MOVING FORWARD TOGETHER

38th CHORI Summer Student Research Symposium 2019

Friday, August 9 • 9AM-4PM

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

UCSF Benioff Children's Hospitals
Oakland | San Francisco

August 9, 2019

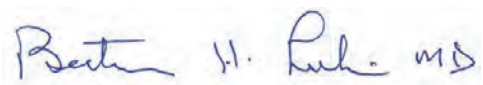
Welcome to the Annual CHORI Summer Student Research Symposium (SSRP). In the summer of 1981, we hosted our first research program to a handful of students; today as we celebrate the 38th year, the program has quadrupled in size, but our mission has remained the same, focused on increasing the diversity of science- which is represented in abundance in this summer's matriculating class. The theme of our Symposium this year, 'Moving Forward Together', capitalizes on the importance of collaboration in science. Our CHORI summer interns represent the beauty of collaboration, creativity and hope for the future in biomedical research.

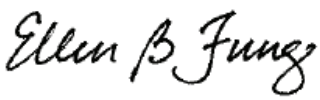
The CHORI SSRP provides a short-term education and training to high school and undergraduate students with a broad range of backgrounds and experience. Despite their diverse backgrounds, all these trainees have one common goal - they are considering careers in biomedical research and other health care fields. Today's oral and poster presentations constitute the conclusion of a nine-week long program that has featured a rigorous mentored guided research project and education curriculum.

Today, we invite you to learn about the original research projects that our trainees were involved in. Students asked important basic and clinical research questions such as: "What are the effects of pubertal suppression on bone in transgender youth?", "Does mitochondrial dysfunction affect cholesterol metabolism?", "Can a simple blood test serve as a novel marker of cardiovascular heart disease," or "Are healthy foods purchased from vending machines on college campuses?" Please mingle and chat with the all the students, 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, the core of our leadership team, as well as Kathy Schultz, Jennifer Beckstead, 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, ACHPP, the Bert Lubin Scholarship Fund 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,





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Principal Investigator & Co-Director
CHORI Summer Student Research Program

Ellen B. Fung, PhD RD CCD
Associate Scientist
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CHORI Summer Student Research Program

Contents

Contents

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LIGHT-A-SPARK, #EDUC3-08399

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

Awarded to: Drs. Mark Wong and Seti Sidharta

The Alameda County Health Pathway Partnership

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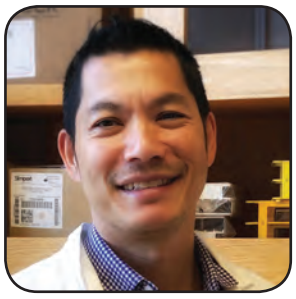

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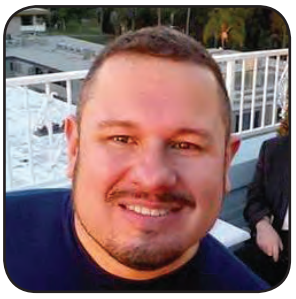

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2019

CHORI Summer Student Research Program Curriculum

Program Orientation: June 10, 8:30-4:30 pm
Location: CHORI Little Theatre
Catered continental breakfast and lunch provided

- Introduction and background to SSRP, explanation of curriculum
- Keynote lecture
- Computer access, badging, CHORI tour

If students cannot make the June 10th orientation, a make-up orientation is offered on June 17th from 1:00-3:00 pm. Students are required to complete the orientation BEFORE beginning their projects.

Safety Training: June 12, 10:00 – 1:00 pm
Location: CHORI Little Theatre
Mandatory safety training with CHORI Safety Officer, Miriam Fang. If students cannot make the June 12th training, a make-up class is offered on June 18th from 1:00-4:00 pm. Students are required to complete this training BEFORE beginning their projects.

Meetings with Off-Site Mentors
June 12, 10:00 – 11:00 am UCSF Mentor Orientation Meeting
Undergraduate students with mentors at UCSF will travel to the Parnassus campus along with the SSRP Co-Director to meet with their mentors (Location: Campus Library 215/216; UCSF)
June 12, 2:30 – 3:30 pm UCB Mentor Orientation Meeting
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; UCB)

Basic Science Boot Camp: June 13 (12:00 – 4:00 pm) June 14 (9:00 – 5:00 pm)
Location: June 13: NEOS Conference Room, CHORI; June 14: CHORI Lab TBD
Mandatory basic laboratory training for high school students who will be working in wet laboratories (at CHORI or UCB). Optional opportunity for undergraduate students working in labs interested in a refresher, if space is available.

Student Photo Day: June 17, 9:00 am
Location: CHORI Main Courtyard
All students must be present on photo day, CHORI main courtyard. Dress should be business casual.

Community Building Activities: June 17, 10:00 – 12:00 pm
Location: CHORI Library

Research Project. June 12 - August 9
Student interns will conduct research with assigned mentor. The details of research plan are left to the mentor. Each summer intern will follow the procedures, and schedule, laid out by their respective labs or clinic.

Written Research Plan. Due: June 26 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 and should 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 are expected to work closely with their mentor in the preparation of a research plans. Mentors must review and approve the plans before submission will be accepted. 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 20 – August 1
Location: CHORI, BCHO & UCSF
Students are required to attend weekly lectures delivered by CHORI, UCSF, UCB and BCHO 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 on **Thursday afternoons**. Location will either be at CHORI in the Little Theatre, BCHO Auditorium or at UCSF Parnassus Campus. Refreshments will be provided.

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

Abstracts: Due July 17 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 and should include:

- Title
- Statement of problem
- Objective or hypothesis
- Methods
- Results or anticipated outcomes
- Conclusions
- Acknowledgements

An abstract template is provided as a download from this link:
http://www.chori.org/Education/Summer_Internship_Program/summer_curriculum.html .Mentors must review and approve the plans before submission will be accepted. 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.

CHORI Summer Student Research Symposium, August 9, 2019
Location: CHORI Library
A one-day symposium will be held on Friday, August 9th. Family members, teachers, lab members and friends are welcome to attend. 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. All students *are **required*** to participate and present their research projects. 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. 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.

Summary of Important Dates 2019:

June 10	**Program Orientation**: 8:30 am – 4:30 pm
June 12	**Safety Training**: 10:00 – 1:00 pm
June 12	Off-Site Mentor Visits *(Required for students working at UCSF & UCB only)*
June 13 & 14	Basic Science Boot Camp *(Required for High School Students working in labs)*
June 17	**Student Photo Day** meet at 9:00 am CHORI Main Courtyard
June 17	**Community Building Activities**: 10:00 – 12:00 pm
June 17	Make up Orientation: 1:00 – 3:00 pm - CHORI Little Theatre
June 18	Make up Safety Training: 1:00 – 4:00 pm
June 19	Stem Cell Workshop, UCB: 9:00 – 12:00 pm (*Required for CIRM students only*)
June 26	**Written Research Plan** due by 4:00 pm
July 3	**Personal Statement** due by 3:00 pm
July 17	**Abstracts** due by 4:00 pm
August 9	**Summer Student Research Symposium**, All Day, CHORI Library
August 11 & 12	CIRM Poster Day, Pasadena, CA (*CIRM students only*)

Bold Assignments/Trainings Required for All Students

Program Seminars: *July 3, 11, 18, 25, 31: 3:00 – 5:15 pm at CHORI Little Theater*
June 27, 3:00 – 5:15 pm at BCHO Auditorium
June 20, 3:00 - 5:15 pm at UCSF Campus, Location TBD

Social gatherings tentatively scheduled for: July 11 & July 25, 5:30-7:00 pm
Vital Signs Workshop, tentatively scheduled for: July 18, 5:15 – 6:30 pm

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

***Questions about these assignments? Contact Roi Edwards:** ssrp@chori.org; V: 510-450-7604*

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

Lecture Series 2019

June 13 Thursday
CHORI Theater


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

June 20 Thursday
UCSF MedSci 214


The Dream and Journey of an Academic Medical Career — 3:00 PM
Lenny Lopez, MD, MDiv, MPH (UCSF)

Getting the Most out of Scientific Literature — 4:00 PM
Kala Mehta, DSc, MPH (UCSF)

June 27 Thursday
BCHO OPC Auditorium


Cancer Immunotherapy: The Real Silver Bullet? — 4:00 PM
Anu Agrawal, MD (BCHO)

What is a Sports Medicine Physician? — 5:00 PM
Cindy J. Chang, MD (BCHO)

July 3 Wednesday
CHORI Theater


Elevator Talks - Session 1 — 3:00 PM
SSRP Students

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

July 11 Thursday
CHORI Theater


Virtual Reality as a Pain Therapy for Pediatric Patients — 3:00 PM
Simon Robertson (KindVR)

Elevator Talks - Session 2 — 4:00 PM
SSRP Students

July 18 Thursday
CHORI Theater



Elevator Talks - Session 3 — 3:00 PM
SSRP Students

Wait, You Mean I Have to Talk? In Front of People?? — 3:30 PM
John McDonnell (CHORI)

The Human Cell Atlas Project: a Google Maps for Biology — 4:00 PM
Aaron Streets, PhD (UC Berkeley)

July 25 Thursday
CHORI Theater


Pregnancy and Rheumatoid Arthritis: Can we learn from nature? — 3:00 PM
Damini Jawaheer, PhD (CHORI)

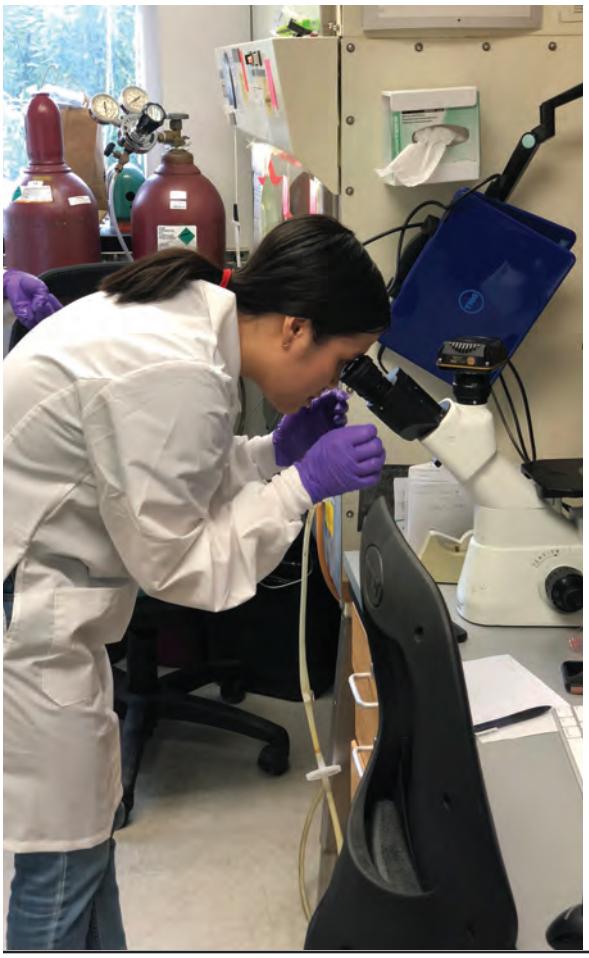
Elevator Talks - Session 4 — 4:00 PM
SSRP Students

August 1 Thursday
CHORI Theater

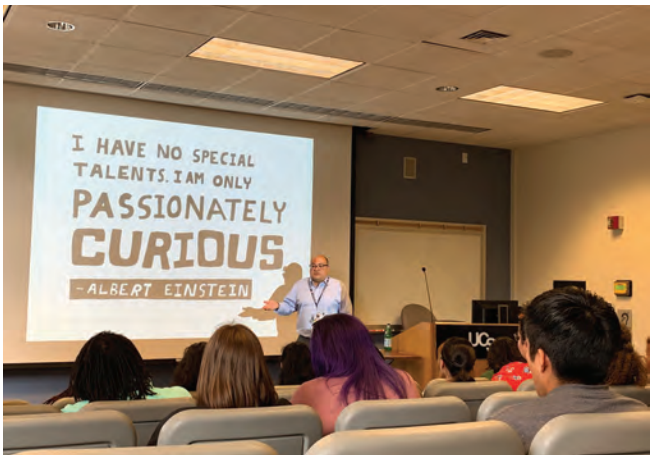

Everything Matters: Even Zinc — 3:00 PM
Janet King, PhD (CHORI)

Ethics of Science Case Studies — 4:00 PM
David Killilea, PhD (CHORI)

2019 Summer Students



2019 Summer Students



2019 Summer Students

JOIN US

MOVING FORWARD TOGETHER

38th CHORI Summer Student Research Symposium 2019

Friday, August 9, 2019 • 9AM-4PM

Jonathan Aguayo

University of California, Berkeley

Determining the roles of NCKX4 on KLK4-mediated Enamel Matrix Protein Degradation during Amelogenesis

Mentor:
Yan Zhang, MD PhD

Funded by: National Institutes of Health

Hello, my name is Jonathan Aguayo and I am a rising senior at UC Berkeley studying cell and developmental 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.

After having partaken in the CHORI Summer Student Research Internship a year ago, an experience where I learned so much about conducting real-life science, I knew I had to reapply for another summer. This program has opened my mind up to the world that is biological science research in ways I could have never imagined. Knowledge is a wonderful thing, and I will never stop my pursuit in acquiring more of it. I want to thank everybody involved in this program, including all the faculty involved in CHORI and especially to my mentor Dr. Yan Zhang for taking me under her wing.

Introduction

Amelogenesis is a multistep biological process through which highly calcified enamel tissue forms to protect the underlying dentin and pulp. This process is orchestrated by ameloblasts, specialized epithelial cells, and takes place in three stages: the secretory stage, the transition stage, and the maturation stage. During the secretory stage, ameloblasts synthesize and deposit enamel matrix proteins, which act as a guide for the growth of calcium phosphate-based crystals. Successful crystal growth is dependent on the degradation and removal of enamel matrix proteins from developing enamel matrix. Retention of proteins in the late maturation stage of enamel matrix may lead to amelogenesis imperfecta, a condition characterized with soft and brittle enamel.

Hypothesis/Objective

Nckx4 is a potassium-dependent sodium-calcium exchanger. With the deletion of Nckx4 function, hypomineralized enamel and retention of enamel matrix proteins were observed. KLK4 is the major proteinase released by ameloblasts during the maturation stage to hydrolyze enamel matrix proteins and remove them from the forming enamel layer. We hypothesize that the deletion of Nckx4 deteriorates the efficiency of KLK4 to degrade enamel matrix protein, leading to enamel matrix protein retention and amelogenesis imperfecta.

Methods

Histological H&E staining and immunofluorescence staining were employed to track enamel matrix protein retention in both Nckx4 wild type and Nckx4 null mouse enamel matrix. KLK4 enzymatic activity in hydrolyzing the major enamel matrix protein amelogenin will be measured by in situ zymography. Maturation stage enamel matrix, rich with KLK4, will be incubated with substrate FITC-gelatin to quantitate the KLK4 activity in Nckx4 wild type and Nckx4 null mouse enamel matrix.

Results or Anticipated Results

Our histological analyses showed that a significant amount of enamel matrix protein was detected in the maturation stage of enamel matrix of Nckx4 null mice as compared to that in Nckx4 wild type mice. KLK4 in the maturation stage of enamel matrix of Nckx4 null mice was less efficient in hydrolyzing amelogenin and FITC-gelatin as compared to wild type.

Discussion/Conclusions

In addition to Nckx4's function as a potassium-dependent sodium-calcium exchanger, Nckx4 is critical for the activity of KLK4, the major proteinase that removes enamel matrix proteins at the maturation stage of enamel formation. Factors as to why null Nckx4 in the mouse enamel matrix affects KLK4 enzymatic activity is still under investigation.

Acknowledgments

I would like to thank Dr. Zhang for this wonderful experience and wish her and her lab well in their future endeavors.

Keywords

Amelogenesis, ameloblasts, amelogenesis imperfecta, enamel matrix, enamel

Samantha Alvarado

Effect of ERT Compliance on Biochemical Measures of GAG Storage in MPS Disease

Mentor:
Jacqueline Madden, PNP
Funded by: Doris Duke Charitable Foundation

My name is Samantha Alvarado and I recently graduated from Holy Names High School in Oakland. In the fall, I will be attending Southwestern University in Georgetown, Texas. This is my second summer participating in the CHORI program, and I luckily was placed to work in the gastroenterology department again. The CHORI program strengthened my determination to pursue a career in the medical field, yet it also allowed me to realize that I would rather work with adults than children. I will be majoring in Biology and minoring in International Studies. I still hope to become a doctor and travel to impoverished countries that need medical aid. Children's Hospital Oakland does a beautiful job of helping minorities, and I would love to work in an environment such as this one. CHORI exposed me to the world of clinical research and I aspire to do more research in my learning career, as I have learned the importance of it. I am tremendously grateful to my mentor, Jacqueline Madden, who taught me so much and for allowing me to be by her side this summer.

Introduction

Mucopolysaccharidosis (MPS) is a condition where the body is missing a specific enzyme needed to break down chains of sugar molecules, glycosaminoglycans (GAGS). Health problems occur due to the accumulation of GAGs in lysosomes. Urine GAG (uGAG) levels are biomarkers for MPS. Physicians look at the total GAG excretion and subtypes (HS, CS, KS, and DS) to identify the severity and type of MPS and to monitor response to ERT (Enzyme Replacement Therapy). With ERT, it's possible to slow down the progression of MPS, but not cure it.

Hypothesis/Objective

ERT (Enzyme Replacement Therapy) compliance is important in maintaining low GAG (glycosaminoglycans) storage levels as measured by uGAG.

Methods

After IRB approval, medical records of patients with MPS receiving ERT at BCHO (n=22) will be reviewed for the number of uGAG tests done since 2014. Patients with any type of MPS (I, II, IVA, and VI) who have had two or more uGAG tests will be included in the study population and assigned a study ID. Results of uGAG testing will be recorded as either WNL (within normal limits) or as a fold increase over the upper limit of normal (ULN). This will allow for comparison between subjects where the reference range differs because of age or changes in methodology. The number of missed doses of weekly ERT in the 4 weeks and in the 26 weeks (6 months) prior to the uGAG test will be recorded.

Anticipated Results

It is expected that ERT compliance in the 4 weeks before uGAG testing will have a greater impact on results than the compliance over 26 weeks.

Discussion/Conclusions

This research is significant for clinicians to better understand the temporal relationship between uGAG results and ERT compliance.

Acknowledgments

A huge thank you to my extremely helpful mentor, Jacqueline Madden, for her dedication to teaching me about her work and patients. Also, thank you to Ginny Gildengorin and Erin Jozwiak for aiding us with this project.

Keywords

MPS, ERT, uGAG

Natalie Asemi

Sonoma State University

Pharmacokinetics of Pediatric Chemotherapeutics

Mentor:
Caroline Hastings, MD

Funded by: National Institutes of Health

My name is Natalie Asemi. I am a first generation Iranian American, entering my final year at Sonoma State University majoring in Biochemistry and minoring in Sociology. It was in my high school biology course where I found myself intrigued by topics relating to the human body and found science capable of answering and giving rise to new questions. I felt drawn to sociology after taking my first class in the subject. It has heightened my ability to recognize the role social factors play in influencing health while giving me the knowledge to act and create change. Through the culmination of my life experiences, I realized that medicine embodied a marriage of my passion to serve others and help them find comfort in difficult times as well as my interests in sciences, which is why I knew the field was right for me.

I am very grateful to Dr. Caroline Hastings and Dr. Anu Agrawal for allowing me the opportunity to perform clinical research to understand how we can work to improve pediatric cancer patients outcomes who come from diverse populations. They have inspired me through the humility and compassion they show each day through their noble efforts. CHORI has allowed me to gain new perspectives, foster my creativity, and solidify my goals of becoming a physician.

Introduction

Substantial racial differences exist in both incidence and treatment outcomes among pediatric cancer patients. Studies in patients with acute lymphoblastic leukemia, the most common childhood malignancy, have shown that African American, Hispanic, and Native American children fare worse than Caucasian and Asian children. This has been similarly reported in pediatric acute myelogenous leukemia. Some of this gap can be explained by lower socioeconomic status, and, potentially, compliance differences; however, genetic differences in chemotherapeutic drug metabolization also alters response and side effect profile. Clinical therapeutic protocols have not considered race or ethnicity in dosing guidelines for chemotherapeutics which remain based solely on body surface area. Studies have shown improved clinical outcomes can be achieved through the use of pharmacokinetic modeling to optimize the target therapeutic window of chemotherapeutic drug exposure to decrease toxicity and increase efficacy of treatment.

Hypothesis/Objective

Patients will have variable metabolism to high dose methotrexate (HD-MTX) due to differential characteristics. We hypothesize that age, body mass index (BMI), and self-reported ethnicity may be variables which impact HD-MTX metabolism in pediatric patients with cancer.

Methods

Retrospective analysis will be done on patients who received high dose methotrexate as a part of their treatment regimen at UCSF Benioff Children's Hospital Oakland between 2010-2015. Patient information will include diagnosis, age, sex, self-reported ethnicity, BMI, baseline laboratory parameters, HD-MTX levels through drug clearance, and side effects. Data will be collected from electronic records and paper charts. We will create a database, analyze the data using univariate and multivariate analysis to analyze potentially significant variables. Secondarily we will engage with InsightRx, a local partner, in the creation of a pharmacokinetic model based on the data collected.

Results or Anticipated Results

We anticipate that certain baseline factors such as BMI, age, and self-reported ethnicity may play a role in the metabolism of HD-MTX and subsequently side effects. Accounting for these covariates will guide the creation of a better fit pharmacokinetic model for our diverse population.

Discussion/Conclusions

Individualized patient differences likely in part drive chemotherapeutic metabolism and side effects. Based on the collected data and analysis, we aim to inform appropriate individualized dosing for patients receiving HD-MTX.

