Make up Safety Training Date: June 19, 1:30 – 4:30 pm*)

Full Program Orientation: June 18, 9:00 – 4:00 pm
Location: CHORI Little Theatre
Catered continental breakfast will be served at 8:30 am, and lunch will be provided.

- Keynote lecture, introduction and background to SSRP, explanation of curriculum
- Community building activities

Lunch with Scientific Mentors: June 18, 12:00 – 1:00 pm (BCHO, CHORI)

Meetings with Off-Site Mentors
June 13, 11:00 – 12:00 pm Undergraduate students with mentors at UCSF will travel to the Parnassus campus along with the SSRP Co-Director to meet with their mentors (Location: CL 221, Parnassus)
June 13, 2:00 – 3:00 pm High school CIRM Students with mentors at UCB will travel to UCB along with SSRP Co-Director to meet with their mentors (Location: 415 Li Ka Shing Building, UC Berkeley)

Basic Science Boot Camp: June 14 (12:00 – 5:00 pm) June 15 (9:00 – 5:00 pm)
Location: June 14: NEOS Conference Room, CHORI; June 15: Room 2411, CHORI
Mandatory basic laboratory training for high school students who will be working in wet laboratories (at CHORI or UCB). Optional for undergraduate students working in labs interested in a refresher.

Research Project. June 13 - August 10
Student interns will conduct research with assigned mentor. The details of research plan are left entirely to the mentor and each summer intern will follow the procedures, and schedule, laid out by their respective labs/clinic.

Written Research Plan. Due: June 27 by 4:00 pm
Students must submit to the Program Coordinator a written Research Plan outlining their project. The Research Plan should be a minimum of 3 pages long (Arial, 11pt, double spaced) and include:

- Statement of hypothesis & specific aims
- Background
- Methods
- Anticipated outcomes of project
- Significance
- Citations

Research template provided as a download from this link:
http://www.chori.org/Education/Summer_Internship_Program/summer_curriculum.html
Students will work closely with their mentor in the preparation of these research plans, and mentors should review and approve the plans before submission. Figures, flow charts and schematics may be used to illustrate the research plan. The written plan will be sent to: ssrp@chori.org, and must include student's name, mentor's name and the title of the project.

Weekly Seminars: Thursdays, June 21 – August 1
Location: CHORI & UCSF
Students are required to attend weekly lectures delivered by CHORI, UCSF and CHRCO faculty members. The lectures will cover various scientific topics, including women's and minority's issues, career decisions, and Responsible Conduct of Research. Seminars will be held most weeks on **Thursdays from 3:00 – 5:15** pm. Location will either be at CHORI in the Little Theatre or at UCSF Parnassus Campus. Refreshments will be provided.
The CHORI/UCSF all student programs mixer will be held on **Wednesday, Aug 1: 12:00 – 3:30 pm** at UCSF (Location TBD)

Student Photo Day: June 28, meet at 1:30 pm
Location: CHORI Main Courtyard
All students must be present on photo day, CHORI main courtyard. Dress suggestion: business casual.

Personal Statement: Due July 5 by 3:00 pm
All students submit a one paragraph brief (100-150 word) personal statement to be included in the symposium book.

Abstracts: Due July 18 by 4:00 pm
Students will work closely with mentors to submit an abstract concisely summarizing their work. The abstract should be roughly 300 words (Arial, 11pt, single spaced) and include:

- Title
- Introduction
- Objective <or> Hypothesis
- Methods
- Results <or> Anticipated Outcomes
- Conclusion(s) (Suggested as available)
- Acknowledgements
- Keywords

An abstract template is provided as a download from this link:
http://www.chori.org/Education/Summer_Internship_Program/summer_curriculum.html

2018 CHORI Summer Student Symposium, August 10, 2018
Location: CHORI Library
A one-day symposium will be held on Friday, August 10 where all students *are **required*** to participate. Students will work closely with their mentors in the preparation of presentations. A committee comprised of the Co-Directors and other members of the CHORI scientific community will review the abstracts for the Symposium. Abstracts will be chosen either for an oral or a poster session for the Symposium. Family members, teachers, lab members and friends are welcome to attend.

The Symposium will be comprised of morning oral presentations (10 minutes each, with 5 minute discussion). In the afternoon, a poster session will be held during which the presenters will be on-hand to explain their research project. A catered breakfast and lunch will be provided for all attendees on the Symposium day. Awards will be given to the best poster and oral presentations given at the symposium. A certificate of participation in the CHORI Summer Student Research Program will be awarded to all students who successfully complete the program.

Summary of Important Dates:

June 11, 2018	**Admin Orientation**: 9:30 A.M. – 1:00 P.M. (*Required for all students*)
June 11, 2018	**Safety Training**: 1:00 – 4:00 pm
June 12, 2018	BCHO Hospital Tour (10:00 – 11:00 AM- Tentative)
June 13, 2018	**Off-Site Mentor Visits** *(for students working at UCSF & UCB only)*
June 14 & 15, 2018	**Basic Science Boot Camp**- *(Required for High School Students working in labs)*
June 18, 2018	**Program Orientation**: 9:00 – 4:00 PM (*Required for all students*)
June 19, 2018	Make up Safety Training: 1:30 – 4:30 pm
June 20, 2018	Stem Cell Workshop, UCB: 9:00 – 12:00 pm (CIRM students only)
June 27, 2018	**Written Research Plan** due by 4:00 pm
June 28, 2018	**Student Photo Day** meet at 1:30 pm (Required for all students)
July 5, 2018	**Personal Statement** due by 3:00 pm
July 18, 2018	**Abstracts** due by 4:00 pm
August 1, 2018	**CHORI/UCSF All programs mixer** & works in progress (Required for all students)
August 6 & 7, 2018	CIRM Poster Day, Davis, CA (*CIRM students only*)
August 10, 2018	**Summer Student Research Symposium**, CHORI Library (*Required for all students*)

***Program Seminars**: June 28, July 5, 12, 19, 26: 3:00 – 5:15 pm at CHORI Little Theater*
June 21 3:00-5:15 pm & August 1st, 12:00- 3:30 pm at UCSF Campus, Location TBD

Social gatherings will be held during the summer, dates TBD

***Detail about the program, please visit**: www.chori.org/ssrp*

***Questions about these assignments? Contact:** sssrp@chori.org*

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BCHO: UCSF Benioff Children's Hospital Oakland
CHORI: Children's Hospital Oakland Research Institute
UCSF: University of California, San Francisco
UCB: University of California, Berkeley
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CHORI Summer Student Research Program

Lecture Series 2018

June 14 Thursday
CHORI Little Theater

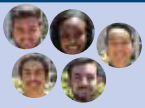

Bone Marrow Transplant: The Patient Perspective
Nancy Noonan, RN (BCHO)
Marcy Moriarty, RN (BCHO)
4:00 PM

June 21 Thursday
UCSF Medical Sciences Building

Learning How to Find Yourself in Academic Medicine
Valy Fontil, MD, MAS, MPH (UCSF)
3:00 PM

Reading and Reviewing Scientific Articles
Kala Mehta, DSc, MPH (UCSF)
4:00 PM

June 28 Thursday
CHORI Little Theater

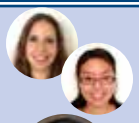


Advice from your CHORI SSRP Peers
Ali, Armen, Brittany, Elijah, & Eric (CHORI)
2:30 PM

Elevator Talk Session
3:15 PM

Careers and Roles as a Physician-Scientist
Theo Roth (UCSF)
4:00 PM

July 5 Thursday
CHORI Little Theater



The UC ANR Nutrition Policy Institute: Conducting Nutrition Research That Can Inform Policy
Christina Becker/Janice Kao, MPH (UC, Agriculture and Natural Resources)
3:00 PM

Achieving Health Equity
Dayna Long, MD (BCHO)
4:00 PM

July 12 Thursday
CHORI Little Theater

Medical Devices: From Concept to Clinical
Marcela Weyhmiller, PhD (BCHO)
3:00 PM

Elevator Talk Session
4:00 PM

July 19 Thursday
CHORI Little Theater

Use of Virtual Reality to Manage Pain in Sickle Cell Disease
Anne Marsh, MD (BCHO)
3:00 PM

The Science Behind Stem Cell Transplants and Gene Therapy
Mark Walters, MD (BCHO)
4:00 PM

July 26 Thursday
CHORI Little Theater

Lessons From the Big Mack: The Secret Sauce of Immunogenomic Informatics, and Avoiding a Big Data Pickle
Steve Mack, PhD (CHORI)
3:00 PM

Wait, You Mean I Have to Talk? In Front of People??
John McDonnell (CHORI)
4:00 PM

August 1 Wednesday
UCSF TBD

A Career Studying Homelessness
Margot Kushel, MD (UCSF)
2:00 PM

A Randomized Trial to Evaluate Local Antibiotics after Open Tibia Fracture in Tanzania.
Syed Ali, MD (UCSF)
3:00 PM

Association of Pre-Liver Transplant Frailty with Early Post-Transplant Complications
Laila Fozouni (UCSF)
3:00 PM

2018 Summer Students

2018 Summer Students

2018 Summer Students

FACES OF SCIENCE

CHORI 37th Summer Student Research Symposium 2018

FRIDAY, AUGUST 10, 2018 • 9 AM–4 PM

ADD YOUR FACE.

Jonathan Aguayo

University of California, Berkeley

Observing the Presence and Movement of Pig MGE Cells as a Means to Understand and Apply Their Function Towards Human Brains.

Mentor:
Mariana Casalia, PhD

Funded by: National Institutes of Health

Hello, my name is Jonathan Aguayo and I am an undergraduate at UC Berkeley majoring in Molecular and Cellular Biology. I find great interest in the overarching field of health sciences, an interest that stemmed from a very young age due to a curious obsession of illness. This fixation with sickness would drive me to scour the internet to figure out everything I thought was wrong with my body whenever I became sick; thus, here I am, ready to dive in head first in a career as either a physician or medical researcher.

Despite enjoying all my major courses at university, I felt as though it was time to actually apply what I learned after two years at Berkeley into something more practical. As such, I was extremely excited to get started in this program after being accepted. My time spent working with Dr. Mariana Casalia in the Baraban Lab at UCSF studying treatments for temporal lobe epilepsy has been an absolute blessing, and I cannot put into words how great it is to finally apply all my knowledge into a practical application while also learning so much about how to navigate a wet-lab setting. Thank you again, Mariana.

Introduction

The ganglionic eminence is a region of the mammalian embryonic brain that generates cortical interneurons. The Medial ganglionic eminence (MGE) is a subsection of this structure that is notable for its production of inhibitory interneurons. Lack of such inhibition is known to induce various neurological diseases, such as temporal lobe epilepsy. In order to gain insight on the MGEs of human brains, this project will look to study and characterize the MGEs of pigs, a similar mammal, to track where the interneurons being generated from the MGE are located at a specific point in time and to see if they are plentiful enough to warrant using as a model for humans.

Hypothesis

The tests used to count and quantify the number of specific interneurons within the MGE in pigs should convey a high population of developing inhibitory interneurons, such that the pig MGE could be considered a viable model to gain a higher understanding of interneuron formation, migration, and diseases in humans.

Methods

Embryonic pig brains are frozen and sliced by a cryostat machine before being numbered and placed onto slides. The slides predicted to house the MGE are taken for staining. There are two methods of staining utilized: TSA staining and Immunofluorescence staining; both methods use primary and secondary antibodies to bind onto specific proteins markers that are unique to individual interneurons types. The most notable protein marker is NKX2.1, which identifies cells generated by the MGE. Once the stains are completed, the tissues could be imaged, the cells could be counted, and a description of the MGE is made.

Anticipated Results

The images from our tests conveyed increasingly high concentrations of NKX2.1 cells in our MGE while all other portions of the brain significantly lacked the same density of NKX2.1-bearing cells.

Discussion/Conclusions

The high concentration of NKX2.1 cells generated from the MGE is indicative of a highly-active region developing interneurons aplenty. This is promising; the pig's ability to create such a high volume of inhibitory interneurons is able to simultaneously help create a general reference model while also providing an animal candidate that could possibly act as a reservoir of cells for transplants to treat various conditions.

Acknowledgements

I want to thank Dr. Mariana Casalia for the opportunity and wish her and the lab the best on all their research to come.

Keywords

Ganglionic Eminence, interneuron, MGE, cryostat, antibodies

Alex Ahilon-Jeronimo

Oakland Technical High School

Lysosome Form and Function Affect Endoplasmic Reticulum Quality Control

Mentor:
Ryo Higuchi-Sanabria, PhD

Funded by: California Institute for Regenerative Medicine

My name is Alex Jeronimo. I will be attending college at UC Merced, pursuing a public health major. My aspiration in life is to have a beneficial impact on those around me and my community at large. To leave an impact that will last long after me.

I've since, through personal experience and preference, decide to pursue a career in health care. I've committed my time to explore and experience the countless different occupations within the field, whether it be clinical or administrative. A setting I haven't really given a chance for myself to explore has been the in the field of research. This summer I was able to change that. The CHORI summer research program has become my first opportunity to get an in-depth understanding of the setting and people who make up the field of research. My experience has already unraveled my principal understanding of what it meant to work in the field. I've learned lessons from my mentor and the program, I know will help me grow personally and academically. In the end, The CHORI summer research program has allowed me to begin the next stage of my life without any regrets of selling myself short to a possible career path. A field and career, I now am able to see myself actively participating in.

Introduction

The lysosome is a cellular organelle, referred to as the "trashcan" of the cell, due to its primary function to digest intracellular material. The endoplasmic reticulum (ER) is a vast intracellular network of membranes, which function as the manufacturing center for macromolecules of the cell. The lysosome and ER carry out critical, yet seemingly opposing, functions of catabolism and anabolism, thus it is essential that the organelles be in constant communication to ensure cellular homeostasis. However, a method of communication between the lysosome and ER has yet to be identified.

Hypothesis/Objective

Lysosomal function is essential for maintenance of the ER under conditions of stress. Therefore, perturbations in lysosomal function would sensitize the organism to ER stress.

Methods

To determine the function of lysosomes in ER quality control, we tested the sensitivity of worms with lysosomal dysfunction to tunicamycin, a chemical agent that perturbs ER function. The read-out will be the intensity of activation of a transcriptional reporter for UPR-ER, hsp-4p::GFP. This reporter allows quantification of UPR-ER activation as a marker for ER stress, where higher levels of GFP indicate increased ER stress. Similar experiments were carried out in neuronal progenitor cells and embryonic stem cells where the effect of either genetic or chemical perturbation of lysosomal function on sensitivity to ER stress were tested.

Results/Discussion

We found that perturbations of lysosomal function resulted in increased sensitivity to ER stress. This is potentially due to the requirement of lysosomes in recycling essential nutrients. Some of these nutrients, such as the amino acid, arginine, are essential for glutathione synthesis, which is a biomolecule required for redox balance and buffering against the toxic effects of reactive oxygen species. In this study, we found the first direct evidence that lysosomal function is essential for maintenance of ER homeostasis. The contribution of this work is significant to the medical community as amino acid availability may be a potential therapeutic target for lysosomal storage disorders. For example, if lysosomal storage disorders result in phenotypic consequences due to the decreased pool of amino acids required for redox homeostasis, amino acid supplementation may treat symptoms in a cheap and virtually harmless manner.

Samantha Alvarado

Holy Names High School

Implementation of a Stoss Therapy Protocol

Mentor:
Mala Setty, MD, Ellen James, PhD PNP

Funded by: Doris Duke Charitable Foundation

My name is Samantha Alvarado and I'm a rising senior at Holy Names High School in Oakland. Since I could remember, I have always wanted to be a doctor. I dressed up as a doctor as a little girl and played with my dolls as they were patients of mine. When I was told about the CHORI program, I knew this grand opportunity would bring me one step closer to my dream, which I am forever grateful for. I have always loved school. I enjoy learning more about my community and other communities around the world. The CHORI program has given me an opportunity to research and learn more about patients in Oakland and other cities. While working with my mentors, Ellen James and Dr. Setty, I witnessed a glimpse of the world of Gastroenterology. I was able to follow around other doctors and nurse practitioners as well, and I am thankful they took the time to teach me about what they love to do. They not only taught me about constipation, g-tubes, and inflammatory bowel disease, but they gave me insight into the medical field. I also got to meet a bundle of adorable children. Because of CHORI and it's amazing motto, I am leaving this summer program with the confidence that I will pursue a career in health care as a strong Hispanic woman.

Introduction

Inflammatory Bowel Disease, also known as IBD, is a disorder in which the intestines become extremely inflamed due to a person's immune system attacking healthy cells. There are two different types of IBD: ulcerative colitis and Crohn's disease. Both types of IBD have demonstrated an increased risk for vitamin D deficiency. A normal vitamin D level is greater than 30 ng/mL. A deficiency of vitamin D is worrisome because vitamin D is essential for bone health and to absorb calcium from food and supplements. About 60% to 70% of patients with IBD have a deficiency of vitamin D, and the remainder have an insufficiency of Vitamin D. This deficiency of vitamin D affects IBD by correlating with patients having a higher risk of being hospitalized and needing surgery. Stoss therapy is a type of supplementation to provide high doses of vitamin D to patients with deficiency. Patients who deem high risk for inflammation, much like patients with IBD, are eligible for stoss therapy.

Objective

To evaluate the feasibility of implementing a high dose of vitamin D supplementation protocol in pediatric patients with inflammatory bowel disease at UCSF Benioff Children's Hospital Oakland (UBCHO).
To evaluate data and identify barriers to following the Stoss therapy protocol as prescribed.

Methods

Evaluate data collected on patients who received high dose vitamin D supplementation, counting the number of completed data points (blood test results)as per the UBCHO Stoss therapy protocol.
Categorize reasons for missing data.

Anticipated Outcomes

The anticipated outcomes are that we will be able to follow the Stoss protocol and obtain all data points (lab results) from majority of IBD patients.

Conclusions

Identifying the challenges and barriers to implementing a Stoss therapy protocol will allow us to put in place specific measures to improve our ability to follow it as prescribed. This will lead to improved overall vitamin D levels which, in turn, may impact on the health of patients with IBD.

Acknowledgments

I would like to thank my mentors, Ellen James and Dr. Setty, for their abundance of guidance and knowledge they have given me this summer. Thank you to the whole Gastroenterology department for allowing me to be in the clinic and office. I would also like to thank the Doris Duke Charitable Foundation for their generous aid that allowed me to participate in such a wonderful program.

Keywords

Vitamin D, Stoss therapy, Inflammatory Bowel Disease

Bonny Alvarenga

University of California, Berkeley

Mineral Levels in Samples from NP-C Patients Treated with HPβCD

Mentor:
David Killilea, PhD; Kathleen Schultz, MS

Funded by: Volunteer

My name is Bonny Alvarenga and I am a rising senior at UC Berkeley pursuing a bachelor's degree in Molecular and Cell Biology with an emphasis in Immunology and Pathogenesis. It was when I drew my first Punnett square in high school that I became interested in the diverse development of humans and then in college an interest in the development of diseases within the human body. I joined SSRP at CHORI because I support their mission to expose underrepresented youth to the research experience. I strongly believe that to best serve and advocate for a diverse population within health fields, there needs to be a greater promotion of diversity amongst those in power to address health disparities and diseases across communities. Researching Niemann Pick Type C disease has allowed me to gain exposure to clinical aspects of research that will help me in the future when I pursue a career as a physician-scientist.

I would like to thank my mentors, Dr. David Killilea and Kathy Schultz, for welcoming me into their lab, giving me plenty of guidance and support, and for providing me with an enriching experience I will never forget.

Introduction

Niemann Pick Type C (NP-C) is a rare, autosomal recessive disease caused by a mutation in either the *NPC1* gene or the *NPC2* gene, which code for proteins essential for the intracellular transport of unesterified cholesterol. The mutation disrupts the metabolism of cholesterol, causing toxicity via build up in the lysosomes and endosomes. Neurological defects are common due to Purkinje cell death, causing clinical symptoms similar to Alzheimer's Disorder (AD), thus NP-C's nickname, 'Juvenile Alzheimer's.' Identical twins diagnosed with NP-C at UCSF Benioff Children's Hospital, Oakland (BCHO) were approved by the NIH and FDA to be treated with the compound 2-Hydroxypropyl-beta-cyclodextrin (HPβCD), shown to be effective in animal models and present in some household cleaning products. In a pilot study with the NP-C twins, we found abnormally low levels of Cu, Fe, and Zn in cerebrospinal fluid (CSF). The correlation between the experimental treatment and mineral levels has not yet been fully examined.

Hypothesis

HPβCD has a restorative effect on aberrant mineral levels in NP-C patients, including the normalization of low levels of Cu, Fe, and Zn in CSF.

Methods

The clinical coordinator from BCHO will be contacted for the NP-C clinical protocols. The CSF samples sent to CHORI from the clinic will be organized and documented. An elemental analysis will be conducted by inductively coupled plasma optical emission spectrometry (ICP-OES) to examine the correlation between the mineral levels and the treatment to provide insight to the clinical pathology of the disease.

Results

We hope to observe any correlations between treatment and mineral levels in the NP-C patients.

Conclusion

Correlations in mineral levels and the treatment may indicate potential in future meta-analysis research to learn more about the mechanics of NP-C and prove useful in examining similar diseases, such as AD.

Acknowledgements

Thank you to Dr. Caroline Hastings and the NP-C team at BCHO for their cooperation in making this project possible and my mentors, Dr. David Killilea and Kathy Shultz, for the guidance they have provided.

