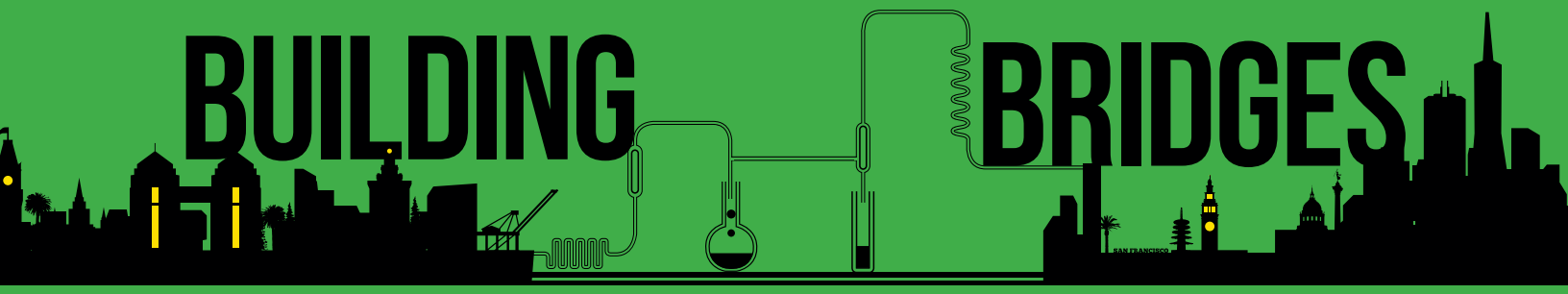
CHORI
summer research symposium 2015



A SHOWCASE FOR YOUNG MINDS IN RESEARCH

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

UCSF Benioff Children's Hospitals
Oakland | San Francisco

August 14, 2015

We are pleased to invite you to the 2015 CHORI Summer Student Research Symposium! Today we are here to celebrate both our wealth of diversity and the spirit of scientific enquiry that has been evident in our young investigators who are the future generation of biomedical research. The CHORI Summer Research Program provides short term education and training to high school, undergraduate, and post-baccalaureate 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.

We invite you to learn about the various state-of-the-art research topics that the trainees were involved in, ranging from muscle reconstruction using stem cells, lipoprotein and apolipoprotein metabolism, epidemiology of rheumatoid arthritis, methodologies to study DNA damage, the host immune response and so much more. Please mingle and chat with 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.

We take this opportunity to thank all of CHORI, UCSF Benioff Children's Hospital Oakland, and UC Berkeley mentors and supervisors who are the backbone of the program. We appreciate their time, effort, and profound commitment for mentoring the students. A very special note of appreciation also goes out to Chandra Andrews-Wright, Phillip Bollinger, Beate Illek, Horst Fischer and all CHORI and CHRCO 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 National Institutes of Health (National Heart Lung and Blood Institute), the Doris Duke Charitable Foundation Clinical Experience for High School Students, the California Institute for Regenerative Medicine Creativity Award, the Elizabeth Nash Foundation and a number of Anonymous donors.

The CHORI Summer Research Program has quadrupled in size since inception over 35 years ago, yet each year, financial support for the program is one of our biggest challenges. Given the severe budget constraints facing our research and education systems, we are constantly revising the program in an effort to uphold its excellence and value. Now is the time for you to consider supporting our program. Your philanthropic support will ensure continuation of this important scientific and educational experience for the trainees.

We wish the trainees all the very best in their future endeavors. We also request that they will keep in touch with us regarding how the program impacted their academic

Sincerely,

Bertram H. Lubin, MD
President, Chief Executive Officer &
Principal Investigator
CHORI

Janet C. King, PhD
Interim Senior Vice President, Research &
Executive Director, CHORI

Vasanthy Narayanaswami, PhD
Associate Scientist
Principal Investigator & Co-Director
CHORI

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

Support for the 2015 CHORI Summer Student Research Program provided by:

The short term research education program to increase diversity in Health Related Research from the National Institutes of Health ~ National Heart Lung and Blood Institute:
#R25 HL 125451-01
PI: Bertram Lubin, MD & Vasanthy Narayanaswami, PhD

The Elizabeth Nash Foundation

CHORI / UC Berkeley Summer Stem Cell Research Internship Program for High School Students
Creativity Award #TC1-05946