Acknowledgments

Dr. Hastings, Dr. Agrawal, CHORI Program Coordinators, NIH

Keywords

Pharmacokinetics, HD-MTX, acute lymphoblastic leukemia

Noor Ayyad

University of California, Davis

Production of Neisseria Gonorrhoeae Candidate Vaccine Antigens in Escherichia Coli

Mentor:
Peter Beernink, PhD

Funded by: National Institutes of Health

Hello, my name is Noor Ayyad. I'm a rising junior at UC Davis, having just graduated from Contra Costa College. I'm a first generation Palestinian-American college student and hope to major in Biology with a minor in Public Health. Growing up in an immigrant family has made me more aware of the health issues and the lack of resources they have back in Palestine. Seeing this inspired me to one day open my own clinic in Palestine, serving low-cost medical advice and treatments to the people who don't have access to basic health rights.

CHORI gave me the opportunity to immerse myself and clear my doubts, knowing for sure I would like to pursue a goal in the medical field. I would like to thank my mentor, Dr. Beernink, for giving me his time to explain things thoroughly. I would also like to thank the Beernink lab members, especially Claudia, for all their help this summer.

Introduction

Gonorrhea is an important public health problem and a common disease in the United States. With an estimated 62 million new infections annually, it is one of the most widespread sexually transmitted diseases. The bacterium that causes these infections, Neisseria gonorrhoeae, is unique in its ability to have a diverse population that varies in their surface proteins. This variation leads to a variation in their severity as an infection. Specific subtypes are able to avoid mucosal and serum immune responses and are more likely to spread the infection, while other subtypes have become antibiotic resistance to some if not all available antibiotics. It is imperative that antibiotic resistance in N.gonorrhoeae is monitored and researched so that the development of new treatments would be available in the future and this continues to be a curable infection. The progress of an effective anti-gonococcal vaccine is the key to prevent and control gonococcal infections. In this study, we tested six proteins for their potential as candidates vaccine antigens against gonococcal diseases.

Objective

To produce and isolate six different proteins through bacterial transformation, protein expression, and purification. To then identify which of the purified proteins would be possible candidates for gonococcal vaccines.

Method

To test for possible antigen uses for anti-gonococcal vaccine, we are using E.coli strains containing pET21 plasmids encoding six proteins: MetQ, GNA1220, Rmp, MIP, BamA, and LptD which are derived from N. gonorrhoeae and have been DNA sequenced verified. The plasmids encoding these proteins will be transformed into the E. coli BL21 (DE3) expression strain. We will then isolate proteins from the transformed E. coli and purify the proteins of interest for antigen testing by Nickel affinity chromatography for further testing of their immunogenicity.

Anticipated Results

We anticipate that we will be able to obtain at least one protein that is a good candidate for further testing for antigen characterization and vaccine development. By investigating these proteins, it will give us more knowledge as we continue the research into examining how other proteins might be of use for future vaccines against N.gonorrhoeae.

Conclusions

It is estimated that by 2050, most N. gonorrhoeae strains will have developed antibiotic resistance and our current treatments will be ineffective. Research such as this project is vital if we hope to keep this common infection preventable or curable. Gonococcal vaccine development is a promising area of research, and this project is just one step within that pipeline as we try to develop these vaccines.

Acknowledgments

I would like to thank Peter Beernink for his amazing mentorship and for giving me the opportunity to gain hands-on experience. Thank you to all the lab members who have helped me. I would also like to thank the NSF/NIH and CHORI for giving me this opportunity.

Keywords

Neisseria gonorrhoeae, BL21 (DE3), vaccines, protein expression

Haley Barton

California State University, Stanislaus

Health Literacy and Education Disparities in Teens With Diabetes

Mentor:
Alison Reed, MD, Tariq Ahmad, MD,
Ellen Fung, PhD RD CCD

Funded by: National Institutes of Health

I am Haley Barton and I attend California State University Stanislaus. In the fall I will start my third year studying Health Science, with a concentration in Administration and Leadership. I have always had a passion for helping others and an interest in medicine. Growing up in San Diego, I saw a large gap in wealth, education and health. I aspire to help limit the gap and be a role model for my community. I plan to graduate and move back to San Diego where I hope to make a difference in the community. I aspire to be passionate about the work I do and hope to work on health education or public health policy after graduation.

I am greatly appreciative of the opportunity to work with Dr. Ellen Fung, Dr. Allison Reed and Dr. Tariq Ahmad this summer. Being in a clinical setting has given me exposure that has confirmed my passion for medicine. Being surrounded by educated and driven scientist, students and doctors has been fulfilling to say the least. Working in Endocrinology has allowed me to learn more about my own condition, Type 2 Diabetes, and connect with other who face similar challenges.

Introduction

Diabetes is a disease that affects the body's ability to produce or respond to the hormone insulin. This impaired ability results in abnormal metabolism of carbohydrates and elevated glucose levels in the blood. Although there is Type I and Type I, which are different, both deal with the hormone insulin and have similar treatment regimens. In 2015, 30.3 million (or 9.4%) of the American population had diabetes. However, there has not been much research of health literacy of diabetics and how it affects their health. Health literacy can be defined as the ability of a patient to receive and comprehend health education and use the information to use it to make appropriate health decisions.

Hypothesis

Children with diabetes whom are treated at UCSF Benioff Children's Hospital Oakland have gaps in their health literacy that is affected by age, gender, location, and socioeconomic status. We may be able to associate high A1c levels and more frequent occurrences of DKA with lower levels of health literacy.

Methods

In order to collect data on the Health Literacy levels of patients 14 to 21 years old, we used the TRAiD. TRAiD is the Transitional Readiness Assessment in Diabetes. This survey is a clinical tool previously used in the Madison Clinic to help diabetes teams determine the readiness of teens during transitional periods. We used this tool to observe behaviors of patients when it comes to their care, as well as their knowledge about their condition. We planned to take the data collected from the survey and patient charts to make associations between the health literacy of patients and their health. The survey asks about how many times a patient has experienced DKA (Diabetic Ketoacidosis) within the last 6 months as a marker of how well they are doing with their condition. Patients most recent lab results of Hemoglobin A1c were also recorded for the study from the patient charts as another indicator of overall status of condition.

Anticipated Results

It was anticipated that patients with higher levels of health education would have lower levels of A1C and lower occurrences of DKA. Unfortunately, because of the lengthy IRB process, this study was delayed and I was unable to see any results in time for submission to the symposium guide. We plan to present our data in the form of a poster at the symposium.

Discussion/Conclusions

Results will be presented in poster form at the symposium. The potential significance of this research project was to introduce new research on Health Literacy and correlate it with health of diabetic patients, which has little research on the topic currently. This research would have also been significant and especially useful to the health educators in the Endocrinology department at UCSF Benioff Children's Hospital Oakland since the sample of patients for this study is made of their patients. This data would have been applicable and may have highlighted any gaps in health education that could be improved in order to best serve their patients.

Keywords

Health Literacy, Health Education, Diabetes

Jacob Braslaw

University of California, Santa Barbara

Impact of Time to Operating Room on Management and Outcomes of Pediatric Femoral Shaft Fractures

Mentor:

Coleen Sabatini, MD MPH

Funded by: Volunteer

My name is Jacob Braslaw and I am a rising senior at UC Santa Barbara, majoring in Environmental Science and Biology. As a student I have always had an intrinsic passion in science and math, but my interest in medicine developed in high school. Having a family member in the hospital gave me the unique opportunity to watch physicians and medical staff in real time. Observing the physicians ability to problem solve and interact with patients on a personal level was inspiring to me. The benevolent care that is provided to patients by clinicians is what made me interested in pursuing medicine.

This summer, I was lucky enough to be a part of the CHORI Student Summer Research Program which gave me the opportunity to explore my interests and new possibilities. CHORI helped me to develop skills in research and statistical analysis that I will be able to take with me throughout my academic career. I would like to thank my fantastic mentor Dr. Coleen Sabatini who provided me guidance in my research project and an immersive learning experience that was both challenging and gratifying.

Introduction

The US News and World Report ranks children's hospitals yearly. In their methodology they state that pediatric orthopaedic programs are evaluated, in part, by their treatment of femoral shaft fractures. Orthopaedic programs are awarded more points if a high percentage of femoral shaft fractures are treated in under 18 hours from time of presentation to the facility. Currently, there is no research published assessing the quality of the 18-hour metric. There has been a paucity of research done on the optimal time to treat femoral shaft fractures. The timing for treatment of pediatric femoral shaft fractures remains up for debate.

Objective

To determine if there is a difference between the outcomes of pediatric femoral shaft fractures treated under in 18 hours compared to those treated in over 18 hours from time of presentation to the emergency department.

Methods

This is a retrospective study that will be looking at patients age 0-17 that were treated at UCSF BCHO between 2016 and 2019. Statistical measures we are looking at are, the time lapsed from presentation in the facility to the start of operation and the outcome of the patient. The outcome of the patient is measured by the time taken to heal and the end of care range of motion ipsilateral knee and hip. Statistical analysis of the aforementioned variables will be used to assess if there is a difference in outcome between patients treated in under or over 18 hours from time of presentation.

Anticipated Results

We anticipate to find that an 18 hours or less time lapse from presentation to facility to the start of surgery is not a statistically significant indicator for success of patient outcome with a femoral shaft fracture.

Discussion

The results hold significance because they can show that US News and World Report is incorrectly evaluating pediatric orthopaedic programs. This would alleviate the pressure felt to treat a patient within 18 hours.

Acknowledgments

Thank you to my mentor, Dr. Coleen Sabatini for her guidance and patience throughout the project. I would also like to thank current medical student, Xi Chen for all her help.

Keywords

Femoral Shaft Fractures, Pediatric Orthopaedics, US News and World Report Methodology

Batya Brose

Berkeley City College

Statin and its Adverse Effect of New Onset Diabetes

Mentor:
Antonio Munoz

Funded by: National Institutes of Health

Hello, my name is Batya Brose I am currently and undergraduate at Berkeley City College majoring in Neuropsychology. I've always been very curious about the functions of the mind, consciousness, and the source of mental illness. I've worked closely in a wide range of addiction and mental health services, I've seen many individuals try to reap the benefits of rehab and have been hijacked by a insidious disease known as addiction. This has motivated me to want to be part of the innovative research towards further understanding addiction and mental health from a neurology perspective. As I continue through the program my passion for science grows deeper as I experience cell culture, lectures about current research and individual talks with the brilliant staff hear at CHORI. This program has opened my eyes to a variety of paths I never knew existed.

Background

Prescribed to more than 35 million Americans, statins are the most commonly prescribed class of cardiovascular disease drugs. While they are effective at preventing heart attacks, in some individuals they increase the risk of developing new-onset diabetes, or NOD. It is not understood yet to why statin use leads to NOD in some patients but not others. Diabetes is caused when there are defects in insulin secretion from b-cells in the pancreas. Saturated fatty acids cause b-cell death, an effect known as lipotoxicity, while unsaturated fatty acids, such as arachidonic acid, can protect against lipotoxicity. We have created a panel of induced pluripotent stem cells (iPSCs) from statin users who developed NOD (Cases), and those who did not (Controls). In prior studies, we found evidence that arachidonic acid protection against lipotoxicity may contribute to the diabetogenic effect of statins.

Hypotheses

NOD Cases will be more sensitive to lipotoxicity, and less sensitive to the protective effects of arachidonic acid compared to Controls, and statin treatment will reduce this protection in Cases, but not Controls.

Methods

iPSCs from16 case/control pairs matched by gender and ethnicity, will be plated in a 96 well plate and treated with 0.4mM palmitate, 10um, 20um, 50uM arachidonic acid, and 250uM Atorvastatin in media without fatty acids or BSA. Media with BSA only and/or a Sham buffer is a negative control for fatty acid and statin. Cell viability will be assessed via MTT assay and calculated as a percentage of the respective control.

Anticipated Results

Cases will have greater cell death after palmitate and statin exposure versus Controls. Adding arachidonic acid will mitigate the lipotoxicity to a greater degree in Controls compared to Cases.

Discussion/Conclusions

Successful demonstration that statin treatment increases lipotoxicity in NOD Cases compared to Controls will establish this pathway as a novel factor that contributes to the adverse effects of statin treatment. These results may help inform the development of precision medicine standards for statin use.

Keywords

Statin, Lipotoxicity, Type 2 Diabetes, adverse outcomes, iPSC, cell viability.

Angie Bustos

University of Portland

Are Children with Adverse Childhood Experiences at a Higher Risk for Poorly Controlled Asthma?

Mentor:
Karen Daley, MFT

Funded by: National Institutes of Health

I'm a rising senior at the University of Portland pursuing a degree in Biology with a minor in Neuroscience. Last summer I had the opportunity of participating in the CHORI summer program for the first time. I was able to gain experience with patients one on one, learn more about the process of clinical research, and the process of developing a question into a research project. I am very lucky to be back again this year and apply all I learned last summer to a new project. My experiences with CHORI have allowed me to explore multiple careers in the medical field. I am so grateful to CHORI because without them I would have never truly believed that I could obtain any career I set my mind to.

This summer while at the UCSF Benioff Children's Hospital primary care clinic, I was able to gain more knowledge on adverse childhood experiences and the pathophysiology of asthma. I would like to thank Dr. Dayna Long, Dr. Neeta Thakur, and Roberto Mok for all their time and guidance they gave me this summer. I would also like to thank the resource team at the primary care clinic and CHORI for such an unforgettable opportunity.

Introduction

In the United States, there are about 34.8 million children who are affected by adverse childhood experiences (ACEs and Toxic Stress). Adverse childhood experiences or ACEs are traumatic events that occur during a person's childhood. A high number of adverse childhood experiences can lead a child to experience toxic stress and therefore be more susceptible to chronic diseases. Previous studies have found that an increased number of ACEs correlates with poorer mental and physical health outcomes (Oh, et al.). Among those poor health outcomes are chronic diseases such as asthma.

Asthma is a condition in which the bronchioles swell and produce extra mucus making it more difficult to breathe. The cause of asthma is unknown, but most patients have asthma triggers. About one in thirteen people have asthma, and it is estimated about 8.4% of children are also affected by asthma. Although only 8.4% of children are affected by asthma, asthma is the third leading cause for hospitalization in children under the age of 15 (Asthma Facts).

Hypothesis/Objective

Children who have experienced adverse childhood experiences (ACEs) at a greater rate are more likely to have poorly controlled asthma since ACEs increase a child's likelihood to develop asthma and to have generally poorer health outcomes.

Methods

Patients who were diagnosed with Asthma and participated in the PEARLS study, which was seeking to validate the pediatric ACE screener, were identified. Out of 555 patients around 330 patients indicated they had been diagnosed with Asthma. Out of these 330 patients, 30 patients were selected for a chart review. For chart extraction purposes, only patients over the age of five were chosen. Furthermore, patients were divided into three groups of ten. The three groups were patients who, at the start of the study, had no ACEs, 1-3 ACEs, and 4+ ACEs. The medical charts of these patients were reviewed for asthma diagnosis and assessment, asthma control test scores, spirometry data, and medications relevant to asthma.

Results or Anticipated Results

We hope that the results of this chart extraction will reveal if children with a high ACE score are at risk of poorly controlled asthma.

Discussion/Conclusions

If the results reveal that children with a high ACE score are at a greater risk of poorly controlled asthma then there are major implications for the treatment these children receive which should be explored.

Acknowledgments

I would like to thank my mentors, Karen Daley, Dr. Long, Dr. Thakur, and Robert Mok. I would also like to thank all of the UCSF Benioff Primary Care Clinic staff and the Resource Team.

Keywords

Asthma, Adverse Childhood Experiences, Albuterol

Kaylianna Cadena

Emory & Henry College

Importance of Bone Quality in Predicting Fractures in Common Pediatric Diseases

Mentor:
Ellen Fung, PhD RD CCD

Funded by: Doris Duke Charitable Foundation

My name is Kaylianna Cadena and I will be furthering my education at Emory & Henry College located in Virginia. Something in me has always called me to the field of medicine. I feel this strong passion to make a difference in the world through work in medicine, whether it is for adults, children, or seniors.My passion for wanting to help others has helped influence me to wanting to pursue a career in the medical field. I am willing to devote my life and future to saving lives and discovering the cures that are yet to come.

Being apart of CHORI has allowed me the opportunity to get one more step closer to pursuing a career in the medical field. CHORI is an amazing program that allows for youth from underrepresented communities and background like myself a chance to explore the medical field through research. I am beyond grateful to be apart of this life changing, innovative, and advanced program. Alongside from being passionate about the medical field and I am also drawn to advocacy. Throughout the years I have come to realize that the medical field consists of both assisting those in need of help and advocating for those who are voiceless. Thinking about all endless things I can accomplish excites me for my future.

I would like to thank the CHORI Summer Program and specifically my mentor Dr. Ellen Fung for providing me with this wonderful experience. Thank you Dr. Ellen for constantly challenging my thinking when it came to research and for pushing me to think outside the box. I have learned so much from you and am beyond grateful to have had you as my mentor this summer.

Introduction:

Patients with chronic pediatric diseases such as Thalassemia (Thal), Sickle Cell Disease (SCD), Celiac, and Crohn's Disease are at risk for osteoporosis, a condition of bone fragility and fracture morbidity. Once thought to be a disease of the elderly, now understood to begin in childhood. Lack of early bone development determines osteoporosis risk in later years.

DXA is an instrument used to assess bone mineral density (BMD) through low radiation X-ray imaging. A BMD Z-score of <-2.0 is predictive of fracture. However, BMD is not 100% accurate, and fractures occur in patients with normal BMD values. Trabecular Bone Score (TBS) is a textural software which determines microarchitecture and bone quality from the DXA image. TBS has been shown to predict fracture in postmenopausal osteoporosis, whereas limited data are available on its use in common pediatric diseases.

Objectives:

To explore the relationship between, and accuracy of, bone quantity assessed by BMD and bone quality by TBS in predicting fractures in patients with chronic pediatric diseases.

Methods:

A retrospective chart review was conducted in subjects > 35 kg, who had a spine BMD performed by DXA between 01/01/10 and 07/01/19. Only scans from patients with a diagnosis of Thal, SCD, Crohn's or Celiac Disease were re-analyzed using the TBS software (TBS Insight, Medimaps v 3.0.2, Geneva, Switzerland). Some patients had more than one scan performed, these longitudinal scans were used to assess how the relationship between BMD and TBS changed over time. Fracture history, calcium intake, disease severity was abstracted from the medical record and related to BMD and TBS. STATA (v15.0, College Station, TX) was used to assess outliers, compare BMD and TBS by diagnosis, and association with a fracture. A $p<0.05$ was used to define significance.

Expected Results:

We anticipate that BMD and TBS will be lowest in patients with Thal. BMD and TBS are expected to be highly correlated and their combined use will be most predictive of fracture. These data will support the future use of TBS in focusing clinical treatment on pediatric patients with the greatest risk of fracture.

Troy Coaston

Tulane University

Effects of Mindfulness Based Interventions and Gender on Stress, Burnout and Cognitive Performance in Surgical Residents at an Academic Center

Mentor:
Carter Lebares, MD

Funded by: National Institutes of Health

My name is Troy Coaston, I am a senior at Tulane University located in New Orleans, Louisiana. Through volunteering with high-school students in New Orleans, I have gained a profound understanding of how important it is to have a good role model and mentor. Personally, I have interest in medicine and a desire to be a doctor, but until recently, I haven't had anyone in the medical field to talk to about my goals, or how to obtain them. I am very lucky programs like CHORI's Summer Student Research program exist, to connect students like me to medical professionals. Unfortunately, I know many students I volunteer with have never had and might not ever have an opportunity like what CHORI offers. Knowing this has only strengthened my desire to go into medicine, not only to serve patients, but also so I can serve as a role-model and mentor to students like the ones I work with in New Orleans. This summer, I was placed at UCSF and I've had the great privilege of having Dr. Carter Lebares as a mentor. I am assisting her in her research relating to reducing stress and burnout among physicians and residents. Thank you to Dr. Lebares and the CHORI team for giving me this tremendous opportunity.

Contributing Authors

Ekaterina Guvva

Introduction

In multiple high-stress, high-performance professions, Mindfulness-Based Interventions (MBIs) have been shown to improve cognitive function and decrease burnout, stress, and depression. In this randomized controlled trial, we examine the effects of a tailored MBI on surgeon trainees, and how any effects might vary by gender.

Hypothesis

A tailored MBI will reduce stress and improve cognitive function in surgical trainees at an academic center, as compared to an active control. Our secondary hypothesis is that changes in stress and cognition, in both intervention and control groups, will show gender differences.

Methods

First-year surgical residents were randomized to either an active control group or to Enhanced Stress Resilience Training (ESRT), a derivative of Mindfulness-Based Stress Reduction tailored for surgeons. For each condition, at three time points, depression, perceived stress, and burnout were measured using published scales. Additionally, executive function was measured using a neuropsychological battery of executive function. Data were then analyzed using ANCOVA, with baseline scores as a covariate.

Anticipated Results

The ESRT participants will perform better in executive function tasks and display lower levels of stress, burnout, and depression than the active control. Females will display higher levels of emotional exhaustion and males will exhibit higher depersonalization levels.

Discussion/Conclusions

Overwhelming stress negatively effects physician quality of life and quality of care, making stress reduction critically important and impactful in medicine. Success of such interventions will depend on feasibility and tailoring, considering both cultural and gender differences in their design. Differences and associations observed in this study will be useful for modifying future intervention techniques.

Acknowledgments

Huge thank you to Dr. Lebares and Katya for the support, guidance, and patience.

Keywords

Mindfulness, Stress, Burnout

Hanan Dabwan

Contra Costa College

Evaluating Rab Co-Localization for Chlamydia Trachomatis Ocular and Urogenital Strains

Mentor:
Deborah Dean, MD MPH

Funded by: National Institutes of Health

Hello. My name is Hanan Dabwan and I am entering my 4th year at a JC. I am hoping to transfer to UC Davis for the fall of 2020, majoring in Biochemistry and Molecular Biology. After obtaining my Bachelor of Science Degree, I wish to apply to the Clinical Laboratory Science program or continue my education in forensic science. Coming into CHORI, I knew I wanted to do lab work and some type of research and being placed under an amazing supervisor such as Dr. Deborah Dean, it completely exceeded my expectations. I have learned so much about the field of research in Chlamydia and it is truly a blessing to be a part of all the great work and research in this lab. Being in a laboratory has always been one of the most exciting things for me. To have this opportunity is something I am truly proud to be a part of.