Keywords

CSF, 2-Hydroxypropyl-beta-cyclodextrin, ICP-OES, meta-analysis, NP-C

Alexandra Alvarez

University of California, Berkeley

Host Regulation of *Chlamydia trachomatis* TARP by Signal Peptide Proteolysis

Mentor:
Deborah Dean, MD, MPH

Funded by: National Institutes of Health

My name is Alexandra Alvarez and I'm a rising junior at the University of California, Berkeley majoring in Molecular and Cell Biology and minoring in Toxicology. This summer I've been working with Dr. Deborah Dean researching Chlamydia trachomatis to understand the pathway it undergoes inside the human body in hopes to learn about potential future treatments. I have always been interested in the field of science because it gave me answers to the questions I had. This curiosity made it difficult to decide exactly what career path I wanted to pursue- did I want to be "behind the scenes" in a lab or did I want to be seeing patients as a physician? Participating in the CHORI Summer Research Program allowed me to further narrow my goals by giving me the opportunity to work inside a reputable laboratory and has taught me to not let my circumstances define me. Through my work, I have been able to collaborate with amazing peers inside and outside the laboratory as well as develop essential research skills.

I am so grateful for the staff and directors at CHORI, the NIH foundation, and my kind-hearted mentors who have taught me so much and gifted me with this wonderful opportunity.

Introduction

In the 1980s, *Chlamydia trachomatis (Ct)* was discovered to be the most common cause of sexually transmitted diseases worldwide. *Ct* is an obligate intracellular bacterium that uses a Type-III Secretion System to secrete proteins required for entry into the cell, which means that it grows in its host and can only survive inside it. One protein secreted by this is the translocated actin-recruiting phosphoprotein (TARP), which facilitates entry. It has been found in the Dean Lab to linger in the host cell until 10 hours post infection and is quickly degraded to almost undetectable levels by 13 hours. The aim is to measure TARP levels in cells infected with *Ct* strain L2 and transfected with a vector that encodes for TARP to investigate how degradation of this protein occurs.

Hypothesis

Degradation of TARP occurs in infected cells but not in transfected cells. Therefore, it is hypothesized that there is a chlamydial protein that mediates this degradation.

Methods

Preliminary data show that, by Western Blot, TARP degrades in infected cells but not transfected cells; we used transfection assays and FACS analysis to confirm this. We performed transfection assays on HeLa cells with four P2A (self-cleaving peptide) vector variants: P2A, P2A wild type TARP, P2A with a mutated TARP, and P2A with a deleted TARP. The P2A vector has mCherry-TARP (red) and AmCyan (blue) separated by a P2A peptide sequence. The mCherry-TARP was in the cytosol and the AmCyan localized to the nucleus. Green fluorescent phalloidin was used to stain actin filaments, which determined whether there is aggregation occurring, which could inhibit degradation of TARP. Transfected cells were fixed and visualized under fluorescence microscopy at 24h, 32h, 36h, and 40h to find the optimal time point for cleavage of the expressed protein hybrid by the P2A peptide sequence. FACS analysis was then used to compare levels of AmCyan to levels of mCherry.

Anticipated Outcomes

We expect the FACS analysis to show equal levels of AmCyan to mCherry, showing that there is no degradation of TARP occurring. If there is more AmCyan than mCherry then that shows signs of degradation of TARP in transfected cells. With these results, we would know that transfected TARP does not degrade the same way as TARP expressed by Ct infected cells, suggesting that there is a chlamydial protein causing its degradation.

Discussion

Understanding how *Ct* infects and how its major proteins function is essential, such as TARP. Understanding this pathway for survival could potentially allow for new treatments to be made that specifically target these proteins.

Acknowledgements

I would like to thank Deborah Dean, MD, MPH, and Awad Faddoul for their guidance and the rest of the Dean Lab for their support.

Keywords

Chlamydia trachomatis, transfection, infection, TARP, degradation

Sakina Bambot

Carlmont High School

Assessment of Sensitivity of Novel Nuclear SNP Probe Capture Next-Generation Sequencing System (NGS) for Detection of Maternal Stem Cells in Baby's Blood After In-utero Bone Marrow Transplant

Mentor:

Shelly Shih, MS, Sandy Calloway, PhD

Funded by: California Institute for Regenerative Medicine

Hi, my name is Sakina Bambot and I am a rising senior at Carlmont High School. I have always loved science, but I don't know exactly what area of science I want to pursue a career in. My experience with a condition called Duane Syndrome, which affects the peripheral vision in one of my eyes, inspired me to want to look further into the medical side of science. I am extremely grateful to this program for providing me with the opportunity to conduct research this summer. Thank you to my mentors at the Calloway Lab for all of their time and guidance.

I have learned an incredible amount these past weeks, and from being in the lab to listening to some amazing seminar speakers, I have become much more confident in my abilities and have gained insight into what my future career path might look like.

Introduction

Alpha thalassemia is an autosomal recessive blood disorder that affects the production of hemoglobin. Without intervention, affected fetuses would die in utero or soon after birth. Currently, serial red blood cell transfusions are used to treat fetuses with such blood disorders. After birth, patients either continue to receive transfusions or undergo a hematopoietic stem cell transplant. Research has shown in-utero hematopoietic cell transplantation (IUHCT) to be a more effective alternative method because as opposed to a transplant after birth, a fetus' immune system is more tolerant to the mother's stem cells during pregnancy. Recently, researchers at UCSF performed the first in-utero transplant of the mother's stem cells into the fetus, resulting in a live birth. In order to ensure future success, a sensitive and reliable quantitative method is needed for detection of the mother's stem cells in the baby to determine the extent of stem cell engraftment because engraftment could be less than 1%. The current method of detection, qPCR provides a qualitative assessment, whereas the next generation sequencing (NGS) assay, developed by the Calloway lab, targets α-globin regions directly to quantitatively determine the percentage of the mom's DNA present. An alpha-thalassemia baby has 2 deletions, therefore reads in the deleted regions would be from the engraftment of maternal stem cells.

Objective

To assess the limit of detection of a probe capture NGS system on varying ratios of the mother's DNA in order to determine if the system can be reliably used to detect maternal stem cells in the baby's blood after in-utero bone marrow transplant.

Methods

Contrived mixtures consisting of baby's DNA spiked with maternal DNA will be tested in duplicates at 5%, 1%, 0.1%, and 0.01%. DNA libraries will be constructed following our library preparation process. Three to five DNA libraries will be pooled for probe capture enrichment and sequenced on a NGS platform. Data analysis will be carried out using NextGENe software for alignment, coverage analysis, and mutation calling.

Results or Anticipated Results

We expect that the probe capture NGS system will be able to detect maternal DNA in the 5%, 1%, and 0.1% mixtures.

Discussion/Conclusions

If maternal DNA is detected in the 0.01% mixture, we can be confident that the 0.1% mixture is within the detection limit of the probe capture NGS system. If maternal DNA is detected in the 0.1% mixture but not the 0.01% mixture, reliability of the 0.1% mixture will need to be established through further testing.

Acknowledgements

Thank you to my mentors Dr. Sandy Calloway and Shelly Shih for their guidance, time, and patience.

Keywords

NIPT, next-generation sequencing, autosomal recessive, low-level mutations, chimerism, alpha-thalassemia, probe capture enrichment

Amarjit Bath

Saint George's University

The Voice of the Patient: Evaluating Sickle Cell Disease Health Care Disparities and How They can be Addressed by Care Redesign

Mentor:

Marsha Treadwell, PhD

Funded by: National Institutes of Health

My name is Amarjit Kaur Bath and I am a first year medical student at Saintt Georges University. I am a returning CHORI intern, working with Dr. Treadwell this summer. Being part of the CHORI program has been a major stepping-stone in my life as I had the opportunity to conduct basic science and clinical science research through this program. CHORI has helped me nurture my curiosity and passion for medicine by exposing me to different facets of research.

I would like to thank Dr. Treadwell and Dr. Fung for giving me this wonderful opportunity. I would especially like to thank Dr. Treadwell and her team for taking the time to answer my endless questions and for offering me the opportunity to acquire priceless knowledge on Sickle Cell Disease.

Introduction

Individuals with sickle cell disease (SCD) face many barriers to accessing health care ranging from inadequate treatment in emergency departments (ED) to fragmentation of outpatient care, to lack of access to preventive services. These barriers need to be lowered so patients affected with this disease can obtain adequate health care and improved quality of life. Objectives: To highlight patient's voices about potential strategies to redesign the way health care is delivered, to address health care disparities faced by youth and adults with SCD.

Methods

We will use qualitative methods to perform secondary data analysis with data collected for a community based needs assessment in Northern California. Fifty-five patients (ages 15 to 45 years) were interviewed on topics including barriers to accessing primary, specialty and urgent care, and what is and is not working about their care. We are using thematic analysis to code the interviews and identify overarching themes related to health disparities that impact access to outpatient and ED care and potential strategies to redesign care.

Anticipated Outcomes

We anticipate that patients will report barriers to care primarily in the ED but also related to insurance. We expect that they will cite the transition from pediatric to adult care as particularly problematic and that they will underscore such potential strategies for care redesign as patient navigators, and personalized versus generalized care. We expect that the need for compassionate SCD care will be emphasized.

Conclusions

Patients with SCD face barriers that make access to all aspects of healthcare challenging. By highlighting the voice of the patients, we will refine our understanding of the healthcare disparities this vulnerable population faces. This work will guide healthcare organizations to accelerate progress towards enhanced outcomes for patients, providers and communities.

Acknowledgements

I would like to thank Dr. Treadwell and Dr. Fung for giving me this opportunity and broadening the horizons of my knowledge on SCD.

Keywords

sickle cell disease, disparities, care redesign

Angie Bustos

University of Portland

What are the Obstacles in Allowing Children to Explore Their Innate Resiliency?

Mentor:
Mindy Benson, MS PNP, Karen Daley, MA

Funded by: National Institutes of Health

I am a rising junior at the University of Portland pursuing a degree in Biology with a minor in Neuroscience. Since I was in kindergarten, I've wanted to pursue a career in medicine. Despite the looks of confusion and reminders from various people that medical school would be many years of my life I still want to go medical school. CHORI has been an amazing experience where I have been able to validate my reasons for pursuing medical school. This environment has made me realize I **can** turn an interest into a career. Furthermore, CHORI has allowed me to see that the barriers I and our communities face are no match for our resiliency.

This summer while at the UCSF Benioff Children's Hospital primary care clinic, I assisted with the recruitment process with the Pediatric ACEs Screening and Resiliency Study. Having grown up in a low-income neighborhood, the goal of this study hit close to home. My experience with this study allowed me to learn and experience things I only thought possible in my dreams. I would like to thank the resource team at the primary care clinic and CHORI for such an unforgettable opportunity.

Contributing Authors

Dayna Long, MD, FAAP

Introduction

With 34.8 million children in the US being affected by adverse childhood experiences (ACEs), the majority of the next generation is impacted (ACES and Toxic Stress). Not only do ACEs lead to a higher risk of serious health conditions but they also lead to a higher risk for negative health behaviors (Center for Youth Wellness, 2014). Children who have 4 or more ACEs are 2.42 times more likely to have chronic obstructive pulmonary disease, 2.4 times more likely to have a stroke, 1.9 times more likely to have cancer, and 10.3 times more likely to use injection drugs.

The Resiliency Clinic is a dyadic caregiver and child group based model, which serves as a form of intervention to mitigate the effects of ACEs. This clinic is an innovative group visit with a focus on mindfulness intervention and emotional and somatic health. The Resiliency Clinic was made with the intent to captivate as many families as possible from different backgrounds, yet there are inconsistent attendance rates.

Objective

To determine if there is a correlation between a higher ACE score and a lower attendance rate

Methods

A survey regarding the barriers which could affect attendance rates and the effectiveness of the Resiliency Clinic was given to caregivers. The survey was distributed at either the third or fourth study visits. If a family had already completed the study they were given the survey over the phone.

Anticipated Results

We hope the survey will reveal the effectiveness of the Resiliency Clinic and expose any barriers that prevent patients from attending sessions. Furthermore, we hope to see if there is a correlation between the number of barriers a patient has to his or her ACE score.

Conclusions

We hope the results of this study helps improve the resiliency clinic and can eventually influence how future intervention programs are structured.

Acknowledgements

I would like to thank my mentors, Karen Daley and Mindy Benson, Dr. Long, Roberto Mok, Cherri Harris, Nitasha Sharma, Nai Pharn and all of the UCSF Benioff Primary Care Clinic staff.

Keywords

Adverse Childhood Experiences (ACEs), Resiliency, Interventions

Citations

"ACES and Toxic Stress." *Center for Youth Wellness*, Center for Youth Wellness.

Center for Youth Wellness. "A Hidden Crisis, Findings on Adverse Childhood Experiences in California." Center for Youth Wellness, Nov. 2014.

Catherine Campusano

Saint Joseph Notre Dame High School

Analysis of Gene Expression Profiles in Erythroid Cells to Identify Drivers of Erythroid Differentiation

Mentor:
Dario Boffelli, PhD

Funded by: California Institute for Regenerative Medicine

My name is Catherine Campusano and I am rising senior at St. Joesph Notre Dame High School in Alameda. Since I can remember, science has been the focal point of my imagination. In the revolving door of careers that captivated my mind as a child, an undercurrent of scientific study always remained. As the years progressed, that fascination only grew, yet I continued to have no real understanding of what a career in the sciences actually entailed. Before the Summer Students Research Program, research was an extremely intimidating and seemingly impossible task that I felt completely unequipped to even attempt. While engaging in research for the first time brought with it many challenges, it also helped to demystify the field. The SSRP program this summer has illuminated the field of research in a way that is only possible through direct participation. It has cemented my commitment to embarking on a scientific undergraduate education as I enter my final year of high school and prepare for college. I offer my deepest gratitude to the SSRP organizers, Fiona Hennig, and my mentor Dr. Dario Boffelli, for giving me the opportunity to engage in research this summer at CHORI.

Contributing Authors

Fiona Hennig

Introduction

The advent of CRISPR genetic editing has opened an array of doors for treatments to cure chronic illnesses. Monogenic disorders in erythrocytes are an attractive target for CRISPR editing because hematopoietic stem cells can be easily obtained from patients, manipulated in culture, and transplanted back without risk of rejection. Many human blood disorders are caused by hematopoietic defects, but a detailed understanding of hematopoiesis remains rudimentary due to the transient nature of the differentiation pathway. With the recent development of single cell trajectory analysis, it is now possible to study hematopoiesis without having to isolate cells at distinct stages of the differentiation pathway; these stages can be reconstructed computationally.

Objective

Use available single cell gene expression data to study erythrocyte differentiation, with particular focus on lineage commitment to erythroid cells from hematopoietic stem cells and the process of enucleation.

Methods

This project will specifically utilize the data from three previous experiments conducted by other research teams, stored online and accessible to anyone. Data analysis is carried out using existing statistical software in R Studio. In order to adjust for experimental differences in the datasets, batch corrections are conducted using the "MNNcorrect" package. The package Monocle analyzes gene expression matrices, using cell expression profiles to assign a pseudotime to each cell and order cells along a computational differentiation pathway. Previously characterized genes— such as Gypa— that identify cells at specific stages of the erythroid differentiation pathway are used to orient and verify pseudotime assignments. Monocle then identifies significant gene expression changes as a function of pseudotime. Next these genes are ordered then clustered based on their peak expression in the pseudotime order. The clusters will then be analyzed for enriched GO terms using GOrilla to get a better understanding of the underlying biological processes during differentiation.

Anticipated Outcomes

Analysis of biological processes will identify genes driving the process of enucleation in erythrocytes.

Conclusion

A better understanding of erythroid differentiation could reveal possible new gene targets for CRISPR editing. If the correct genes for specific hematopoietic blood lineages can be identified, greater accuracy can be assured in engineering of hematopoietic stem cells.

Acknowledgements

Boffelli Lab, California Institute for Regenerative Medicine, CHORI Summer Research team, Gallagher and Socolovsky Lab

Keywords

Hematopoetic stem cells, CRISPR, single cell trajectory, MNNcorrect, pseudotime, enucleation

Netzali Can

Arroyo High School

Finding correlation between HbA1c levels and blood pH in type 1 diabetes patients experiencing diabetic ketoacidosis (DKA) across diverse ancestries.

Mentor:
Janelle Noble, PhD, Nancy Keller, PhD

Funded by: Doris Duke Charitable Foundation

My name is Netzali Can. I will be entering my senior year at Arroyo High School in San Lorenzo, CA. I joined the CHORI student summer program because research is an area I have not explored before and I wanted to learn about the work that happens in scientific labs and make connections with researchers whom I can learn good techniques from while being exposed to projects that strike my interest. In the future, I plan on applying my knowledge from the SSRP to a career in research or health, focusing on issues that affect my own culture and community. My aspirations have been heavily influenced through watching my parents constantly work hard to do better for themselves, their families, their students, and the public.

I would like to thank my amazing mentors, Dr. Janelle Noble and Dr. Nancy Keller, for helping me grow as a potential researcher and person, as well as the other members of the Noble lab who enhanced my experience by showing me kindness and patience when I was just starting out.

Introduction

We hypothesize pH and HbA1c will differ between DKA and non-DKA patients with type 1 diabetes (T1D) and these values will differ among ancestries.

Objective

Study Hispanic, European, and African ancestry pH and HbA1c in the context of DKA and find differences by comparison.

Methods

Data were collected at presentation from medical records of patients diagnosed between 2007-2017 at UCSF Benioff Children's Hospital Oakland. Inclusion criteria included either Hispanic (n= 60), European (n=59), or African (n =55) ancestry, between 2-18 years old, and DKA status. The median blood pH of Hispanic patients in DKA was compared to the median blood pH of Hispanics not in DKA. The median HbA1c of Hispanics in DKA was compared to the median HbA1c of Hispanics not in DKA. The median blood pH and HbA1c of Hispanic patients were found. Significance of any differences between means or medians of blood pH and HbA1c were determined using parametric or nonparametric tests defined by $p<0.05$.

Results

Preliminary assays in Hispanic patients:

- median pH= 7.34 and median HbA1c= 11.2;
- median HbA1c in patients in DKA= 11.3 and median pH in patients in DKA 7.22;
- median blood pH in patients not in DKA= 7.38 and median HbA1c in patients not in DKA= 10.8.
- 38% of Hispanic patients in DKA, 42% of European patients in DKA, and 56% of African patients in DKA.
- Median HbA1c in patients in DKA was higher than those not in DKA but not statistically higher ($p=0.16$).

European and African data are being assayed. We anticipate patients in DKA will have significantly lower pH, and variations among ancestry groups will be found.

Discussion

In other T1D studies, different values have been found when comparing patients of different ancestries, including that non-Caucasian children experience more severe DKA and higher HbA1c. Knowing these differences should allow enhancement in treatment and disease management for minority patients.

Acknowledgements

Janelle Noble, Nancy Keller, Gregory Martin

Keywords

DKA, T1D, HbA1c, pH

Marisol Contreras

University of California, Davis

Translating the CHORI Summer Student Research Program to the Public

Mentor:
Ellen Fung, PhD RD

Funded by: National Institutes of Health

I am a first-generation college student and senior entering my second year of college (possible through dual enrollment) at UC Davis majoring in Biochemistry. Throughout my education and growing up in Richmond CA, I am able to see firsthand how hard it is to reach for higher education because of adverse challenges.

I aspire to one day break the poverty cycle in my community and have equity of healthcare and education. Though these missions are too massive for one person to solve, one can only work towards it to create a positive impact. Other goals of mine are to one day start a scholarship fund, mentor in a non-profit, and being the first in my family to attend graduate school. What sparked my interest in Science, Technology, Engineering, and Mathematics (STEM) was how curious I am to understand what exactly goes on in our bodies and how to help cure sickness with medicine created.

Having the opportunity to show to the public the talent our community has by acknowledging the student's work gives others in the community inspiration to reach for STEM education. I am thankful to work with CHORI to be able to create a positive impact that will motivate students to apply, know they belong in STEM, and feel capable of receiving a STEM education.

Introduction

The CHORI Summer Student Research Program has been training underrepresented students in the sciences for the last 4 decades. However, the ability to communicate its objective to potential interns and future funders has been inadequate. Many students experience an unsupportive educational system where STEM is not promoted. The CHORI program offers unique research opportunities for these students allowing them hands on experiences with STEM, in clinical and laboratory settings. Therefore, the creation of marketing materials that are both inclusive to the community through representation and exemplify the uniqueness of the CHORI program is important in promoting this reality to students who would not have come across it as easily otherwise. Providing the students a voice to express their experience in the program assures donors that the program they help fund is making a positive impact on the lives of these students. Therefore, marketing materials were designed with the goal of stimulating an interest in the STEM field for future students.

Objective

To provide the students voice through compelling print and video materials that translate the objectives of the program to future interns and funders.

Methods

Over the course of 9 weeks, reviewed previously developed marketing materials and identified insufficiencies. Conducted extensive interviews with students in the program. Utilized Adobe Premiere and Pages to draft inclusive marketing materials with feedback from the SSRP leadership team that exemplified objectives of the program.

Anticipated Results

At the end of the program anticipate to have developed 3 major marketing tools: 1) A slide deck for use by the director at informational events, 2) An informational tri-fold pamphlet for tabling events, 3) and 'The Face of Science' informational video highlighting student stories with interviews. Anticipate these tools will help motivate students in our community to feel as though they belong in STEM and to apply to the program.