CHORI / CHRCO Doris Duke Clinical Research Experience for High School Students #2014150
PI: Vasanthy Narayanswami, PhD and Bertram Lubin, MD

Anonymous Donors

The Children's Hospital & Research Center Foundation

Paxi's Pizza, Lafayette CA

Volunteer Recognition 2015

We would like to thank the many volunteers that took time out of their busy schedules to help this program succeed:

From CHORI and the UCSF Benioff Children's Hospital

Adam Davis, MPH, MA Director of Clinical Grants and Program Development	Assisted with Grant submissions
Frans Kyupers	Abstract Reviews
Jennifer Beckstead	Tours at Orientation
Kathy Shultz	Tours at Orientation
Frans Kuypers	Assisted with Lab Tours to Anonymous Donors to the program
Julie Saba	Assisted with Lab Tours to Anonymous Donors to the program
Gwenn Lennox	Fundraising support
Greg Moe	Application Reviews
Ward Hagar	Application Reviews
Debbie Dare	Graphic Design for the Symposium
Neelam Phalke	Clinical Presentation
Elaine Pico	Casting Clinic
Lauren Flowers	
Rosann Dial	
Dion Duncan	
Willie Williams	
Mike Weinstead	Symposium Co-Chair

2014 Program Staff

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Principal Investigator
President & Chief Executive Officer
UCSF Benioff Children's Hospital Oakland

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Clinical Co-Director
Director, Adolescent Medicine
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Principal Investigator & Basic Science Co-Director
Associate Scientist at CHORI
Assistant Professor, Department of Chemistry & Biochemistry, California State University Long Beach

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Beate Illek, PhD
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Staff Scientist at
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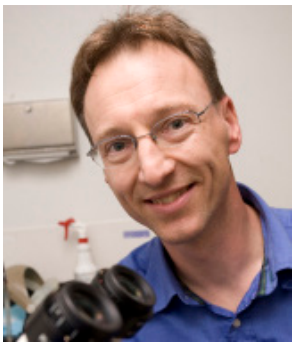

Horst Fischer, PhD
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Scientist at
Children's Hospital Oakland Research Institute

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Professor of Medicine
Academy Endowed Chair for Innovation in Teaching, Director Pathways to Discovery Program in Clinical and Translational Research Infectious Disease Program . UCSF

Phillip C Bollinger
Program Coordinator
Senior Systems Analyst at
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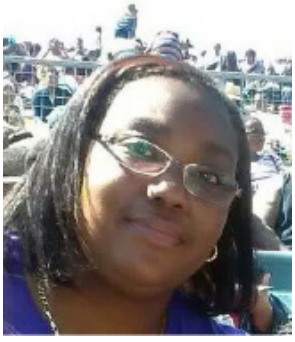

Chandra Andrews-Wright
Program Coordinator
Student Services & Visiting Scientist Coordinator at Children's Hospital Oakland Research Institute

Mentors:

Mahin Azimi, MD
Lela Bachrach, MD
Mindy Benson, PNP
Peter Beernink, PhD
Giorgio Cavigiolio, PhD
Deborah Dean, MD, MPH
James Feusner, MD
Horst Fischer, PhD
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Swapna Shenvi, PhD
Wendy Su, MD
Marsha Treadwell, PhD
Gordon Watson, PhD
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2015 CHORI SUMMER STUDENT LECTURE SERIES

Thursdays 3pm CHORI Little Theater/UCSF

 Chandra Andrews-Wright, Summer Research Program Coordinator	June 18, 2015	Check-in
  Alka Kanaya, MD & Kala Mehta, D.Sc. Epidemiology & Biostatics, UCSF	UCSF-Parnassus Library CL 221 and CL222 June 25, 2015	Seminar: Heterogeneity of Diabetes in Asian Americans Workshop: Reading and Reviewing Scientific Articles
  Vasanthy Narayanaswami, Ph.D., Associate Scientist, CHORI; Associate Professor, CSULB & Ellen Fung, Ph.D., RD, Associate Scientist, CHORI	July 2, 2015	Peer Review Authorship Publications  Seminar: Janelle Noble, PhD Title: What is HLA and how is it like ice cream?
  Beate Illek, Ph.D. & John Matsui, Ph.D., Director of UC Berkeley Biology Scholars Program	July 9, 2015	Student Meeting Seminar: Ethical Issues & Conflict of Interest
  Phillip Bollinger, Senior Systems Analyst CHORI IT & Tariq Ahmad, MD	July 16, 2015	Workshop: Effective Scientific Presentation Seminar: Everything you always wanted to know about hormones, but were afraid to ask
  Beate Illek, Ph.D. Gordon Watson, Ph.D.	July 23, 2015	Research Discussions: students present (5 min presentations) Seminar: Gene Therapy for Inherited Diseases
  Beate Illek, Ph.D. Steve Mack, Ph.D.	July 30, 2015	Research Discussions: students present (5 min presentations) Seminar: Using Human Leucocyte Antigen Genes to Investigate human Disease and Evolution.
 TBA	Located at: UCSF August 5, 2015	Seminar: TBA Presentations from Medical Students Social Mixer