Contributing Authors

Kyung Hoon Min, Ratchaneekorn Buddee, Zainab Gandhi

Introduction

Chlamydia trachomatis is the leading cause of STD's and according to WHO, is responsible for blindness/visual impairment of 1.9 million people world-wide. One of the concerns is that those infected, are less likely to seek treatment at an early stage, due to the asymptomatic nature of the disease. Looking at chlamydia's developmental cycle, we see that the process of infection happens in a period of 24-72 hours, depending on the specific strain. The bacteria lives within the host cell and during infection, elementary bodies (EB) attach to the cell wall and enter the cell. 6-8 hpi, the EB's transform into reticulate bodies (RB) that multiply within the cell forming an inclusion. The inclusion doubles in size and the RBs transform back into EB's, eventually lysing the cell, releasing the EBs and infecting adjacent cells. The goal is to understand why certain strains of chlamydia have a favorable infection rate with specific tissue types as opposed to others. We think part of the reason is due to intracellular trafficking controlled by Rab proteins. In studying Rab protein exclusion/association with chlamydial inclusions, we better understand which pathways chlamydia is actively interfering with. In all cells and pathways of a cell, Rab GTPases are present and serve as molecular guides regulating the information, transport, and fusion of transport vesicles as a general mechanism of regulating traffic between organelles.

Hypothesis

The objective is to identify the association/relation of forty-three RabGTPase proteins with 3 strains of Chlamydia. An ocular Ba strain, a urogenital E strain and an LGV L2 strain. To confirm this interaction, Nocodazole, a synthetic compound that de-polymerizes the microtubule network, is used as a control. With Nocodazole, we can confirm that specific Rab proteins are co-localizing with the inclusion and that the inclusion is disrupting or influencing their behavior within the cell. The addition of Nocodazole will aid in observing the reversibility of actin polymerization, thus confirming the true nature between the Rabs and the inclusion.

Methods

HeLa cells are transfected/electroporated, in which they are introduced to a high voltage electrical pulse to temporarily open the cell and allow DNA to flow through. Approximately 4-24 hours after transfecting, the cells are infected with the respective trachomatis strain (Ba, E, L2). Depending on the strain, between 24-72 hpi, the wells are treated with Nocodazole and incubated for 4 hours. After incubation half of the wells will go through a series of washouts using fresh HeLa media, to remove traces of the Nocodazole added, while the other half remains treated. After the washouts, the wells are dyed with the appropriate dyes and incubated for an hour before they are ready to image using live-cell z-stack imaging.

Anticipated Results

With Nocodazole treatment, we anticipate that co-localization of the Rab proteins will disintegrate the actin polymerization of the inclusion. When the Nocodazole is washed out, the co-localization will reoccur around the chlamydial inclusion, thus proving the true nature of the relationship between the Rab GTPases and the inclusion.

Discussion

We are trying to see the differences in intracellular trafficking pathways with Rab co-localization in three different strains of Chlamydia, that is ocular strains, urogenital and LGV. The role of Nocodazole addition is to prove that any co-localization of the Rab proteins with the inclusion is purely due to the inclusion directly influencing the way that the Rab proteins behave in the cell.

Keywords

Chlamydial inclusion, Rab proteins, Nocodazole

Jocelyn Diaz

Lawrence University

The Effects of Multiple Freeze Thaw Cycles on the Measurement of Zinc Concentration in Human Plasma and Serum

Mentor:

Andrew Hall PhD, Christine McDonald ScD

Funded by: Doris Duke Charitable Foundation

My name is Jocelyn Diaz a CHORI Summer Program and Doris Duke Charitable Foundation alum who is a rising sophomore at Lawrence University in Appleton, Wisconsin. I participated in the CHORI summer program in the summer of 2017. My world has completely changed since that summer. Since that summer doors have been opening for me left and right. It is because of CHORI I find myself in a wonderful liberal arts college majoring in biology and minoring in government. CHORI has instilled many skillful clinical/laboratory techniques and life lessons in me. The one life lesson that stuck with me in 2017 and continues to stick with me now is that nothing is unreachable, everything is attainable as long as you strive and push for it. The mentors I have had both times and the staff and directors of CHORI have been nothing but remarkable. Nothing I will ever do will be enough to repay my mentors and the CHORI staff back for all they have done for me both times around. It is because of them I have a long fulfilling academic road ahead of me. It is because of their encouragement and support I plan to get a master's in public health and become a pediatric nurse practitioner. I owe all my successes to this phenomenal program, who knows where I would be without this program.

Introduction

Zinc is an essential micronutrient that is vital for promoting healthy growth during childhood, immunocompetence, and neurobehavioral development.[1] An inadequate amount of dietary zinc can lead to zinc deficiency. Currently, one of the biomarkers recommended to evaluate the zinc status of a population is plasma and serum zinc concentration. Although the measurement of zinc status seems simple, there are many factors that can create an opportunity for error. Much of this potential error can be reduced with good practice in the collection, and processing of the samples.

Objective

The objective of this study is to measure the effects of multiple freeze thaw cycles on the mean concentration of zinc in both plasma and serum samples.

Methods

Tubes of pooled plasma and serum that had been stored at -20°C will be used. Samples will be thawed for one hour before analysis. Samples will be digested using analytical grade concentrated nitric acid overnight at 60°C. Each digested sample will then be diluted with deionized water, vortexed and centrifuged, and analyzed for the zinc concentration by ICP-OES. All steps will then be repeated two more times to complete the three freeze thaw cycles. A two-tailed student t-test will be used to determine difference in mean plasma zinc or serum zinc concentration in samples that have been through two vs. one or three vs. one freeze thaw cycles.

Anticipated Outcome

We anticipate that there will be no change in the mean zinc concentration of plasma or serum after three freeze thaw cycles.

Conclusion

Repeated freeze-thaw cycles are common, but not typically accounted for. A small change in the measured value of plasma or serum zinc concentration can lead to a large difference in the estimated proportion of a population that is zinc deficient. This small change can impact the design of intervention programs.

Acknowledgments

I would like to thank Dr. Hall and Dr. McDonald for all their support and guidance throughout this summer. I would also like to acknowledge the Doris Duke Charitable Foundation for their generous funding that enabled me to participate in this enriching summer program for the second time.

Keywords

Zinc, Plasma, Serum, Freeze Thaw Cycles, Measurement

Citations

[1] King, J. C., Brown, K. H., Gibson, R. S., Krebs, N. F., Lowe, N. M., Siekmann, J. H., & Raiten, D. J. (2016). Biomarkers of Nutrition for Development (BOND)-Zinc Review. The Journal of nutrition, 146(4), 858S–885S. Advance online publication. doi:10.3945/jn.115.220079

Van Dinh

Holy Names High School

The Role of Mitochondrial Stress Response in Aging and Physiology.

Mentor:
Ryo Higuchi-Sanabria, PhD

Funded by: California Institute for Regenerative Medicine

My name is Van Dinh and I am a rising senior at Holy Names High School. Growing up, I had always been interested in science but never thought about it as a possible career path. In my past few years as a high school student, I have been exploring different career fields, including engineering and law, to discover what I want to pursue in the future. While these experiences were undoubtedly interesting and memorable, it was difficult to picture myself doing these types of works for the rest of my life. Until this summer, I had avoided considering the science field because I did not want to contribute to the heavy stereotype surrounding Asian Americans and this career path. But as I was running out of options, I figured that I should give this field a try. Hopefully by the end of this internship, I will expand my knowledge about science and have a clearer answer about my passion.

Introduction

Even the slightest mitochondrial dysfunction has been linked to numerous diseases, such as parkinson's disease, alzheimer's disease, huntington's disease, and schizophrenia. This suggests that proper functioning of mitochondria is essential for a healthy physiological state. Because mitochondria play a significant role in cellular health, cells have adapted many quality control mechanisms to protect mitochondrial function. The unfolded protein response of the mitochondria (mtUPR) is a complex and broad mechanistic pathway, which is required for maintaining proper function of mitochondria. In the presence of mitochondrial stress, the damaged mitochondria send signals to the cell's nucleus to turn on specific genes that will repair the damages. During this process, multiple genes are upregulated. Understanding the major genes involved in regulating this important process is critical in identifying novel therapeutic targets for age-related diseases.

Hypothesis

While the major transcription factor involved in activating mtUPR, ATFS-1, is already known, we hypothesize that other important regulators of mtUPR must exist to work either in concert or independent of ATFS-1. Here, we propose a large-scale screening effort to identify these factors.

Methods

Previous work in the Dillin Lab identified over 2,000 genes that are upregulated in human neuronal precursor cells (NPCs) under conditions of mitochondrial stress. 600 homologs are represented in C. elegans for these 2,000 genes. In this study, we will determine which of these 600 genes are required for whole-animal survival under conditions of mitochondrial stress, using the model organism, C. elegans. Mitochondrial stress will be triggered in the worms using rotenone, the same chemical used in the NPC screen. We will determine which gene is required for survival under rotenone stress, by performing systematic knockdown of each of these 600 genes, and determining which genes, when knocked down, cause death and/or activation of mtUPR in the presence of rotenone. In C. elegans, we accomplish efficient gene knockdown by delivering RNAi vectors through their bacterial food source. Moreover, we will determine which genes are required for mtUPR function. Finally, we will take these genes back into NPCs and determine their role in NPC survival and mitochondrial health.

Anticipated Results

I believe that at least some of the 600 genes tested will be required for mitochondrial function and mtUPR, as these genes have been shown to be activated under conditions of mitochondrial stress in NPCs. I also expect that several of these genes will be required for mtUPR, such that their knockdown will either suppress or enhance mtUPR activation. We have already found that knockdown of eps-8 (ortholog of EPS8LN2), results in activation of mtUPR and increased lifespan. eps-8 is a gene that has been characterized in actin filament assembly, and thus a role in lifespan through mitochondrial quality control is novel and exciting.

Discussion/Conclusions

Because there are so many diseases related to mitochondrial dysfunction, it is important to know how these organelles are being protected in stressed cells. Knowing which specific genes are involved in mitochondrial quality control can lead to novel therapeutic approaches in two ways: 1) these targets can be activated in diseases that are caused by mitochondrial dysfunction, and 2) these targets can be suppressed in diseases that are caused by hyperactive mitochondria (e.g. cancer). Here, we find eps-8 as a novel regulator of mitochondrial quality control and lifespan regulation. Because a knockdown of the gene promotes mtUPR and increases lifespan, we believe it is a negative regulator of mtUPR, and that its inhibition results in increased mitochondrial quality control and organismal health.

Keywords

Mitochondria, aging, stress response.

Sofia Espinoza

Encinal High School

Conditional Reprogramming Primary Human Nasal Epithelial Cells for Investigating the Effect of Vaccine-Elicited Antibodies on Colonization by Neisseria meningitidis

Mentor:
Greg Moe, PhD, Vianca Vianzon

Funded by: California Institute for Regenerative Medicine

My name is Sofía Espinoza and I am an incoming senior at Encinal High School in Alameda. I've never been a big fan of science, and when I applied to this internship I hoped to change that. By pushing myself out of my comfort zone, I was able to experience what not a lot of kids my age aren't able to. I've been able to work in a professional lab environment, take part in legitimate scientific research, and learn new things every day, both about cells and what it's really like to work as a microbiologist. What I like most about the program is that while it is vastly challenging, it pays off in so many ways. Not only has it changed my perspective on science, but it also inspired me to want to pursue a career in microbiology.

Introduction

Neisseria meningitidis (Nm) can cause bacteremia and meningitis that progresses rapidly, resulting in death or severe complications. We have developed a native outer membrane vesicle (NOMV) vaccine with over expressed antigens and attenuated endotoxin. Recently, we conducted immunogenicity studies of the NOMV vaccine in mice and infant rhesus macaques. Since Nm is an obligate human pathogen, we have used reprogramming to produce primary nasal epithelial (pNE) cell cultures to investigate how the vaccine-elicited antibodies might affect colonization and invasion of Nm. Conditionally reprogrammed nasal epithelial cell culture serves as a more physiologically relevant model of the human nasopharynx in which to study colonization and invasion by Nm than immortalized epithelial cell models.

Hypothesis

Vaccines that elicit high titers of antibodies against conserved outer membrane proteins will prevent membrane shedding and invasion of pNE cells.

Methods

pNE cells were cultured over a 6-week period in co-culture with irradiated 3T3-J2 mouse fibroblasts.
The pNE cells were differentiated at an air-liquid interface.
Nm will be added to pNE cells with and without vaccine-elicited antibodies and control serum followed by bacterial counting to quantify the effect on colonization and fixing and staining to visualize the characteristics of the colonizing bacteria.
Primary antibodies to specific epithelial cell markers, Nm proteins, and Nm capsular polysaccharide; and Alexa Fluor secondary antibodies were used to mark each antigen.
Fluorescence micrographs were recorded using a Zeiss LSM-710 laser scanning confocal microscope

Anticipated Results

The conditionally reprogrammed cells (CRCs) will contain the diverse epithelial cell types typical of the human nasopharynx
Nm strains will colonize and invade the CRCs
Vaccine elicited antibodies that may provide community protection will prevent capsular polysaccharide and membrane shedding that is required for Nm to invade epithelial cells

Discussion/Conclusions

Vaccines that can both protect the vaccinated individual and prevent transmission between individuals (community protection) are most effective in preventing disease. We expect that vaccine-elicited antibodies will limit membrane and capsular polysaccharide shedding, which, we have established, is required for Nm invasion of the pNE cells.

Acknowledgments

Thank you to my mentors Dr. Greg Moe and Vianca Vianzon for your time and support, to the SSRP staff for giving me this opportunity to enhance and broaden my educational spectrum, and to CIRM for funding this research project.

Keywords

Neisseria Meningitidis, primary nasal epithelial cells

Chima Ezeh

Foothill High School

Validating Stemness-Related Markers in Breast Cancer

Mentor:
Mam Mboge, PhD

Funded by: California Institute for Regenerative Medicine

I am an incoming freshman studying neuroscience at Columbia University. My passion for science was sparked by phenomenal career development courses at my high school, and has only further grown from the support I have received from CHORI these past two summers.

I returned to the program this summer to not only build off my past research experience and add to my existing scientific knowledge, but to also add meaningful context to my newfound interest in neuroscience. During the program last summer, it was truly eye-opening to see the extent of poverty, violence, and declining mental health in East Oakland. Through health equity seminars part of the program and my brief time in this community, I became intrigued by the concept of social determinants of health and desired to learn about how both biological and social factors contribute to the incidence of neurodegeneration in underserved populations. Aside from demystifying what a research career entails, the CHORI program has undoubtedly helped clarify my career path.

This summer, I had the incredible opportunity to work under Dr. Mam Mboge at Berkeley Lab in her research studying the role of the extracellular matrix in breast cancer. Thank you Dr. Mboge for your unconditional support. I will undoubtedly use the research skills you taught me throughout my academic endeavors.

Introduction

Cancer stem cells (CSCs) are a subset of tumor cells that possess stem-like properties, such as self-renewal and differentiability, which help sustain the tumor and contribute to its aggressiveness. Recent studies have attributed this "stemness" phenotype to CSC surface markers, such as CD24, CD44, and CD49f. To gain insight into CSCs' role in cancer metastasis, we aim to (1) compare the expression of these stemness-related markers across, and within, cancer subtypes using patient data from public databases, and (2) to validate the expression of these stemness-related markers in malignant and non-malignant human mammary epithelial cells in 3D cell culture.

Hypothesis

Our 3D cell culture model will recapitulate the expression of stemness-related markers seen in malignant and non-malignant mammary epithelial cells from breast cancer patient samples.

Methods

1. Data mining in CBioPortal using TCGA datasets and Kaplan-Meier Plotter for survival analysis
2. Growth and phenotype of HMT3522 S1 (non-malignant), T4-2 (malignant), and T4-2 Rev (treated with PD98059 growth inhibitor) cells, under 2D and 3D conditions
3. Analyze RNA-sequencing data from S1, T4-2, and T4-2 Rev cells cultured under 3D conditions and confirm results using Western blotting

Results

Kaplan Meier Plotter:

1. High CD24 expression correlates with significantly lower recurrence-free survival (RFS) in breast cancer patients.
2. High CD44 expression correlates with significantly higher RFS.
3. No significant correlation between CD49f expression levels and RFS.

RNA Seq Data:

1. CD24 expression is highest in S1 and slightly higher in T4-2 Rev than T4-2.
2. CD44 expression is highest in S1 and T4-2, but considerably lower in T4-2 Rev.
3. CD49f expression is highest in T4-2 and slightly higher in T4-2 Rev than S1.

Discussion/Conclusions

Our data suggest that low CD24 but high CD44 and CD49f expression are associated with increased malignancy. These findings corroborate the CD24 low/CD44 high expression pattern in cancer cells established by breast cancer patient data on TCGA CBioPortal. Ultimately, with a model that recapitulates in vivo conditions of the human mammary epithelium, we can identify potential therapeutics that target CSCs.

Keywords

Stemness-related markers, cancer stem cells, malignant/non-malignant cells

Carla Fernandez

University of California, Berkeley

Symptoms of Depression and Anxiety in Patients with E/Beta Thalassemia and Beta Thalassemia Major

Mentor:
Ashutosh Lal, MD

Funded by: National Institutes of Health

Hello, my name is Carla Fernandez. I am a rising senior at the University of California, Berkeley (Go Bears!) double majoring in Psychology and Legal Studies. Both of my parents are immigrants and I am the second oldest of 5 sisters. I am passionate about mental health care in communities of color. Specifically, I am intrigued by the stigmatization of mood disorders (like depression) and substance use disorders (like alcoholism) in these communities. As a first generation, woman of color, it is often difficult to find opportunities that will help me develop professionally. CHORI has given me this tremendous opportunity, allowing me to experience first hand what it is like to conduct research in a professional setting and empower other women of color to pursue STEM careers. This summer I researched symptoms of depression and anxiety in patients with thalassemia to better understand the psychological distress in chronic illnesses. My ultimate goal is to obtain a PhD in clinical psychology and open up psychological services for low income communities of color. Thank you to Dr. Ash Lal and Meghan Foe for always guiding me through this process. Last but not least, special thank you to my family who made me who I am today and especially to my mom. Gracias por todo, soy tu mariposa traicionera.

Contributing Authors

Meghan Foe, Wendy Murphy, Robert Yamashita

Introduction

Mental and emotional health is an important yet often underrecognized dimension of wellness and care for people with chronic illnesses such as thalassemia. This leads to a tendency to treat the medical aspects of chronic illness while neglecting the psychosocial and emotional aspects of the patient experience. In order to begin addressing psychological distress in this patient population, we also need to understand factors related to anxiety and depression, as well as barriers to accessing treatment and support for psychological distress. This study aims are: (1) to compare the prevalence of depression and anxiety symptoms in the beta thalassemia major and E/beta thalassemia patient populations, (2) to identify psychosocial, demographic, and medical factors that are related to experiences of psychological distress, and (3) identify needs and barriers in accessing mental health care for patients with beta thalassemia major and patients with E/Beta thalassemia.

Hypothesis/Objective

The objective of this research is to assess the prevalence of symptoms of depression and anxiety in the thalassemia population and barriers to mental health care.

Methods

Participants completed a self-administered survey containing questions about psychological well-being as measured using the Hospital Anxiety and Depression Scale (HADS), chelation adherence, demographic information, thalassemia clinical care, social support, future perceptions, and barriers to accessing psychological care.

Anticipated Results

Results from this study will explore correlations between the prevalence of anxiety/depression symptoms and various factors such as thalassemia diagnoses, clinical care, physical health, psychosocial factors, and demographic factors such as gender, age, and socioeconomic status. These results will contribute to our understanding of the factors and consequences related to psychological distress in these patient populations. Results from this study will also describe the barriers patients face in accessing mental health care in a high resource thalassemia care center.

Discussion

We hope this leads to a better understanding of the mental health care needs in patients with chronic illnesses and informs the development of future studies and interventions to better serve these patient populations.

Keywords

depression, anxiety, e/beta thalassemia, beta thalassemia

Siobhan Garry

University of California, Berkeley

Bone Mineral Density (BMD) in Gender Diverse Youth Initiating Puberty Suppression: Effects of Low-dose Sex Steroids for Low Baseline BMD.

Mentor:
Janet Y. Lee, MD MPH

Funded by: Bert Lubin Scholarship Fund

I am a rising senior at the University of California, Berkeley majoring in bioengineering with a concentration in medical devices and technology. My interest in engineering began in high school and I gravitated towards a medical/biological focus because I love working with people and recognized the universal importance of equitable healthcare. My previous experience working in a body composition and bone densitometry lab, advocating for LGBTQ+/transgender rights and designing academic projects focused on innovation in transgender healthcare provided an excellent basis for summer research under Dr. Janet Y. Lee — adult and pediatric endocrinology fellow at UCSF. Participation in the CHORI Summer Student Research Program has exposed me to the work of clinician scientists and the plethora of unique, dynamic career paths in the field of medicine. I am very thankful for all of the knowledge and invaluable mentorship I've received as a program participant. I aspire to continue exploring my interests in medicine, clinical research, transgender healthcare and medical devices in graduate school or industry.

Introduction

Children and adolescents with gender dysphoria (1) can undergo pubertal suppression as the first step of their gender-affirming medical care. The Endocrine Society's published guidelines recommend intervention in the first stages of puberty (2). Transgender youth who receive puberty blockers are hypogonadal for the duration of pubertal suppression (3). Sex hormones accelerate bone mass accretion (4); thus, supression theoretically reverts bone mass accrual to pre-pubertal rates. Previous studies demonstrate the effect of puberty blockers in lowering BMD Z-scores of transgender youth and, on average, patients did not reach their pretreatment BMD Z-scores after over 5 years on gender-affirming sex hormones (5). These data suggest that peak bone mass (PBM) may be delayed or attenuated by treatment and raises concern for transgender youth with low baseline BMD Z-scores prior to pubertal suppression.