Conclusion

The creation of compelling, professional video, and print marketing materials, will promote CHORI's mission of changing the face of STEM to reflect the talent that exists in our community. Marketing the program as the face of science is vital in ensuring the growth mindset of our community to reach their full potential.

Acknowledgements

Thank you to my family, community, Metas, and Students Rising Above for motivating me to reach for higher education, and to not settle for less than my full potential.

Keywords

Diversity, Marginalized Communities, STEM, FirstGen, Motivation

Alexandra Crawford

University of California, Berkeley

Testing the Effects of Statins on Mitochondrial Function in Induced Pluripotent Stem Cells and Myoblast Cells

Mentor:
Ronald Krauss, MD, Sarah King, PhD

Funded by: Volunteer

My name is Ally Crawford. I am a rising junior at University of California, Berkeley, majoring in Integrative Biology with an emphasis in Human Biology & Health Sciences. I plan to pursue a career in the sciences by pursuing a Ph.D. or an M.D.

I am deeply grateful for the opportunity to conduct research at Children's Hospital Oakland Research Institute. I am passionate about the indispensable role of research to alleviate human suffering. Research is the root of our discoveries, our cures, and our progress in health and wellness vital for our happiness as individuals and societies. My experience in this program, surrounded by intelligent and inspirational scientists, doctors, and peers has solidified my passion for scientific research. I am extremely grateful to my mentors, Dr. Krauss and Dr. King, for providing this opportunity as well as to the entire Krauss laboratory for their constant support, inspiration, and guidance.

Introduction

Statins are a widely used lipid-lowering medication. However, statin use risks side effects such as incident type 2 diabetes as well as myopathy, a neuromuscular disease where muscle fibers do not function properly, resulting in muscular weakness. The reason for statin-induced myopathy and type 2 diabetes is unknown.
Muscle cells contain very high mitochondrial content, leading investigators to suspect that statins might have a direct effect on mitochondrial function in patients who develop statin-induced myopathy. Mitochondrial dysfunction has also been implicated in the pathogenesis of Type 2 Diabetes.

Mitochondrial oxygen consumption is a fundamental measurement of mitochondrial function. We will be measuring the oxygen consumption rate (OCR) in induced pluripotent stem cells (iPSCs) and myoblasts. The iPSCs have been generated from the peripheral blood mononuclear cells (PBMCs) from statin-users who participated in Pharmacogenomics of Statins Therapy study. We will also investigate the effects of statins on myoblasts, which are myogenic cells that are more differentiated than iPSCs and may have more similarity to mature skeletal muscle cells. Understanding the direct effects of statins on mitochondrial function could help us understand why some individuals develop adverse side effects from statin use.

Objectives

To investigate the effects of statins on mitochondrial function in iPSCs and myoblasts.
To determine indicators for the development of statin-induced myopathy and type 2 diabetes.

Methods

The iPSCs and myoblasts are treated for 24h with atorvastatin, simvastatin, or vehicle (control). The Agilent Seahorse XF analyzer with the Mito Stress Test Kit sequentially injects compounds that target crucial components of the electron transport chain, while simultaneously recording the oxygen consumption rate of the cells, giving us key parameters of mitochondrial function.

Results and Anticipated Results

The iPSCs have shown very limited mitochondrial function. The OCR graphs for iPSCs have shown a flat curve and appear to have high levels of non-mitochondrial respiration. This indicates that the iPSCs must utilize other cellular organelles to maintain a healthy cellular metabolism and agrees with reports in literature that iPSCs have immature mitochondria. Our findings suggest that iPSCs are not an ideal model for investigating mitochondrial function.

We are currently testing the effects of statins on myoblasts. The preliminary data indicates that myoblast have more mitochondrial function than the iPSCs. Therefore, we can expect to be able to make conclusions about the effects of statins on the mitochondrial function of myoblasts.

Acknowledgments

I would like to thank my mentors, Dr. Krauss and Dr. King, as well as to the entire Krauss laboratory.

Keywords

Mitochondria, Statin, iPSC, Myoblasts

Saher Dareida

University of California, Berkeley

A Pilot Study of the Association between Chronic Transfusion Therapy and Renal Function in Adult Sickle Cell Disease Patients

Mentor:
Ward Hagar, MD

Funded by: National Institutes of Health

My name is Saher Daredia and I'm a rising junior at UC Berkeley, majoring in Molecular Cell Biology and Public Health and minoring in Global Poverty and Practice. My passion for science began as a childhood fascination with observing backyard specimens under a toy microscope. During high school and now in college, I have engaged with lab-based research through studies ranging from Drosophila speciation to arsenic exposure in Chile. Looking to further expand my comfort zone and dive into a new challenge, I excitedly accepted the invitation to participate in CHORI's Summer Student Research Program (SSRP). This summer, I had the privilege of learning from my amazing mentors, Dr. Ward Hagar and Christy Hoehner-Cooper at the UCSF Benioff Children's Hospital in Oakland. Under their guidance, I not only designed my first clinical research study, but I also honed my communication and critical thinking skills to independently present my findings. CHORI's SSRP has improved my understanding of the holistic nature of healthcare and helped me to further develop the confidence and tenacity needed be successful in the larger scientific community. With these skills, I ultimately hope to pursue a career that combines research and advocacy to promote the health of marginalized communities.

Contributing Authors

Christine Hoehner, NP, Lynne Neumayr, MD

Introduction

Sickle cell disease causes deoxygenated red blood cells to become sickle-shaped, activating inflammatory and cytokine cascades which leads to cell adhesion in the vascular endothelium and overall obstruction of blood flow to organs. While survival rates for pediatric sickle cell patients have improved, adult survival rates have been stagnant. Transfusions are well-established for treating disease complications. Long term effects of transfusion, including iron loading of kidneys, are unknown.

Objectives

- To determine if chronic transfusion therapy is associated with renal decline in adult sickle cell patients
- To define the natural history of renal decline in hyper-transfused sickle cell patients
- To assess the covariates of patient characteristics and biomarkers of disease severity (including hemolysis) in predicting renal function

Methods

Transfusion history, clinical and laboratory data including albumin to creatinine ratio, serum creatinine, vitamin D (25 OH), lactate dehydrogenase, and erythropoietin levels were retrieved from the Department of Hematology/Oncology database for all adult sickle cell patients (≥18 years) chronically transfused at UCSF Benioff Children's Hospital Oakland from 2014-2018. Standard parametric and nonparametric models were generated to identify predictor variables that associate with and predict renal decline.

Anticipated Results

Lifetime transfusion burden and transfusion exposure during this time period will be associated with renal decline. The rate of decline measured by increasing urinary albumin to creatinine ratios will be related to covariates including gender, age, blood pressure, lactate dehydrogenase, vitamin D, ferritin, and erythropoietin levels.

Discussion/Conclusions

This study will help define the natural history of renal decline in hyper-transfused adults with sickle cell disease. Understanding these clinical markers can assist in evaluating renal function in chronically transfused adult sickle cell patients. Using this information, prospective studies can be designed to evaluate alternative therapies in order to preserve renal health and to improve overall adult quality of life.

Acknowledgements

Ward Hagar, MD, Christine Hoehner, NP, Lynne Neumayr, MD, National Institutes of Health (NIH)

Keywords

Sickle cell disease, Chronic transfusion therapy, Sickle cell nephropathy, Siderosis

Brittney Deadwiler

Harvard University

What Does it Take to Ask Hard Questions About Health?

Mentor:
Dayna Long, MD, Artanesha Jackson, MSW

Funded by: National Institutes of Health

My name is Brittney Deadwiler and I am a rising senior at Harvard University, studying Neurobiology with a secondary concentration in African American Studies. Last summer, I had the opportunity to be a part of the 2017 CHORI Summer Research Program and, under the mentorship of Dr. Christine McDonald, I looked into the risk factors of stunting amongst Malian children with moderate acute malnutrition. This experience sparked my interest in clinical research and data analysis. I am pleased to have been able to participate in the CHORI program for a second year, utilizing the skills I acquired in my previous summer experience and learning so much more as I conducted clinical research in a healthcare setting.

I would like to thank my mentors Dr. Dayna Long and Artanesha Jackson as well as the Family Information and Navigation Desk (FIND) staff and the staff of the UCSF Benioff Children's Hospital Oakland primary care clinic for providing me with this engaging and enlightening summer experience.

Introduction

In recent years, the Family Information and Navigation Desk (FIND) and its corresponding FINDconnect online platform were implemented at Children's Hospital Oakland to "assist healthcare staff in systematically identifying and addressing 'social determinants of health'". Individuals that enroll patients onto FINDconnect conduct screenings for socioeconomic needs, mental health (of patients and caregivers), developmental health, and resiliency. After conducting these screenings, families are provided with resources to address their needs.

Objectives

1. Identify predictors of comfort in communication with patients regarding their socioeconomic and mental health needs.
2. Establish more concrete ideas on how to improve comfort and confidence in providing socioeconomic needs and mental health screenings.

Methods

A survey was created for this project which includes questions regarding demographics, Adverse Childhood Experiences (ACEs), personal beliefs of the impact mental health and socioeconomic needs have on patients' physical health, and a self-analysis of personality. In order to determine which predictors significantly impact levels of comfort in providing screenings, independent sample t-tests and one-way ANOVA tests were conducted to compare the means of comfort levels between groups for each predictor. The second part of the study is a qualitative analysis of interviews with a randomly selected group of survey participants.

Results

After preliminary data analysis of the surveys given to CHORI summer students, it was found that there was a significant difference in the means of comfort levels in groups divided by training in providing screenings, self-perceived confidence, an individual's ACEs score, personal beliefs, and comfort sharing personal hardships at a p-value < 0.10.

Discussion/Conclusions

The findings of this project are significant as they can be implemented to improve the quality of mental health screenings and socioeconomic needs screenings in primary care clinics. Mental health and socioeconomic needs significantly impact patients' physical health and thus, it is imperative that individuals that regularly provide care for these patients feel comfortable and confident in their ability to screen for and address these needs.

Keywords

Social determinants of health, Mental health, Family Information and Navigation Desk (FIND)

Chima Ezeh

Foothill High School

Nose in a Dish: Characterization of Conditionally-Reprogrammed Cells to Study the Colonization of *Neisseria meningitidis*

Mentor:
Gregory Moe, PhD, Vianca Vianzon

Funded by: California Institute for Regenerative Medicine

Hi, my name is Chima Ezeh. I live in Pleasanton, CA, and I am a rising senior at Foothill High School. I developed a passion for science and medicine after taking classes like Principles of Biomedical Sciences and Human Body Systems, which introduced me to the host of diseases that affect millions of people worldwide and the medical innovation underway to combat such illnesses. Soon, school became more than just another perfunctory task of my day and its impact much more profound than merely a grade percentage in a class; reading about genuinely intriguing topics to me like oncogenesis and Alzheimer's Disease not only prepared me for subsequent tests in my science classes but also served as a stepping stone of my journey into finding a cure for both ailments.

CHORI's summer student research program helped advance this goal, broadening my scientific insight by applying it to a research-based setting and fostering my growth as both a student and researcher under the guidance of its renowned faculty and my mentors Dr. Greg Moe and Vianca Vianzon

Introduction

Neisseria meningitidis (Nm) colonizes the human nasopharynx and may cause bacteremia and meningitis, resulting in death or severe complications. We have used a human bronchial epithelial (HBE) cell culture model to study the effects of antibodies on Nm colonization and invasion, but the HBE model lacks cilia, mucus secretion, and diversity of cell types typical of human nasopharynx tissue. Using conditional reprogramming, primary nasal epithelial (pNE) cells will be induced to take on characteristics of adult stem cells, cultured to produce large quantities of cells, and then induced to differentiate back to pNE cells as a model system for investigating Nm colonization and the effects of vaccine-elicited antibodies on colonization.

Objective

To characterize primary nasal epithelial (pNE) cell cultures and Nm colonization of pNE cells using fluorescence microscopy.

Methods

1. pNE cells were cultured over a 6-week period in co-culture with irradiated 3T3-J2 mouse fibroblasts
2. The pNE cells were differentiated at an air-liquid interface
3. NmB and NmC strains will be added to pNE cells with and without vaccine-elicited antibodies and control serum followed by fixing and staining
4. Micrographs were recorded using a Zeiss LSM-710 laser scanning confocal microscope

Anticipated Results

We expect the pNE cells to form a stable monolayer with intact cell-cell junctions and produce cilia, lysozyme, and mucus that provide a harsh but more representative environment of Nm colonization.

Conclusions

With a cell culture model that more closely resembles the human nasopharynx, we can study the colonization of Nm under conditions similar to those occurring naturally. In addition to testing the effects of immune cells and vaccine-elicited antibodies on colonization, cells from vaccinated and unvaccinated subjects will be tested to determine whether their immune statuses are reproducible in cell culture.

Acknowledgements

Thank you to my mentors, Dr. Greg Moe and Vianca Vianzon, and the SSRP staff for this unique opportunity for science education. Also, thank you to CIRM for funding this research project.

Keywords

Neisseria meningitidis, colonization, conditionally-reprogrammed cells

Oliver Fajardo

University of California, Berkeley

Asthma Intervention: Effectiveness of Asthma Education for Reducing Incidents of Hospitalizations and Emergency Department Visits

Mentor:
Mindy Benson, MS PNP, Karen Daley, MA

Funded by: National Institutes of Health

Hello everyone, my name is Oliver Fajardo, and I graduated UC Berkeley in Sociology last month. A career in healthcare did not cross my mind until two years ago. My year-long engineering internship in the Silicon Valley left me questioning my goals. There was something big missing for me in the field of technology, and I needed to find out "why?"

Upon further exploration in college, I began to take an interest in my science and health classes and became a certified nurse assistant to gain exposure to the healthcare field. From my interests in technology, to the clinical exposure at Highland Hospital's Emergency Department, I realized that the human component was the crucial aspect missing in the career I desired. I am happy to be in CHORI this year. Despite being a non-stem major, CHORI offered the opportunity to further explore my interest in science and healthcare.

The exposure to the research process in the primary care setting is helping me understand what it takes to be able to translate research into clinical practice. I am grateful for this opportunity that will impact the way providers screen for risk factors in health!

Introduction

As of the year 2016, the American Academy of Allergy, Asthma, and Immunology determined that 8.3 % of children in the United States have Asthma. For Oakland residents, the California Health Interview Survey determined that the rate is more than double at 18.6%. The relevancy of this chronic lung disease in children poses a challenge on how to address the health needs of the community. According to asthma control recommendations made by the Mayo Clinic, it requires a multi-step approach which the UCSF Benioff Children's Hospital Oakland Claremont Clinic provides through its asthma clinic education program. These first steps include tracking symptoms through a diary log to recognize patterns of asthma occurrence and triggers. The second step requires measuring how well the lungs work through spirometry tests, which measure air capacity in the lungs through inhalation and exhalation. Lastly, adjusting treatment plans to a child's current needs requires a long term relationship with a medical provider.

Hypothesis/Objective

Do the Federally Qualified Health Center's (FQHC) Asthma Team clinic appointments with patients who landed in the emergency department (ED) from an acute occurrence of Asthma lower the incidences of ED hospitalizations?

Methods

To determine acute occurrences of asthma and ED hospitalizations, a weekly report of all patients admitted to the ED is conducted. From this list, we searched for patients in the EPIC electronical health record system (EHR) database that were admitted for hospitalization due to asthma/respiratory distress. Once identified, the asthma team reaches out to patients within two to three weeks of their asthma related hospitalization to provide asthma service and education with the goal to reduce and prevent future emergency visits.

Anticipated Results

I anticipate that children of families who have not followed up with the FQHC Asthma Team will have higher occurrences of ED hospitalizations due to lack of asthma control education.

Discussion/Conclusions

Analysis of EPIC EHR data and following-up with hospitalized patients for asthma related incidents presents clinicians and providers at the Oakland Claremont Clinic the opportunity to better address the health needs of asthma patients to prevent a future asthma related hospitalizations.

Acknowledgements

Robert Mok, LVN, Karen Daley, MA LMFT, Cherri Harris, LVN, Mindy Benson, PNP, Nitasha Sharma, Nai Pharn

Keywords

Asthma, Exacerbation, Respiratory Distress, Intervention, Education, Asthma Control, Wheezing, Coughing

Marina Franco

California State University East Bay

Food as Medicine: Reviewing Parent Role-Modeling Behaviors

Mentor:
June Tester, MD, MPH

Funded by: National Institutes of Health

My name is Marina Franco. I am a first-generation college student and a senior at Cal State East Bay majoring in health sciences. My ultimate career goal is to become a nurse practitioner.

From paperwork to bedside, my passion for patient care has reached into multiple areas of healthcare through volunteer experiences. The impact and importance of scientific research was recently introduced to me last year, my first epidemiology course.

Living in a low-income neighborhood my entire life, I've always been interested in how I could help my community live a healthier and safer lifestyle.

Working with Dr. June Tester gave me the opportunity to explore that interest. Our team worked on ways to educate food insecure families and potentially change their dietary behaviors with education, guidance and support. With the help of CHORI, I am prepared and inspired to continue down this path and continue my involvement in scientific research.

Introduction

Food security is a social determinant of health that can impact chronic disease risk because of poor nutrition. Consumption of refined grains instead of whole grains is particularly known to worsen Diabetes risk. Parental role-modeling is known to have a direct impact on children's diet behaviors.

Hypothesis

Introducing whole grain and vegetables to food insecure families with home deliveries will improve parental role-modeling for eating whole grains.

Methods

In 2017, 60 families were identified at UCSF Benioff Children's Hospital Oakland clinic by referral to specialty care for pre-diabetes. Families received a weekly delivery with vegetables and whole grains. Parent-child dyads participating in the study completed pre and post surveys before and after the intervention period. Survey tools assessed parental role-modeling in eating whole grains. There were 5 ordinal response categories (e.g never, rarely, sometimes, most times and always). The Wilcoxon signed ranks test was used to test for significance in the median difference between pre- and post- results.

Results

Wilcoxon test showed a significant increase in distribution of answers for each of the 5 role modeling questions. For example, the median for "eating whole grain pasta, brown rice and whole grain bagels" shifted from "rarely" to "sometimes". The baseline consumption for "eating whole grain cereals and bread" was high and remained unchanged, though there was a significant shift in the overall distribution from pre- and post-intervention responses.

Discussion/Conclusion

Findings from the 2017 study inform the study I have been involved with this Summer. The current study does not identify patients by a health factor such as pre-Diabetes, but rather on food insecurity. The demographics represented in safety-net clinics such as La Clinica de La Raza, represent vulnerable populations. Continuing similar studies will allow researchers to scale up and reach cities around the Bay Area that are not usually targeted such as Hayward and Richmond.

Acknowledgements

Thank you to Children's Hospital Oakland Research Institute, UCSF, and the NIH for making this possible.

Keywords

Food Insecurity, diet intervention

Eric Garcia

Pomona College

Determination of Identity and Differentiation of Transplanted Human Neural Progenitor Cells into the Neonatal Mouse Brain

Mentor:
Mercedes Paredes, MD PhD

Funded by: Doris Duke Charitable Foundation

My name is Eric Garcia and I'm a rising sophomore at Pomona College majoring in Neuroscience. Science has always been of interest for me, and CHORI has granted me an incredible opportunity to explore several research areas of interest. After creating and presenting my own research project examining blood transfusion therapy for sickle cell patients with Dr. Ward Hagar in 2016, I'm very excited to return as a Doris Duke Charitable Foundation alumnus and high school student mentor this year. This summer, I worked in the UCSF neurology department under the guidance of Dr. Mercedes Paredes and Quetzal Flores. The goal of my project is to examine later inhibitory neuron development in a xenotransplant model.

I am studying human neural progenitor cells transplanted into neonatal mice brains. I will evaluate how these cells have differentiated and matured at 7 months post-transplantation. Studying the human brain directly is imperative to understanding interneuron development and can provide insight into mechanisms of normal neuronal development necessary for the creation of treatments for various neurodevelopmental diseases, such as epilepsy.

Introduction

Inhibitory neurons, also known as interneurons, play a crucial role in balancing excitation and inhibition in the brain. These cells are born in the ganglionic eminences (GE), progenitor regions of the embryonic brain cortex. The medial ganglionic eminence (MGE), a distinct subregion of the GE, is reported to make about 60% of total cortical interneurons, specifically the somatostatin (SST) and parvalbumin (PV) subtypes. This project aims to study the development of human MGE cells (hMGE) when transplanted into a neonatal mouse brain, and would allow for analysis along a longer timeline than would be allowed through cell culturing.

Objectives

Determine the identity of hMGE cells infected with GFP-expressing lentivirus, and map their distribution in the injected mouse brain at 7 months post-transplant. Determine if transplanted hMGE cells infected with GFP-lentivirus express molecular markers of interneurons or glial cells.

Methods

Immunohistochemistry analysis was performed on post-transplanted mouse brain tissue to look for expression of interneuron-subtype or glial markers in transplanted hMGE cells infected with the GFP-lentivirus. Images were collected on a Zeiss Axiovert 200M microscope for spatiotemporal mapping of transplanted hMGE cell distribution. Confocal microscopy using a Leica SP8 generated images for cell type quantifications. All analyses were performed using Neurolucida software (MBF Bioscience).