2015 CHORI SUMMER STUDENT RESEARCH PROGRAM CURRICULUM

Orientation: June 15, 2015
There will be an all-day orientation for summer interns on Monday, June 15, 2015, from 9:00 am until 4:00 pm. Continental Breakfast will be served at 8:30 a.m. Lunch will be served.

Agenda to include:
- Introduction and Welcome from Bertram Lubin, M.D., President & Chief Executive Officer, UCSF Benioff Children's Hospital Oakland
- Introduction by Janet King, Ph.D., Interim Vice President, Executive Director, CHORI
- Overview and program review by Ellen Fung, RD, Ph.D., Associate Scientist, CHORI, Co-Director CHORI Summer Program
- Explanation of curriculum by Vasanthy Narayanaswami, Ph.D., Associate Scientist, CHORI, Faculty, California State University, Long Beach, Co-Director CHORI Summer Program
- Keynote lecture by P.J. Utz, M.D., Professor of Medicine, Program Director, Medical Science Training Program, Stanford University
- IT presentation by Phillip Bollinger
- Administrative Review by Deborah Ellen
- Tour of CHORI and HEDCO buildings

Safety Training: June 16, 2015
The mandatory Safety Training with CHORI Safety Officer, Miriam Fang will be held on Tuesday, June 16th from 9:00 am to 12:00 pm. The students will be required to complete this training before beginning their project.

Research Project: June 15, 2015 to August 14, 2015
The students will conduct research with assigned mentor. The details of project and research plan are left entirely to the individual mentor and each summer intern will follow the procedures, and schedule, laid out by their respective labs.

Written Research Plan: July 6, 2015
Students must submit to the Program Coordinator a written Research Plan outlining their project. The Research Plan should be 3 pages long and include:
(a) Statement of hypothesis
(b) Specific aims
(c) Background
(d) Methods
(e) Anticipated outcome of project
Students will work closely with their mentor in the preparation of these reports, and mentors should review and approve the reports before submission. Figures, flow charts and schematics may be used to illustrate the research plan. The written report will be sent to: summerstudentprogram@chori.org, and must include student's name, mentor's name and the title of the project.

Weekly Lectures:
Current Topics in Health and Disease
Students are required to attend weekly lectures delivered by CHORI , CHRCO and UCSF faculty members. The lectures will cover various scientific topics, including women's and minority's issues, career decisions, teen health issues and Responsible Conduct of Research.

Student Photo Day: July 2, 2015
All students must be present.

Evaluations:
As part of the Summer Program, we ask that all students participate in an anonymous on-line survey at the beginning, midpoint and the end of the program. Links for these surveys will be sent out by the director. Completion will only take 5-10 minutes.

2015 CHORI Summer Student Symposium: August 14, 2015
A one-day symposium will be held on Friday, August 15, 2015 where all students are required to participate. The students will submit an abstract concisely summarizing their work, which will be considered for an oral or a poster session for the Symposium. Abstracts are due on July 22, 2015 by 4:00 pm. A committee comprised of the Director, Co-Directors and other leading members of the CHORI scientific community will review the abstracts for the Symposium. Students will work closely with their mentors in the preparation of abstracts and presentations. Family members, teachers, lab members and friends are welcome to attend.
The Symposium will be comprised of oral presentations (10 minutes each, with 5 minute discussion), and a poster session during which the presenters will be on-hand to explain their research project. A catered breakfast and lunch will be provided for all attendees on the Symposium day.
A certificate of participation in the CHORI Summer Student Research Program will be awarded to those who successfully complete the program.