Hypothesis

BMD Z-scores and bone mass accrual (primary outcomes) are preserved in transgender adolescents with low baseline BMD during pubertal suppression therapy supplemented with low-dose sex steroids. Patients with low-dose sex steroid intervention experience similar progression of puberty, growth velocity and change in BMI Z-scores (secondary outcomes) compared to patients on blocker monotherapy.

Methods

This is a longitudinal retrospective chart review study approved as an exempt study by the UCSF institutional review board. Manual collection of de-identified data from electronic medical records were organized in a REDCap database hosted by secure server.

Anticipated Results

Low dose sex steroids effectively supplement puberty blockers to mitigate the expected decrease in BMD Z-scores for patients with low baseline BMD. Bone mass accrual is higher in those who received low-dose sex steroids compared with those on blocker monotherapy.

Discussion/Conclusions

Transgender youth with a low baseline BMD are at increased risk of attenuated PBM and possible increased fracture risk later in life when treated with current protocols. Our findings suggest a strategy for mitigating this potential risk in transgender youth with low baseline BMD prior to pubertal suppression.

Keywords

transgender youth, bone mineral density, DXA, puberty blockers

Awo Gulaid

Head Royce High School

Review of Bone Health in Pediatric Celiac Disease and Assessment of Physical Activity Index

Mentor:
Mala Setty, MD

Funded by: Doris Duke Charitable Foundation

My name is Awo Gulaid, and I am a rising senior at Head-Royce School in Oakland. For most of my life I have wanted to become a doctor. When I moved from Somaliland to America, I would walk around my house and kindergarten classroom saying that I wanted to be a doctor. Now, at 17-years-old, I've realized that the same dream still holds true. The CHORI SSRP has given me the opportunity to learn from professionals in a field that I might interested in going into. With the help of my mentor, Dr. Mala Setty, I have gotten the chance to shadow appointments in the GI Clinic and the Inpatient Clinic. I am very grateful for the many nurses and doctors who have allowed me shadow their appointments and learn about their profession. I feel like I have gained multiple mentors because of the willingness to teach that I have felt in the Gastroenterology Department. This summer program has helped me realize that I hope to make an impact on the medical field and show that as a strong, black, Muslim woman I am capable of achieving my dream, regardless of the barriers that are in my way.

Contributing Authors

Zena Harvill

Introduction

Celiac Disease (CeD) is a chronic autoimmune condition triggered by the ingestion of gluten which causes intestinal damage and extraintestinal manifestations. It has long been recognized that low bone mineral density (BMD) of all sites of the skeleton is a common complication of untreated CeD. Delayed diagnosis thus leads to greater loss of bone mineral density (BMD), osteopenia and osteoporosis, and, importantly, overall increased fracture risk. It has been shown that adherence to a gluten-free diet (GFD) can reverse the histologic changes in the intestine. It can also correct the biochemical evidence of calcium malabsorption. Several studies also note that a GFD can normalize BMD after the first year, primarily seen in children below the age of 4 at diagnosis. It is well known that vitamin D, parathyroid hormone, and physical activity, especially high-impact physical activity is beneficial for bone accretion especially among adolescents and young adults. Our skeletons adapt to intense physical activities, which increases BMD. The effects of physical activity on bone health in pediatric patients with CeD has not been previously assessed per our search of the literature.

Hypothesis/Objective

We hypothesize that monitoring serology, nutrition, and physical activity can result in an overall normal bone mass in patients with celiac disease and can help predict those who require active monitoring during their childhood to prevent osteopenia and osteoporosis in adulthood

Methods

In this study, we will use the physical activity questionnaire for older children (PAQ-C) and adolescents (PAQ-C) to measure general physical activity levels from childhood to adolescence in our population. We will also use DEXA scans from patient charts to analyze the BMD of our population. We will also use the information we have in our records to see what the study shows us about the prevalence of CeD and its relation to other variables such as BMI, vitamin D, and calcium intake..

Results or Anticipated Results

We believe this study will show us the incidence of low BMD in our population. We hope it will show us how the incidence of low BMD relates to nutritional status, age, ethnicity, growth parameters, laboratory studies(serology, Ca, PTH, Ph, Vit D), and severity of the disease. Hopefully, it will also show us that physical activity increases bone mass in CeD pediatric patients.

Discussion/Conclusions

This study is significant because it can lead to a new development in literature in medical research since the effects of physical activity on bone health in pediatric patients with CeD has not been previously assessed per our search of the literature. There is a debate about whether or not children's BMD should be checked; hopefully, this study will show that checking BMD during childhood can help those who are at high risk for low BMD. Most importantly, this study can help us prevent, monitor, and treat low BMD in pediatric patients with CeD, so the low BMD does not move with them through adulthood and result in a reduced quality of life.

Acknowledgments

Dr. Mala Setty, Gastroenterology Department at UCSF BCHO

Keywords

Celiac Disease, BMD, physical activity

Maryum Haidari

University of California, San Diego

Gene Expression Signatures Associated with Rheumatoid Arthritis and Polyarticular Juvenile Idiopathic Arthritis

Mentor:
Damini Jawaheer, PhD, Matthew Wright, MS

Funded by: National Institutes of Health

Hello, my name is Maryum Haidari and I am a rising sophomore at UC San Diego. I am studying Human Biology and am interested in pursuing a career in healthcare, specifically relating to pathology or psychiatry. I have always been interested in understanding the causes and symptoms of mental and physical abnormalities, as well as the intersectionality between the two.

I am very fortunate to be a part of CHORI's summer program as it has been an ideal career-building and hands-on learning opportunity. It gave me the chance to integrate myself into a research environment, while providing me with the support and guidance of a highly qualified mentor. This summer I explored bioinformatics which is something I had never been exposed to before, but this program gave me the opportunity and resources to develop a new interest and skill. I am thankful for my mentor, Dr. Jawaheer, and Matt for guiding and supporting me throughout my project and teaching me how to conduct my research.

Introduction

Rheumatoid Arthritis (RA) is a chronic autoimmune disease in which the immune system attacks one's own joints causing pain, swelling, and deformity due to severe inflammation and joint destruction. Polyarticular Juvenile Idiopathic Arthritis (polyJIA), which occurs in children, displays symptoms that closely resemble adult RA. The causes of both diseases are unknown; it is also unknown whether these diseases share a common etiology or if there is much overlap in their underlying biology. We propose that examining gene expression patterns in each disease may provide insight into their biology and allow us to determine how much they overlap or differ from each other.

Objective

Identify a gene expression signature associated with RA and determine whether it overlaps with the gene expression signature associated with polyJIA.

Methods

A dataset consisting of patients with RA (n=112) and healthy controls (n=45), and patients with polyJIA (n=6) and healthy children controls (n=8) was selected from Genome Expression Omnibus (GEO). Gene expression levels between patients with RA and healthy controls were compared using the GEO2R software. Thresholds for significant differential expression between the two groups were an adjusted p-value of less than 0.05 and a fold-change expression of 2. Functional enrichment analysis of the differentially expressed genes was performed using Webgestalt and Cytoscape. The same analyses were repeated for the polyJIA patients and healthy children controls.

Anticipated Results

Some genes will be significantly differentially expressed between cases and controls, both in RA and polyJIA. We also anticipate some overlap in genes and pathways that are associated with each disease.

Discussion/Conclusions

This research can help us identify biological differences between patients with RA (or polyJIA) and healthy controls. Specific genes that are significantly differentially under-expressed or overexpressed, can potentially represent novel drug targets.

Acknowledgments

I am extremely grateful for Dr. Jawaheer and Matt's patience, guidance, and support throughout my project.

Keywords

Rheumatoid Arthritis (RA), Polyarticular Juvenile Idiopathic Arthritis (polyJIA), Gene expression

Isa Harrison

University of Wisconsin, Madison

Evaluating Sales of Healthy Options in Vending Machines at the University of California

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

Funded by: Volunteer

Hello, my name is Isa Madrigal Harrison. I am a Bay Area native and a rising sophomore at the University of Wisconsin, Madison. I plan on majoring in Biochem or Chemistry. I have not yet settled on a career path, but this program has made me sure that I would like to continue studying and learning science. My love of science has been constant throughout elementary and high school, when I learned about basic human anatomy, biology and physics, to my first year of college, where my favorite class was chemistry. This summer has been a chance to see how science affects not only public health but also public policy and social equity and to apply everything that I have learned to the real world. I am grateful to have had the chance to participate in the program this summer. I would especially like to thank my mentor Janice Kao. She was very supportive and understanding through the process. I would also like to thank Patsy and all the other workers at NPI for supporting me and sharing their knowledge. Lastly I would like to thank my parents for always giving me rides.

Introduction

Vending machines are a quick and easy way to get food, which makes them appealing to students. Unfortunately, they are often filled with unhealthy options. In an effort to encourage healthy eating across UC campuses, Nutrition Policy Institute (NPI) led the development of the UC Healthy Vending Guidelines (HVG) for food and beverages sold in vending machines. Some UCs have adopted these or similar guidelines, while others defer to the vending machine companies they contract with to define what is healthy. Extent of healthy vending efforts vary widely and some schools are implementing comprehensive initiatives that extend beyond vending, while others are working primarily on vending machines.

Objectives

To evaluate change in sales of healthy vs unhealthy items stratified by type of healthy vending program implemented by the campus.

Methods

Annual sales data and information about healthy vending standards adopted at each campus were collected from 4 UCs (Riverside, LA, SF, Berkeley), between 2015 and 2019. Vending machine items were categorized into healthy vs unhealthy, by reviewing product nutrition labels in order to calculate whether items meet the HVG, campus standards, or vendor standards. Sales data are summarized by unit sales and dollar sales.

Results

UCB adopted HVG standards in 2019. UCLA and UCSF use previously developed guidelines similar to HVG. UCR uses a vendor-defined healthy vending initiative with less stringent standards for "healthy." Data presented will include change in annual sales of healthy and unhealthy foods and beverages for each campus, from 2016-2019.

Discussion/Conclusions

Results will provide insight into whether sales of healthy foods and beverages sold from vending machines differ based on type of healthy vending program implemented. Valuable information about sales of healthy items over time and differences in vending programs can help guide other universities and campuses interested in implementing their own healthy vending initiatives.

Acknowledgments

CHORI SSRP, UC Global Food Initiative, UC Nutrition Policy Institute, and all participating UC campuses.

Keywords

Healthy vending guidelines, nutrition environment, college campus, vending machine sales analysis

Lilian Hernandez

University of California, San Diego

Identifying the Differences in Stem Cell Populations during Breast Cancer Progression under Three Dimensional Conditions

Mentor:
Mam Mboge, PhD

Funded by: National Institutes of Health

My name is Lilian Hernandez, I am a senior at the University of California, San Diego and I am majoring in Global Health with a minor in Biology. Growing up in a small Guatemalan town that lacked adequate medical access spurred my desire to work towards equitable medical care, and it ultimately inspired me to pursue a career in the medical field. Under the guidance of my mentor, Dr. Mam Mboge, this summer, I was able to conduct research on breast cancer and learn more about such an important field of research. I am certain that the experiences and skills I gained this summer will guide me towards a medical career and give me a well rounded research experience. I ultimately hope that I can pursue a career that combines both research and medicine, as well as advocating for equitable medical care. I am grateful to the CHORI SSRP for this amazing opportunity as it has provided me with experiences that will help me stand out and ultimately achieve my long term career goals. CHORI not only provided me with a great research experience, but it also gave me the opportunity to meet amazing people. I would also like to thank my mentor, Dr. Mam Mboge for her constant support and guidance throughout this summer.

Introduction

Despite the advances in detection and treatment of breast cancer, it still remains the second leading cause of cancer related deaths among women. Cancer stem cells (CSC) have been identified to be responsible for tumor initiation, maintenance, and therapy resistance in a process that is potentially regulated by the extracellular matrix (ECM). CSC endow stem cell-like properties, and are capable of self-renewal and dedifferentiation. Within tumors, these malignant cell populations can be distinguished from their non-malignant counterparts based on specific cell surface marker expression. Previous studies have identified CD44+/CD24- and CD49f+, as malignant cells in breast cancer. Therefore, by performing our experiments under an in vivo-like 3D microenvironment, we will be able to accurately evaluate the phenotypic consequences of the expected increased stemness in malignant cells.

Objectives

Determine if the HMT3522-breast series of cell lines yield cell populations similar to that of known CSCs based on the expression of CD24, CD44, and CD49f.
Determine the phenotypic consequences of increased stemness and phenotypic reversion in 3D.

Methods

The HMT3522-breast series was obtained from breast reduction mammoplasty and span from non-malignant (S1) to cells that form tumors in mice (T4-2). Phase-Contrast microscopy was used to observe the differences in phenotype of the cells, under 2D vs 3D conditions, and following treatment with growth blocking inhibitors (GBI). Immunofluorescence imaging was used to determine the expression of CD24, CD44 and CD49f under the same conditions.

Results

Our results showed that treating malignant cells, cultured in 3D environments, with GBIs induces the formation of structures that resemble normal mammary glands. Further, increased expression and populations of CD44+/CD24- and CD49f+ were observed in the malignant, in comparison to non-malignant cells, and those treated with the GBIs.

Conclusion

Together, these findings validate the expression of stemness related markers in our novel 3D breast cancer model. With this information, we can now begin to elucidate the mechanisms that regulate CSC growth and therapeutic resistance.

Acknowledgments

Thank you Drs. Mboge, Bissell, the entire Bissell lab, NIH and CHORI for this incredible research experience.

Keywords

CSC, ECM, 3D

Alex Jeronimo

University of California, Merced

The Role of TMEM55B in Regulating Hepatic Intracellular Triglyceride

Mentor:
Yuanyuan Qin, PhD, Marisa Medina, PhD

Funded by: National Institutes of Health

My name is Alex Jeronimo and I am a rising Sophomore at the University of California, Merced pursuing a public health major. I have had the honor of participating in the CHORI Summer Research Program (SSRP) for the last two summer sessions. As a first-generation student, I like so many were confronted with the fear of the unknown as high school came to an end and college began. The CHORI Program has and continues to be one of my most valuable experiences after high school. I've had the opportunity of not only participating in a new academic community but have also been able to network with a number of peers and passionate mentors. My experience at CHORI and UC Berkeley Labs have above all else helped deepen my understanding about the field of research, more than I could ever have imagined. Where I use to believe the research was meant for the select few, I now know it's a career open to anyone with the passion to ask questions and determination to solve them. The CHORI summer research program has helped propel me into a new stage in my life, where I work to answer what I wish to become in the future. With a personal ambition to have a beneficial impact on those around me and my community at large, I now see myself working in research in pursuit of that goal. A vision made possible with the support of this program and all those who make it up.

Introduction

Nonalcoholic fatty liver disease (NAFLD) is a growing consequence of an increasing rate of obesity worldwide. In western populations, it is the main cause of chronic liver disease. Currently, there are no pharmacologic interventions for the prevention or treatment of NAFLD. NAFLD is the excess accumulation of lipids in the hepatocyte (i.e hepatic steatosis), which may result from dysregulated triglyceride synthesis, secretion, and/or oxidation. Recently, we found that knockdown of TMEM55B, a known regulator of cellular cholesterol levels, reduced endogenous mitochondrial oxygen consumption rates (OCR) by ~49%, $p<0.0001$, and completely prevented oxidation of exogenous fatty acids in a human hepatoma cell line (HepG2). In addition, when we treated C57BL6/J male mice with anti-sense oligonucleotides (ASO) against Tmem55b, we observed a ~90% decrease in hepatic triglyceride secretion after Tmem55b knockdown compared mice treated with a non-targeting control. Thus, we seek to examine whether TMEM55B may contribute to the accumulation of triglycerides within a hepatocyte.

Hypothesis

Based on our preliminary data, I hypothesize TMEM55B knockdown will lead to increased intracellular triglyceride accumulation in hepatoma cell lines.

Methods

We will knock-down TMEM55B using siRNAs in hepatoma cell lines Huh7 and HepG2 cells. Cells will then be incubated with 1mM oleic acid and stained with Nile Red to label triglycerides, and Hoechst to label nuclei. Nile red will be quantified in three methods, 1) measuring absorbance at 600nm, 2) Fluorescence activated cell sorting, and 3) quantitative image analysis using the Zeiss LSM 710 confocal microscope. Nile red levels among TMEM55B knock-down and control treated cells will be compared using ANOVA with Tukey's post hoc test in GraphPad Prism 7. P-values <0.05 were considered statistically significant.

Results

TMEM55B knockdown will result in greater Nile red staining, indicating higher levels of intracellular triglyceride.

Discussion

NAFLD is a growing epidemic, attributed to the combination of poor diet and sedentary lifestyles. Successful completion of our study will elucidate a novel pathway that modulates lipid accumulation in the liver, and thus will advance our understanding of the pathobiology underlying NAFLD.

Kayla Jones

Holy Names High School

Quality of Life : Sickle cell

Mentor:
Lynne Neumayr, MD, Brigid Roy, CIP

Funded by: Doris Duke Charitable Foundation

Hi, my name is Kayla Jones, and I am a High school senior at Holy Names High School. This summer I wanted to explore the clinical and research aspects of medicine. My interest in medicine started at a young age when I had the responsibility of helping take care of three family members with stage 3 & 4 cancer. My role as a care giver allowed me to understand different aspects of patient care and also learning about the many procedures and medicines needed. I was lucky to have been placed with my mentors Brigid Roy and Lynne Nuemayr. I worked in the IRB department and the Sickle cell clinic. I have a blood disorder called storage pool deficiency so it was very interesting working with patients that as well have a blood disorder. I worked on measuring the quality of life of a sickle cell patient and learning the processes of getting clinical trials approved while working in IRB. This summer I wanted to see if research was a part of the medical field I was interested in. I have become very interested in research but also enjoy and value working with patients. This program has given me lots of experience of learning my interest. I feel blessed to be apart of a program like CHORI as a high school student and don't regret the early morning commutes and late night reading assignments. THANK YOU again to my amazing mentors and a big shout out to Lisa and Swap, for taking me under your wing.

Introduction

Sickle cell is a heritable, recessive genetic condition in which a mutation in the protein hemoglobin causes red blood cells to "sickle" and create clots at branch points in blood vessels. It is a heterogeneous disorder affecting approximately 100,000 individuals in the United States and millions worldwide. The symptoms include anemia, pain crises (vaso occlusion), swelling, and ischemia-reperfusion injury. Complications include stroke, acute chest syndrome, kidney and liver damage, and increase susceptibility to infections.

Hypothesis/Objective

The Goal of this to collect quality of life measures with a focus on ASQ-ME with patients with Sickle Cell Disease. Evaluate the Impact and feasibility of collecting quality of health data during clinic visits. Identify predictors of quality of life measures in Sickle Cell Disease

Methods

Obtaining written consent to administer to pediatric and adult sickle cell patients measures of health related quality of life(HRQL). With consent, the data will be inputted in the Grandad registry. The Grandad registry is lead by John Hopkins University with the goal of creating a registry of patients with sickle cell anemia, their demographic characteristics, disease related complications, and biomarkers. This is a cross sectional survey, to help measure the mental, emotional, and physical impact SCD has on one's quality of life. The main tool of focus will measure the QOL of sickle cell adult patients is the ASCQ-ME tool. The tool is a patient reported outcome measurement system and in the case it is being used to measure patients with Sickle Cells Quality of Life. The ASCQ-ME tool focuses on: pain (frequency and severity), emotional impact, sleep impact, social impact, and stiffness impact a Sickle Cell patient may endure. The ASQ-Me tool has 30 items and the 6 subscales above and is scored from 0-100. A score of 0 is a low QOL and a score of 100 is a high QOL. The scale is normed at a mean of 50 and a standard deviation of 10.

Anticipated Results

We anticipate in enrolling at least 30 patients during the month of July. The scores on the Health related quality of life (HRQL) will be compared to patient demographic data and laboratory values known to impact disease severity. We will analyze these relationships with the goal of identifying predictors of (HRQL). Potential variables of interest include genotype, age, gender, disease severity, Hydroxyurea use, hemoglobin level, white blood cell count, and depression/ anxiety.

Acknowledgments

I would like to acknowledge Lynne Neumyr, Brigid Roy, Lise Du, and Swap Mushiana. Their amazing mentorship helped tremendously throughout my summer and helped build my confidence and knowledge of Sickle Cell.

Keywords

Sickle Cell, Quality of Life, ASCQ-ME, Surveys

Alexander Li

University of California, Berkeley

Isolating a Novel Population of Erythroblastoid Cells

Mentor:
Dario Boffelli, PhD

Funded by: National Institutes of Health

My name is Alexander Li and I am a rising junior at the University of California, Berkeley majoring in Molecular and Cell Biology. Although I had been fascinated at the complexity of cells and organelles since high school, I realized after coming to college that I had no idea what a biology degree would offer in terms of career paths. Being a first-generation college student and with parents not from scientific or health backgrounds, I had no clue what research entailed of. Joining the Summer Student Research Program allowed me to experience and really change my perspective on what research is like: rather than being intimidating, after working with Dr. Dario Boffelli and Dr. Seok-Jin Heo on isolating an uncharacterized population of erythroid cells, I have found that research is instead an exciting and highly collaborative process. I am very grateful to Dr. Boffelli and Dr. Heo for taking the time to mentor me and allowing me to work alongside them, as well as to the entire SSRP team for providing me with this wonderful learning opportunity!

Introduction

The differentiation of hematopoietic progenitor cells into erythrocytes follows a relatively linear path, yet analysis of expression data from single cells identified a small population (referred to as "second stream" here) distinct from the cells in the canonical differentiation pathway. These cells exhibit two main characteristics: reduced expression of the non-coding RNA MALAT1 and loss of mitochondrial genes. MALAT1 regulates the catabolism of free heme by participating in the transcriptional activation of HO-1, an enzyme involved in free heme degradation. Lowered MALAT1 expression is expected to result free heme accumulation, producing an environment that could turn the cell hypoxic and yield high concentrations of reactive oxygen species (ROS). These second stream erythroid cells are of unknown physiological significance; their isolation in a pure form is necessary to study their functional role.

Objective

To isolate the second stream cells using an ROS-detecting stain, thus determining whether they are hypoxic.