Results

The majority of GFP+ cells express hNA, a human cell marker, while not all hNA+ cells were GFP+. We have observed co-expression of GFP+ hMGE cells with interneuron markers such as gamma-aminobutyric acid (GABA) and the neuronal marker, NeuN. However, several hMGE cells also express glial markers, such as Olig2 (indicative of oligodendrocyte precursor cells). We are in the process of quantifying the proportion of transplanted hMGE cells that express inhibitory subtype makers, such as SST and PV, and additional glia cells markers.

Discussion/Conclusions

A proportion of GFP+ hMGE cells have differentiate into interneurons at 7 months post-transplant. Virally labeled hMGE cells will represent a model for studying how hMGE cell differentiation and maturation is regulated. Understanding interneuron dysfunction could have implications for creating cell-based therapies for neuropsychiatric diseases such as epilepsy, autism, and schizophrenia.

Acknowledgments

Doris Duke Charitable Foundation, Dr. Mercedes Paredes, Quetzal Flores

Keywords

Medial ganglionic eminence, interneurons, differentiation, GFP-lentivirus, immunostains

Chloe Ghent

University of California, Berkeley

A Modified Assay for Measuring the Anti-nutrient Phytate in Foods

Mentor:
David Killilea, PhD, Kathy Schultz, MS

Funded by: Volunteer

I am an incoming 4th year at UC Berkeley, majoring in molecular and cell biology with an emphasis in biochemistry. My interest in biology sparked in high school upon learning about how many life processes are connected in an intricate way. I further explored this interest in college and discovered a newfound respect for chemistry and its cohesion with biology. As my interests grew, I realized so did the fields I was interested in, through ongoing research. I learned that I could contribute to the betterment of society through research discoveries.

I began volunteering in Dr. David Killilea's nutrition lab this past school year. I was able to prepare samples for mineral analysis that would provide nutritional insight, which engaged my interest in both biology and chemistry. Having the opportunity to investigate my own project under Dr. Killilea's mentorship this summer has exposed me to the creativity of research. I am now more confident in my pursuit of a career in research thanks to the experience I have gained in Dr. Killilea's lab. I am grateful for his guidance and the opportunities provided by CHORI.

Introduction

Phytate is a family of compounds containing negatively charged phosphates that can trap positively charged metal ions, including essential minerals. In developing countries where diets are lacking in mineral-rich meat, high phytate intake can exacerbate mineral deficiencies. The most common assays for phytate use High-performance liquid chromatography (HPLC), which is complex and not widely accessible, or colorimetric kits that are tedious and not always reliable. These concerns have sparked our interest in a more accurate and easily replicable method of determining phytate concentration.

Objective

We plan to create a hybrid method of phytate determination that employs chromatography separation and direct phosphorus detection.

Methods

Column chromatography will be employed to separate free phosphorus and phytate from a sample. The sample will be loaded onto the column and free phosphorus will be eluted with a weak acid rinse while the phytate will be eluted with a strong acid rinse. The eluents from each rinse will be analyzed with inductively coupled plasma-optical emissions spectrometry (ICP-OES), to determine the phosphorus content. Thin layer chromatography (TLC) and a colorimetric kit will also be used to validate the column chromatography technique.

Results

Preliminary studies have proven successful at separating free phosphate from phytate using chemical standards and extracts from oat flour; these studies have achieved greater than 95% phyate recovery. Work is in progress to determine the range of detection and other features of the assay. Once the ability of the column to accurately isolate phytic acid and free phosphorus can be verified, it can be trusted to separate these compounds in food samples.

Discussion

A chromatographic and colorimetric phytate assay hybrid that can successfully isolate and determine phytate levels in plants would provide insight into what foods could off-set or intensify mineral deficiencies in vulnerable populations.

Acknowledgments

I would like to thank the CHORI Summer Student Research Program staff, Bonny Alvarenga, Elijah Goldberg and my mentors, Dr. David Killilea and Kathy Schultz, for their support.

Keywords

phytate, phosphorus, column chromatography, thin layer chromatography, ICP-OES

Elijah Goldberg

Carleton College

Comparing the Efficacy of Clinical Iron Chelators Desferal, L1, and Exjade in a Human Hepatocyte Cell Line

Mentor:
David Killilea, PhD

Funded by: National Institutes of Health

Hi, my name is Elijah Goldberg. I'm a rising freshman at Carleton College, having just graduated from Berkeley High School several months ago. I've had the wonderful privilege to work with Dr. Ellen Fung and Dr. David Killilea at CHORI for the past twelve months, publishing several patient brochures, coordinating and facilitating the development of several studies involving a blood disorder known as thalassemia, and even submitting a manuscript for peer review and eventual publication in an academic journal.

My passion for science and medicine stems from an innate interest in helping others live their lives free from disease and suffering. My time at CHORI has led me to the understanding that while I greatly admire and appreciate research, my interest lies in clinical medicine – I value the interpersonal connections that a physician or nurse may form with their patients, and above all, I feel the intrinsic desire to be physically involved in the care and management of patients. While I cannot control all of the factors that contribute to shaping the lives of others, health is one aspect of life that I hope to influence and improve in my future patients.

Introduction

Thalassemia (Thal) is a blood disorder that affects over 100,000 live births annually. In Thal, one of the hemoglobin genes is mutated so that overall bodily hemoglobin is lowered. To correct for this, patients with Thal are transfused to supplement their hemoglobin. As a consequence, excess iron is also transferred into the patient which can cause serious morbidity. To correct for iron overload, patients with thalassemia are given iron chelators, which remove excess metals from the body. However, researchers have recently hypothesized that chelators may be removing minerals other than iron. Few previous studies have investigated chelator efficacy and selectivity in a simple cellular model, so we used this approach to investigate the relevant clinical iron chelators.

Objective

To determine chelator efficacy and selectivity in a human cell model.

Methods

Using transformed human liver cells living in a low-glucose environment, we induce iron overload by introducing ferrous ammonium citrate to mimic the iron overload present in a patient with Thal. Subsequently, chelators are administered to the cellular environment. After 24 hours, the cells are counted, harvested, and mineral content assessed via inductively coupled plasma-optical emissions spectrometry (ICP-OES).

Anticipated Outcomes

We anticipate that a portion of cellular zinc, copper, and calcium may be removed via chelation. Furthermore, we expect that chelator combinations will prove more efficacious in iron removal than single chelator use.

Discussion

Understanding the mechanisms of mineral removal from the body is paramount to the health of patients with thalassemia. This investigation will provide one of the first steps into the exploration of those etiologies, which include renal excretion and increased mineral requirements. By gaining an idea of what additional minerals are removed by chelation, clinicians may better correct and manage nutrient-related comorbidities in Thal.

Acknowledgments

I would like to thank Dr. David Killilea for his guidance, Kathy Shultz for her laboratory help, and Dr. Ellen Fung for her continual mentorship in all of my projects.

Keywords

Chelator, Iron Overload, Minerals, Thalassemia,

Mario Gonzalez

Berkeley High School

Growth Development and Bone Health in Transfusion-Dependent Thalassemia Patients

Mentor:
Tariq Ahmad, MD

Funded by: Doris Duke Charitable Foundation

Hi my name is Mario Gonzalez, and I'm a first generation student and Mexican-American, going into my junior year at Berkeley High School. My science classes have always fascinated me because of all the applicable knowledge. Whether it was me telling my friends about the type of clouds in the day or stars present in the night, I always found joy in knowing about the mechanics of our world. However, my aunt's arthritis diagnosis sparked my interest in the medical field. As my aunt told our family about her struggles, I couldn't help but feel driven to help her.

That night I spent hours learning about symptoms and treatments for those affected by arthritis to help her. From that point on, I found an interest in the medical field because of the feeling that my actions, minor as they might have been, had an impact on her life.

I applied for the summer program at CHORI because I wanted to have an experience, which allowed me to explore my interest in a professional setting. Overall, my time at CHORI has allowed me to explore new fields of study, while working alongside great mentors to create an unforgettable summer.

Introduction

Thalassemia is an inherited blood disorder caused by a mutation in the HBB gene, where abnormal hemoglobin results in a low quantity of red blood cells. Symptoms include fatigue, weakness, low BMD, minimal growth development, jaundice and can lead to bone marrow hyperplasia if untreated. However, many developments in the identification and treatment of the disorder have drastically increased the life expectancy. The main treatment for thalassemia patients with a severe form of the disorder is repeated blood transfusions. However, the constant transfusions lead to iron overload. As a solution, iron chelation therapy is used to treat patients, but many don't adhere to the chelation regimen.

Objective

The purpose of this study is to find a correlation between IGF-1, bone density, and anthropometric measures.

Methods

The DXA z-scores and IGF-1 values for this research project can be found in the thalassemia database at the UCSF Benioff Children's Hospital Oakland. Using a program on endocrine sciences website (https://www.endocrinesciences.com/services/tools), IGF-1 values were converted to z-scores. After the data is organized chronologically, it will be entered into a software system called, Statistical Analysis System, to determine any statistical significance in the potential correlation.

Anticipated Results

After looking at 40 of the 68 patients with both IGF-1 and DXA scores available, we noticed that 70% of the patient data supported a possible correlation. However, we hope the complete data set will provide statistical significance.

Discussion

It is well described that growth hormone has a role in improving bone density in those with growth hormone deficiency. By identifying a cohort of patients with transfusion dependent thalassemia who may have GH deficiency, steps can be taken to reduce the most common morbidity found in these patients, osteopenia and fracture risk. A small analysis of 6 patients who are on GH in our patient population may shed more light on this situation.

Acknowledgements

Ashutosh Lal, MD, Ginny Gildengorin, PhD

Keywords

Bone Mineral Density (BMD), Insulin-like Growth Factor (IGF-1), Dual Energy X-Ray Absorptiometry (DXA)

Zhihao Guo

Oakland Technical High School

Transmembrane Protein 55B Regulation on LDLR

Mentor:
Yuanyuan Qin, PhD, Marisa Medina, PhD

Funded by: Doris Duke Charitable Foundation

Hello, my name is Zhihao Guo, although it's already present on the top of the page. I am a rising senior at Oakland Technical High School. Growing up in rural China, life was a struggle. For me in particular, I was sick and frail as medication is crazy expensive, universally, well except for some socialist countries. Long story short, people of my community all had low standards of living.

Now, as young man with immense potential, I feel obligated to make a difference, not just for those of my village but to raise the quality of life for all those had been denied of their fundamental human rights. I believe the way to achieve that is through innovations and breakthroughs in science and technology. Throughout the ages every major development in human history was fueled by the discoveries of its time. Only with innovations and breakthroughs could we change the status quo.

Introduction

Cardiovascular disease is the leading cause of mortality in the United States. It is most commonly attributed to high levels of low-density lipoprotein (LDL) in the blood stream, which can accumulate and form blockages. LDLR within the blood can be eliminated by binding to low-density lipoprotein receptors (LDLR).

Recently, the Medina Lab identified transmembrane protein 55B (TMEM55B) as a novel regulator of LDLR protein. TMEM55B knock-down increased LDLR protein degradation, lower protein levels and activity. When LDLDR on the cell surface binds LDL, it is drawn into the cytoplasm. Once inside the cell, the LDLR-LDL complex dissociates and the LDLR protein is either targeted to the lysosome for decay, or recycled back to the cell surface. Although the recycling process is well described, the specific mechanism of how TMEM 55B regulates LDLR protein remains unknown. Defining molecular process of LDLR regulation may provide insight toward the development of new therapeutics for cardiovascular disease.

Objective

To determine whether TMEM55B regulation of LDLR protein levels requires LDLR internalization.

Methods

HepG2 cells were transfected with siRNA against LDLRAP1 and TMEM55B, or a control. After 48 hours, qPCR was used to confirm knock-down of LDLRAP1 and TMEM55B, with values normalized to, CLPTM1 as a loading control gene. Once knockdown has been confirmed, LDLR protein levels were quantified in the cells by incubating cells with a fluorescently labeled antibody. LDLR was visualized via confocal microscopy, and the amount of protein quantified by image analysis.

Expected Results

If LDLR internalization were required for TMEM55B to regulate LDLR, I would expect that TMEM55B knockdown would have no effect on LDLR level in the absence of LDLRAP1. However, if TMEM55B knockdown does reduce LDLR levels in the LDLRAP1 siRNA treated cells, this would indicate the LDLR internalization is not required for TMEM55B to regulate LDLR, suggesting that TMEM55B may regulate LDLR before it can be shuttled to the cell surface.

Acknowledgement

Marisa Wong Medina and Yuanyuan Qin for refining my abstract.

Keywords

Low-density lipoprotein/receptor, transmembrane protein 55B, tranfect, fluorescent

Sarah Holden

University of Washington

Perceptions of Youth and Adults with Sickle Cell Disease Regarding Barriers to Opioid Treatment for Management of Vaso-Occlusive Pain Episodes

Mentor:
Marsha Treadwell, PhD

Funded by: Volunteer

My name is Sarah Holden and I am a rising senior at the University of Washington in Seattle where I am pursuing a major in Molecular Biology. I have always been drawn to science, but I found my interest in pursuing a career in medicine 5 years ago when my older brother was sent to a rehabilitation facility for those struggling with addiction. Through his journey to sobriety I learned about the neurobiology behind addiction and became fascinated with the brain. When he passed away this spring, I knew I wanted to do everything I could to help other addicts find the help needed to lead fulfilling lives and pursue their goals.

I am very grateful to Dr. Marsha Treadwell and Dr. Ellen Fung for allowing me the opportunity to perform qualitative research to understand the barriers patients with Sickle Cell Disease face when seeking opioids. CHORI has allowed me to foster my creativity and dedicate this summer to my brother while solidifying my dreams of becoming a physician. Participating in research at UCSF Benioff Children's Hospital has been both rewarding and challenging, and working on a project that allows me to implement my interest in addiction has been unparalleled.

Introduction

Sickle Cell Disease (SCD) is a genetic disorder primarily affecting African Americans in the U.S. Its hallmark manifestation is pain, which is often undertreated. Patient perspectives are important to consider when developing interventions to address health disparities confronting this population.

Objective

To gather perspectives of youth and adults with SCD regarding barriers to adequate care, including access to opioid medication for management of vaso-occlusive pain episodes (VOE).

Methods

Individuals with SCD ages 15-48 years from 5 Bay Area counties were interviewed beginning in July 2017. Study instruments were modified from qualitative tools used in a large U.S. implementation research consortium that is assessing barriers to care for patients with SCD. Interview topics included

- patient access to knowledgeable care
- experiences in the emergency department (ED),
- experiences with pain management.

Interviews were analyzed using qualitative strategies.

Results

Participants (n = 55) were average age 31.3 years (SD=8.6), 55% female, 87% African American race and 67% had Medi-Cal insurance. 76% were diagnosed with SCD-SS and 67% reported at least one ED visit for pain in the previous 6 months. 88% also reported at least one episode of severe pain at home in the past 6 months for which they did not seek health care. Thematic analyses showed that all participants perceived stigma associated with seeking care in the ED when in pain. They reported a lack of provider knowledge and compassionate care and some described how the stress of their negative experiences worsened their pain.

Discussion

Our findings highlight just how pervasive and impactful the experience of stigma is on health and healthcare for individuals with SCD. Increasing providers' awareness that their behaviors influence clinical interactions and patients' treatment-seeking must be part of any comprehensive program designed to address disparities and improve SCD care.

Acknowledgements

My mentor, Marsha Treadwell, for guiding and supporting me through the process of clinical research.

Keywords

Sickle Cell Disease, Patient Perspectives, Opioid Treatment, Vaso-Occlusive Pain Episodes, Stigma

Malekah Isa

Contra Costa Community College

Cell Type Specific Effects of Statin-Induced Changes in Gene Expression

Mentor:
Marisa Lin Wong Medina, Ph.D, Antonio Munoz

Funded by: National Science Foundation

My name is Malekah Isa and I am an undergraduate at Contra Costa Community College. From a very young age I knew science was my thing since everything I learned during my science lectures kept me burning with curiosity. Taking multiple courses of biology and chemistry at a simple campus with amazing professors, I have gained tremendous knowledge that I will always be thankful for. I am currently majoring in microbial biology and planning to become a Clinical Laboratory Scientist. I loved being in the lab at college but I was yearning for actual hands on experience in research and CHORI is exactly what I needed.

Conducting research with mentors here at CHORI has opened my eyes to a new level of biology which I was unaware of. I am constantly learning everyday while practicing cell culture techniques and maintaining a clean and safe laboratory environment. The experience I am gaining is more than I expected; I am constantly taking in new information and challenged everyday to think deeper while being encouraged to do better and learn more everyday. This is the push I needed to continue my future as a potential scientist. What I am learning here at CHORI is a blessing and I am thankful for this great experience that has shown me how amazing research is.

Introduction

Statins are the most widely prescribed drug for individuals with high cholesterol, a major risk factor for cardiovascular disease. Statins inhibit cholesterol synthesis and reduce intracellular cholesterol levels, which activates a transcriptional response that increases expression of genes involved in cholesterol uptake, ultimately decreasing blood cholesterol levels. Part of this transcriptional response includes a well-documented increase in *HMGCR*, as well as a decrease in *MYLIP* transcript levels, two genes involved in cholesterol metabolism. Although statins are efficacious for reducing cardiovascular disease, they also produce several adverse effects, most notably myopathy and increased risk of type 2 diabetes. The mechanism(s) that leads to statin adverse effects have not been defined. To understand if there are cell-type specific differences in statin effects on gene expression, the Medina lab has created a repository of induced pluripotent stem cells (iPSCs) from individuals who have been prescribed statins and have developed either new-onset diabetes or statin-induced myopathy. With collaborators, these cells have been differentiated into hepatocyte-like cells (iHeps) and myocyte-like cells (iMyos).

Objective

Identify the minimal concentration of simvastatin required to induce a robust and reproducible increase in *HMGCR* and decrease in *MYLIP* in iPSCs, iHeps and iMyos without inducing cell death, and compare this response to human hepatoma cell lines.

Methods

iPSCs, iHeps, iMyos, HepG2s, and Huh7s were grown under standard culture conditions, and incubated with a range of simvastatin concentrations. RNA was extracted from the cells and transcript levels of *HMGCR*, *MYLIP* and *CLPTM* (normalization gene) were measured. Finally, we compared the statin dose response curves.

Anticipated Outcomes

I expect that the induced pluripotent stem cells (iPSCs) differentiated into hepatocyte-like cells (iHeps) or myocyte-like cells (iMyos) will require different concentrations of statin to elicit a transcriptional response compared to either the undifferentiated iPSC. Since muscle cells do not typically express the same array of transporters as liver cells, I anticipate that the iMyos will require a higher dosage of statin compared to iPSCs, iHeps, and the human hepatoma cell lines.

Acknowledgements

National Science Foundation, Marisa Lin Wong Medina, PhD, Antonio Munoz

Keywords

Statins, Cholesterol synthesis, Induced Pluripotent Stem Cells

Katie Jocelyn

University of California, Berkeley

Tumor Stiffness Promotes the Metabolic Reprogramming that Induces Malignancies Through ATF5

Mentor:
Kevin Tharp, PhD

Funded by: National Institutes of Health

My name is Katie Jocelyn and I'm a rising senior at the University of California, Berkeley studying Molecular and Cell Biology – Neurobiology. I was raised by a single mother which inspires me to pursue my dreams.

I love learning about science but I didn't feel sure about biology as a major and career until my sophomore year of college. I took classes on laboratory techniques and was involved with a stem cell research club which sparked my interest in the biomedical sciences as a researcher. I knew that I should study Neurobiology when I took an introductory course and enjoyed doing work outside of what was required.

The CHORI program partnered me up with Dr. Kevin Tharp who, with his extensive knowledge about the world of biology in research and higher education, has aided me in deciding to further my studies in the field of research. The program and Dr. Tharp have done an incredible job of helping me develop the skills necessary to be a successful scientist. My goal is to help improve the quality of life for many and I believe I am one step closer through experiences like the CHORI Summer Student Research Program.

Introduction

Tumors are stiffer than the surrounding healthy tissue primarily due to the reorganization of the extracellular matrix (ECM). Mechanical stress has been found to promote tumor progression and aggressiveness but it is not entirely clear how these mechanical stresses of the tumor microenvironment alter tumor aggressiveness. Tumor aggressiveness has been linked to the transcription factor ATF5, a transcription factor associated with mitochondrial stress responses. ATF5 is found to be upregulated in many stiff/solid tumors and has been therapeutically targeted to prevent tumor aggressiveness. The mechanisms by which ATF5 expression is induced in tumors and why it is required for metastatic tumor progression remains unclear.

Hypothesis/Objective

I hypothesize that the stiff tumor microenvironment may promote ATF5 expression to then promote malignancy and allow cells to adapt to the stiff tumor microenvironment. I will determine if stiff tumors express higher levels of ATF5 and ATF5-regulated targets.

Methods

This study will use breast tumor models retrieved from mice that will target imaging ATF5 and HSP60 proteins in genetic and pharmacological manipulation models of lysyl oxidase activity, which regulates ECM stiffness. In order to detect these affects we will use immunohistochemistry techniques and confocal microscopy by looking at the nuclear accumulation of ATF5 in the cells of tumor models and the abundance of HSP60 expressed in the cell.

Anticipated Results

It is expected that ATF5 will be in higher abundance in the nuclei and HSP60 will have a greater presence within the cells of stiffer tumors.