HOLLISTER

CHORI summer research symposium 2015

BUILDING BRIDGES

FRIDAY, AUGUST 14, 2015 • 9 A.M.–4 P.M.

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

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Amaka Agodi

My name is Amaka Chioma Mae Agodi. Growing up, I have always wanted to become a pediatrician and help young women in marginalized communities pursue a career in medicine. Currently, I am an undergraduate student at the University of Southern California majoring in Health Promotion and Disease Prevention minoring in Natural Science and Health Policy. Because of CHORI, I have had the wonderful opportunity of helping Dr. Razani and her team jumpstart an amazing research study called S.H.I.N.E. that takes patients and their families into nature in attempt to relieve stress and increase physical activity. The patients in the study represent many different marginalized communities so representing these communities was extremely important. Working with the S.H.I.N.E. provided me with unique experiences. I had the opportunity to learn about cultural humility, submitting a research study to the IRB, learning how to run research questionnaires electronically, working as a team, and displaying immense passion. Doing all of these successfully means that goals can be achieved. This program has solidified by dreams and given me the opportunity to realize I can be a clinician, conduct research to advocate on behalf of marginalized communities, and use that research to influence health policy. I would like to thank Dr. Razani, Maoya, Christine, the S.H.I.N.E. team, and the CHORI Summer Program staff for all of the time and information shared.

Funded by: National Institutes of Health

School: University of Southern California

Mentor: Nooshin Razani, MD

Title:
Nature as a stress relief for the African Diaspora

Introduction:

There has not been any documented research on measuring the decreased stress and increased physical activity of people from the African diaspora. Studies have shown that nature can be used as a tool to relieve stress but there were not any specific measured outcomes for the African diaspora.

Objective:
The aims of this study are to capture the varied experiences amongst members of the African Diaspora during a randomized controlled trial evaluating the effect of nature on stress and family bonding. The name of this trial is Stay Healthy In Nature Everyday and is currently being developed and piloted in the UCSF Benioff Children's Hospital Oakland Primary Care Clinic, to encourage families of the African Diaspora to explore nature as a means of stress relief and family bonding, and to ensure that SHINE data analysis and dissemination assesses the specific mental health needs of the African diaspora in order to bring more awareness the varied needs within this subgroup.

Methods:
Redcap is a system used to determine which patients will be in the control and intervention groups because this study is a randomized, controlled trial. Redcap will be used to administer the screening tool, which identifies the eligibility of patients for the study. After completing the screening tool and the family is eligible, they will be given a consent form to sign. After the consent is signed, a physician will administer the caregiver questionnaire on Redcap and the research assistants administer the child's questionnaire on Redcap while watching the child. After the questionnaires are given, the patients will be given pedometers and activity journals in order for them to track their steps and physical activity. During the follow- up visits, the activity journal will be collected in order to receive data on physical activity and steps taken from the caregiver and enrolled child.

Anticipated Outcome of Project:
Exposure to nature through the SHINE program is expected to result in an increase of physical activity due to the positive connection between nature and physical activity along with lowered levels of stress and increased social cohesion. Because of this program participants will be more committed to protecting the environment when they are more connected to and caring of nature (Schutlz, 2002). Because there is no specific data on the outcomes of African immigrants and African-Americans, this study may be the first with specific data.

Key words:
Nature, African Diaspora, African immigrants, African-Americans, stress, physical activity

Chukwuemeka Ajaelo

As I approach college graduation the one question I frequently got asked was "What's next?" which was such a simple but complex question. Without having to elaborate on future plans or career goals, I confidently said I will be interning at Children's Hospital Oakland Research Institute. Those words were short, and sweet enough to stop further questions. The CHORI program has enhanced my drive and will to continue to succeed, I feel humbled and blessed to work alongside scientists and physicians whom are conducting cutting edge research.

I have many goals in life, one of which is to work with all of my heart and strength in whatever my hands find to do. In doing so I believe that with right support system and mentors I will achieve all other goals, and hopefully inspire others along the way.

Regardless of where I want to go and what I want to do in life, my experience at CHORI will be invaluable to my future, for helping me to build a stronger foundation in the sciences and providing the knowledge and skills needed to consistently excel.