Methods

After using Hudep cells to optimize our stain procedure, hematopoietic cells freshly isolated from human bone marrow were stained with a GlyA antibody, which identifies erythroid cells, and the CellROX Green marker, which detects ROS. The cells were then sorted using flow cytometry to collect GlyA+ cells with the highest CellROX Green fluorescence intensity.

Anticipated results

Using ROS-induced Hudep cells, we confirmed that CellROX Green is able to detect ROS in hematopoietic cells. Thus, successful staining of fresh hematopoietic cells may isolate the second stream cells and confirm that they are hypoxic.

Discussion

Hypoxia is a trigger for apoptosis, suggesting that the second stream cells may have failed quality control and are being eliminated.

Furthermore, in sickle cell model mice, free heme levels are increased due to increased hemolysis, causing increased ROS, similar to the second stream cells. Characterization of the second stream cells may thus allow better understanding of sickle cells.

Acknowledgments

I would like to thank Dr. Dario Boffelli for his time and this amazing opportunity to work alongside him and Dr. Seok-Jin Heo.

Keywords

hematopoietic, differentiation, erythrocytes

Kerry Lin

San Leandro High School

Effects of the Removal of Ribosomal Genes in Germline Embryonic Stem Cells

Mentor:
Andrew Modzelewski, PhD

Funded by: California Institute for Regenerative Medicine

Hello, my name is Kerry. I am a first-generation college student and a rising freshman at the University of California, Davis. I am currently majoring in Design but I have plans to change my major to Molecular and Cellular Biology to pursue a career in pathology.

Finding my passion was not easy. Before working at CHORI, I was ecstatic to be an intern at my city's hospital but I soon found out that patient care was not the right career path for me. However, within the next few weeks in the He Lab, I discovered a newfound passion in research.

I would like to thank the CHORI Student Summer Research Program for providing me this unique opportunity and I am honored to have worked with my mentor, Dr. Andrew Modzelewski and the members of the He Lab. I am grateful for their insight and guidance for the summer of 2019.

Introduction

Previous data from the He Lab identified pre-implantation specific gene isoforms and found that by removing these sequences, developmental phenotypes directly impacting stem cell viability and identity were revealed. These deleted genes display phenotypes that cause female mice to be infertile. Male mice develop hydrocephaly (brain swelling), resulting in early death. Mendelian genetics show that a cross between heterozygous parents are expected to produce 25% wildtype, 50% heterozygous, and 25% knockout offspring. However, it is observed that only 6% of knockout mice are born which suggests that oogenesis and early development was impacted in these animals.

Hypothesis/Objective

Examine the morphology of mutant ovaries using histological and immunohistochemical methods to determine if oocytes and germ line stem cells have been compromised after the removal of ribosomal sequences.

Methods

To compare knockout, heterozygous, and wildtype ovaries, the obtained organs are prepared through tissue processing and later sectioned into thin slices. These sections are then placed on glass slides to be stained with H&E. Additionally, immunohistochemistry (IHC) is a technique that will allow us to see where desired antigens are expressed by utilizing the interaction of antibody-antibody binding between primary and secondary antibodies.

Results or Anticipated Results

In this study, we have found abnormalities in heterozygous and knockout ovaries. Wild-type ovaries contained expected stages of follicular development whereas varying stages of follicles in heterozygous and knockout ovaries were less abundant. It is anticipated that wildtype ovaries will contain antigens of interest after obtaining IHC results and knockout ovaries will have little to no indication of the desired genes.

Discussion/Conclusions

We concluded that mutant ovaries shared very little common features with wildtype ovaries. Our current data suggest that follicles in knockout ovaries have been compromised, impacting oogenesis. This work is vital to the study of female fertility which is an issue facing many families throughout the world and understanding an overlooked area of gene structure and regulation.

Acknowledgments

Suifang Mao, Hannah, Jocelyn, Bin Xue, Lin He

Keywords

oogenesis, follicle, immunohistochemistry

Vinh Luu

University of California, Berkeley

BIGSPIDR – Bioinformatically Investigating Genotyped Sequence Polymorphism in Diabetes Research

Mentor:
Steve Mack, PhD

Funded by: National Institutes of Health

Hiya! I'm Vinh Luu and I'm currently a sophomore at UC Berkeley pursuing a Physics Major. To be completely honest, as a Physics major, I had absolutely no interest in medicine coming into this program. I had hoped merely to get some research experience which could help me for my future job searching. Instead, what I got was great experience working in data analysis, and I absolutely love it. Thanks to Dr. Steven J. Mack, I was able to learn how to program in R and use data analysis techniques to do something I find significant – working with Type 1 Diabetes data from patients all around the world, in an effort to find any genetic similarities. It was a lot of fun to be able to make a program that combs through all the data and spit out tangible results that could potentially change the quality of care for patients around the world! While this program hasn't kindled any deeply repressed desire to study medicine, it has still been such a great opportunity to work with such accomplished people.

Contributing Authors

Livia Tran, Graham Ogle, Janelle A. Noble

Introduction

The Human Leukocyte Antigen (HLA) loci is a highly polymorphic region found on chromosome 6p21, which contains key genes in the adaptive immune system. This project will focus on examining amino acid (AA) motif association in T1D patients and controls from Pakistan, Azerbaijan, Bangladesh, Mali and Sudan and possibly from China

Objective

The primary objective of this project is to identify Type 1 Diabetes (T1D) associated AA motifs encoded by the HLA-DRB1 gene in non-European populations. The secondary objective is to expand and improve on the functionality of BIGCAAT software.

Methods

The programming language I will be using to analyze the data is R, used specifically for statistical computing. BIGDAWG is an R program that serves as the core analytic engine for these investigations. BIGDAWG and BIGCAAT work in tandem to build and evaluate amino acid motifs with significant OR changes

Results

Several significant motifs have been found. There is significant correlation between the OR and the AA residues in positions 74:96. These residues in these positions were significant in sextets (6 AA motif) in the Pakistan data set and octets (8 AA motif) in the Azerbaijan data set. A protective effect was identified for AA motifs including 74A and 96Q/H (OR = 0.18/0.26), and a predisposing effect was identified for AA motifs including 74R and 96H.

Conclusions

AA position 74 is encoded by DRBI exon 2 and AA position 96 is the first codon in DRB1 exon 3, which has not been commonly genotyped. These findings suggest that these positions may play a significant role in the disease. BIGSPIDR gives us novel means of investigating disease association by dissecting the contributions of individual AA and previously uninvestigated AA motifs.

Acknowledgments

I would like to thank Dr. Mack for his patience in learning R, and the SSRP for giving me an opportunity to work on a project. I would also like to thank Dr. Noble and Dr. Ogle for providing the data that I am working with for the project. Finally, I would like to thank Livia Tran for her work on the program.

Keywords

Type 1, Diabetes, Polymorphism, Amino Acids (AA), HLA, Genome, Genotype, Alleles, Loci, Locus, Odds Ratio, Exon, Case-control analysis, BIGDAWG, BIGCAAT, BIGSPIDR

Nancy Maciel

Middle College High School

Developing a Research Training curriculum for the Youth Health Equity Council

Mentor:
Baylee DeCastro, MS

Funded by: Doris Duke Charitable Foundation

My name is Nancy Maciel and I graduated from Middle College High School. I will be attending San Marcos State University in the fall and will be majoring in biology or human development. I am a first generation student and have faced many challenges, but I have not let anything stop me from reaching my goals. My mom is an immigrant and came to the U.S for better opportunities. The example that my mom sets for me has made me into the strong woman that I am today. She has always worked hard for my siblings and I, which has motivated me to do the same.

Overtime, I have stepped out of my comfort zone to try new things, which has made me confident and independent. I took the opportunity to apply to CHORI, and thankfully, I now have the chance to be a part of this amazing program.

Being part of the Department of Community Health and Engagement team has exposed me to a new part of the health field, which is Research. I have learned a variety of things such as different techniques to look for valid information for research, food security, and equity.

For my research project, I am developing a research-training curriculum to help the youth council with their research skills. The youth council is a team of high school students who learn about equity and the social determinants of health and advocate for solutions in their community. My goal is to help this youth group develop research ideas and create solutions for a better future.

Introduction

The Youth Health Equity Council (YHEC) was established in 2018 with the partnership of American Heart Association and UCSF Child Health Equity Institute. High school students from San Francisco and Oakland who have an interest in health are invited to apply to YHEC to learn about equity and the social determinants of health and advocate for solutions in their community.

My goal is to develop a research training curriculum for the YHEC team in order to help them learn research skills. It is important to involve youth into research because we should be aware of issues such as food security and health laws which affect many minorities and youth.

Objective

By developing a research training program, I would help enhance research knowledge and build research skills for participating high school students in the youth council

Methods

Complete a landscape assessment of research training curriculum for youth, which will include information such as: what are the specific practices/tools other organizations use to train youth and who are the organizations training the youth.

Anticipated Results

To identify critical aspects of existing training curriculum for youth in order to develop most effective research training curriculum for the Youth Health Equity Council.

Discussion/Conclusions

Through my research, I will create and design a program that will help youth understand components of the research process. The curriculum I design will help the youth be more involved with their surroundings and feel a part of their community as they learn the beginning steps of research.

The goal for this program is to build youth research capacity, so that they can consult with researchers on research projects. Researchers will be able to gain input from the youth on their research proposals, which can help youth be a part of real-world research. It is important to include the youth in the conversation because they grow up knowing more about their community and see issues from another perspective. Being able to know how certain issues affect the youth will give researchers a better understanding of how to create solutions that will benefit the youth in the long run.

Keywords

Youth, Research Training, Participatory Action Research, Youth Health Equity Council, Community Action Research

Sharad Mahajan
Tufts University

Point-of-care Testing for Trachoma

Mentor:
Thuy Doan, MD PhD

Funded by: National Institutes of Health

My name is Sharad Mahajan, and I am currently a rising sophomore at Tufts University in Boston, Massachusetts. I am an alumnus of the CHORI summer program. I decided to return because, in addition to being able to do amazing science, I really enjoyed the wonderful support network that this internship brings.

During my freshman year at college, I had two scary health issues that showed me the importance of healthcare. While I still want to do an MD/PhD program after college, I also want to figure out ways to make healthcare more affordable and accessible to everyone because during major health problems, no one should have to worry about the costs.

First, I want to become a translational scientist who works to translate new and exciting research into applicable treatments. Next, I want to study ways to make sure everyone can have access to these treatments. This summer, I have had the opportunity to work for the Proctor Foundation at UCSF. Since Dr. Fung knew my interest in pursuing an MD/PhD, she put me in a translational research lab under Dr. Thuy Doan. I had a wonderful mentor my first time in the program, and once again, I find myself surrounded by intelligent, caring researchers.

Introduction

Ocular bacterial infection by Chlamydia trachomatis, also known as trachoma, is one of the leading infectious causes of blindness world-wide. The World Health Organization (WHO) has designated trachoma a priority disease, and has led a global effort to promote its elimination through the SAFE strategy: Surgical correction of trichiasis, Antibiotics to reduce the community load of ocular chlamydia, and Facial cleanliness and Environmental improvements to reduce the transmission of ocular chlamydia. While treatment is important, accurate surveillance is also paramount. Currently, surveillance of the disease is dependent on trained field workers to assess disease based on a simplified grading system designed by the WHO. However, this method can confuse trachoma with other infections. While new nucleic acid amplification tests (NAATs) are much more accurate in diagnosing trachoma, they are not always accessible in low resource settings.

Objectives/Hypotheses

The objective of our research is to compare the performance NAA assays that are easy to implement in low resource settings. Specifically, we will evaluate the isothermal and miniPCR detection of C.trachomatis to the gold standard GEN-PROBE APTIMA NAAT. We hypothesize that both the isothermal and miniPCR will have similar sensitivity, specificity, and accuracy compared to the gold standard.

Methods/Results

All laboratory personnel are masked to the identity of the samples. Dry conjunctival samples are suspended in Tris-EDTA (TE) buffer and separated into three different aliquots, one for each testing method. All samples are sent to a CLIA-certified virology lab for gold standard testing. Isothermal C.trachomatis detection was performed according to manufacturer's recommendation (Atila Biosystems, Inc., Mountain View, CA). MiniPCR (Amyplus, Cambridge, MA) NAAT follows conventional PCR protocol, but uses a portable and affordable PCR machine. Amplicons were assessed with a 2% gel. We calculated specificity, sensitivity, and accuracy using the gold standard as a benchmark.

Conclusions

We expect both the isothermal and the miniPCR assays to be in good concordance with the gold standard. These assays have the potential to improve trachoma diagnostics in low-resource areas.

Acknowledgments

I would like the thank the Heintz Laboratory of the Francis I. Proctor Foundation for allowing me to work in their lab this summer: Susie Cummings, Cindi Chen, Dr. Jeremy Keenan, and Dr. Thuy Doan for their help with this project.

Keywords

Chlamydia trachomatis, miniPCR, Isothermal PCR, Trachoma, Ethiopia

Sarah McCarthy

Laney College

Stem Cell Activation in the Mouse Olfactory Epithelium

Mentor:
Rebecca Chance, PhD

Funded by: California Institute for Regenerative Medicine

My intellectual curiosity for science burgeoned during my high school biology class where I was able to learn about the beautiful and complex processes that life depends on to survive. After I developed my love for science in school, I desired to further my interest in science through research. My first research experience was last summer through the SIMR program in Stanford's immunology department studying natural killer cell response to Epstein–Barr virus infection. This summer, the CHORI stem cell research internship provided me with an incredible opportunity to explore my passion for science. Not only did I have the opportunity to strengthen my wet lab research skills this summer, but I also had the opportunity to attend many lectures from a myriad of scientists, meet other intellectually curious people, and apply the textbook knowledge that I learned in my science classes. I would like to thank the CHORI SSRP staff, my incredible mentor Dr. Rebecca Chance, and CIRM for giving me the privilege to participate in this wonderful program. I am leaving CHORI this summer a multitude of skills that I plan on utilizing at Laney College where I begin my studies in chemical biology this fall with the intent of pursuing the physician scientist career path.

Introduction

The olfactory epithelium (OE) provides an excellent model system for studying stem cell activation since it contains adult neural stem cells and is genetically accessible in mice. Horizontal Basal Cells (HBCs) are normally quiescent multipotent progenitors of the OE that can differentiate to produce the cells of the OE. The Ngai lab has characterized using single-cell RNA sequencing (scRNA-seq) and computational methods a pseudotime-ordered developmental lineage of the cell type and FISH-validated gene expression pattern through this process of HBC activation through 14 days when all cell types repopulate the OE.

We investigate the effect of ß-catenin signaling on HBC activation in injury response on proliferation and differentiation. We further investigate the temporal profile of ß-catenin's putative time of effect by probing for a correlated transcriptomic response amongst TCF/LEF targets along our existing scRNA-seq dataset.

Hypothesis

ß -catenin signaling is necessary and sufficient for injury-induced HBC activation in the mouse OE via transcriptional effect.

Methods

We used confocal microscopy of immunostained frozen sections from the mouse OE to analyze which cell types are generated after genetic manipulation or injury. We quantified using ImageJ an effect on terminal fates of cells generated from HBCs in response to injury.
We also cross-referenced the known list of TCF/LEF transcriptional targets in silico with the gene expression patterns in our regeneration dataset to learn which targets are turned on, or off, and when these transitions take place.

Anticipated Results

We expect to find more HBCs entering the neuronal lineage in ß-catenin gain-of-function mouse OE. Conversely, we expect to find fewer suprabasal YFP+ cells in a ß-catenin loss-of-function genetic background.

Discussion/Conclusions

Our aims were to best understand what transcriptomic changes underlie stem cell activation by injury in our model system. Understanding how the body normally repairs adult tissue could inform strategies in the clinic to provide stem cell transplantation therapies to patients.

Acknowledgments

I would like to thank Dr. Rebecca Chance, the members of the Ngai lab, the CHORI SSRP Staff, and CIRM.

Keywords

Stem cell activation, ß-catenin

Kiara Monahan

University of California, Berkeley

Cystic Fibrosis Theratyping: Matching Mutations to Medications

Mentor:
Beate Ilek, PhD

Funded by: Nash Foundation

I am a rising sophomore pre-med student at UC Berkeley. I have always been fascinated by biology, and I previously became involved in research in plant genetics. While that experience made me grow fond of the research process, I realized that I am most passionate about medicine and human biology. In one of my biology classes, we discussed the huge impact that Cystic Fibrosis has on the lives of people with CF, and that discussion stuck with me. I wanted to be a part of the research program at CHORI to learn from a mentor while applying the science I had learned to research on the genetic disease of Cystic Fibrosis that could help those affected.

I am very grateful for this opportunity that has allowed me to learn so much about research, physiology, and career paths in medicine. I especially want to thank my mentor, Dr. Illek, for helping me develop a deeper understanding of the things I learned and supporting me throughout the summer. Dr. Illek has been a wonderful mentor and I am inspired by her work. Overall, this experience has been incredible and I am even more determined to pursue a career in medicine and research.

Introduction

Cystic Fibrosis (CF) is an autosomal recessive disease caused by a mutation in the gene for the Cystic Fibrosis Transmembrane conductance Regulator protein (CFTR). CFTR is an anion channel that mediates Cl- and HCO3- transport in epithelia. Often, symptom-focused treatment is used for CF. However, in 2012 the FDA approved the first CFTR modulator drug, Kalydeco®, that addresses the root cause of CF. Theratyping is a new approach that classifies CFTR variants based on their response to CFTR modulators to match medications to CFTR mutations. This helps identify effective treatments for each patient using cell samples in the laboratory. Traditional tissue culture using the conditional reprogrammed cells (CRC) method can expand cells 10,000 fold, but the novel EpiX™ technology can expand epithelial cells over 1012 (trillion) fold using cells obtained from a gentle nasal swab.

Hypothesis/Objective

To use planar cultures of nasal and bronchial epithelial cells to provide an airway model to study normal and mutant CFTR function in individuals.

Methods

Non-CF human bronchial epithelial cells (HBEs) from 9 individuals were plated at passage 0. Nasal cells from 5 CF patients at BCHO were expanded using EpiX™ technology, and cells from 15 different CF patients were expanded using the CRC method using irradiated 3T3 fibroblasts and a ROCK inhibitor. Cells were treated with either VX-809 or VX-661, or were untreated. Ussing assays were used to measure chloride currents in response to a cAMP agonist, VX-770, and CFTR inhibitors.

Results

The transepithelial parameters of 2D airway EpiX™ cultures and CRC cultures are in a similar range. The five CF genotypes tested can be divided into two groups: responders and non-responders. The F508/R117H,7T genotype showed the largest response (ΔI CFTR = -13.06±0.62 μA/cm2). The F508del/F508del genotype was a non-responder (ΔI CFTR = -1.77±0.62 μA/cm2).

Discussion/Conclusions

EpiX™ expansion of cells allows for a novel model for CFTR theratyping: studying responses to CFTR modulators in the laboratory so that patients can be matched with an effective drug.

Acknowledgments

Dr. Beate Illek, Dr. Ngoc Ly, Dr. Elizabeth Gibb, Dr. Walter Finkbeiner, the SSRP program, and The Elizabeth Nash Foundation

Keywords

Cystic Fibrosis, theratyping, CFTR modulators, CF mutations

Mia Moreno

Santa Monica College

Mobilize Against Hep C: The DeLIVER Care Van

Mentor:
Jennifer Price, MD PhD

Funded by: National Institutes of Health

Hi, my name is Mia Moreno and I am an undergraduate student at Santa Monica College majoring in Biology. I am interested in therapeutic solutions to cancer and better detection methods particularly as it pertains to minority women's health disparities. My goal is to address the health disparities in minority communities, as an OB/GYN doctor.

This summer I was given the wonderful opportunity to work with Dr. Jennifer Price at UCSF. I have assisted her in providing HCV screening and liver disease staging through a mobile medical van to communities heavily impacted by the Hepatitis C virus. My time spent with Dr. Price has allowed me to explore the many possibilities of the medical field and I am very excited to learn all I can this summer. Thank you, Dr. Price, for giving me the opportunity to work alongside you and to observe the fascinating work you do.

Introduction

Hepatitis C is a liver infection caused by the Hepatitis C virus (HCV) and kills more Americans than any other infectious disease. Despite new HCV treatments arising, only a minority of people living with HCV have been cured due to the dissolution in the HCV care cascade. There is a high number of individuals living with HCV who are undiagnosed and untreated in the San Francisco area. HCV screening, confirmatory testing, and linkage to care remains a significant challenge.

Hypothesis/Objective

We hypothesize that providing HCV screening and liver disease staging via a mobile medical unit will be feasible and acceptable among communities disproportionately impacted by HCV.

Methods

A UCSF shuttle bus was equipped with a phlebotomy station, Fibroscan®430 Mini+ and
clinical exam table. Screening with the OraQuick® HCV Rapid Antibody (Ab) test was performed in various settings: 1) street outreach; 2) community events; and 3) a methadone clinic. HCV Ab+ clients were offered venipuncture for confirmatory HCV RNA and genotype, Fibroscan®, HCV counseling, and linkage to care. Fibroscan® was also offered to clients awaiting their HCV Ab results.

Results or Anticipated Results

241 clients completed HCV Ab screening. Among the HCV Ab+, 53 underwent HCV RNA confirmatory testing on the van (68%) and 20 were HCV RNA+ (38%). HCV Ab+ individuals were more likely than HCV Ab- to be marginally housed, have Medi-Cal insurance, and report ever injection drug use (IDU).

Discussion/Conclusions

The DeLIVER Care Team has begun the process of linking patients to HCV care providers. However, confirmatory testing and diagnosis remain a barrier in the fight against HCV. By providing patients with the necessary resources to receive HCV screening, confirmatory testing and care linkage, as a community, we can improve the lives of the individuals living with HCV.

Acknowledgments

I would like to thank Dr. Jennifer Price, Rachel Kanner, Yesenia Laguardia, and Emily Valadao for this incredible experience and I wish them all the best in their future research.