Discussion/Conclusions

It has been shown that ATF5 is the instigator of the cellular machinery that induces the characteristics of tumors that lead to metastasis. Testing the effects of increasing stiffness on ATF5 activity is crucial to understanding how to control and eliminate metastases in many cancer types.

Acknowledgements

I would like to thank my mentor, Dr. Kevin Tharp and the program coordinator, Dr. Ellen Fung for their contributions as well as those involved in providing this great learning experience.

Keywords

ATF5, HSP60, metastasis, malignancy, mitochondria, ECM

Laneé Jung

Smith College

Molecular Cloning and Production of Human Anti-Factor H Binding Protein Antibody Fragment (Fab) 7B10

Mentor:
Peter Beernink, Ph.D.

Funded by: National Institutes of Health

My name is Laneé Jung and I am a rising junior at Smith College studying Biochemistry and Economics. Upon arriving at CHORI, I spent my sophomore year working in a lab that focuses on combating lymphatic filariasis. From this experience, I knew that I wanted to continue working with infectious diseases as well as increase my knowledge on biomedical applications in research.

The Beernink lab focuses on improving vaccines that are caused by the bacterium Neisseria meningitidis. Working in the Beernink lab has not only stimulated my intellectual thinking but has also expanded my curiosity in vaccines. In the future, I would like to attend medical school and continue my research with infectious diseases. I would like to thank CHORI and my mentor, Dr. Peter Beernink for this amazing summer research experience.

Introduction

Meningococci are bacteria that cause life-threatening cases of sepsis and meningitis. In 2016, the CDC reported approximately 370 cases of meningococcal disease in the United States. Infants and adolescents are most susceptible to contracting meningococcal disease.

Currently, there are two licensed meningococcal serogroup B (MenB) vaccines that contain Factor H-binding protein (FHbp). The function of FHbp is important in its use as a vaccine antigen because it binds to the human complementary regulatory protein Factor H (FH). In immunized wild-type mice, it was found that FH does not bind to FHbp and consequently mouse serum anti-FHbp antibody (Fab) inhibits binding of human FH to FHbp. However, in immunized humans the serum antibodies do not inhibit binding of FH to FHbp, which might limit the effectiveness of FHbp vaccines. Previous studies show that Fab 7B10 enhanced FH binding by 6-fold which is important because antibody-mediated enhancement of FH to the bacteria might increase their ability to survive in the bloodstream.

Hypothesis/Objective

The purpose of this project is to successfully clone and express Fab 7B10 in *Escherichia coli* through the methods of codon optimization (mutating the codons) and synthetic gene assembly and to learn molecular cloning research techniques.

Methods

I used overlap extension polymerase chain reaction (PCR) to join and amplify the variable heavy (VH) and constant heavy (CH) chain gene fragments and, separately, the variable light (VL) genes and constant light (CL). I then joined the heavy and light chain gene fragments by a similar PCR approach. The DNA fragments were purified, ligated into pGEM®-T Easy plasmid and transformed into chemically competent E. coli. Plasmid DNA clones will be verified by DNA sequencing. A DNA fragment encoding Fab heavy and light chains will be excised from the pGEM®-T Easy Vector and cloned into pET22 and expressed in *E. coli.*

Anticipated Results

I anticipate that once I obtain the joined Fab clones, the encoded protein sequences should match the previous sequence of Fab 7B10, however the gene sequences will differ due to the codon optimization. From that point, the synthetic genes will be able to be subcloned into the pET22 plasmid and expressed in *E. coli.*

Conclusions

In the future, Fab 7B10 will be used for further characterization of antigen binding, inhibition of FH binding to FHbp as well as protein production for structural studies. In future studies, Fab 7B10 could be converted to an intact IgG molecule to investigate its ability to elicit human anti-FHbp bactericidal activity.

Acknowledgements

I thank NIH and CHORI for this incredible research opportunity and Dr. Beernink for all of his support and expertise. I would also like to thank Vianca Vianzon, Kelsey Sharkey, Claudia Perez Portillo, Howard Kim, Audrey Hollingsworth-Rood, Emma Ispasanie and Malik Reza for their technical assistance.

Keywords

Meningitis, Serogroup B, Factor H binding protein, Fab, gene production, cloning

Amritpal Kaur

University of California, Berkeley

Identifying Youth Impacted by Child Sex Trafficking in Alameda County: Can Spotlight Help?

Mentor:
Lela Bachrach, MD

Funded by: National Institutes of Health

My name is Amritpal Kaur and I am a rising senior at UC Berkeley. My inspiration with medicine began at a young age of seven, I always wanted to explore what was inside my body. Having researched with Dr. Bachrach on the human trafficking of adolescents in the Alameda county, has opened my eyes for my passion for public health. This CHORI opportunity has reminded me that my goal has always been to be a contributing factor to help change the lives of others.

I am still exploring what field of medicine I would like to pursue however, CHORI has given me a great opportunity to shadow doctors in different fields of medicine. I would like to thank my mentor Dr. Bachrach, for being patient with me and for guiding me through what it takes to be a scientist. I would also like to thank CHORI, for allowing me to be part of such a great opportunity.

Introduction

Alameda County is a hot spot for child sex trafficking. This profitable crime often flies under the radar because exploiters intentionally evade detection, and victims may experience stigma, shame, and/or trauma bonds such that they don't self-identify as a victim. The Internet, with anonymous and accessible online classified ads, has facilitated sex trafficking and expanded the reach of exploiters.

A local nonprofit called Thorn uses technology to combat the sexual exploitation of children. They have developed Spotlight, a tool that harvests phone numbers, Post IDs, and other publicly available information from online sex marketplaces. This study aims to elucidate if Spotlight could be used in a medical setting to identify youth impacted by sex trafficking.

Hypothesis/Objective

Spotlight can be used in a medical setting to help identify youth that are experiencing commercial sexual exploitation.

Methods

This project entails a retrospective analysis of youth previously identified by providers at UBCHO as being at high risk for or involved in sex trafficking. Chart review will be conducted for phone numbers provided by patients, as well as demographics and risk factors for sex trafficking involvement. The phone numbers will be looked up in a secure, non-linked version of the Spotlight database. If a phone number provided by a patient is present in the Spotlight database, that indicates that there has been a recent online posting for sexual services involving that phone number, increasing suspicion that the patient is indeed impacted by sex trafficking.

Anticipated Results

- Patients previously identified as involved in sex trafficking will have telephone numbers that match in the Spotlight database.
- A control group of low-risk youth will not have matches in the Spotlight database.
- Risk factors on the adolescent psychosocial screener can prompt providers to use the Spotlight database in a prospective setting, in concert with other screening tools for child sex trafficking that are in development.

Acknowledgements

Dr. Lela Bachrach, Dr. Ellen Fung, SSRP program

Keywords

Child sex trafficking, screening and identification, technology, Spotlight

Clara Kochendoerfer

Piedmont High School

Investigating the Heterogeneity of Lipoprotein(a)

Mentor:
Ronald Krauss, MD, Sarah King, PhD

Funded by: Volunteer

Hello, my name is Clara Kochendoerfer and I am a rising senior at Piedmont High School. Throughout my life, I have always been fascinated by the living world around me. Whether through watching documentaries about the hydrothermal vents of the ocean or making bread and pickles after learning about fermentation in biology class, my curiosity about science has become stronger the more I learn. However, when my great grandmother was diagnosed with dementia and possibly Alzheimer's disease, I knew I needed to get involved in biomedical research to help my community and people like my great grandmother.

I am extremely thankful that I had the opportunity to participate in the CHORI Student Summer Research program this summer! The program completely changed my perception of science, as previously I had only learned it out of a textbook, and taught me how challenging, yet fun and rewarding performing research can be. I am extremely grateful for the mentorship I received from Dr. King and Dr. Krauss, who guided and supported me throughout my project.

Introduction

High serum lipoprotein(a) (Lp(a)) levels are an emerging risk factor for atherosclerotic cardiovascular disease. Lp(a) consists of an Low Density Lipoprotein (LDL)-like particle, containing a single molecule of apolipoprotein B, that is covalently bonded to apolipoprotein(a) (apo(a)) by a single disulfide bond. Lp(a) particles between individuals differ in the size of the alipoprotein(a) and the size of the LDL particle. Prior research indicates that patients who have more, smaller LDL particles, as opposed to fewer larger LDL particles, are at greater risk of atherosclerotic heart disease.

Hypothesis/Objective

The goal of our project is to determine whether variations in apo(a), LDL size, and/or protein composition predominantly contribute to heterogeneity in Lp(a) particle size.

Methods

We isolated Lp(a) from an anonymous donor who had a high concentration of serum Lp(a) using ultracentrifugation. Using ion mobility, we analyzed the size composition of those fractions that contained Lp(a). Next, we plan to spike one of our control samples with low Lp(a) concentration with the isolated Lp(a) and use ion mobility to detect the size range of the isolated Lp(a).

Additionally, a collaborator provided us with Lp(a) particles isolated from human plasma samples by immunoprecipitation. We compared the peak particle size of the isolated Lp(a) with the LDL peak particle size from the corresponding plasma using ion mobility. We plan to repeat this process with other anonymous donors who have various isoforms of Lp(a) and use ion mobility and mass spectrometry to determine whether the size heterogeneity of Lp(a) is related to its protein composition. We have not yet been successful isolating Lp(a) using immunoprecipitation.

Anticipated Outcomes

Variations in apo(a), LDL size, and protein composition contribute to heterogeneity in Lipoprotein(a) particle size.

Acknowledgements

I would like to thank Dr. King and Dr. Krauss for their amazing mentorship throughout the summer and Bahareh Sahami and the rest of the Krauss Lab staff their patience and lab assistance.

Keywords

Lipoprotein(a), Immunoprecipitation, Ultracentrifugation, Low Density Lipoprotein (LDL)

Mara Liang-Jones

Piedmont High School

Pupil Lab Headsets to Determine Which Biometric Measurements, Specifically Relating to the Movement of the Eyes, Are Most Specific for Detecting Drowsiness

Mentor:
Rachel Kuperman, MD

Funded by: Volunteer

My name is Mara Liang-Jones and I am a rising junior at Piedmont High School. From a young age, I have always been interested in medicine and the opportunity I got from CHORI has given me a chance to pursue that passion. I am especially interested in pediatrics because I love being around their genuine innocence, which inspires me to earn the trust that they place in healthcare workers.

This summer, I have been able to further explore this topic as well as learning more about what I would like to do in the future. I was given an extraordinary opportunity to work alongside many very talented people and witness firsthand how they interact with patients and families. This has been an amazing experience and I will be forever grateful for this opportunity.

I would like to thank my mentor, Dr. Kuperman, for her guidance and support throughout this summer. I would also like to thank the staff in the neurology department for their assistance throughout this summer. Lastly I would like to thank the staff at CHORI for everything that they do.

Introduction

Epilepsy is defined as a neurological disorder defined by recurrent unprovoked seizures. The cause of these seizures is often unknown and can occur at anytime which is why antiepileptic drugs (AED) are often prescribed to patients in hopes of preventing the seizures from occurring. AEDs have an effect on sleep architecture, resulting in daytime sleepiness in these patients. This is dangerous because sleep deprivation is a seizure trigger. Drowsiness has also been known to be a result of nocturnal seizures, which often go undetected due to lack of visibility. Another cause of sleep deprivation is sleep apnea. High rates of sleep apnea are associated with epilepsy; if treated, it can improve drowsiness.

Objective

To be able to use a pupil labs headset to detect which oculometric variables measured are most specific for drowsiness detection.

Methods

Patients wear an ocular tracking device to detect drowsiness which can be seen through an increase in the percentage of eyelid closure time and a decrease in the speed at which their eyelids close. The device focuses on the pupil and tracks its movements using three small cameras, two focused on the pupil and one world camera, which focuses on the surrounding area.

Anticipated Results

We anticipate that patients who are drowsy will have an increase in pupil diameter as well as slower eye movements. Decrease in blink frequency is also expected in these patients.

Acknowledgements

I am extremely grateful to Dr. Rachel Kuperman for her endless patience, guidance and support throughout the summer.

Keywords

epilepsy, seizure, antiepileptic drug (AED), drowsiness, pupil, micro cameras, percentage eyelid closures

Jonathan Luo

Albany High School

Brown Adipose Tissue Substrate Uptake Determines Substrate Usage and Metabolic Program

Mentor:
Peter James Zushin

Funded by: California Institute for Regenerative Medicine

Hello, my name is Jonathan Luo and I am currently a rising senior at Albany High School. Throughout my childhood and on into adolescence, I have been fueled by an unending passion for science and mathematics, drawn to the wealth of knowledge, advances, and innovations inherent in STEM fields, especially in terms of biology and biomedicine. Hence, I applied to CHORI, specializing in stem cell research, as I believe that nothing epitomizes the future of biomedicine better than that. Their potential truly excites me, and I aspire to witness the day when stem cell treatments advance far enough to allow for the rapid treatment of degenerative diseases still plaguing society today. Thus, I am extremely grateful for an opportunity like CHORI, as it has allowed me to contribute directly towards that wonderful goal. Extending my gratitude further, I would also like to thank my mentor Pete Zushin, who has provided me with valuable guidance and knowledge in the field of adipose biology. What is more, as much as I have learned throughout the research process, I have also enjoyed and grown from it. Undoubtedly, my experience in CHORI has been unforgettable, and one that I will only continue to cherish.

Contributing Authors

Andreas Stahl, PhD

Introduction

Within mammalian biology, there exist two types of adipose tissue: Brown adipose tissue (BAT) and white adipose tissue (WAT). BAT and WAT serve opposing functions, in which BAT dissipates energy in the form of heat, whereas WAT is an energy storage site. As such, BAT is important in the regulation and maintenance of body temperature in the mammals. Because of this, BAT possesses great potential as a means to combat health concerns related to overnutrition due to its ability to metabolize lipids. If implemented as an injectable that recruits a hosts stems cells and differentiates them toward a brown adipocyte fate, this novel therapeutic could be an effective means of reducing the amount of excessive circulating lipids seen in obesity and also potentially decreasing the amount of adipose tissue within a patient's body. This injectable may be a solution to the obesity epidemic now prevalent in many countries around the world.

Hypothesis/Objective

Brown adipocyte function and activity is highly dependent on fuel uptake. We aim to describe the gene expression changes in various genetic knockout brown adipose tissue-derived stem cells at different points of differentiation in 2D (tissue culture) and 3D (implant) to build a better synthetic BAT implant.

Methods

Adipose-derived mesenchymal stem cells are isolated from murine fat pads, differentiated toward adipocytes, and mRNA is extracted at different time points. The mRNA is reverse transcribed into cDNA and quantitative polymerase chain reaction (qPCR) is performed to analyze relative gene expression in both 2D, and 3D settings.

Anticipated Results

Differential mRNA expression of fuel uptake and usage genes based on 2D versus 3D.

Discussion/Conclusions

We expect to describe differences between the mRNA expression of fuel uptake and usage genes during the differentiation of stem cells to mature brown adipocytes, based on their environment and genotype. Our findings will help us to to develop an injectable, hyaluronic acid-based implant which may help to combat obesity in a regenerative manner.

Keywords

(brown) adipose tissue, adipocyte, implant, obesity, stem cell

Alishah Momin

Pomona College

Validating Caries Indices from An Electronic Health Record

Mentor:
Joel White, DDS, MS

Funded by: National Institutes of Health

My name is Ali Momin, a rising senior at Pomona College, majoring in Molecular Biology. Growing up as a first-generation, low-income, and an immigrant scholar has shown me how often dental care is inaccessible & unaffordable for underprivileged communities. Ultimately, my journey has inspired me to pursue a joint degree in Dentistry and Public Health following my undergraduate career, with an affirmed commitment to working in underserved communities.

Throughout my summer experience, I have been able to contextualize clinical research specific to quality and outcomes of dental care. We hope to contribute to existing research by longitudinally examining change in quality of dental care provided as an outcome measure. Under the guidance of my mentor, I have cemented my interested in dentistry and dental research, honed my skills in clinical research, and found a niche of research to pursue in the future.

Introduction

The development of the Electronic Health Records (EHRs) system has allowed for the unification of patient information across different disciplines of medicine and dentistry. Dental researchers now have the ability to longitudinally track oral health measures through Dental Quality Metrics (DQMs) within a given population. A quality metric is a designed tool that allows the user to quantify the quality of a selected aspect of patient care. When applied to dentistry, DQMs can be used by dental professionals to measure their quality of dental care and assess the outcomes of their care. However, to do this, it must be measured first by a validated metric.

Hypothesis/Objective

The objective of this study was to design, program, test, and validate automated EHR procedures used to calculate caries indices through the Caries Risk Assessment (CRA) DQM. With an efficient and validated DQM, like the EHR automated CRA, outcomes of care can be evaluated longitudinally for effectiveness of programs for caries prevention.

Methods

A data sample was extracted from a set of 11,500 patients that were seen for an dental exam in 2015-2016 (T0 exam date) and subsequently seen for a dental exam in 2017-2018 (T1 exam date). Random purposive sampling was used to extract 54 subjects with the intention of validating conditions for 3 types of dentition (Primary, Mixed, Permanent) and 3 levels of decay experience, measured by the CRA (Low, Moderate, High). The CRA for each subject was validated manually by two calibrated reviewers for agreement and disagreement with the EHR automated CRA.

Anticipated Results

Lin's Concordance Correlation will be used to assess agreement between EHRs calculation and the reviewers. Additionally, three changes to the automated CRA will be implemented to include the following:

- Planned filling procedures without diagnoses of decay
- Restorative procedures in children under 12 with endodontic diagnoses
- Preventative Resin Restorations with diagnoses of decay.

Discussion/Conclusions

We hope to conclude that caries indices, an important primary outcome measures for research and patient care purpose, can be reliably derived from an EHR. The ability to assess outcomes of care will allow for further analysis on oral health disparities, success of caries prevention programs, and effectiveness of care provided by dental professionals.

Jerusalem Nerayo

Pomona College

A Mobile Health Approach to Promoting Healthy Relationships in a Clinical Setting

Mentor:
Lela Bachrach, MD

Funded by: National Institutes of Health

Hello, my name is Jerusalem Nerayo. I am a rising sophomore at Pomona College, and I plan to major in either biology, molecular biology, or africana studies. I was fortunate enough to participate in a program that exposed me to wet lab research the summer of my junior year in high school. After a year in college, I sought a summer program that offered direction and independence combined with a clinical experience, which CHORI uniquely satisfied.

I hope to gain clarity after this summer, contrasting both summer research experiences to help me decide if I prefer to take the PhD route, with a snippet from my summer in lab, the MD route, after interacting with patients in teen clinic, or neither. There's increasing pressure by friends, family, and college faculty to find clarity, and I am finding it most feasible to prioritize my interest for my research to subside the fear for the big decisions I have to make in the road ahead.

I want to thank my wonderful mentor this summer, Dr.Bachrach, for creating a perfect balance between guiding me and providing me independence in my summer project, along with teen clinic staff for helping me administer survey.

Introduction

Adolescent relationship abuse (ARA)--defined as repeated acts of physical, sexual, or emotional abuse by one youth on another in the context of a dating relationship-- is associated with poor health outcomes. ARA is common, yet rarely identified in clinical settings. Our UBCHO team partnered with Futures Without Violence to update the safety card on healthy relationships for use in clinical settings. We also collaborated with Oakland Unified School District to add an interactive healthy relationship quiz to the Healthy Oakland Teens mobile app as another resource to educate adolescents about healthy relationships. We set out to evaluate the acceptability of the app versus the paper safety card to youth in the Bay Area.

Hypotheses/Objectives

- To determine if patients prefer getting access to resources about healthy relationships via an app or paper safety card
- To examine the effect of a brief mobile technology-based intervention on patients reporting if they have ever been impacted by ARA
- To assess the user-friendliness of the "Healthy Relationship Quiz"

Methods

Participants will be recruited in the UBCHO Teen Clinic to complete a self-administered computer-based survey. The inclusion criteria are patients between ages 11 and 24, of all genders, presenting for any reason. Exclusion criteria include patients who don't speak English, those medically or psychiatrically unstable or presenting for sexual assault, and those for whom participating in this study would interfere with their medical care.

Preliminary Results

After surveying 30 patients, we concluded that 93% of patients found the "Healthy Relationship Quiz" to be user-friendly. Forty percent of patients had no preference for the app or paper safety card. Ten percent of those surveyed were more likely to state they or someone in their lives have been impacted by ARA or IPV after a mobile intervention.

Acknowledgements

I would like to thank my mentor Dr. Lela Bachrach and the staff at Teen Clinic for helping me with my project.

Keywords

Adolescent Relationship Abuse(ARA), Intimate Partner Violence(IPV), Mobile Health Technology

Nicholas Nido

Archbishop Riordan High School

A Comparison of the Clinical Applications of Musculoskeletal Stem Cell Research Versus The Claims Made In a California Clinical Setting About Its Practical Application

Mentor:
Coleen Sabatini, MD, MPH

Funded by: Doris Duke Charitable Foundation

My name is Nicholas Nido and I am a rising senior at Archbishop Riordan High School. Ever since I was a young boy, I was always interested in the sciences, particularly in biology. My interest in the sciences would continue to expand as I grew up, and it was this same interest that ultimately led me to apply to CHORI. This summer research program has given me the opportunity to experience a myriad of new things such as how to write a research proposal, hear lectures from various medical and scientific professions, and make new friends. My mentor, Dr. Coleen Sabatini, aided me during the process and allowed me to experience how working in a hospital setting truly was. I am thankful for this program and all that it has allowed me to experience during the summer. It has allowed me to solidify my pursuit in science as a career and allowed me to grow as a person.