Funded by: National Institutes of Health

School: University of California, Santa Cruz

Mentor: Peter Beernink, PhD

Title:
Sequence Polymorphisms in Rhesus Macaque Complement Factor H Affect Binding to Meningococcal Factor H Binding Protein Vaccine Antigens

Introduction:
Neisseria meningitidis (meningococcus) is a Gram-negative encapsulated bacterium that causes potentially fatal cases of meningitis and sepsis (blood poisoning) in humans. Two licensed meningococcal serogroup B vaccines contain Factor H binding protein (FHbp). Meningococci bind complement regulatory proteins including Factor H (FH) to evade the immune system. FH domains 6 and 7 bind to FHbp. Rhesus macaques vary in FH binding to the FHbp antigen. Two sequence polymorphisms at residue 352 and 360 in FH domain 6 are associated with the binding phenotype. Tyrosine 352 and Proline 360 are associated with high binding, whereas Histidine 352 and Serine 360 are associated with low binding. Since binding of FH to FHbp antigens decrease protective anti-FHbp response, we hypothesize that differences in macaque FH sequences and serum FH concentrations impact the protective antibody responses to vaccines containing FHbp.

Objective:
To identify frequencies of sequence polymorphisms in macaque FH that are associated with a high or low binding phenotype, and to quantify the FH protein in the sera of individual macaques. The amount of FH, which varies in humans, can affect the protective antibody response, which is a correlate of protection against meningococci.

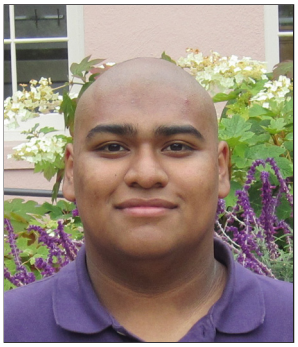
Methods:
We prepare genomic DNA from macaque blood, PCR amplify the exon encoding FH domain 6, and sequence the DNA product. We will use enzyme-linked immunosorbent assay (ELISA) and surface plasmon resonance (SPR) with anti-FH antibodies to quantify macaque FH in serum from individual animals. The FH concentrations will be determined from a standard curve using purified human FH.

Anticipated Outcome:
Based on previous results, we expect to find as many as five FH genotypes with high or low binding to FHbp. We anticipate that the concentration of FH in macaque sera will vary similarly to humans (~200 to 500μg/ml). The overall impact of the project is to better understand the variability in the sequences and serum concentration of FH in macaques, which are likely to affect the antibody responses of macaques immunized with FHbp vaccines.

Acknowledgments:
I would like to thank the Beernink Lab and CHORI for an awesome research opportunity.

Keywords:
Neisseria Meningitidis, Factor H

Maopeli Ali



Hello, my name is Maopeli Ali. I am a rising senior at Archbishop Riordan High School. While growing up, I was curious about many different things. I tried to take art of many things at least once. Because of this, I am an avid lacrosse player and actor in my school's theater program. This curiosity continued into my studies and allowed me to find my interest in science. Science has always been am interest of mine. For me, science was the only way to explain how the world worked and why events occurred the way they do. I also came from a harsh background, which made me want to make a change in this world. I chose to be in Chori because I want to make a difference in someone's life. Being in Chori ahs been an opportunity that I will never forget. This program gave me experience that has really shown me what it is to be a researcher. The experiences in the Chori program will stay with me forever.

Funded by: Doris Duke Charitable Foundation

School: Archbishop Riordan High School

Mentors: Swapna Shenvi, PhD, Ellen Fung, PhD, and Janet King, PhD

Title:
The Effects of Zinc Supplementation on Zinc Transporters, Glucose Tolerance, and Oxidative Stress in Thalassemia

Introduction:
Thalassemia is a genetic disease that doesn't allow the carrier to produce mature blood cells. This disease has many complications that range from weak bone health to diabetes. Patients with thalassemia are often zinc deficient which has been associated with the complications described above. Our lab recently conducted a study to assess the effect of zinc supplementation on bone health in patients with thalassemia. The aim of this study is to test the effect of zinc supplementation on transcription levels of zinc transport proteins and antioxidant enzymes.

Hypothesis:
Diabetes and oxidative stress in thalassemia may be caused by low zinc. Zinc supplementation may improve glucose handling, lower oxidative stress, and improve zinc metabolism.