Keywords

Hepatitis C Virus, HCV care cascade

Adriana Muñoz

California State University San Marcos

Title: Improving the CHORI Summer Student Research Program Marketing Landscape

Mentor:
Ellen Fung, PhD, RD, CCD, John McDonnell

Funded by: National Institutes of Health

I am a recent first-generation graduate from California State University San Marcos. I completed my Bachelor of Arts in Communications. I am very appreciative of the opportunity to be the Marketing Analyst Intern for this summer's student program at CHORI. This summer I will be working on Summer Student Research Program Alumni outreach, interviews to gather student experience (past and present) and utilizing my freshly graduated communication skills to continue the promotion of this program to the public. Since I am a first-generation student I am able to sympathize with alike students and gain insight on the inequities that come-up throughout pursuing higher education. Not being a STEM related major gives me a very different perspective on the subject. I have worked part-time my whole college career and utilized any possible resource that I could find.

I love being able to participate in a program like CHORI that provides mentorship, experience in the field and resources for under-represented students furthering higher education. Moving forward from this program I would like to continue working for a program or business that holds similar values to CHORI. I would like to work in the communications field doing PR work, external and internal affairs along with any type of interviewing aspects. It would be my dream to work with a company that is owned by a person of color like myself and/or first-generation college student. I believe that first gen students are entirely capable of doing so many great things in the near future especially in the STEM field

Introduction

The primary goal of the CHORI Summer Student Research Program (SSRP) is to increase diversity in science, technology, engineering, and math (STEM) careers. For the last 4 decades, SSRP has provided scientific training, resources and community to underrepresented students. The unique curriculum provides opportunities that have encouraged hundreds of students to pursue STEM careers. Despite program success, there has been a disconnect with communicating the message to future students and funders. Marketing the program through content creation was emphasized this summer. Past and present student stories help communicate the profound impact the program has on them along with continuing to promote the contents of this program.

Objective

The aims of my work this summer is 3-fold:

1. Conduct a thorough Marketing Analysis of the CHORI SSRP,
2. Assemble empowering stories of past and present SSRP interns to share in social media campaign,
3. Query alumni to understand program relevancy.

Methods

Current marketing material (e.g. print, media, Instagram, Facebook) will be reviewed and analyzed for relevancy to populations of interest. Interviews of current students and past alumni will be conducted and communicated through Adobe InDesign. An online questionnaire will be developed utilizing SurveyMonkey.com to distribute to Alumni.

Significance

Analysis of current program marketing, gathering feedback from Alumni and efficiently communicating stories of Alumni will allow CHORI SSRP to effectively message. The elements that were focused on this summer will support future funding efforts and preparation of the program for future students.

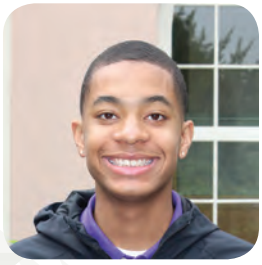
Keywords

Marketing, Analysis, Facebook, Instagram

Dwayne Pittman III

Moreau Catholic High School

External artifacts and their effect on accuracy of BMD assessments



Mentor:
Ellen Fung, PhD, RD, CCD

Funded by: Doris Duke Charitable Foundation

Hello, my name is Dwayne Pittman lll. I am going into my Junior year at Moreau Catholic High school in Hayward. Ever since middle school, I have always wanted to be a Scientist. I will always look up different things about Science that I can learn about and I will even go to my Science teachers at lunch and talk about Science. I began to become more and more focus on Science when I got to high school. When my parents told me about the CHORI program, I knew this would be a great opportunity to fulfill my dream by participating in the STEM program. Researching was a little struggle for me, but once I began to work with Dr. Ellen Fung, it became easier to understand and I enjoyed the topics and the research subjects that we were doing. The CHORI program has opened a lot of doors for me. I am able to meet different doctors and scientist and learn what they study, why they want to study that, and how they got to where they are right now. The lectures that I attended were very enlightening. I'm starting to enjoy researching different things and learning about them as well. In the future, I plan on becoming a Sports Medicine Doctor, so that I can help all athletes recover from their injuries. Being a basketball player in high school myself, makes me have a greater drive for Sports Medicine. My drive has been influenced by watching my parents repeatedly work hard to do better for themselves and their family. I would like to thank my amazing mentor, Ellen Fung, for helping me grow as a researcher and as a person. She also has helped improve with my self-esteem and be more social with others.

Introduction

DXA is an enhanced form of X-ray technology used to measure BMD, a proxy for bone loss/osteoporosis. DXA uses a very small dose of ionizing radiation to produce pictures of inside of the body. It is a completely painless procedure that is easily performed and exposes the patient to minimal radiation. BMD is typically a very reliable and reproducible test when there are no artifacts present on or in a patient. Previous research has shown that certain artifacts (e.g. dense clothing, bullets, kidney stones, calcium supplements) may affect the accuracy of BMD assessments. It remains unclear if common external artifacts (buttons, piercings, braces, surgical clips) observed in pediatric scans will affect BMD accuracy.

Objective

To understand the effect of external artifacts on the accuracy of DXA assessments.

Methods

Eight types of external object artifacts were assessed for their effect on spine BMD accuracy by DXA (Hologic Horizon-A, Bedford MA). These included both plastic and metallic buttons, rings, piercings, necklace, zipper, and surgical clips. Each object was scanned 10 times, on 3 different calibration phantoms, both on and next to the bone. Results were compared to the phantom scanned without artifacts and analyzed by STATA (v15.0, College Park, TX); $p<0.05$ considered statistically significant. A clinically significant difference was considered as a value > 0.026 g/cm^2, the least significant change for our scanner.

Results

Preliminary results suggest that objects made from gold result in a clinically significant deflection of X-ray, or a 'black hole effect', and decreased BMD, whereas other metal artifacts comprised of surgical steel, titanium, silver, brass and nickel (e.g. buttons, zippers, piercings) result in higher BMD values. Plastic objects do not appear to have a clinically significant effect on BMD accuracy. Effects on soft tissue accuracy have yet to be examined.

Conclusions

These results suggest that all metal external artifacts should be removed from patients prior to scanning, if feasible, to improve BMD accuracy. Other dense plastic objects may not have an effect on accuracy. Inability to remove dense metallic artifacts prior to scanning, may lead to inaccurate clinical assessment and inappropriate recommendations.

Acknowledgments

Ellen Fung, Lisa Calvelli

Keywords

Bone Mineral Density (BMD), Dual Energy X-Ray Absorptiometry (DXA), Artifacts

Emma Pond

University of California, Berkeley

HLA Genotyping Assay Development

Mentor:
Janelle Noble, PhD

Funded by: Volunteer

My name is Emma and I am a junior studying Chemical Biology at UC Berkeley. Since high school, I have been fascinated by the ways that chemistry explains biology and this major is the perfect way to explore this passion. I hope to continue my study in this area after undergrad by pursuing a PhD, an MD, or studying in an MD/PhD program.

This summer, I am working on developing an assay for HLA genotyping. The HLA region is a section of the genome responsible for labeling certain cells as "self" and other cells as "infected" so that the immune system can target them for destruction. Because the HLA region helps direct the immune system, certain HLA haplotypes can affect autoimmune disorders such as Type 1 Diabetes.

Methods for genotyping (determining the haplotype of an individual) have improved over the years, but current genotyping kits are very expensive and require several labor-intensive rounds of ligation to index the DNA once is has been amplified. This summer, I am testing a new type of assay that uses special primers to index the DNA at the same time that it is amplified.

These primers have been tested before at a single locus in the HLA region but I am testing them at 15 different loci to determine whether this assay method might be a suitable replacement for current genotyping kits.

Introduction

The human leucocyte antigens (HLA) are peptide-presenting proteins on the surface of cells that contribute to the immune system; classical antigens include class I (A, B, C) and class II (DR, DP, DQ) antigens. The HLA region, which encodes these proteins, is the most highly polymorphic in the human genome and has been implicated in many autoimmune disorders. Many different methods of HLA genotyping exist of varying cost and complexity; however, because the HLA region is so highly polymorphic, HLA genotyping is often expensive.

Objective

The goal of this project is to develop a streamlined and cost-effective HLA genotyping assay.

Methods

There are four steps required to genotype genomic DNA using next-generation sequencing (NGS): amplification, indexing, sequencing, and analysis. Steps between amplification and sequencing vary in complexity and difficulty depending on the genotyping kit used. This project uses "shuffle and stub" primers in 2-step PCR which allows simple, rapid library preparation.

Anticipated Results

16 different primer pairs will be tested at 15 different exons representing 8 genes in the HLA region that encode the 6 classical antigens. Successful amplification and sequencing are anticipated due to successful prior testing of two of the primer pairs used. Further successful testing will result in an assay that provides rapid, simple, cost-effective genotyping results at sufficient resolution for most research-based HLA genotyping applications

Discussion/Conclusions

If successful, this assay will provide HLA genotyping at a resolution sufficient for many HLA genotyping purposes but at a fraction of the cost of other available genotyping methods. This will make HLA genotyping less cost-prohibitive for research studies. In the future, this assay could be further streamlined to incorporate multiplex PCRs, which would further reduce the cost and effort spent on genotyping. Additionally, this assay design has potential applications in genotyping other loci in the human genome.

Acknowledgments

Dr. Janelle Noble, CHORI, Gregory Martin, Ningyi Song, Shana McDevitt

Keywords

Genetics, HLA, PCR, assay development, Type 1 Diabetes

Ishika Prashar

Middle College High School

Comparison of Standard Biostatistics with Big Data Analysis Techniques

Mentor:
Ward Hagar, MD

Funded by: Doris Duke Charitable Foundation

Hello, my name is Ishika Prashar and I just graduated from Middle College High School in San Pablo. I will be attending UC Berkeley in hopes of majoring in computer science or data science. Being an immigrant and seeing my mom work so hard in order to provide for our family has been my biggest motivation to break barriers and pursue my aspirations. Coming from a traditional Indian family, being able to pursue STEM hasn't been the easiest, but having support from my mom and amazing programs such as Students Rising Above and CHORI has been much appreciated.

I am interested in learning about the intersection between technology and medicine, and CHORI has finally given me an outlet to explore this field. Dr. Hagar has graciously designed an amazing research plan for me where I get to analyze medical data using frequentist statistics and big data analysis techniques. Thanks to his help, I have learned so much about the field of machine learning, statistics, and data science, all things I knew nothing of before. CHORI has shown me that although some dreams may seem daunting, nothing is impossible if you put in the work and have amazing people to support you by your side.

Contributing Authors

Dr. Ward Hagar, Lynne Neumayr

Introduction

Big data analysis techniques have found important applications in commercial and research fields. However, these techniques have not been evaluated for their application to medical data analyses. While there is great promise in using big data techniques to discover new relations and predict treatment outcomes, its implications in clinical medical research remains unknown. In current research practice, medical data is analyzed using frequentist biostatistics. This pilot study will analyze whether techniques commonly used in big data analyses will give consistent results to standard medical biostatistics.

Hypothesis/Objective

Frequentist biostatistics yields different results than big data analysis

Methods

We will use R Software and RStudio to perform standard medical statistics such as linear logistic regression on a large de-identified clinical dataset. We will also use an established big data algorithm KNIME to perform big data analyses such as k-clusters and random forest. We will then compare the answers given by the different techniques to each other. If we get different answers, a secondary analysis will be to see at what size the datasets separate.

Anticipated Results

We anticipate that big data techniques will give different results. However, we could see that big data techniques and standard statistics differentiate only when data is over a certain size.

Discussion/Conclusions

This pilot study investigates the steps in using newer analysis techniques on medical data that can be automated to evaluate information real time. We hope to develop a scalable framework to allow future datasets to be analyzed with statistical software approaches.

Acknowledgments

Thank you CHORI for this opportunity and the Doris Duke Charitable Foundation for their support. Thank you, Dr. Hagar, for taking the time to mentor me and for teaching me that I shouldn't be afraid of asking questions. I want to thank my Mom for patiently supporting me throughout all my endeavors. Finally, I want to thank Students Rising Above for giving me help and access to this internship, and my advisor Tanya for encouraging me to apply.

Kendal Reed

Spelman College

If Words Could Kill

Mentor:
Dayna Long, MD

Funded by: National Institutes of Health

My name is Kendal Kamaria Reed a rising sophomore Health Sciences major at Spelman College in Atlanta, Georgia, from the SF Bay Area. As an aspiring physician, a career in health has been a goal of mine since the time I could remember. I am blessed to have been surrounded with phenomenal African American health care providers throughout my life, and I want my future patients to be able to see themselves in me just as I saw myself in my providers.

This was my first research experience and I cannot thank CHORI enough for this amazing opportunity. Over the past nine weeks I have worked diligently under the mentorship of Dr. Dayna Long investigating how discrimination influences the prevalence of asthma, ADHD, and obesity in youth. In addition to this research, I helped update resources in the Family Information & Navigation Desk (FIND) database as well as shadow Dr. Long in her primary care and asthma clinics. My time at CHORI has sparked a new love for clinical research investigating social determinates of health and is something I wish to continue throughout my career.

I would like to thank Dr. Long, the CHORI staff, NIH, and the Claremont Primary Care Clinic staff for supporting me and making my first research experience a great one.

Introduction

The PEdiatric ACEs Screening and ResiLiency Study (PEARLS) is the first randomized controlled trial of early childhood adversity in a pediatric safety net clinic. The PEARLS questionnaire screens for adverse childhood experiences (ACEs) and toxic stress during well child primary care checkups and is filled out by the patient's caregiver. If the child endorsed one or more stressors, then the patient connected with tools to help relieve the stress that they are experiencing.

ACEs are stressful or traumatic events experienced prior to the age of 18 that are linked to poor life habits. Such habits include early interactions with smoking and drinking in adolescents leading to negative health outcomes. Discrimination, defined as unfair treatment on an individual or group based of identity factors such as race, color, sexual orientation, or religion, can be classified a type of ACE or stressor. People can experience discrimination in many ways whether it is being denied of a service, being called a derogatory term, receiving more force from law enforcement, or through microaggressions. Since individuals can experience discrimination in various capacities, it is an important phenomenon to monitor as the stress it causes may have negative influences on a person's health.

Methods

Using the data collected form PEARLS questionnaire, the patients that endorsed positive screenings for discrimination will be extracted. Of these 52 patients their complete medical history will be analyzed to determine the top three health outcomes.

Anticipated Results

After reading background articles on discrimination and its influence on asthma, a strong correlation is to be anticipated. In addition, since ACEs and toxic stress are linked to bad lifestyle habits and disruptive behaviors a significant relationship is expected to be seen in ADHD and obesity as well.

Discussion

The results of this study are significant important because patients are living in a society where discrimination based off of race, immigration status, gender identity / expression, and sexual orientation are on a rise, it is vital to understand how these stressors are affecting their health.

Keywords

Discrimination, Pediatrics, ACEs, Asthma, ADHD, Obesity, Toxic Stress,

Erin Rosales

University of California, San Diego

Testing of a Procedure for Isolating Lipoproteins from Mouse Plasma for Analysis by Ion Mobility

Mentor:
Ronald Krauss, MD, Sarah King, PhD,
Jennifer Beckstead, MS

Funded by: National Institutes of Health

Hello! My name is Erin Rosales and I am a rising senior at the University of California, San Diego majoring in Human Biology with a minor in Global Health. UC San Diego is a renowned public research university and competition can prove challenging with securing research opportunities. I am grateful to be a part of the dynamic summer research program at Children's Hospital Oakland Research Institute (CHORI).

My time at CHORI has been an integral part of my journey as a biology major. I was able to experience the camaraderie among lab scientists, principal investigators and student interns. Among the program's highlights are the lecture series and seminars held at the UCSF Benioff Children's Hospital, Oakland campus. These sessions have introduced me to the significant impact that health professionals and scientists have in clinical research. Once I graduate from UC San Diego, I will continue to immerse myself in clinical research, while pursuing health professional graduate programs.

Introduction

Increased blood cholesterol levels serve as a risk factor for cardiovascular diseases (CVD). Mice, Mus musculus, are animal models often used in scientific research, specifically for human diseases such as atherosclerosis. Atherosclerosis occurs by an accumulation of lipids and cholesterol that aggregate in plaques along the walls of a patient's arteries.

Our lab currently uses a magnetic bead method to isolate lipoproteins from human plasma. This method is designed to bind and isolate only lipoproteins, and not interfering plasma proteins such as albumin and fibrinogen. Samples are analyzed using Ion Mobility (IM) lipoprotein fractionation which separates unmodified lipoproteins by size and provides direct measurement of lipid subclasses. While this procedure has been validated in human plasma, it has not been for mouse plasma. Mouse models play an important role in lipoprotein research; therefore, we are validating the magnetic bead method for IM in murine plasma.

Hypothesis/Objective

To assess the use of the magnetic bead method for recovery of murine plasma lipoproteins for analysis by the ion mobility.

Methods

A collaborator provided several mouse plasma samples for which we used a magnetic bead and dialysis procedure to isolate lipoproteins. Lipid values in untreated plasma vs. post-dialysis of triglycerides, cholesterol and high-density lipoproteins (HDL) were analyzed. The same procedure was followed for human plasma samples from a completed study in the Krauss laboratory.

Triglycerides, total cholesterol and HDL were measured using a Liasys assay. Percent recoveries were calculated from the untreated plasma and post-dialysis procedure. The IM data was analyzed and collected, comparing characteristic peak particle size distributions of mouse plasma and human plasma.

Anticipated Results

We expect values of triglycerides, total cholesterol and HDL recoveries in both mouse plasma and human plasma to yield 100% recovery using the magnetic bead method. Past IM results have shown mouse plasma has a prominent peak in the "midzone" region, which lies between HDL and Low-Density Lipoprotein (LDL) curves, respectively. We plan to analyze the region's components as the midzone is known to increase the risks of CVDs.

Discussion/Conclusions

Cardiovascular diseases serve as the leading cause of death nationwide and worldwide. Lipoprotein profiles are used to assess the risk for heart disease, and the ion mobility procedure is a means for analyzing lipoprotein particles in the major size subclasses. Mice are one of the most commonly used model animals for human atherosclerosis and related cardiovascular diseases.

Acknowledgments

My deepest gratitude to Dr. Krauss, Dr. King, and Ms. Beckstead who are wonderful mentors, in addition to Bahareh Sahami's guidance. The enriching laboratory experiences have inspired me to continue exploring various aspects of research.

Keywords

Cholesterol, Lipoproteins, HDL, Mouse, Plasma

Lynda Solis Chavez

University of California, Berkeley

Using Human Liver Cells to Measure the Efficacy of the Clinical Iron Chelators

Mentor:
David Killilea, PhD

Funded by: National Institutes of Health

Hello, my name is Lynda Solis Chavez and I am currently a rising second year at the University of California, Berkeley majoring in Chemistry. I always enjoy learning about the different aspects of science because it allows me to learn how the world around me works. However, my interest specifically in chemistry began my junior year of high school, where I took a college level introductory chemistry course, and made Aspirin. The process of producing Aspirin inspired an interest in research concerning the interaction between medication and the human body.

Coming from a low-income community and being a first-generation student of color, I was never exposed to programs that provided me an opportunity to do research. The goal of the Student Summer Research Program at CHORI is to provide research opportunities to those from disadvantaged backgrounds. I joined CHORI because it allowed me my first opportunity to do research in a community where I felt comfortable and knew I would grow as a researcher.

I would like to thank Dr. David Killilea and Kathy Schultz for allowing me to grow as a researcher with the patience, guidance and knowledge that they have given to me this summer.

Contributing Authors

Kathy Schultz, MS

Introduction

Sickle cell and thalassemia are inherited diseases that result from mutations to the hemoglobin affecting the production of hemoglobin and healthy red blood cells. This causes a high turn-over of red blood cells in the body, elevating the body iron stores while simultaneously causing anemia. To address the anemia, frequent blood transfusions are performed which further increases the iron in the patient's body. To reduce the excess iron, drugs called chelators were developed to remove the iron. Recently, combinations of the chelators are starting to be used but their clinical effects have not been as well studied. This study is intended to test the efficacy of these chelators and their combinations.

Objective

To evaluate and determine the efficacy and selectivity of clinically-relevant iron chelators used in combination.

Methods

The efficacy of clinically-relevant iron chelators will be studied in single or combination treatments. First, iron chelation activity will be measured in a cell-free fluorescence metal binding assay. Then, chelator activity will be measured in the transformed human liver cell line HepG2. These cells will be treated with ferric ammonium citrate solution (FAC) that mimics the iron overload followed by a 24-hour rest period to allow the cells to metabolize the excess iron. Then, the iron chelator(s) are applied to the cell at varying concentrations and combinations. Afterwards, the cells are harvested and measured for metal content using the inductively coupled plasma optical emission spectrometer (ICP-OES). Cell health and growth will also be monitored during treatments.

Anticipated Results

It is expected that the combinations of iron chelators will better remove the iron from the cells than a single chelator alone.

Discussion/Conclusions

Being able to understand the efficacy of different iron chelator combinations will allow for improved clinical strategies for those any disease which experience excess iron.

Acknowledgments

I would like to Elijah Goldberg for advice as well as Tony Munoz and Denise Muñoz for guidance while learning cell culture.

Keywords

Chelator, iron overload, micronutrients

Alp Sozat

Head Royce High School

Effect of Genetic Variation on Lipid Droplets using Patient-Derived iPSCs

Mentor:
Marisa Medina, PhD

Funded by: California Institute for Regenerative Medicine

My name is Alp Sozat and I am a student at the Head-Royce school in Oakland. My interest in biomedicine began around ninth grade, when I chose the CRISPR-Cas9 technology for a school research project. I then interned at the Samsun Training and Research Hospital in Turkey for a couple weeks, where I shadowed a surgeon in the Orthopedics and Traumatology Department. The following year, I interned at the Istanbul Faculty of Medicine in Turkey, where I shadowed doctors and other medical professionals in the Department of Neurology. I also took UC Berkeley's ATDP course on Advanced Biotechnology, where I was exposed to some lab practices and tools. I applied to the CHORI Summer Research Program for the opportunity of learning through hands-on research. So far, I have learned a lot about non-alcoholic fatty liver disease and important cell culture practices thanks to my mentors, Tony Munoz and Marisa Medina.