Background

Adult stem cells are unique because they are unspecialized and pluripotent. This unique characteristic gives them the ability to develop into a variety of different cell types which allows them to replace damaged or diseased cells. The human body is capable of producing two types of stem cells, embryonic or "adult". Embryonic stem cells are created by the fusion of two adult gametes. This fusion creates an embryo that is composed of stem cells. Ultimately, these cells differentiate and develop into a human child. Somatic or "adult" stem cells can be found in various organs and tissues in the adult body. They are more limited in their ability to differentiate because they have to some degree have already differentiated. There are two main characteristics that define stems cells. Firstly, they possess the ability infinitely renew themselves through cell division even after long periods of inactivity. Secondly, they can be induced to become specific organ/tissue cells depending on the physical and experimental conditions they are exposed to. As a result, stem cells can be manipulated so that regeneration can occur on a molecular level in the body as a whole.

Objective

To compare claims made by stem cell clinics in California about their treatments which alleviate musculoskeletal conditions in contrast to the available research on the actual effects of stem cell treatments and therapies on those conditions.

Methods

Our first step in conducting this study, is to develop of list of all the stem cell clinics in California. From there, we will use a spreadsheet to classify which musculoskeletal conditions/ problems these clinics claim to treat. These include, but are not limited to, rheumatoid arthritis, osteoarthritis, as well as, knee, hip, shoulder, or back injuries. Additionally, we will explore the costs and outcomes that these clinics claim their therapies will produce. After gathering all of this data from the California stem cell clinics, we will conduct a review of the of the literature to summarize the available data on the efficacy of stem cell treatments for musculoskeletal conditions. From there, we will be able to compare the claims made by the stem cell clinics with the available literature on stem cell efficacy for treatment of these different musculoskeletal conditions.

Anticipated Outcomes

I anticipate that many of the claims being made by stem cell clinics in California, will not match the available research and data on musculoskeletal stem cell treatments. This study will ultimately positively impact patients and physicians alike. It will give physicians the necessary insight they need in order for them to properly determine their patients potential treatment options. Furthermore, patients will benefit because their treatment options will be more realistic and effective.

Conclusion

With our research, we hope to disprove any false claims being made by stem cell clinics in California in regard to their various treatment options. Additionally, we hope to determine which stem cell treatments for musculoskeletal conditions are viable and researched backed for future patients.

Acknowledgments

Thank you to my mentor Dr. Coleen Sabatini for aiding and guiding me through this research project and to the friendly staff of the Orthopaedic Center. I would also like to thank the Doris Duke Charitable Foundation for the funding they provided that allowed me to partake in this summer research program.

Keywords

Adult Stem Cells, Embryonic Stem Cells, Musculoskeletal Conditions.

Parsa Noori

University of California, Davis

The Roles of NCKX4 on the Enamel Formation

Mentor:
Yan Zhang, PhD

Funded by: National Science Foundation

My name is Parsa Noori and I am a rising junior at UC Davis, majoring in biological sciences. I migrated to the United States from Iran when I was only 13 years old. After learning English and graduating from high school I enrolled in Contra Costa College and found my passion in science. During my time attending CCC, I became very interested in dentistry as a profession, especially after shadowing my dentist for some time and becoming more familiar with the everyday work this interest only grew. After graduating from UC Davis I am planning to attend dental school and later join the dentist without borders so that I can be a positive force for dental health and help the less privileged around the world.

I would like to thank the CHORI Summer Program for giving me this wonderful opportunity which has not only allowed me to further my understanding of the research part of the dental health but also to interact with some of the brightest minds that I have ever encountered. I also would like to thank my mentor, Dr. Yan Zhang at UCSF for allowing me to join her amazing team and work on this research project.

Introduction

NCKX4 is a K^+-dependent calcium/sodium exchanger which is indispensable for enamel formation. Lack of NCKX4 exons 15, 16, and 17 in humans, and 6 and 7 in mice can result in formation of a poorly calcified enamel, a condition known as Amelogenesis Imperfecta (AI). Teeth of AI patients are prone to rapid wear and breakage as a consequence of poorly biomineralized enamel layer

Hypothesis

We hypothesize that during enamel biomineralization, NCKX4 plays a critical role in regulating maturation ameloblast morphogenesis and enamel matrix protein removal.

Methods

Mouse model with the deficient NCKX4 gene was used to investigate the roles of NCKX4 during maturation stage in ameloblasts.

Micro CT: X-ray micro-tomography scans of the specimen were acquired by MicroXCT-200 (Carl Zeiss, Pleasanton, CA) at Biomaterials and Bioengineering Correlative Microscopy Core (BBCMC), UCSF School of Dentistry.

Histology and Immunostaining: After euthanizing with carbon dioxide asphyxiation followed by cervical dislocation, mandibles were dissected from 6-week old wild type and *Nckx4*$^{-/-}$ mice and fixed in 4% PFA/ 0.2M Na-cacodylate overnight at 4°C. Fixation were followed by decalcification in 8% EDTA (pH 7.3) at 4°C for 2 weeks. The samples were then dehydrated, embedded in paraffin, and sectioned along a sagittal plane. Sections were stained with H&E for the morphology analysis. Rabbit antibodies recognize amelogenin, laminin 5 subunit and claudin-1 proteins will be used to do the immunostaining on the mouse incisor sagittal sections.

Quantitative PCR analysis on mouse molar maturation ameloblasts: Mouse first molars, in which the ameloblasts were at the maturation stage of development, were micro-dissected from P12 day wild type and *Nckx4*$^{-/-}$ mice. Total RNA was purified from maturation ameloblasts using Direct-Zol RNA miniprep Kit. Five-hundred nanograms of total RNA from each sample was used as template for cDNA synthesis using SuperScript III Reverse Transcriptase. After standardizing with GAPDH endogenous control, delta CT method was used to quantify the relative expression levels of target genes between wild type and *Nckx4*$^{-/-}$ mouse maturation ameloblasts.

Anticipated outcomes/Conclusion

We expect that loss of NCKX4's function will disrupt the polarity and adhesion of the ameloblasts to the basement membrane and the enamel matrix protein removal during the maturation stage. As the result of this research we will have a better understanding of the functions of NCKX4 during the amelogenesis not only as a Ca^{2+} transporter but also as regulators for cell adhesion and vesicle trafficking.

Acknowledgements

I would like thank Dr. Yan Zhang and her team for their mentorship and guidance.

Keywords

NCKX4, Amelogenesis, Amelogenesis Imperfecta

Angel Okoro

University of California, Santa Barbara

Examining Potential Barriers to Treatment Access for Chronic Hepatitis C Virus Infection in San Francisco

Mentor:
Jennifer Price, MD

Funded by: National Institutes of Health

My name is Angel Okoro. I am a rising Junior at University of California, Santa Barbara, studying Biochemistry and Microbiology. My brother was diagnosed with Type I Diabetes when I was three years old. At the time, we were living in Lagos, Nigeria, where hospitals lacked basic equipment like glucometers. After several years living with this situation, my parents decided to migrate to a developed country with better medical resources. A year ago, my youngest brother was also diagnosed with Type I Diabetes. Without organizations like CHORI that work to save and improve lives through medical research while nurturing children through life-altering illnesses, I would have lost both of my brothers. My brothers' stories coupled with the impact that medical research has made in my life inspired me to pursue research and medical volunteer work.

I have been volunteering at medical clinics since I was fourteen, and I have been teaching chemistry to elementary students for two years. However, I have never had the opportunity to conduct research. Through the CHORI Summer Student Research Program, I hope to achieve basic and clinical research training experience to further my interest in pursuing biomedical research.

Introduction

Hepatitis C virus (HCV) infection is a bloodborne disease that is the leading cause of liver-related deaths in the United States. There are approximately 3.2 million people with chronic HCV in the United States. Current HCV treatment of direct-acting antiviral drugs coupled with ribavirin is highly effective with an average sustained HCV virologic response of 95.7%. However inadequate insurance coverage, and limited treatment access pose as substantial treatment barriers.

Objective

The aims of this research are to determine potential barriers to HCV care linkage in San Francisco, to create a map of geographic locations of HCV providers, to identify insurance restrictions among HCV providers, and to identify treatment access deserts.

Methods

Through data extraction of Google Maps, it was determined that there are 333 medical facilities in San Francisco. Potential HCV providers were assessed from a list of facilities that received HCV-positive tests in the past year. Each provider on this list was contacted and cross-referenced with an incomplete list of HCV providers obtained through public domains and through collaboration with the San Francisco Department of Public Health and the End Hep C San Francisco Initiative.

Anticipated Results

Out of the 333 facilities, 79 facilities (24%) had received a HCV-positive test in the past year. Among these 79 facilities, it is anticipated that 40% have at least one HCV provider. It is anticipated that access to these providers varies by insurance status, and current data suggests a lack of providers in lower-class areas of San Francisco.

Conclusion

Among facilities in San Francisco that provide HCV screening, only a minority have direct access to HCV providers. Moreover, we anticipate that access to these providers will be limited by patients' insurance status. This suggests that access and insurance pose as barriers to HCV treatment. San Francisco is severely impacted by HCV, and HCV prevalence in San Francisco is twice as high as in the rest of the United States which highlights the importance of confronting these barriers.

Acknowledgements

Special thanks to Dr. Jennifer Price, Emily Valadao, and Rachel Kanner for guidance and support, and to CHORI and UCSF for providing this invaluable experience. Thank you to The National Institutes of Health for funding.

Keywords

hepatitis C virus, HCV, health services accessibility, treatment, insurance

Pawan Paleja

Concord High School

Impacts of a Modest and High Increase in Dietary Zinc on DNA Damage, a Potential Cellular Indicator of Zinc Status

Mentor:
Coralie Signorell, PhD

Funded by: Volunteer

My name is Pawan Paleja and I am a graduating senior from Concord High School. I will be attending UC San Diego in the fall where I plan to double major in computer science and molecular biology.

When I began high school as a freshman, I never could have imagined how interested in science as I've now become. In fact, a couple years ago, I wanted nothing more than a future as just a regular IT guy. But through some amazing classes and teachers, an interest for science was ignited in me. This summer, at CHORI, I've had the incredible opportunity to explore that interest in research, which has caused a complete upheaval of my previous career plans.

Though my time here has been as intensive an experience as one can imagine, I've been able to learn a great deal, not only about nutrition and lab work, but also much about myself as well. Thank you to my mentor and to all the coordinators and speakers of the CHORI Summer Program, who have made these past weeks some of the most impactful and educational weeks of my life, thus far.

Contributing Authors

Jung H. Suh, PhD, Barbara Sutherland, PhD, Janet C. King, PhD

Introduction

Zinc is a micronutrient essential to metabolic processes, either as a structural, regulatory, or catalytic ion. Zinc deficiency hampers the normal functioning of processes requiring zinc, such as growth, tissue healing, and immune response. As zinc plays a role in maintaining the structural integrity of key DNA repair proteins and pro-antioxidant enzymes, DNA damage can become more pronounced in a zinc-deficient population.

Objective

The focus of this project is to investigate how different dietary zinc intakes affect DNA damage, blood pressure, heart rate, hemoglobin, height and weight in healthy men.

Methods

Participants underwent 10 weeks of controlled consumption encompassing 3 metabolic periods (MPs): 2 weeks of a low zinc and high phytate intake, 6 weeks of a normal zinc intake, and 2 weeks of 25 mg zinc supplementation or placebo. At the start of the study and the end of each MP, anthropometric data was collected and the COMET Assay will be used to quantify DNA damage.

Anticipated Results

We expect that DNA damage will increase during MP1, decrease during MP2 and stay stable during MP3, while blood pressure, heart rate, hemoglobin will decrease during MP1 and stay stable afterwards. Body mass index is expected to remain stable throughout the study.

Discussion

The COMET assay has been employed in human studies to measure DNA single-strand breaks. In two zinc depletion-repletion studies, DNA damage increased significantly after consumption of either 4 or 6 mg Zn/d and decreased during repletion, despite no changes to plasma zinc. Therefore, DNA strand breaks may be a potential functional indicator of zinc status, suggesting that DNA integrity is one of the first metabolic functions to improve with a modest increase to zinc intake. Our results could endorse this conclusion.

Acknowledgements

Thank you to Dr. Signorell and the entire King Lab for all they've done for me.

Keywords

Zinc, Nutrition, Antioxidant, DNA Damage, Bioindicator

Teresa Perez

Leadership Public School
Food as Medicine Pilot Study

Mentor:
June Tester, MD, MPH

Funded by: Doris Duke Charitable Foundation

My name is Teresa Perez and I am a rising senior at Leadership Public School Richmond. I have always had an interest in clinical medicine because my future career job is to be a nurse or a pediatrician. I believe in the importance of health as a value and have had many experiences that inspired me to find the importance in health.

When I had to take my mom to the ER, during the visit, I noticed the doctors treated my mom with respect and care. The whole process really interested me. Such as the way the doctors took good care of my mom, the steps they took in order to achieve a task and all the good things they provided us in order for my mom to maintain a good health.

Because of this, I'm attracted to health, especially caring for children. CHORI has provided me the basic skills and knowledge of what is it like to be a part of the health field. I took initiative to join a program that could enlighten about how to research and how to start. I am determined to pursue my career goal in the medical field, wellness and working with children.

Contributing Authors

Marina Franco, Carina De la Cueva

Introduction

Many low-income families have poor nutrition that contributes to health conditions like diabetes. Food insecurity is a social determinant of health that is becoming more commonly looked at in health care.

Objective

We plan to conduct an intervention done through engagement of clinics and markets directly towards benefiting food-insecure families.

Methods

30 families will be identified from the La Clinica Pediatric clinic. We will screen for food insecurity using two food security screening questions on paper that will be managed by Medical Assistants to families with children (ages 9-11). Families who screen positive of food insecurity, will be followed up with informed consent forms and surveys that will be administered by the Preventive Medicine Supervisor and Health Coach volunteers. The surveys will include items about knowledge and consumption of vegetables and whole grains. Weekly vegetable, whole grain deliveries and recipe videos on tips to maintain a healthy food consumption to homes with families that screen positive in food insecurity, can improve diet in vulnerable populations such as food-insecure families.

Anticipated results

This study will be to scale a previously conducted pilot from UCSF Benioff Children's Hospital Oakland to other community health centers like La Clinica have a better understanding the needs, challenges and opportunities in addressing food insecurity in high-risk populations. We hope this will encourage participants will increase their interest and continue to sign of for community-supported agriculture box deliveries to their homes on their own and impact their knowledge and consumption of healthy produce. We anticipate that children will improve the frequency with which they report eating vegetables and whole grains. We anticipate that parents will increase their self-efficacy of serving their children healthy foods. We also anticipate that over 50% of families will express interest in signing up for future deliveries of CSA produce.

Conclusion

This study is in particular purpose to improve health outcomes and significant results from food interventions.

Acknowledgements

Thank you CHORI and DDCF for giving me this wonderful opportunity.

Keywords

Food Insecurity, Pre-diabetes, Low-income

Armen Phelps

University of California, Berkeley

Application of the HemeChip Point of Care Device for Real-time Monitoring of Hemoglobin S Levels in Chronically Transfused Patients with Sickle Cell Disease

Mentor:
Carolyn Hoppe, MD

Funded by: Doris Duke Charitable Foundation

I am a rising freshman studying molecular and cellular biology at UC Berkeley. I chose molecular and cellular biology because I wanted to study in the intersection of biology and chemistry. I love learning about both living things, and atoms and molecules, so molecular biology sounded perfect.

This summer I got to work in the Hemoglobinopathy lab at CHORI, which definitely sparked my interest in protein chemistry as it is a perfect application of molecular biology. During my college experience, I hope to explore this field further and find a niche in the world of medicine that I am passionate about. I applied to the CHORI program for the second time this year because this program gives students the opportunity to try out numerous experiences and find a branch of medicine that they truly enjoy.

After having a basic science experience in the program in 2016, I came back to have a clinical experience this year, in order to narrow down my decision of the career path that I will take. I want to thank Dr. Carolyn Hoppe, Mahin Azimi and everyone in the Hemoglobinopathy Reference Lab for their incredible support and guidance this summer.

Introduction

Red cell transfusion (RCT) is a vital treatment in sickle cell disease (SCD). By increasing normal hemoglobin (%Hb A) levels and reducing sickled hemoglobin (%Hb S) levels, chronic RCT helps to prevent stroke and other morbid complications of SCD. Because the change in %Hb S varies within and between individuals in response to RCT, timely monitoring of %Hb S is critical to ensure that %Hb S is kept at sufficiently low levels between scheduled RCT. Capillary electrophoresis (CE) and high-performance liquid chromatography (HPLC) are currently used to quantify and monitor %Hb S levels in regularly transfused SCD patients. These methods require complex, centralized laboratory equipment and highly trained technicians.

Blood samples are routinely batched for testing and results are often unavailable until several days after the test is ordered, requiring clinicians to make treatment decisions based on past results. A point-of-care test (POCT) that quantifies %Hb A and %Hb S levels before and after transfusion could serve as a useful clinical tool to inform patient-specific transfusion requirements, thereby minimizing excessive transfusions and their associated risks.

Objective

To assess the feasibility and accuracy of the HemeChip POCT for quantitation of %Hb S in SCD patients receiving regular transfusions. The HemeChip POCT is a miniature version of the electrophoretic methods used in the laboratory for quantitation of hemoglobin fractions.

Methods

After consenting eligible subjects, blood samples were collected pre- and post-transfusion during a scheduled RCT visit. For each sample, the %Hb fractions were quantitated using both the HemeChip device and CE. The HemeChip results were compared with the CE results to assess the accuracy of the HemeChip device.

In the HemeChip assay, whole blood (diluted and lysed) is applied to a cartridge containing a cellulose acetate strip. An electric current is run through the cartridge, separating the hemoglobin fractions by charge. Real-time images of the electrophoresis are captured by the portable reader, and built-in software analyzes the results, extracts relevant peak positions, and performs quantitative analysis.

Preliminary Results

After testing samples from the first 5 patients enrolled, the HemeChip device gave read-outs of 100% Hb S or 100% Hb A, despite all samples having a %Hb A of 30-82% and %Hb S of 10-60%, according to CE. Further discussion with the Hemex team revealed that the device's algorithm cannot accurately analyze the hemoglobin bands separated during electrophoresis due to inadequate light transmission within the machine. Testing will resume, pending correction of this issue by Hemex.

Keywords

Red cell transfusion, point-of-care test, capillary electrophoresis

Arturo Ramirez

Contra Costa Community College

Hypersensitivity Rates to Intravenous PEG-asparaginase in Patients with Acute Lymphoblastic Leukemia at UCSF Benioff Children's Hospital Oakland

Mentor:
Steve Oakes, PhD, Kimery Leong, PhD

Funded by: National Science Foundation

My name is Arturo Ramirez and I am a transfer student from Contra Costa College getting ready to enter my junior year of college at UC Berkeley with a major in Chemical Biology under the College of Chemistry. Although I am interested in the field of medicine, I am still unsure of what career I want to pursue. I became interested in the chemistry portion of medicine because I enjoy learning about the how different chemicals in drugs interact within the body such as how they're metabolized and what they're metabolized to. I joined the CHORI program because I just wanted to get the experience of working within the medical field and do some research involving medicine as well.

Introduction

PEG-asparaginase (PEG-ASP) is an enzyme used for patients with acute lymphoblastic leukemia (ALL) as chemotherapy derived from *Escherichia coli* bacteria. However, the enzyme can sometimes produce an immunogenic response in patients. The enzyme was administered intramuscularly to patients with ALL; however, it was given intravenously later to reduce pain. Patients receiving it IV were more likely to experience hypersensitivity such as anaphylaxis. Patients who experienced hypersensitivity to PEG-ASP were switched to Erwinase® which is asparaginase derived from *Erwinia chrysanthemi* bacteria. Erwinase® is given through six IM injections, so giving PEG-ASP IM would be more efficient and less painful.

Hypothesis

At UCSF Benioff Children's Hospital Oakland (BCHO), the allergic reaction rate to PEG-ASP is higher than the North American average. It's shown by literature that administering PEG-ASP IM to ALL patients has lower hypersensitivity rates than IV. However, at BCHO it's only administered IV. If rates for IV administration are higher than expected, switching to IM could yield lower hypersensitivity rates.

Methods

We did a retrospective chart review of ALL patients receiving PEG-ASP or Erwinase®. The patients' medical records describe their reaction to the drug. If patients were treated with diphenhydramine, hydrocortisone, or epinephrine afterwards, it's classified as a allergic reaction. After reviewing patient records, a hypersensitivity rate was determined showing how many patients experience hypersensitivity to IV PEG-ASP based on number of patients who received PEG-ASP. This rate was compared to research studies also conducted on hypersensitivity rates to determine whether BCHO's hypersensitivity rates are high.

Anticipated Results

Our anticipated results are to: make practitioners aware of allergic reaction rates to IV PEG-ASP, determine whether hypersensitivity rates at BCHO are higher than expected, and reduce risk of ALL patients experiencing hypersensitivity.

Acknowledgements

I am grateful to Dr. Kimery Leong and Dr. Steven Oakes for guiding me through summer research. It was a really enjoyable experience and thank you to CHORI allowing me to participate in the program.