Methods:
20 patients with thalassemia (12 female, 27.8±6.0 years), were supplemented with zinc (20 mg/d) for 3 months. Fasting blood was drawn before and after supplementation. Plasma zinc, malondialdehyde (MDA) and mRNA levels were measured in each sample. mRNA was measured in two genes: (1) the zinc exporter (Znt1), and (2) the rate limiting enzyme in the synthesis of the antioxidant, glutathione [glutamate cysteine ligase catalytic subunit (Gclc)]. The gene expression measurement protocol was carried out in 3 steps: extraction of RNA from blood, reverse transcription, and q-RT-PCR. MDA, a measure of oxidative stress, was measured by gas chromatography-mass spectrometry (GC-MS).

Anticipated Outcomes:
We anticipate zinc transporter expression will correlate to the increase zinc levels following zinc supplementation. We also expect an increase in antioxidant mRNA and reduction in MDA levels following 3 months of zinc supplementation.

Significance:
The significance of this study is that it can improve the lives of people with Thalassemia and possible extend their lives.

Acknowledgements:
Thank you to Kevin Chen and Darryl Chow for assistance in RNA extraction and Reverse Transcription procedures.

Naylani Allen

My name is Naylani Allen and I am an African American woman born in Oakland, CA. I spent half my life growing up in Hayward, CA. I moved to Oakland in 2013 because my mom's apartment rent was incredibly high. Being a Single mother raising three little girls was hard financially. So we moved back to Oakland, and I began my high school career at Castlemont High School. Back in Hayward, I really didn't know or fully understood the importance of education so I didn't try or ask for help, and as a result of that I didn't have stellar grades. That all changed when I took a class in high school called Ethnic Studies. Ethnic Studies is class that teaches about the counter-narrative, a story that isn't normally told in institutions, about the injustices and oppression done upon people of color. As an African American woman this deeply impacted me personally and in my education. Racism and stereotypes have historically forced people of color to become statistics that can be simply wiped of the face of the earth by unjust systems. This not only encouraged myself to be better as a person and form a fondness and desire for my people's history, culture and traditions that I didn't learn growing up in a white dominated society. This also affected my desire to do good in school and challenge the notion that because I am Black and a woman, I am expected to play a certain role created by the American System.

Funded by: Doris Duke Charitable Foundation

School: Castlemont High School

Mentor: Wendy Wu, MD

Contributing Authors: Naylani Allen and Wendy Su, MD

Title:
Prophylactic Malrotation Surgery for Heterotaxy Patients.

Introduction:
Heterotaxy is a congenital condition in which a person's organs are positioned on the opposite side of the body. Intestinal malrotation is commonly associated with heterotaxy. A potential fatal complication of malrotation is volvulus which can potentially result in short gut syndrome and possibly death. Thus heterotaxy patients often had prophylactic surgery (Ladd's procedure) to prevent volvulus.

Hypothesis:
Heterotaxy patients would benefit from prophylactic surgery for malrotation.

Methods:
Retrospective chart review of heterotaxy patients treated at BCHO in the past 10 years. Data collected on the associated anomaly; diagnostic imaging findings; surgical findings, complications and long term follow up.

Results:
Between the years of 2006 to 2015, 12 heterotaxy patients were identified. 7 are male and 5 are female. 9 patients had structural cardiac anomaly, most common is double outlet right ventricle. All 12 patients had Upper GI study to assess for malrotation. 10 were found to have malrotation and all received Ladd's procedure, which 8 were prophylactic-based and 2 was symptom-based. Out of the 8 that had prophylactic-based surgery, median age for surgery is 36 days old, 5 are long term survivors, 3 died from cardiac failure. Of two patients who had emergency surgery due to symptoms, one was found to have volvulus but no bowel ischemia. Neither had associated cardiac anomaly and both are well at 5 and 9 years. Upper GI for two did not show evidence of malrotation so they did not receive Ladd's procedure, one died due to a congenital Myasthenia Gravis, and the other is well at 6 year follow up.

Conclusion:
Heterotaxy patients with malrotation can have Ladd's procedure performed safely. Since all patients with asymptomatic malrotation all had elective surgery, the risk of volvulus without surgery cannot be determined based on our data.