Introduction

Non-alcoholic fatty liver disease (NAFLD) is a spectrum of liver disorders characterized by excess liver fat (i.e. steatosis) in the absence of alcohol consumption. NAFLD may progress to cirrhosis and liver failure, and is currently the leading cause of liver transplant in the U.S. Obesity and type 2 diabetes both can underlie NAFLD. Additionally, two gene variants (PNPLA3 rs738409 and TM6SF2 rs58542926) have been strongly associated with NAFLD in multiple populations. PNPLA3 is involved in triglyceride hydrolysis in adipocytes, while TM6SF2 modulates triglyceride-rich lipoprotein secretion. In hepatocytes, both mutations are loss-of-function variants, leading to lipid overaccumulation in lipid droplets, organelles that convert toxic lipids into neutral lipids and store them. We have generated a panel of subject-derived induced pluripotent stem cells (iPSCs), which include carriers and noncarriers for the PNPLA3 and/or TM6SF2 gene variants.

Objective

To test whether iPSC lines that carry TM6SF2 and/or PNPLA3 gene variants have increased cellular triglycerides compared to lines without either variant.

Methods

The iPSCs were incubated in HCM Media with or without 0.1 mM of oleate for 24 hours and subsequently stained with Nile Red dye to label triglycerides and Hoechst dye to label nuclei. Cells were then imaged with a fluorescent microscope, and the intensity of Nile Red and Hoechst were quantified by a fluorescence plate reader and FACS to calculate average lipid amount per cell in each sample. We compared the differences in lipid droplet content and morphology of iPSCs with oleate, only BSA, and both groups.

Anticipated Results

iPSCs with TM6SF2 and/or PNPLA3 gene variants will accumulate more lipids than iPSCs with neither gene variant when exposed to media enriched in oleate; iPSCs exposed to only BSA will have no differences in lipids.

Discussion/Conclusions

These studies may demonstrate that iPSCs can be used as cellular models of genetic contributors to NAFLD, which may lead to their downstream utility in NAFLD diagnosis and treatment.

Keywords

NAFLD, TM6SF2, PNPLA3, Lipid droplets, iPSCs, Oleate.

Lauren Staelin

Miramonte High School

Prevalence of Anxiety Disorders in Patients with Rett Syndrome

Mentor:
Mary Jones, MD MPH

Funded by: Volunteer

My name is Lauren Staelin, I'm 16 and a rising senior at Miramonte High School. I've been interested in neuroscience ever since I saw the inside of a sheep's brain for the first time, but I became interested in specializing in pediatric developmental disorders when I started volunteering at the hippotherapy clinic, Xenophon. There, I met many remarkable young people struggling with a wide range of physical and mental disabilities who awakened in me an urge to understand and help them as best I could. I started reading articles about autism on my own time, and decided that CHORI was a unique opportunity to pursue my interest. I enjoyed my experience this summer learning about Rett Syndrome and the effects that neurological disorders have on the rest of the body. I'm so grateful for the opportunity CHORI provided me, and I hope to put the techniques I learned to use in my future research. I'd like to give a special thanks to Dr. Jones, my mentor, and to Dr. Fung, who helped us on our journey.

Introduction

Rett syndrome is a rare monogenetic neurological disorder affecting mainly females. It is not degenerative and longevity is into the 6thdecade. Research is actively directed at a genetic cure, but more clinical research to alleviate day-to-day symptoms is needed. Affected individuals suffer loss of purposeful speech, loss of purposeful hand use, and difficulty with mobility. Rett is characterized by imbalances in the autonomic nervous system. Anxiety and mood variations, common in Rett, are however puzzling. Vagal tone and parasympathetic activity is low compared to sympathetic activity. In recent years, the gut microbiome has been shown to have an influence on the vagus nerve, and is the focus of studies for anxiety and mood disorders. A recent study showed Lactobacillus, an over the counter pro-biotic, was able to decrease anxiety in mice through the vagus nerve.

Objective

To gain an understanding of the nature and prevalence of anxiety related behaviors in Rett Syndrome.

Methods

All individuals currently cared for within the Rett clinic at UCSF Benioff Children's Hospital Oakland were surveyed. A 'Survey Monkey" survey was sent electronically to 200 patients and caregivers to complete. The surveys were derived from validated questions used in previous clinical trials. Survey responses regarding anxiety related behavior will be compared with previously published data in other populations. Associations between anxiety and demographic and clinical severity data will be explored.

Anticipated Results

The results from this prevalence study will be used as pilot data for a randomized clinical trial to test the effects of Lactobacillus Rhamnosus, an oral pro-biotic, on anxiety related behaviors in selected Rett syndrome patients. It is anticipated that consumption of Lactobacillus Rhamnosus for 4 weeks will lead to a reduction in anxiety related behaviors and blood markers of stress.

Tanya Tannous

University of California, Berkeley

Testing of a Probe Capture Next-Generation Sequencing Assay for Analysis of Nuclear STR and SNP Markers

Mentor:
Sandy Calloway, PhD, Shelly Shih, MS

Funded by: National Institutes of Health

My name is Tanya Tannous and I am a rising senior at UC Berkeley pursuing a bachelor's degree in Molecular and Cell Biology with an emphasis in Biochemistry and a minor in Toxicology. This summer I have been working in Dr. Cassandra Calloway's lab researching tools for DNA analysis, specifically when the DNA is highly degraded.

Throughout my educational career, my fervor for science combined with my fascination with the law led me to the intersection of the two, forensic science. My experiences as an intern in Dr. Calloway's lab have transcended textbooks I so feverishly read. Last summer, I was given the opportunity to travel to El Salvador to aid in the scientific endeavor to reunite family members that disappeared during their armed conflict. This eye-opening experience elucidated the ability of forensic science to have significant applications in not only criminal cases, but human rights cases as well, further solidifying my passion and career goals.

I would like to extend my sincere gratitude to my wonderful mentors, Shelly Shih, Dr. Cassandra Calloway, and Dr. Henry Erlich, along with the SSRP organizers, for allowing me the privilege to partake in an enriching research experience.

Introduction

DNA from biological samples in forensic casework may be mixed or in degraded condition. In samples with highly degraded DNA, one or both primer binding sites may not be intact. Conventional PCR amplification and Capillary Electrophoresis analysis of Short Tandem Repeats (STR) may fail due to the absence of intact primer binding site(s). Probe capture enrichment can be advantageous for highly degraded samples as it utilizes overlapping biotinylated probes to capture fragmented DNA. Previously, we demonstrated that our SNP probe capture panel can capture DNA fragments as short as 75 bp and as low as 0.5 ng while yielding 99 – 100% reportable SNPs. Here, we tested the performance of the SNPv3.0 and STRv1.0 probe capture panels from the same shotgun libraries. Successful proof of concept would be advantageous to the forensic community as STR markers would allow for compatibility with the FBI CODIS database.

Hypothesis/Objective

The probe capture next-generation sequencing assay will be successful in capturing >97% of the targeted SNP markers and successful in capturing >80% of the targeted STR markers.

Methods

Three commercial control DNA and 12 blood-derived DNA population samples were prepared using a "shotgun" approach and given unique dual indexed barcode sequences. DNA shotgun libraries were pooled for probe capture enrichment using SNPv3.0 and STRv1.0 probe capture panels. The enriched products were sequenced on Illumina MiSeq. SNP and STR sequence data were analyzed using NextGENe, GeneMarker®HTS, and MaSTR Software.

Anticipated Results

We expect to achieve >97% of targeted SNP markers using our custom SNPv3.0 probe capture panel in samples with input amounts of DNA at 25 ng. We expect to see > 500× diploid read depth / SNP and balanced heterozygote ratios for most of the SNPs. For the STRs, we expect to achieve >80% of the targeted markers.

Discussion/Conclusions

The successful development of probe capture NGS assays would provide practitioners an alternative method to PCR amplification for analyzing challenging samples, including highly degraded samples and mixtures. Specifically, the proof of concept of probe capture enrichment of both SNP and STR markers from single DNA shotgun libraries would be of great utility, as multiple types of genetic markers can be captured and analyzed. Last, successful development of the probe capture panels can be applied to other fields including medical, anthropological, evolutionary, population genetics, and human rights issues.

Acknowledgments

I would like to thank Shelly Shih for her unwavering patience and teaching, Dr. Calloway and Dr. Erlich for providing invaluable guidance, and Christian López-Peña and Gunmeet Bali for their support.

Keywords

Next Generation Sequencing (NGS), Single Nucleotide Polymorphism (SNP), Short Tandem Repeat (STR), Massively Parallel Sequencing (MPS), Probe Capture, Target Enrichment

Tajii Thomas

Howard University

Assessing Wellbeing Among UCSF Surgery Residents: A Comparison of 2016 and 2019 Survey Data

Mentor:
Carter Lebares, MD

Funded by: National Institutes of Health

My name is Tajii Thomas and I am a recent graduate of Howard University with a BS in Sports Medicine. My ultimate goal is to attend medical school and become a physician. My interest in medicine was first sparked years ago when my little sister was badly injured in an accident and hospitalized for three weeks. Spending weeks at the hospital with her allowed me to learn about the different challenges that physicians take on. The doctors I observed were constantly problem-solving and utilizing their critical thinking skills. Furthermore, my experience participating in the CHORI SSRP program last year allowed me to gain even more exposure to the roles that physicians play. Not only did I engage in research, I also shadowed both in the clinic and the OR. This experience further motivated me to pursue a career in medicine, and I even developed a special interest in surgery.

This summer I had the wonderful experience of working with Dr. Carter Lebares, a gastrointestinal surgeon at UCSF and co-founder of the Center For Mindfulness in Surgery at UCSF. I assisted with her initiative to mitigate burnout and stress among surgery residents. through mindfulness-based intervention. Doing research with Dr. Lebares has been such an insightful experience and has given me direct exposure to the action-packed lifestyles of surgery residents. I appreciate the CHORI program for granting me this opportunity.

Introduction

Burnout is defined as a prolonged response to chronic emotional and interpersonal stressors on the job. Burnout has been linked to decreased professionalism and poorer patient outcomes, and its prevalence is estimated at 69% among surgical residents, nationally. In 2016, we found a high prevalence of burnout among surgery residents at UCSF, with strong correlations to overwhelming stress, clinically-relevant depression symptoms and alcohol misuse. This prompted the initiation of several programmatic interventions, on the level of individuals, systems and the institution, including cognitive training to enhance stress resilience; initiatives to improve self-care inside and outside the hospital; and changes to resident workforce and work schedules.

Hypothesis/Objective

Providing mindfulness-based cognitive training and program-wide initiatives to support resident wellbeing will decrease the prevalence of high burnout, perceived stress, state anxiety, depression, and alcohol misuse among surgery residents at UCSF.

Methods

A comprehensive survey, comprised of published measures of perceived stress, state anxiety, depression, alcohol use, burnout, and dispositional mindfulness was administered to all clinical and lab residents in the UCSF Department of Surgery in 2016 and again in 2019. Descriptive statistics from the two years were compared in order to gauge the overall effectiveness of well-being initiatives.

Anticipated Results

We anticipate a decrease in the prevalence of high burnout, perceived stress, state anxiety, depression, and alcohol misuse among surgery residents at UCSF. We also predict higher levels of mindfulness.

Discussion

Identifying effective methods by which resident wellbeing can be improved will inevitably invoke programs and practices that combat the effects of burnout. Improving the overall wellbeing of surgery residents will enhance their quality of life and their ability to provide quality care to patients.

Acknowledgments

I'd like to thank my mentor, Dr. Carter Lebares, as well as Ekaterina Guvva for their unwavering support and commitment.

Keywords

Burnout, Mindfulness Based Stress Reduction, surgeon wellbeing

Maria Uribe

University of California, Davis

The Effects of the Mitochondrial Dysfunction on Cholesterol Metabolism as a Result of FCCP Treatment

Mentor:
Ronald Krauss, MD, Sarah King, PhD

Funded by: Lubin Fund

My name is Maria Uribe. I am a rising senior at the University of California-Davis. I am currently pursuing an undergraduate degree in Neurobiology, Physiology and Behavior with an emphasis in Neurobiology. My interest in science began in fifth grade when I had to write a report on the animal Dwarf Caiman. Writing this report made me really interested in science because I learned terms like food chain, ecosystems, habitat, and species.

My interest in science got more refined as a moved from elementary school to high school. I dreamt about being a marine biologist up to my sophomore year of high school. However, my career path changed once I got exposure to classes like physiology and human anatomy. Taking these classes made me want to become a physician. After I finished high school my family and I moved from San Francisco to Richmond. The shift in culture, community , and health care access between these two cities reinforced my desire to go into the medical field. I want to go into medical school and become a successful physician so I can come back and treat the kids in my community.

I am beyond grateful to have the opportunity to conduct research in the Children's Hospital of Oakland Institute as a summer intern. I am grateful because this opportunity allows me to get exposure to research which is a side of science I have not seen before. In addition to exposure CHORI allows me to connect with likeminded student and faculty members.

Contributing Authors

Kelly A. Garton

Introduction

Cholesterol metabolism is very important because it helps with the production of hormones, food digestion and lipid transport. However, overproduction of low-density lipoprotein (LDL) commonly known as "bad cholesterol" can lead to cardiovascular diseases. Statins are commonly prescribed drugs used to lower cholesterol levels. Statins work by inhibiting the production of cholesterol, but a major side effect is muscle disease. The pathology behind statin induced muscle disease is very complicated, but research shows that there is a correlation between statin use and mutations of genes that encode for mitochondrial function.

A pilot study in our lab uncovered a potentially interesting relationship between mitochondrial energy metabolism and cholesterol metabolism. A gene that encodes for an important mitochondrial transport protein, translocase of outer membrane 40 (TOMM40), was found to be statin responsive. Interestingly, knocking down TOMM40 in cultured human hepatocyte cell lines resulted in increased transcription for low-density lipoprotein receptor (LDLR) and increase cholesterol uptake. This experiment supports the idea that cholesterol metabolism and the mitochondria energy metabolism are closely related. The purpose of the current work is to further investigate the relationship between mitochondrial energy metabolism and cholesterol metabolism through less specific mitochondrial disruption.

Hypothesis/Objective

Treating HepG2 cells with the mitochondrial toxin, mitochondrial oxidative phosphorylation uncoupler (FCCP), will increase the transcription of LDLR and the uptake of LDL.

Methods

For this experiment HepG2 cells will be treated with two different concentrations of FCCP After the FCCP treatment is completed the RNA will be extracted, complementary DNA will be synthesized, and qualitative PCR will be used to measure the expression levels LDLR

Results or Anticipated Results

The anticipated result for this experiment is to see an increase in transcription of LDLR in the HepG2 cells.

Discussion/Conclusions

The results of this research will help us understand the relationship between mitochondrial metabolism and cholesterol metabolism. A broader understanding of this relationship can help improve the treatment of cardiovascular disease with statins.

Acknowledgments

I would like to thank my mentors, and Jennifer Beckstead and Ally Crawford for sharing their knowledge with me throughout this process.

Ray Weeks

Cornell University

The Effect of Magnetized Ferromagnetic Objects on Liver Iron Concentration Measurements using SQUID Biosusceptometry and Methods of Demagnetization.

Mentor:

Marcela Weyhmiller, PhD

Funded by: Volunteer

Hello! My name is Ray Weeks. I am 22 years old and I am originally from Chicago, Illinois. I have spent the past four years in upstate New York at Cornell University majoring in biological engineering. This summer I am teaming up with Dr. Marcela Weyhmiller to investigate the effects that magnetized ferrous objects have on liver iron concentration measurements from the SQUID ferritometer. "SQUID" is short for Superconducting Quantum Interference Device and CHORI is home to one of three that exist in the world today. The device measures the induced voltage generated between a superconducting magnet and the iron inside a patient's liver tissue and this can be used to calculate the approximate iron concentration of a patient's liver. When patients have their measurement taken shortly after an MRI, any ferrous implants/objects they have on them may interfere with the readings. My research is to experiment with demagnetization methods to cancel out any distortion in the magnetic field that these objects create. In addition to working at CHORI, I am also dedicating 3-4 hours every day to rowing and training on the US Men's Senior national rowing team. Rowing has been a major part of my life since I began high school and I have been competing on the collegiate and international levels throughout my college career. In the future, I hope to qualify a boat to row in the Olympics.

Introduction

The SQUID (Superconducting Quantum Interference Device) Ferritometer is a non-invasive method to quantify liver iron concentration through its magnetic signal. Irremovable ferromagnetic objects can interfere with the SQUID measurement particularly after an MRI (Magnetic Resonance Imaging). The remnant magnetization can be so great that the SQUID test cannot be performed. This research examines dental appliances and their effect on SQUID measurements after being magnetized. A demagnetization method was tested to evaluate its ability to nullify the effects of the magnetized braces.

Hypothesis/Objective

Quantify the effect of ferromagnetic objects as a function of liver iron concentration readings, remnant magnetization and distance. Also, evaluate the effectiveness of demagnetization and to develop techniques to correct for the magnetic signals within the limits of the magnetic correction sub-program (by Roland Fischer).

Methods

Phantoms were constructed from a model skull and braces. Polyethylene bottles filled with deionized water or concentrated manganese chloride solution were used to approximate signals from normal iron and iron overloaded patients, respectively. SQUID measurements were performed by testing different total remnant magnetization values of the object and the distance from the object to the sensor. Objects were magnetized using neodymium magnets and demagnetized with a Realistic™ High Power Video Tape Eraser. After the SQUID data was collected, an initial analysis was completed using "HTanalysis.exe software" and results entered into Excel.

Results

I anticipate that objects with a magnetic field strength less than ~5 Gauss will have negligible effect on the results. I predict that there will be a linear correlation for magnetic field strength and an inverse cubed correlation (1/R3) for distance; both in relation to the degree of disruption on the SQUID LIC measurements. The demagnetization technique has successfully decreased any remnant magnetization to under 2 Gauss, allowing us to perform subsequent measurements with no distortion artifacts.

Discussion/Conclusions

For many patients at risk for iron overload, annual MRI's are common. The remnant magnetization after an MRI can prevent patients with irremovable ferromagnetic objects from getting their annual or biannual SQUID. This research suggests that demagnetization can be used to nullify the magnetic signal from an MRI.

Acknowledgments

Roland Fischer, PhD, Vinh Luu

Keywords

SQUID, Ferritometer, Iron Overload, Thalassemia, Magnetic Susceptometry, Liver Iron

David Xia-Zhu

University of California, Berkeley

Senescence as a Response to Cancer

Mentor:
Julie Saba MD, PhD

Funded by: Lucas Fund

I am an aspiring scientist intrigued by the world around me. Growing up in the Bay Area has given me the perspective to see the health disparities in my community. I aspire to use my background in biomedical and environmental sciences to study the intersections between health and environment. I chose to work for the CHORI summer program to learn more about the intricacies of cancer and understand its function in the human body. I am a rising Senior at the University of California, Berkeley studying Biological Chemistry with a minor in Marine Science. Using my interest in biochemistry and health, I hope to continue a career in oncology and pediatric medicine.

I would like to thank my mentors Julie Saba and Joanna Lee for guiding me through my research experience and teaching me the skills I need to pursue a career in science. I am grateful to the Saba Lab for their support and mentorship.

Contributing Authors

Joanna Lee PhD

Introduction

MLL1 chromosomal rearrangements occur in certain types of leukemia, giving rise to novel fusion proteins that are present only in the cancer cells. These fusion proteins drive the development of leukemia by complex mechanisms that lead to the turning on of genes that are normally turned off in mature blood cells. These genes maintain cell "stemness", maintaining the cell in an immature state that is highly proliferative and unable to differentiate. AF1q is an oncogene that is a translocation partner to MLL and has been shown to worsen cancer prognosis. Senescence is the normal process of cell aging, commonly caused by the shortening of the ends of chromosomes, or telomeres, and ceasing cell division. However, senescence has also been shown to be activated in the presence of oncogenes or DNA damage (i.e., oncogene-induced senescence, OIS). Cellular senescence is a fail-safe response to damaged DNA in cells that prevents cancer by restricting mitosis. The inactivation of tumor-suppressor proteins can mitigate the senescent response. However, senescence can be triggered by AF1q silencing. In this project, we will study AF1q's relationship with MLL fusion proteins and its effect of senescence as a response to damaged DNA.

Hypothesis/Objective

1. To find a negative correlation between senescence and AF1q expression in Mixed Lineage leukemia cells.
2. To determine whether PC-3 cells use senescence as a DDR mechanism to tumorigenesis.
3. To determine if sphingosine kinase inhibitor (SKI) can be used to mitigate tumor growth through AF1q expression in PC-3 cells.

Methods

AF1q expression: We will measure AF1q expression level through Western Blot.
Phenotype analysis: We will test AF1q silencing effects on proliferation through crystal violet staining. We can identify senescent cells by "Senescence-associated beta-galactosidase" or SA-betaGAL staining.

Results or Anticipated Results

I expect to see that MLL rearranged leukemia cells express high levels of AF1q. I also expect to find that silencing AF1q causes reduced proliferation. I expect to find a negative interaction between AF1q expression and senescence such that when AF1q is silenced in MLL rearranged leukemia cells, oncogene-induced senescence caused by the MLL fusion protein will be activated.

Discussion/Conclusions

This proposal will give us insight on the relationships between cell cycle division and senescence. It will allow us to consider other induction factors of senescence and potentially use senescence to mitigate tumorigenesis.

Keywords

Senescence, Oncogene, Tumorigenesis, Leukemia

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

Back Row, Left to Right:
Troy Coaston, Sharad Mahajan, Jonathan Aguayo, Haley Barton, Siobhan Garry*, Alexander Li, Mia Moreno, Adriana Muñoz, Vinh Luu

Front Row, Left to Right:
Batya Brose, Natalie Asemi, Linda Solis Chavez, Lilian Hernandez, Maryum Haidari, Kendal Reed, Angie Bustos, Erin Rosales, Tajii Thomas, Carla Fernandez, Alex Jeronimo, Lauren Staelin*, Tanya Tannous

*Neither Siobhan nor Lauren's research is funded by NIH

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 projects 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. These students will have the opportunity to present their results twice, at the annual CIRM-SPARK conference this year held in Pasadena, CA, and again today during the CHORI symposium.