Keywords

Hypersensitivity, acute lymphoblastic leukemia, Erwinase®, pegylated-asparaginase

Lara Ramirez

Holy Names High School

Effect of High Dose Vitamin D Supplementation on Bone Density in Patients with Thalassemia

Mentor:
Ellen Fung, PhD, RD

Funded by: Achieve

Hello, my name is Lara Ramirez and I am a rising senior at Holy Names High School. I became interested in science at age five when I collected insects and hid them under my bed away from my mother. My mother never liked insects, so she got me a rabbit to raise. My passion for science grew as I cared for my rabbit, but sadly I had to put away my passion aside since Guatemala didn't have any sources for me to continue exploring my passion for science. When my parents and I came to California, I was able to continue exploring my passion for science through school science fairs. Through science fairs I became interested in many areas in the science field and I didn't know what I wanted to explore more. This is one of the reasons I applied to CHORI to help me pave my future path. At CHORI I had the privilege to work under Dr. Ellen Fung working to determine if high dose of vitamin D supplementation has a positive effect on bone mineral density Z-scores before and after vitamin D supplementation, in patients with Thalassemia. Through the process I not only condensed my interest, but stretched my interest further. I have concluded that my future will have some research in the fields of cardiology, cancer, or medicine. I am thankful for Dr. Fung for allowing me to work with her and making my summer fun. I am also thankful for Lisa and Veronica for teaching me about what it is to be part of HEDCO. Elijah as well for always offering to help and his movie suggestions.

Introduction

Thalassemia (Thal), a genetic disorder of hemoglobin synthesis, is associated with many risk factors for low bone mass, including hypogonadism, decreased vitamin D, and reduced physical activity. Vitamin D, a crucial nutrient for bone health, is frequently low in Thal due to inadequate intake or poor cutaneous synthesis. USCF Benioff Children's Hospital Oakland (BCHO) clinic has been providing high dose vitamin D supplements at time of transfusion to reduce individual cost and improve adherence. In July 2013 this regimen changed to a more potent form of vitamin D, cholecalciferol (D3).

Hypothesis

Bone mineral density (BMD) improves in patients with Thal who are provided high dose vitamin D3 supplementation.

Methods

Data was collected from electronic medical records of patients >5 years with a diagnosis of Thal cared for at BCHO. BMD by DXA was considered abnormal with a Z-score <-2.0. 25OHvitaminD was used as the biochemical marker of vitamin D adequacy, with sufficiency > 30 ng/mL. Statistical models were developed using STATA v15 and considered significant at $p<0.05$.

Results

A total of 188 patients (50% female, 23±13.7 yrs) with 2,820 vitamin D values were included in this retrospective study. 58% of Thal patients had insufficient vitamin D, however 25OH increased significantly with D3 supplementation (25.5 vs. 31.1 ng/mL, $p<0.001$). Low bone mass was observed in 58% of patients, and was associated with male gender, increased age and insufficient vitamin D. In contrast to our hypothesis, BMD Z-score tends to decrease with vitamin D3 supplementation (-2.1 vs. -2.3, $p=0.06$). Patients with low bone mass had higher 25OH values compared to those with normal BMD Z-scores ($p<0.001$).

Discussion

Nearly two-thirds of patients with Thal have low vitamin D and are also at risk for fragility fracture. However, there is a complicated relationship between 25OHD, vitamin D supplementation and bone health in Thal, possibly related to increased calcium excretion. Before vitamin D supplementation is endorsed for all patients, these relationships should be explored in more detail. Low cost, non-invasive interventional strategies are sorely needed for patients with Thal to improve bone health and quality life.

Keywords

BMD, Vitamin D, Thalassemia

Mohamed Soufi

Lynbrook High School

Exploring Relationships between Trabecular Bone Score and Vertebral Fracture in Patients with Thalassemia

Mentor:
Ellen Fung, PhD RD

Funded by: Alex Lucas Memorial Fund

I was certain my future career lied in STEM but couldn't decide on anything specific until I shadowed the renown part time researcher, surgeon, and professor Dr. Acimi the summer of my sophomore year. He introduced me to the world of medical research and how independent and free it was. It was like no other STEM career and I knew I had found my passion.

CHORI fulfils all the checkboxes when it comes to independent research. I am currently working under Dr. Fung, an accomplished doctor and researcher in the field of osteology. I am delighted to know that I am doing something actually meaningful for her and her team. I hope to use the skills I have acquired and refined over the course of this summer to kickstart my future in medical research as a rising freshman at Caltech pursuing a pre-med track.

Introduction

Osteoporosis is a condition, characterized by a decrease in bone mass and density with enlarged trabecular space resulting in porosity and bone fragility. This condition causes more than 9 million fractures annually and is mainly observed adults over 60. It is difficult to identify pre-osteoporotic symptoms, that is, before fractures develop.

The thalassemias, rare genetic disorders from individuals from the Mediterranean, Africa, or South Asia, prevent the body from producing enough hemoglobin and thereby fewer red blood cells. To produce more red blood cells, bone marrow expands, consequently interrupting bone formation leading to cortical bone thinning. Many individuals with thalassemia (Thal) require frequent blood transfusions which lead to iron overload, endocrinopathies and osteoporosis.

Objective

To determine the prevalence of poor bone quality as assessed by trabecular bone score (TBS) and its relationship to vertebral fracture in patients with thalassemia (Thal).

Methods

Data will be collected from the UCSF Benioff Children's Hospital Oakland Bone Density Clinic Database from patients with Thalassemia scanned between June, 2010 and 2018. Only spine scans in patients above 10 years of age who weighed > 40 kg at the time of the scan will be re-analyzed using the TBS Medimaps® software. Lateral spine scans will be reanalyzed and categorized according to vertebral anomaly type and severity. Data will be analyzed using STATA v 15.1.

Anticipated Outcomes

A strong positive relationship between Trabecular Bone Score in patients with Thal and number and severity of vertebral fractures. It is likely that this relationship is influenced by patient's age and possibly endocrine status. If these data prove significant, TBS Z-score may be incorporated into clinical decision making for patients choosing bisphosphonate therapy.

Acknowledgments

I would like to thank Dr. Fung and Hoon Min the Dean lab manager for mentoring me through the program.

Keywords

Trabecular Bone Score, Thalassemia, Vertebral Fracture Assessment

Tajii Thomas

Howard University

Mobilizing Against Hepatitis C in San Francisco

Mentor:
Jennifer Price, MD, PhD

Funded by: National Institutes of Health

My name is Tajii Thomas and I am a senior Sports Medicine major/Chemistry minor at Howard University. Upon graduating, I hope to attend medical school. My interest in medicine was first sparked after my sister was involved in a horrible accident. Spending weeks at the hospital with her allowed me to learn so much about all of the elements that go into patient care. The doctors I observed were constantly problem-solving and utilizing their critical thinking skills. This motivated me to pursue a career in medicine so that I too could be involved in making sure that patients receive the best, most advanced treatment possible.

This summer I had the wonderful experience of working with Dr. Jennifer Price at UCSF. I assisted with her initiative to mobilize against Hepatitis C by utilizing a mobile van to provide testing and care linkage in San Francisco. Through this internship, I was able to make so many connections and get direct exposure to what goes on behind the scenes at the hospital. Participating in the CHORI program has completely reenergized my passion for health care and has definitely inspired me to continue on my journey to become a doctor.

Introduction

Hepatitis C virus (HCV) kills more Americans than any other infectious disease. In San Francisco, about 2% of the population is infected with the virus. Since HCV has little to no symptoms until the virus becomes advanced, only about 50% of those infected with HCV are aware of their status. For my project, I assisted with an initiative to improve the HCV care cascade by increasing the rate of HCV diagnosis in San Francisco.

Hypothesis/Objective

By utilizing a mobile medical van to travel around the city of San Francisco and provide HCV screening, blood testing, and care linkage, we can raise HCV awareness in San Francisco and begin to eliminate the public health threat that HCV poses.

Methods

We launched a mobile medical unit designed to travel around San Francisco and provide HCV screening and care linkage among populations at risk for HCV. We offered rapid HCV antibody testing to determine past exposure to HCV, HCV RNA confirmatory testing to determine whether an active HCV infection was present, and Fibroscan testing to determine the stage of liver fibrosis in patients who'd been exposed to the HCV antibody. Information was collected from patients regarding different risk factors that impact HCV transmission.

Results or Anticipated Results

A total of 12 HCV rapid antibody tests were performed on the van. Two of these tests yielded positive results, indicating exposure to HCV. Of the two patients with positive HCV antibody results, X completed HCV RNA confirmatory testing and X returned positive, indicating chronic HCV infection. One of the two patients who tested positive underwent a Fibroscan on the van and was found to have mild/no liver fibrosis. X out of X of patients found to have chronic HCV were referred to a specialized HCV provider. Of the 12 patients tested, 45% identified as LGBTQ, 42% were experiencing homelessness or unstable housing, and 67% currently use injection drugs.

Discussion/Conclusions

Testing and diagnosis remains the largest barrier in curing Hepatitis C. By providing more resources for HCV testing and care linkage, we can drastically improve the HCV care cascade.

Acknowledgements

Special thanks to Dr. Jennifer Price for being an amazing research mentor. I'd also like to thank Emily Valadao and Rachel Kanner for their unwavering patience and support throughout the course of my research this summer.

Keywords

Hepatitis C Virus, HCV care cascade, liver fibrosis, Fibroscan

Raquel Traseira-Pedraz

University College London

What Beverages Can Be Served to Infants and Children in licensed Childcare Sites: 50 State Policy Analysis

Mentor:
Lorrene Ritchie, PhD RD, Dani Lee, MPH RD

Funded by: National Institutes of Health

My name is Raquel and I have just finished my second year of medical school at University College London. Being part of CHORI has provided me with the perfect platform to learn about a wide range of paediatric research methods and given me a unique insight into what working in research could be like. Up until now in my studies there has been a great focus on Physiology and hard science and little course content related to the study of human society and social relationships. Having the opportunity to work at the Nutrition Policy Institute this summer has shown more how socio-cultural and behavioural factors have a massive impact on health and well-being among different populations.

I am so grateful for the guidance from Dr Ritchie and Danielle Lee in my project where I am in investigating the implementation and adherence of beverage policies in licensed child care settings in the hope that future enhancements to these laws will improve children's eating habits. I am learning that preventative health care is of huge importance, as it does not only increase the well-being of the general population but also greatly reduces future health care costs, a real issue for the most vulnerable groups in society.

Contributing Authors

Sophia Navarro, Natasha Frost, Lorrene Ritchie, Danielle Lee, Ken Hecht

Introduction

Obese children are approximately five times more likely to be obese in adulthood than normal weight peers, providing a compelling case for early interventions to promote healthy lifestyle behaviors. Over 60% of children under 5 years in the US regularly attend childcare, thus these settings offer an ideal location for obesity prevention efforts. Beverage policies implemented and adhered to in licensed childcare settings have the potential to improve children's dietary patterns, resulting in a healthier population.

Objective

Identify disparities between childcare beverage polices in each state and provide a snapshot of the current state laws.

Methods

The Public Health Law Center at Mitchell Hamline School of Law used legal analytical methods to create an infographic map based on state childcare licensing laws on 14 beverage policies in 50 states.

Policies were coded as 1 being standard not addressed, 2 being standard partially met, and 3 being standard fully met. Childcare settings were stratified by childcare centers (CCC) and family childcare homes (FCCH). Percentages, means and quartiles were calculated for each policy and each state.

Outcome

Overall, an average of 19% of states had beverage policies standards fully met. Childcare centers were more likely to have beverage standards fully met compared to FCCHs (23% vs 16%). Rhode Island, Illinois and Mississippi CCC's, had the highest average policy-quality metric (2.71, 2.57 and 2.42 respectively).

Conclusions

Although there was large interstate beverage policy variability, CCCs consistently performed better then FCCHs for standards being met. This research will be used to inform future policy and practice improvements.

Acknowledgements

This research was funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health under Award Number R25HL125451. I would also like to thank Lorrene Ritchie and Danielle Lee as my mentors in this research.

Keywords

Family Childcare Home, Childcare Center, Beverage, Policy

Eliana Tucker

Saint Mary's College

Refining CRISPR-Mediated Gene Editing to Correct the Sickle Mutation

Mentor:
David Martin, MD

Funded by: Volunteer

My name is Eliana Tucker. I am a rising senior at Saint Mary's College High School. I've loved science ever since I was little. A lovingly designed and independently funded science program at my elementary school sparked my love for research, development, and discovery. I have held this passion throughout my years as a student and continue to hold this desire for discovery. The opportunity to learn from two amazing mentors, Dr. Wendy Magis and Dr. David Martin, the kind of opportunity I have never gotten in my years of science classes made up of 30 or more other students, has been incredible. And the fact that I have been around peers who share my interests and who I have been able develop my ideas and share my goals with, just makes my time with the CHORI Student Research Program that much more valuable.

I hope to continue on to a scientific career, working with technology not dissimilar to the genetic manipulation technology I have worked with this summer. In the future, thinking grandly, I would love to apply genetic manipulation to our crops in order to combat the drastic degradation of our farmlands and to improve the world's agriculture methods, making our farming more sustainable and improving the relationship between humans and our environment as well as the human condition as a whole.

Introduction

Homozygosity for the sickle mutation in the ß-globin gene results in a defective form of hemoglobin (HbS) that causes sickle cell disease (SCD). SCD is the world's most common monogenic disorder. Annually ~300,000 individuals are born with SCD; most die in childhood. The only currently available curative treatment for SCD is hematopoietic stem cell transplantation (HCT), but this therapy has potentially fatal complications.

Because SCD is caused by a single mutation, targeted gene editing to correct the mutation could cure anybody with SCD. The recent development of a programmable RNA-guided DNA endonuclease known as CRISPR-Cas9 has made targeted gene editing much more flexible and accurate.

Hypothesis/Objective

Homology-directed DNA repair mediated by Cas9 is facilitated by the provision of donor templates derived from both strands of the targeted site. Previous work with a single donor template has corrected the mutation in about a third of genomes in the cell population. We aim to improve on that result.

Methods

Cas9 ribonucleoprotein (RNP) consists of a nuclease protein (Cas9) complexed with an RNA that guides the RNP to a sequence in the genome. The donor templates are short pieces of DNA (oligonucleotides) that have the same sequence as the normal ß-globin gene in the region of the sickle mutation, are complementary to either strand, and overlap for part of their length.

Cas9 RNP is assembled in a tube, the two donor templates added to the solution, and the mix is added to the stem cells in a special buffer designed for electroporation of hematopoietic stem cells. The cells are then electroporated on a Lonza nucleofection apparatus.

After six days, genomic DNA is isolated from some of the cells. The edited region is amplified with PCR and Illumina sequenced to establish the efficiency of gene. Some of the cells are differentiated into erythrocytes in culture, and Illumina sequencing of erythrocyte RNA will measure the proportion of erythrocytes carrying the corrected gene.

Results

Use of the overlapping oligonucleotides S1B1 and S1C1 yields correction of the sickle mutation in 14.8% of alleles from an edited pool of hematopoietic stem cells. However, use of two overlapping oligonucleotides (which form a double stranded oligo due to complementarity) proves to be more toxic to the blood stem cells than with the use of a single stranded donor oligo.

Discussion/Conclusions

This experiment has established that the use of two overlapping oligonucleotides leads to excess toxicity and degradation of the donor cells. Additionally, the cells that do survive are only edited around 15% of the time, which is not an improvement over other methods of editing that yield up to 35%.

Keywords

Sickle cell, globin, CRISPR, gene editing, hematopoietic stem cell

David Xia-Zhu
University of California, Berkeley
Clots in Kids with Cancer

Mentor:
Caroline Hastings, MD

Funded by: National Institutes of Health

I am a first generation Chinese Peruvian immigrant raised in Oakland, CA. I aspire to use my background in biomedical and environmental sciences to contribute to the health field, whether it be in research, medicine, or conservation studies. I chose to work for the CHORI summer research fellowship to attain clinical research experience and directly work with patient data. This summer has allowed me to put human faces to my research and see the impact of my work in my communities. This project has helped me gain a better understanding of medicinal research and the field of oncology. I am currently a rising 3rd year at the University of California, Berkeley studying Molecular and Cell Biology with an emphasis in Biological Chemistry. Using my interests in biochemistry and health, I hope to continue exploring a career path in oncology and pediatric care.

I would like to thank my mentors and the Hematology/Oncology team for providing guidance and mentorship throughout the fellowship. I would like to thank Dr. Cheryl Cohler especially for her direct mentorship with me and setting up clinical experience opportunities for me.

Contributing Authors

Natalie Ward, Cheryl Cohler, Anu Argawal.

Introduction

Venous thromboembolism (VTE) are associated with high morbidity and mortality in patients with cancer. Specifically, in children with cancer, VTE occurs at rates between 2.1-16%. Cancer can be considered a hypercoagulable state where there is activated coagulation and reduced fibrinolysis. In children with cancer, central venous catheters (CVC) are most commonly used as a safe and compassionate administration of chemotherapy, transfusions, and medications. However, use of central venous catheters is associated with VTE. Studies also show a correlation between ALL treatment therapies and increased risk of thromboembolism. Combinations of chemotherapy such as steroids, vincristine (VCR), and asparaginase that induce rapid complete remission increase the activity of haemostatic proteins. Thus, the hypercoagulable state is induced via the suppression of antithrombin and plasminogen and elevation of F VIII/vWF complex. Nonetheless, *all* treatment therapies continue to be studied as there is not enough evidence suggesting asparaginase's causation of significant intravascular coagulation. This project was pursued to further understand the risk factors of VTE.

Objective

To assess the potential risk factors of venous thromboembolism in children with cancer based on presence of central venous catheters and administration of chemotherapy.

Methods

Patient information based on potential risk factors for VTE including type of malignancy, presence of major surgery, chemotherapy agents, and type of CVC will be collected from electronic and paper charts on all patients admitted between 2000 and 2010 to UCSF Benioff Children's Hospital Oakland. We will create a database of all patient data for patients with and without VTE. We will analyze the data to look for trends or significant variables associated with VTE.

Anticipated Results

Patients with more frequent CVC placements will be at greater risk for VTE.
Patients with Peg-Asparaginase and VCR chemotherapy protocols will be at greater risk for VTE.

Discussion/Conclusions

As results are still pending, we will further analyze our data to draw correlations between chemotherapy, CVCs, type of malignancy, and CBCs to determine the risk factors of VTE in pediatric patients.

Keywords

Central venous catheter, venous thromboembolism, cancer, chemotherapy, clot

Pei Wen Xiao

Oakland High School

Examining the Effects of Hyperglycemia and Aging on Neural Stem Cell Behavior In Vitro

Mentor:
Phillip Kang

Funded by: California Institute for Regenerative Medicine

My name is Pei Wen Xiao and I am a rising senior at Oakland High School. My interest in science was the result of an accumulation of unanswered questions as a child and the way science answered to my curiosity, allowing me to explore and understand the world in a unique way. In retrospect, I have always found science fascinating, but in the past year, I have also come to the realization that science is a powerful tool that can be used to solve many of the problems in the world especially in regards to health. However, I have struggled to explore my interest in medical research because I come from an immigrant family who is not well-acquainted in such areas. Thus this opportunity was important to me because it gave me invaluable mentorship and research experience that I wouldn't be able to obtain otherwise. I am extremely grateful for my mentor's patience and willingness to share his knowledge as he guided me through this project. Moving forward, I am more confident that I want to pursue a career in health science and research.

Introduction

Neural stem cells (NSCs) are multipotent stem cells that can differentiate into neurons and glial cells of the central nervous system through neurogenesis and gliogenesis. In the adult mammalian brain, neurogenesis in the subgranular zone (SGZ) of the hippocampal dentate gyrus is important for cognitive functions such as learning and memory. Previous studies observed that diabetes is associated with impaired cognitive functions and dementia, but the underlying mechanisms are not well understood. In some age-related neurodegenerative disorders such as Alzheimer's, Parkinson's and Huntington's diseases, abnormalities in neurogenesis were observed. Because both conditions impact hippocampal functions in similar ways, it is possible that diabetes and age-related neurodegeneration impact common underlying intracellular mechanisms in NSCs.

Hypothesis

We hypothesize that hyperglycemic and aging conditions will reduce neural stem cell proliferation and neurogenesis *in vitro*. Further, we hypothesize that both hyperglycemic and aging conditions will trigger common intracellular mechanisms.

Methods

To test for proliferation, NSCs were grown in 17.5 mM, 25 mM and 50 mM glucose concentrations for six days before immunostaining for Ki-67, a marker for cellular proliferation. To test cell cycle kinetics, an NSC cell line with fluorescent cell cycle indicators was grown and imaged for three days in the same glucose conditions before image analysis. Hydroxyurea treatment was used to induce aging *in vitro*, characterized by increased pH2AX staining foci. NSCs were differentiated in 1 μM retinoic acid + 1% FBS to stimulate both neural and glial differentiation. Western blotting was used to measure target protein levels in various culture conditions.

Results

Previous experiments showed that increased glucose concentrations decreased the number of NSCs and degree of neurogenesis compared to controls. However, Ki-67 staining showed no significant differences across glucose treatments, implying that reduced cell populations were not caused by a reduced fraction of proliferating cells. Further, cell cycle analysis indicated that NSCs were suspended in G1 phase in higher glucose conditions but did not differ significantly from mannose controls. Therefore, we anticipate that further experiments will reveal increased NSC apoptosis in higher glucose conditions as the principle reason for reduced cell populations. Further, following establishment of the *in vitro* aging model, we anticipate that cells treated with hydroxyurea will similarly display reduced proliferative capacity and neurogenesis.

Discussion/Conclusions

Hyperglycemic conditions that mimic diabetes lead to increased G1 cell cycle phase and increased apoptosis in NSCs. Further, hydroxyurea treatment is an effective platform to study NSC aging *in vitro* and leads to decreased NSC proliferation and neurogenesis. These findings implicate that diabetes and aging may impact adult neurogenesis similarly, providing a novel insight into both disease pathologies.

Acknowledgements

Many thanks to my mentor, Phillip Kang, for his patience and guidance throughout the summer. Thank you, CHORI and CIRM for this incredible opportunity.

Keywords

Neural stem cells, proliferation, neurogenesis, diabetes, hyperglycemia, aging

Serina Young

University of California, Santa Cruz

Red Blood Cell Viability for the Treatment of Cell membrane Disorders

Mentor:
Frans Kuypers, PhD

Funded by: National Institutes of Health

My name is Serina Young, and I am a second year undergraduate student at the University of California, Santa Cruz. My interest in translational research began when I worked on a research project at Stanford Medical School that focused on using allogeneic bone marrow transplantation to treat chronic and acute myeloid leukemia. Since then, I have been heavily fascinated with the development of immunotherapies for the treatment of hematological cancers, including stem cell transplantation, and advancing treatments for cell membrane disorders. In the future, I hope to become a physician scientist specializing in hematology and oncology and developing the next generation of chimeric antigen receptor T- cell therapies. These are special treatments that involve programing the patient's own immune system to fight cancer. I hope one day that I could be apart of the new generation of clinician scientist who are combining there knowledge of basic research and clinical expertise to bring forth the best and most effective therapies to improve the quality of life and well being of those affected by blood disorders.

Introduction

A red blood cell's ability to "deform" and change its shape as it passes through vasculurture of various size throughout the body is important to maintain the health and function of important organs. Parameters that determine red blood cells malleability include intracellular hemoglobin concentration, volume to surface area ratio and also the mechanical structure or the membrane. Sickle Cell anemia is a genetic blood disorder resulting in tissues not receiving enough oxygen. Normal blood cells live for 120 days but sickle cells only live for about 10 to 20 days because of their rigid sickle shape that causes them to break easily while moving through blood pathways. This results in sickle cells dying quickly and the body not being able to replenish them with new red cells at the same rate resulting in anemia. Because of their rigid nature, sickle cells also have a tendency to clot blood vessels in the body, which can lead to organ failure.

Objective

Our Objective is to compare three different cell viability approaches on both normal and diseased blood, and quantitatively correlate the results gained by each to provide recommendations on how to precisely and accurately maximize the use of these technologies to measure red blood cell viability in clinical settings.

Methods

Samples evaluated were sourced from healthy patients who were controls, sickle cell patients, and sickle cell patients who have undergone bone marrow transplantation. Cell deformability was measured using a Laser-assisted Optical Rotational Cell Analyser (LORCA), and traditional Ektacytometer which work by applying sheer stress to red cells in suspension, causing the cells to deform into elliptocytes. A laser is then used to create a diffraction pattern which determines ellipticity. Samples were also tested using Osmotic Fragility Assessment, which measures the optical density of hemolyized red cells in solutions of various osmolarities, indicating the percent of cells that can deform properly.

Anticipated results

Curves produced by the LORCA, Ektacytometer and Osmotic Fragility Assessment will likely indicate a common correspondence at the osmotic minimum, which is the minimum point on the elongation index that represents the osmolality at 50% of red cell hemolysis, the DImaximum which represents the Elongation Index at 290 osmol, and the hypertonic Osmolality, which corresponds to Osmolarity above 290.

Acknowledgments

Dr. Kuypers, Sandra Larkin, and Jay Dandekar

Keywords

Hematology, Sickle cell

National Institutes of Health (NIH) Scholars

This group of undergraduate students was funded by the National Institutes of Health (NIH), Short Term Research Education Program to Increase Diversity in Health-Related Research.
The students were selected from a competitive pool of undergraduates from all over the United States. Each NIH funded student developed their own hypothesis driven project, carried out this project during the 9-week one-on-one mentored program, presented a brief 'elevator talk' about their work to their peers, participated in weekly educational enrichment activities and will be presenting the findings of the results from their project in today's symposium

Pictured
(Back Row: left to right)
David Xia-Zhu, Parsa Noori, Jonathan Aguayo, Arturo Ramirez, Saher Daredia, Serina Young, Marina Franco, Alishah Momin, Raquel Traseira Pedraz, Angel Okoro, Tajii Thomas
(Front Row: left to right)
Amritpal Kaur, Jerusalem Nerayo, Laneé Jung, Angie Bustos, Katie Jocelyn, Malekah Isa, Alexandra Alvarez, Elijah Goldberg, Brittney Deadwiler

Not pictured: Oliver Fajardo, Marisol Contreras.

California Institute for Regenerative Medicine (CIRM) Scholars

This group of students was funded by the California Institute for Regenerative Medicine (CIRM) Leveraging Investment in High School Training Summer Program to Accelerate Regenerative Medicine Knowledge: Light-A-SPARK. Their summer research project's focused primarily on stem / progenitor cell or translational research. In addition, they engaged in patient focused activities such as writing letters to patients who had experienced a bone marrow transplant and meeting with a patient who had received a bone marrow transplant, blogged about their research activities, and attended numerous additional education activities regarding stem and bone marrow transplant. They also volunteered their services to the BMT program here at UCSF Benioff Children's Hospital Oakland during a day long informational program about Bone Marrow Transplant to Families of Patients with Sickle Cell Disease. These students had the opportunity to present their results twice, at the CIRM-SPARK annual conference, and again today during the CHORI symposium.

Pictured
(Left to Right)
Sakina Bambot, Pei Wen Xiao, Jonathan Luo, Catherine Campusano, Alex Ahilon-Jeronimo, Chima Ezeh

Doris Duke Charitable Foundation (DDCF) Scholars

These students were funded by a grant from the Doris Duke Charitable Foundation, Clinical Research Continuum: High School to College Program. Both high school and returning CHORI DDCF Scholars who are now undergraduate students are funded under this program. All students are interested in pursuing careers in bioscience and/or health care. Each DDCF funded student developed their own hypothesis driven project with the assistance of their mentor, carried out this project over our 9-week program, created a detailed individual development plan (IDP), and participated in weekly mentoring meetings and educational enrichment activities. Each student is presenting the results of the findings from their project at the symposium today.

Pictured

(Left to Right)
Armen Phelps, Eric Garcia, Teresa Perez, Netzali Can, Samantha Alvarado, Lara Ramirez,
Nicolas Chris Nido, Mario Gonzalez

Students Presenting Elsewhere

Jenny Juarez, SSRP Alumni 2017

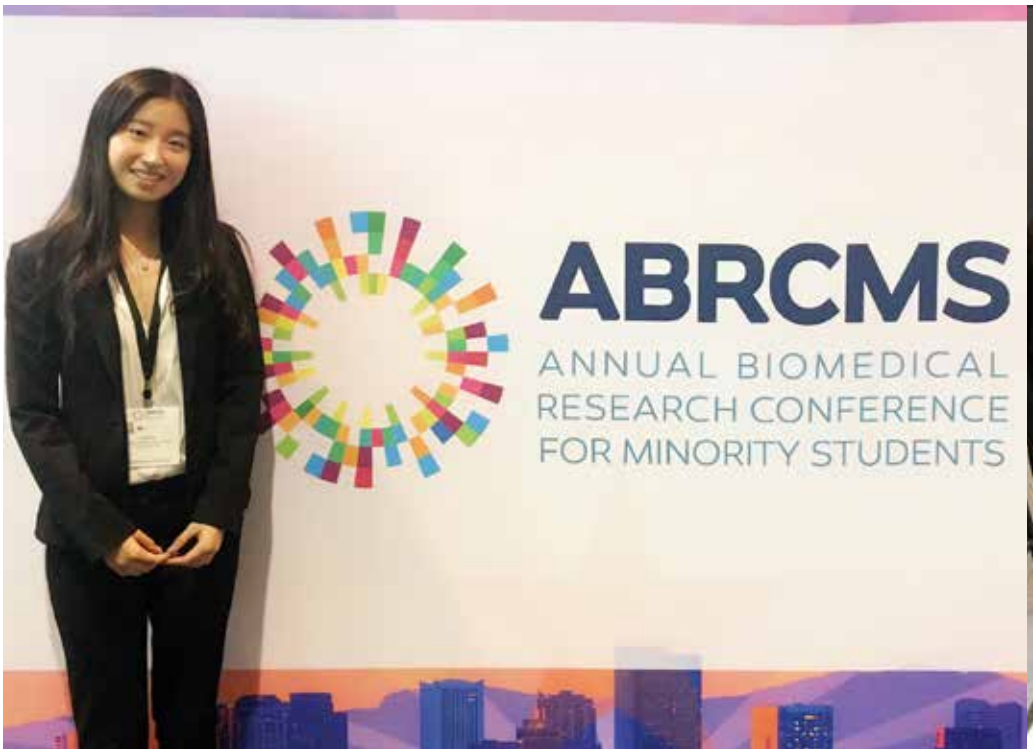
Biomedical Sciences Career Program

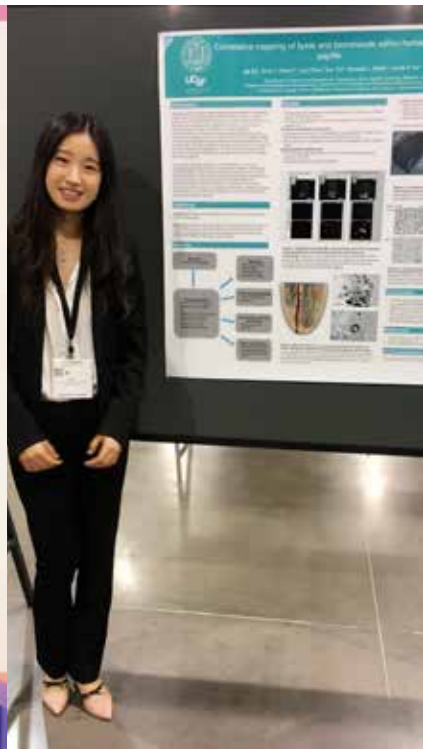
Boston, MA, April 2018

The biomedical science careers program was a phenomenal experience as they highlighted the importance of mentorship. There was also an exchange of information on diverse health and biomedical careers. They had a panel of physicians, nurses and scientists who gave us the opportunity to learn and ask questions about the different stages in the career. Harvard's medical school admission panel was also present and it was great to learn about their expectations.

Also Pictured: Lilian Hernandez

Students Presenting Elsewhere





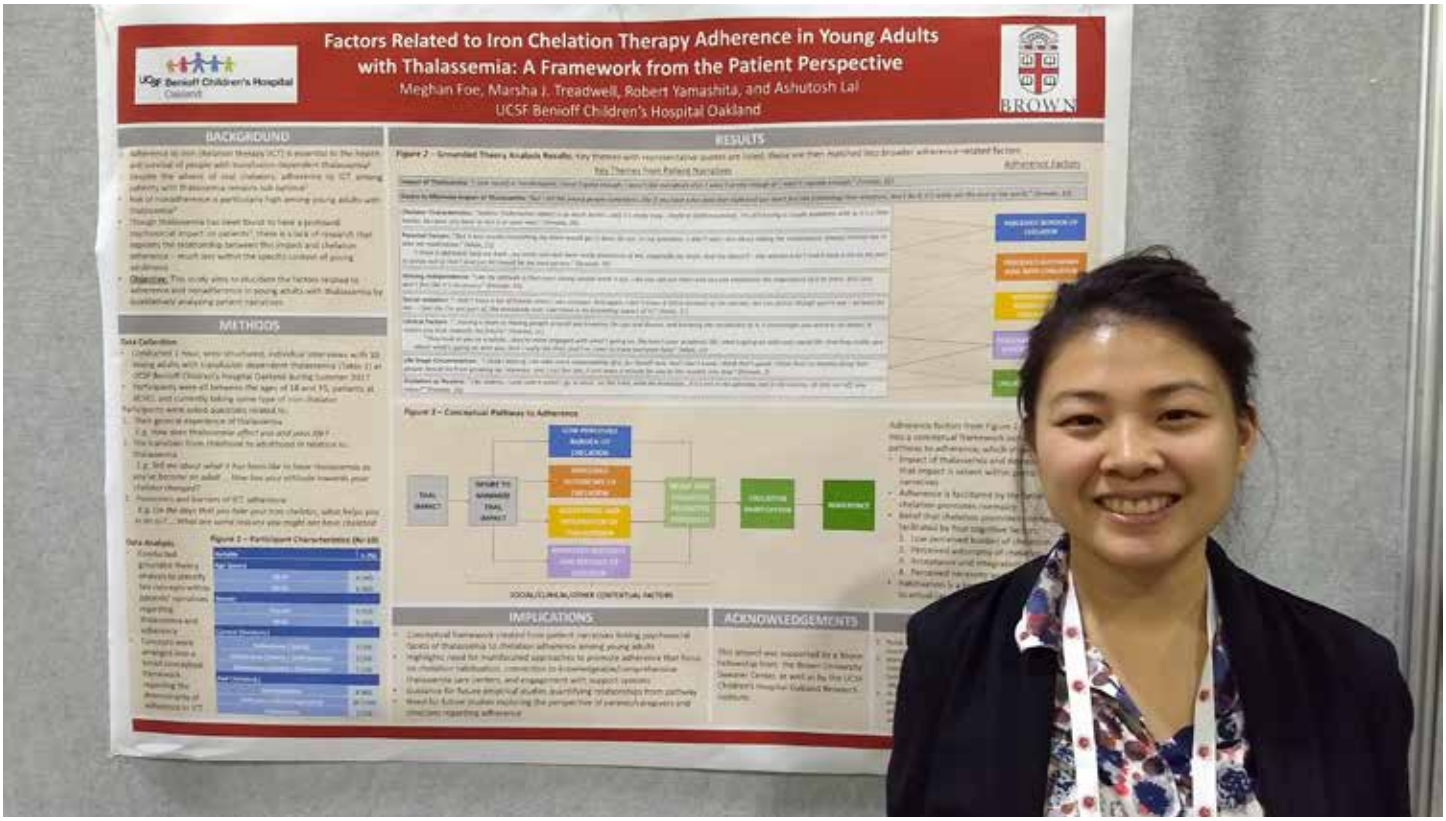
Jia Yu, SSRP Alumni 2017

Annual Biomedical Research Conference for Minority Students

Phoenix, AZ, November 2017

Attending and presenting at ABRCMS 2017 was truly an eye opening experience for me. I have met some really inspiring leaders in the medical field and had opportunities to interact with them. More excitingly, I got the chance to hear the amazing presentation from Dr. Alfredo Quinones-Hinojosa (Dr. Q), who is a leading neurosurgeon, scientist and professor at Mayo clinics. Hearing his story of coming to America as a poor immigrant, and finally strived to where he is now is truly the best part of the conference in my opinion. Presenting at a national conference was also a very exciting experience for me. I have heard some valuable comments about my presentation and project. Seeing myself having confidence to engage in a deep scientific conversation with some leading professors and scientists in the field made me really grateful for the training I received from CHORI and my mentor Dr. Ho during the summer. The extensive literature review and presentation practice over the summer allowed me to speak very scientificly and passionately, which made strong impressions on listeners and opened up to some awesome connections. CHORI pragram had a huge impact on my education, allowing me to find so many good role models in the field, and providing great opportunities for me to work towards my dream. Thanks CHORI for supporting me to go to ABRCMS and having such a wonderful experience. I am also very grateful for my mentor Dr. Ho for putting time into me, and training me to think and work as a scientist.

Students Presenting Elsewhere



Meghan Foe, SSRP Alumni 2017

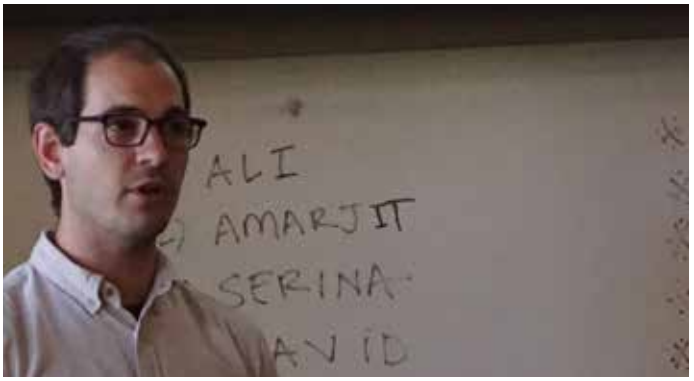
American Society for Hematology

Atlanta, GA, December 2017

This December, I presented a poster about my summer research at the annual American Society of Hematology (ASH) Annual Meeting and Exposition in Atlanta, GA. Due to the unusual weather conditions, I was unfortunately only able to attend the conference on the afternoon of my poster presentation, but even that was an eye-opening experience. This was my first time presenting research on a platform of this scale, and I learned a lot about how to communicate my findings to individuals from a wide range of avenues within the field of hematology. Furthermore, I was fortunate to be able to speak with researchers whose projects and interests aligned with my own, and to learn about different perspectives and approaches to exploring the same topic. From these conversations, I was able to think about how my own research project and interests could further develop in the future. Altogether, presenting at ASH was a wonderful experience, and I am so grateful to CHORI and to my mentors at BCHO for the opportunity to do so!

http://www.bloodjournal.org/content/130/Suppl_1/2080

Mentors and Presenters



This Year's Mentors

Mentor	Department/Division	Location
Anu Argawal, MD	Hematology/Oncology	BCHO
Baylee Decastro, MS	Center for Community Health and Engagement	BCHO
Caroline Hastings, MD	Hematology/Oncology	BCHO
Carolyn Hoppe, MD	Hematology/Oncology	BCHO
Coralie Signorell, PhD	Center for Nutrition & Metabolism	CHORI
Dani Lee, MPH RD	Nutrition Policy Institute	UCB
Dario Boffelli, PhD	Epigenetic inheritance	CHORI
David Killilea, PhD	Center for Nutrition & Metabolism	CHORI
David Martin, MD	Center for Genetics	CHORI
Dayna Long, MD	Pediatrics	BCHO
Deborah Dean, MD MPH	Center for Immunology & Vaccine Development	CHORI
Ellen Fung, PhD RD CCD	Bone Density Clinic	BCHO/CHORI
Ellen James, PhD PNP	Gastroenterology	BCHO
Frans Kuypers, PhD	Center for Sickle Cell Disease & Thalassemia	CHORI
Greg Moe, PhD	Center for Immunology & Vaccine Development	CHORI
Janelle Noble, PhD	Center for Genetics	CHORI
Jennifer Price, MD	Hepatology	UCSF
Joel White, MD	Preventive & Restorative Dental Science	UCSF
June Tester, MD MPH	Pediatrics, Childhood Obesity	BCHO/CHORI
Karen Daley, MA	Primary Care / Asthma	CHORI
Kathleen Schultz, MS	Center for Nutrition & Metabolism	CHORI
Kevin Tharp, PhD	Surgery	UCSF
Kimery Leong, PhD	Pharmacy	BCHO
Lela Bachrach, MD	Adolescent Medicine	BCHO
Lorrene Ritchie, PhD RD	Nutrition & Public Health	UCANR NPI
Mala Setty, MD	Gastroenterology	BCHO
Mariana Casalia, PhD	Neurological Surgery	UCSF
Marisa Medina, PhD	Center for Cardiovascular Disease	CHORI
Marsha Treadwell, PhD	Psychology	BCHO
Mercedes Paredes, MD PhD	Neurology	UCSF
Mindy Benson, MS PNP	Asthma Clinic	BCHO
Nancy Keller, PhD	Center for Genetics	CHORI
Peter Beernink, PhD	Center for Immunobiology & Vaccine Development	CHORI
Peter James Zushin		UCB
Phillip Kang	Bioengineering	UCB
Rachel Kuperman, MD	Neurology	BCHO
Ronald Krauss, MD	Center for Nutrition & Metabolism	CHORI
Ryo Sanbria Higuchi, PhD	Molecular and Cell Biology	UCB

This Year's Mentors

Mentor	Department/Division	Location
Sandra Larkin, PhD	Center for Sickle Cell Disease & Thalassemia	CHORI
Sandra Calloway, PhD	Center for Genetics	CHORI
Sarah King, PhD	Center for Nutrition & Metabolism	CHORI
Sawhel Maali	Center for Community Health and Engagement	BCHO
Shelly Shih, PhD	Center for Genetics	CHORI
Steve Oakes, PhD	Pharmacy	BCHO
Tariq Ahmad, MD	Endocrinology	BCHO
Vianca Vianzon	Center for Immunobiology & Vaccine Development	CHORI
Ward Hagar, MD	Hematology/Oncology	BCHO
Yan Zhang, PhD	Preventive & Restorative Dental Science	UCSF
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
NPI	Nutrition Policy Institute
UCANR	University of California, Agriculture and Natural Resources
UCB	University of California, Berkeley
UCSF	University of California, San Francisco

Notes

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Children's Hospital Oakland Research Institute

37th Summer Research Symposium 2018

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