Left to Right:
Alp Sozat, Chima Ezeh, Sarah McCarthy, Sofia Espinoza, Van Dinh, Kerry Lin

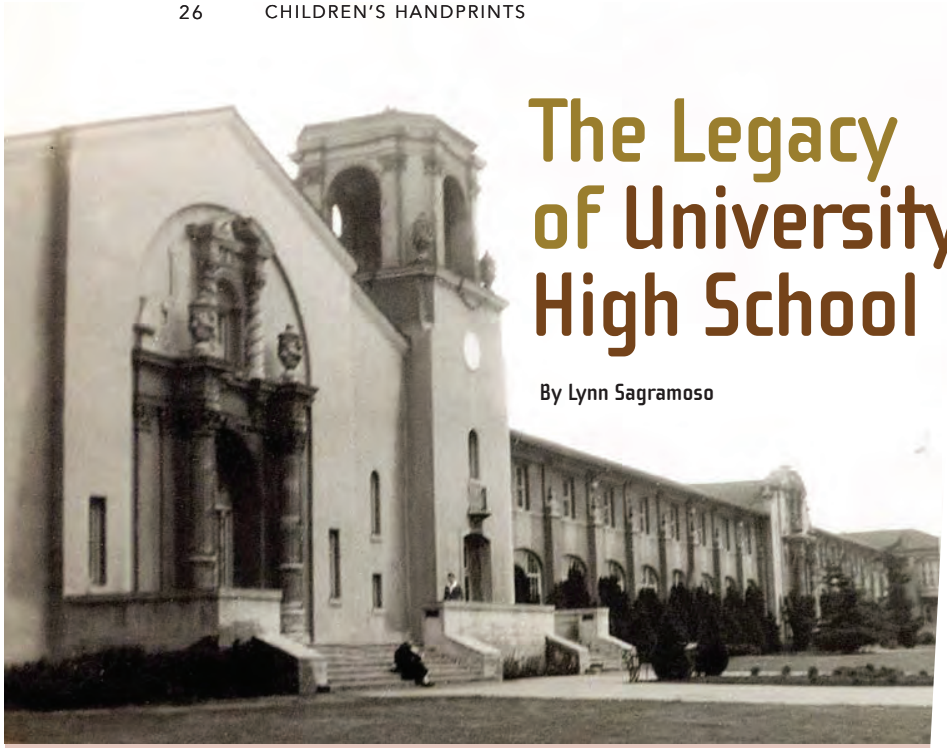
Doris Duke Charitable Foundation (DDCF) Scholars

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, many of whom 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 near-peer mentoring meetings and educational enrichment activities. Each student is presenting the results of the findings from their project at the symposium today.

Back Row, Left to Right:
Ishika Prashar, Dwayne Pittman III, Awo Gulaid, Kayla Jones, Kaylianna Cadena, Jocelyn Diaz

Front Row, Left to Right:
Nancy Maciel, Samantha Alvarado

A Look Back



The Legacy of University High School

By Lynn Sagramoso

Walking the halls and courtyards of what was once University High School, now Children's Hospital's world-renowned research institute, you can almost hear snatches of earnest conversations about the upcoming dance. You might even see—out of the corner of your eye—teenagers holding books rushing off to their next class.

This isn't a ghost story; it's just that the stately buildings gracing 57th and Martin Luther King, Jr. Way continue their legacy, and still hold the vibrant memories and pride that its Uni High students felt, and still feel today.

In 1923, the architect Charles Dickey, designer of the Claremont Hotel, was commissioned by the Oakland school board to build the beautiful University High School. Dickey's vision included Mediterranean-style tile roofs, arcaded porches, courtyards with gardens, wide hallways, light-filled classrooms and an elegant library.

Uni High became one of the most prestigious high schools in the country, nationally recognized as a training school for student teachers and a proving ground for new ideas in progressive education. Students' test scores were among the highest in the nation; and most Uni High graduates went on to the University of California, Berkeley.

It wasn't all tests and homework, though; in a world where bobby socks and saddle shoes held sway, there were spirited football games, elaborate drama productions, afternoon dances, group dinners and weekend outings. The school had a dizzying array of social and scholastic clubs, including an entirely student-run newspaper—very unusual at the time. "We loved our school. Many of us have fond memories and lasting friendships from those days," said Irene Mlejnek Cordes, alumna of the class of 1945, who served as chief Uni High booster until she passed away on March 7, 2006.

World War II was a constant companion of the 1940s Uni High students. Many of the boys joined the local ROTC chapter to get ready to enlist, and younger students held paper drives and sold war bonds to support the troops. "It was hard, because so many of the boys ahead of us had been killed," explained Irene. "That's when the war hit you; it was real."

Notoriety came to some Uni High grads. Al Kelley, class of 1939, was standing only a few feet away when Gen. Douglas MacArthur accepted the Japanese surrender, bringing World War II to a close. Dick Bolt, class of 1928, became an expert in room acoustics in Washington DC, and later helped decipher the infamous Watergate tapes. Others, like Irene, became teachers in Bay Area schools, continuing the tradition of education that Uni High personified.

Unfortunately, changing demographics forced Uni High to close its doors in 1946. From 1946 to 1979, Merritt College occupied the site. But then the

A Look Back

chemistry class 1944

buildings stood vacant, left for years to decay. Graffiti covered the hallways, vandals set random fires, and staircases sagged.

During this period of neglect, several neighborhood and community groups worked hard to promote preservation of the landmark structures, trying to ensure their productive use. About the same time, Children's Hospital was looking for new housing for its growing research team: scientists and physicians working together to investigate and treat diseases affecting children.

It was a perfect match. University High, born as a laboratory for children's education, was reborn as a laboratory for children's health.

Children's Hospital purchased the property and worked with renovators to keep the beauty and integrity of Dickey's architecture alive. Uni High alumni were among the capital campaign contributors, whose gifts helped pay for the extensive renovations completed in 1999. "We were all so thrilled to see our school looking like it did back in its heyday," said Irene.

Today, Children's research institute is not only widely recognized as one of the most visionary and successful pediatric research centers in the world, it remains true to its roots by helping young people discover the wonders of medical research.

Children's scientists mentor the next generation, pairing high school students with principal investigators who help students design and test their own hypotheses. At the end of the summer program, students present their research to their peers. "I am so proud that Children's is doing research in my old school to save kids lives," said Irene. "It seems appropriate that the building continues to help children grow."


library restored - present day

The Gift You Leave Behind

Have you ever dreamed of making a meaningful gift but felt you just couldn't afford it? Many people who feel that way have found a solution. Of all the gifts you could give, a bequest may be the most meaningful one. Like others searching for such a solution, Irene Mlejnek Cordes, a loyal friend of Children's Hospital & Research Center Foundation and a University High alumna, decided to remember Children's Hospital in her will.


Irene

For Irene, making a bequest that helps the Uni High legacy live on was not only exceptionally meaningful, it was also easy to do. There are several ways to leave a bequest to the Hospital.

Your bequest can deliver:

- A specific dollar amount: "I give to Children's Hospital & Research Center Foundation, located at 5225 Dover Street, Oakland, California 94609, the sum of $10,000."
- A specific asset: "I give to Children's Hospital & Research Center Foundation, located at 5225 Dover Street, Oakland, California 94609, all Google stock that I own at the time of my death."
- All or a percentage of your estate: "I give to Children's Hospital & Research Center Foundation, located at 5225 Dover Street, Oakland, California 94609, (x% or 70%) of the residue of my estate."

One primary benefit of choosing a bequest to make your gift is that you don't give up anything now. This can be appealing, if like many people, you prefer the security of having control of your assets until death. It was appealing to Irene because she knew that if she needed her money or assets now, she still had total control over them. But if she didn't need them, she could leave something behind to a cause in which she truly believed.

Irene passed away on March 7, 2006. She will truly be missed by her friends and family, and by all of us here at Children's Hospital Foundation.

The Children's Hospital & Research Center Foundation can work with you or your financial advisor to establish a framework for charitable giving that meets your philanthropic and financial goals. For more information on charitable remainder trusts, or other estate planning, call Margaret Zywicz at 510-428-3361, or visit us online at www.legacyforchildrenscare.org.

Bert Lubin, MD
Pioneer, Visionary, Director
CHORI Summer Student Research Program

"I remember our first year together with the SSRP. We were working in the Bruce Lyon lab. You should be commended for training from six (1981) to 50+ students, each summer, over the last 38 years."

Kathleen Gonzalez
VP, Research Administration
CHORI, 1972–2011

"One of my fondest memories of Bert was when meeting with him about what direction he would like the Summer Student Research Program to go, rapid-fire ideas bounced from him like popcorn. His ideas were visionary. I was awestruck by his abilities as a true visionary."

Deborah Ellen
Program Coordinator
SSRP, 2010–2014

"I loved listening to Dr. Lubin's opening speech each year as he presented the students with humorous information and fantastic historical stories about the CHORI building that housed our research department."

Kristine Munir
Program Coordinator
SSRP, 2002–2005

"One of my fondest memories of Bert was when presenting students with their certificates at the SSRP symposium. He was able to put the shyest of students at ease with his genuine care and humor. It was truly an entertaining experience watching him."

"Inspiring Key Note speaker for both the SSRP and CHAMPS programs"

"He had a way of sincerely connecting with each and every student, and finding each one a meaningful experience and a great mentor."

"The giving volunteer & eternal advocate for pediatric health & innovative treatment. The ultimate mentor, champion and friend"

Michelle Ednacot
Program Coordinator
CHAMPS
2016–2019

"It has been life changing and an absolute honor to work on this pivotal training program with you Bert. Thank you for your vision, passion, and love for each and every student. I have so much more to learn from you Thank you."

Ellen Fung
Co-Director
CHORI SSRP
2014–Present

Students Presenting Elsewhere

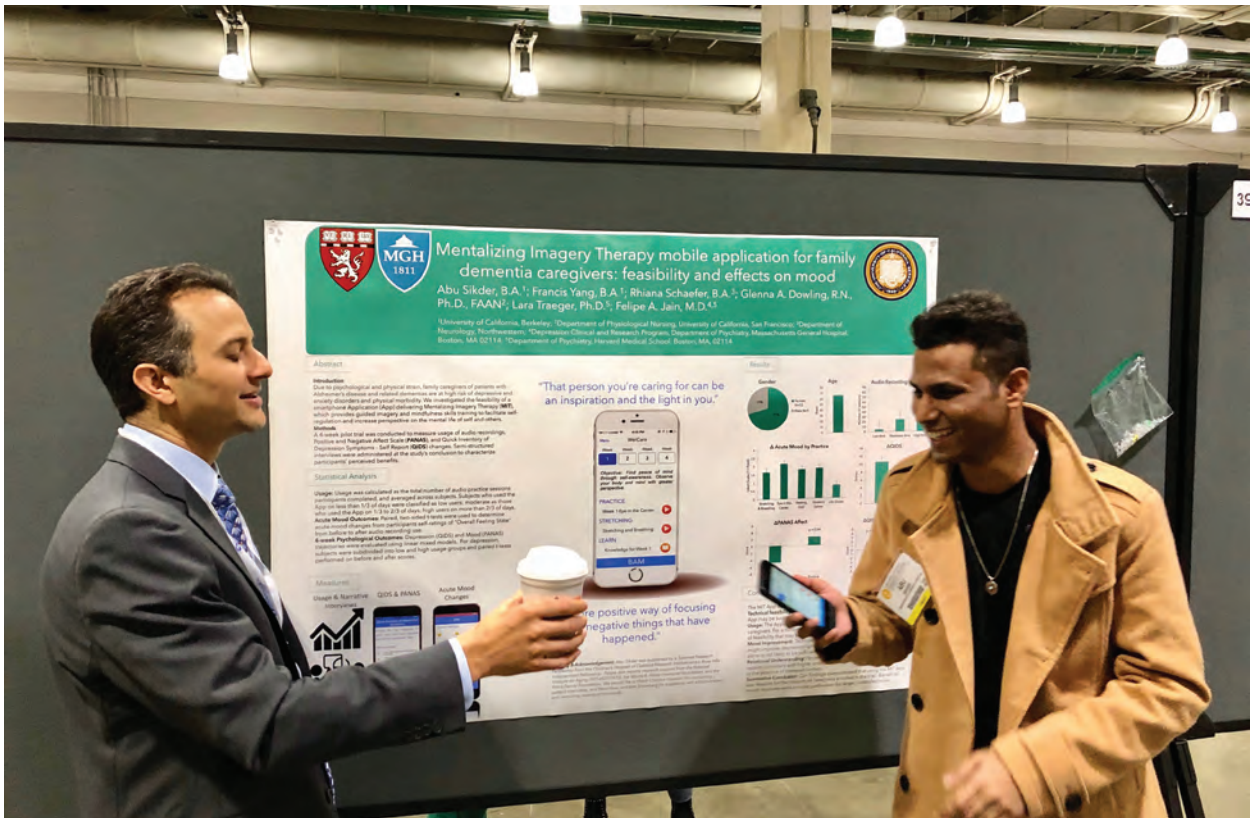
Ali Momin, SSRP Alumni 2018

American Association for Dental Research / International Association for Dental Research Conference

Vancouver BC, June 2019

Attending the AADR/IADR 2019 Annual Meeting was an amazing experience! Aside from being able to network with current dental researchers, and companies, I was also able to gain invaluable advice from many dental school representatives. I presented my work on caries indices derived from an electronic health record as part of the Clinical & Translational Science Network. I also had the opportunity to attend sessions on public health and clinical research which allowed me to see where the field of dental public health is currently and gauge my interests in doing research in this field for the future. It was inspiring to see so many researchers, practitioners, and companies motivated in pushing forward important research in dentistry. I am profoundly grateful for CHORI for their ongoing support in my research journey!

Students Presenting Elsewhere



Sab Sikder, SSRP Alumni 2017

Gerontological Society of America Conference

Boston MA, November 2018

As we walked towards Hynes Convention Center through Boston's congestion, our shoulders brushed through parkas and peacoats repelling the light drizzle. I noticed the cold white snow that fell from the night before - now lifeless and contaminated by dirt and tire marks. Unfortunately, the frosty air pricked my numb face with each step. However, I grew warmer as adrenaline rushed from the thought of presenting two years of rigorous research at a national scientific conference.

After passing a large, purple poster reading "The Gerontological Society of America's Annual Scientific Conference 2018," Dr. Jain, my friend, and I all entered Exhibit C. 500 small stands organized systematically under bright lights which reflected the glossy posters' color. After setting up in poster station 389, we began our 2-hour presentation.

We spoke to doctors, researchers, grad students, and clinicians - all involved with caregiving for dementia patients. Some complimented on our technical skills, and others were intrigued by the scientific results. Lots of business cards, emails, and contact information were exchanged that day in the name of scientific collaboration. Aside from the academic discourse, there was a lot of humor, especially from Dr. Jain. He joked about how revolutionary it would be if a pill could replicate the results of our app-based psychotherapy which only took 30 minutes and did not have any negative physical or emotional side effects.

After taking turns presenting, Dr. Jain went to observe some presentations but quickly came back and said, "Sab, go check out poster 350, I think you'll like it". He was right, I did. He knew I was a sucker for app-based clinical research and to my surprise the conference was filled with them. Not just in quantity but also in quality - along with many other passionate, cutting-edge research for "The Purposes of Longer Lives". I really enjoyed my time at the conference and it brings me peace knowing that I was able help the world in a small but significant way.

Recent Student Publications

Haven Allard

Ellen Fung, PhD RD (2015)

Allard H, Weyhmiller M, Lal A, Fung EB. In-accuracy of spine bone density measurements in patients with hemoglobinopathies and iron overload. Journal Clinical Densitometry, 2019 Jul - Sep;22(3):329-337

Bernice Fuentes

Coleen Sabatini, MD (2015)

Sabatini, C, Fuentes, B. Access to Orthopedic care for Spanish speaking patients in California. Journal of Orthopedics, 2019 in press

Anna Beatriz Gonçalves

Sandy Calloway, PhD (2016)

Shih SY, Bose N, Goncalves ABR, Erlich HA, Calloway CD. Applications of Probe Capture Enrichment Next Generation Sequencing Assay for Whole Mitochondrial Genome and 426 Nuclear SNPs for Forensically Challenging Samples. Genes 2018; 9:1,E49

Sab Sikder

Felipe Jain, MD (2017)

Jain F, Sikder S. Application based psychotherapy for Dementia caregivers. Journal of Medical Internet Research, 2019

Robin Yu

Jennifer Price, MD PhD (2017)

Kardashian A, McKinney J, Huynh N, Yu R, Catalli L, Price JC. Post-sustained virologic response liver stiffness may underestimate fibrosis after direct acting antiviral-containing therapy. Clinical Infectious Diseases 2018 Nov 2 Epub ahead of print.

Aditi Desai

Carter Lebares, MD (2017)

Lebares CC, Hershberger AO, Guvva EV, Desai A, et al. Feasibility of Formal Mindfulness-Based Stress-Resilience Training Among Surgery Interns: A Randomized Clinical Trial. JAMA Surg. 2018 Oct 1;153(10):e182734.

Amber Fearon

Marsha Treadwell, PhD (2017)

Fearon A, Marsh A, Kim J, Treadwell M . Pediatric residents› perceived barriers to opioid use in sickle cell disease pain management. Pediatric Blood & Cancer. 2018 Nov 1:e27535.

Elijah Goldberg

Ellen Fung, PhD RD (2017)

Goldberg E, Neogi S, Lal A, Higa A, Fung EB. Nutritional deficiencies are common in patients with transfusion-dependent thalassemia and associated with iron overload. Journal of Food Nutrition Research, 2018; 6(10):674-681.

Elijah Goldberg

Ellen Fung, PhD RD (2018)

Goldberg EK, Fung, EB. Precision of the Hologic DXA in the Assessment of Visceral Adipose Tissue. Journal Clinical Densitometry, 2019; Mar 20. S1094-6950(19)30002-2.

Raquel Traseria

Lorrene Ritchie, PhD RD (2018)

Traseira R; Navarro S, Lee DL, Frost N; Neelon SB, Cradock A, Hecht K; Ritchie L. A 50-State Comparative Analysis of Regulations on Breastfeeding and Beverage Provisions for Infants and Children at Licensed Child Care Centers and Family Child Care Homes. Submitted to Preventing Chronic Disease, 2019.

Let's Get Social

This Year's Mentors

Mentor	Division/Department	Location
Tariq Ahmad, MD	Endocrinology	BCHO
Jennifer Beckstead, MS	Center for Nutrition & Metabolism	CHORI
Peter Beernink, PhD	Center for Immunobiology & Vaccine Development	CHORI
Dario Bofelli, PhD	Center for Genetics	CHORI
Sandy Calloway, PhD	Center for Genetics	CHORI
Rebecca Chance, PhD	Molecular Cell Biology	UCB
Karen Daley, MFT	Primary Care / Asthma	BCHO
Deborah Dean, MD MPH	Center for Immunobiology & Vaccine Development	CHORI
Baylee DeCastro, MS	Center for Community Health & Engagement	BCHO
Thuy Doan, MD PhD	Proctor Foundation	UCSF
Ellen Fung, PhD RD CCD	Bone Density Clinic	CHORI
Ekaterina Guvva	Surgery	UCSF
Ward Hagar, MD	Hematology	BCHO
Andrew Hall, PhD	Center for Nutrition & Metabolism	CHORI
Caroline Hastings, MD	Hematology/Oncology	BCHO
Ryo Higuchi-Sanabria, PhD	Molecular Cell Biology	UCB
Damini Jawaheer, PhD	Center for Immunobiology & Vaccine Development	CHORI
Mary Jones, MD MPH	Rett Clinic	BCHO
Janice Kao, MPH	Nutrition Policy Institute	UC ANR
David Killilea, PhD	Center for Nutrition & Metabolism	CHORI
Sarah King, PhD	Center for Nutrition & Metabolism	CHORI
Ronald Krauss, MD	Center for Nutrition & Metabolism	CHORI
Ashutosh Lal, MD	Hematology/Oncology	BCHO
Carter Lebares, MD	Surgery	UCSF
Danielle Lee, MPH RD	Nutrition Policy Institute	UCB
Janet Lee, MD	Endocrinology	UCSF
Dayna Long, MD	Pediatrics	BCHO
Steve Mack, PhD	Center for Genetics	CHORI
Jacqueline Madden, PNP	Gastroenterology	CHORI
Mam Mboge, PhD	Molecular Cell Biology & Bioengineering	LBNL
Christine McDonald, PhD	Center for Nutrition & Metabolism	CHORI
Marisa Medina, PhD	Center for Cardiovascular Disease	CHORI
Andrew Modelewski, PhD	Molecular Cell Biology	UCB
Greg Moe, PhD	Center for Immunobiology & Vaccine Development	CHORI
Antonio Munoz	Center for Cardiovascular Disease	CHORI
Lynne Neumayr, MD	Hematology/Oncology	BCHO
Janelle Noble, PhD	Center for Genetics	CHORI
Elaine Pico, MD	Pediatric Rehabilitation	BCHO

This Year's Mentors

Mentor	Division/Department	Location
Jennifer Price, MD PhD	Hepatology	UCSF
Yuanyuan Qin, PhD	Center for Cardiovascular Disease	CHORI
Alison Reed, MD	Endocrinology	BCHO
Lorrene Ritchie, PhD RD	Nutrition Policy Institute	UC ANR
Brigid Roy, CIP	Institutional Review Board	CHORI
Julie Saba, MD PhD	Center for Genetics	CHORI
Coleen Sabatini, MD MPH	Orthopedics	BCHO
Mala Setty, MD	Gastroenterology	BCHO
Shelli Shih, MS	Center for Genetics	CHORI
Vianca Vianzon	Center for Immunobiology & Vaccine Development	CHORI
Marcela Weyhmiller, PhD	Iron Measurement Program	CHORI
Yan Zhang, MD PhD	Preventative & Restorative Dental Service	UCSF

Key to Locations

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

Notes

C · H · O · R · I

Children's Hospital Oakland Research Institute

38th Summer Research Symposium

CHORI Summer Student Research Program
5700 Martin Luther King Jr. Way
Oakland, CA 94609
www.chori.org
www.childrenshospitaloakland.org