Acknowledgments:
All the wonderful ladies in the surgery office at Children's Hospital for welcoming me and allowing me to come into their work space. I also want to acknowledge my AP Biology teacher, Claire Shorall for supporting me and believing in my capabilities.

Keywords:
Heterotaxy syndrome, Intestinal malrotation, Ladd's Procedure, Volvulus

Jacob Amme

Unlike many of the other students whom I've come to know throughout this summer, I entered the program unsure of my career path, even tentative as to whether medicine was the right field for me. Since then, I am astounded with how much my amazing experience in this program has affected me. To have the opportunity to work with and learn from leading biomedical research scientists and perform laboratory techniques beyond even what my school textbooks had described, has truly brought science, and research medicine, to life. As an intern in Dr. Lammer's Laboratory, my experience researching the causes of conotruncal heart defects in infants has been especially rewarding. This summer Nebil and I enriched and developed our genetic library, including capturing a specific region of chromosome 8 linked with an increased risk for conotruncal heart defects, in preparation to sequence this region in all of our samples. Ultimately, we hope our work will help pediatricians to better anticipate and respond to the risk of a child being born with a heart defect. My time at CHORI this summer has been unforgettable, and has done much to convince me of my passion for medicine and biomedical research. I would like to thank the Lammer Lab, especially Ed, Kathy, and Nebil for their support and guidance, and in making this summer a truly memorable experience.

Funded by: California Institute for Regeneration Medicine

School: Albany High School

Mentor: Edward Lammer, MD, Kathleen Schultz, MS, Nebil Mohammed, BS

Title:
Using Genomic Enrichment and Sequence Capture to Sequence Region on Chromosome 8 Correlated to Conotruncal Heart Defects in Infants

Introduction:
Congenital heart defects comprise the most common birth defects, affecting 4-8 per 1,000. Conotruncal heart defects, a type of congenital heart defect, includes Tetralogy of Fallot (TOF). We had previously fine mapped a candidate locus at chromosome 8q21 among 391 California infants with conotruncal heart defects, because a male subject born with TOF showed a microduplication within the ZFHX4 gene and non-coding RNA (ZFHX4-AS1). In our investigation we plan to sequence cases and controls for this 1Mb region, so we can begin to elucidate the end-points of the microduplication and the nature of the strong association signal for conotruncal defects at this locus. The summer research plan is to prepare DNA samples for NextGen sequencing by using an enrichment strategy for the desired DNA sequences across the 1Mb region.

Objective:
Genomic enrichment of the targeted 1 Mb region on chromosome 8q21 of 391 California infants with conotruncal heart defects. We hope to identify the endpoints of the 800-kb microduplication found in the male subject born with TOF as well as identify regulatory regions of the ZFHX4 gene that may be associated with its expression.

Methods:
Our research population consists of 389 infants enrolled in the California Study of Birth Defect Causes and 378 control infants. We will use the SeqCap EZ Library SR enrichment procedure to prepare our sample library for Illumina sequencing. The workflow involves preparation of our whole genome amplified DNA using the KAPA Library Preparation Kits. We will then perform ligation-mediated amplification of the DNA sample library before hybridizing and capturing the target region. We will then perform further amplification of the captured Multiplex DNA using LM-PCR. Finally we will measure the success of our enrichment procedure using a qPCR assay.

Anticipated Outcomes:
We anticipate that the 1 megabase region at chromosome 8q21 will contain regulatory regions associated with conotruncal heart defects.

Acknowledgements:
Thank you to the Lammer Lab, especially Edward Lammer, MD, Kazu Osoegawa, PhD, Kathleen Schultz MS, Nebil Mohammed BS, and Liliya Parkman. I would also like to thank the California Institute of Regenerative Medicine (CIRM) and the CHORI summer research program staff.

Keywords:
congenital heart defects, tetralogy of fallot, genomic enrichment, ligation-mediated PCR

Molly Bates

I am a senior biology pre-med student at Eastern Kentucky University. When I decided to engage in research, I searched for a challenging program with great mentors who perform scientific investigation in a field of my interest. I found that in the CHORI Research Program. My nephew has cystic fibrosis, and I thank the Elizabeth Nash Foundation and my mentors, Dr. Illek and Dr. Fischer, for the opportunity to participate in experimentation that could lead to personalized medicine for patients like my nephew. I also want to thank my fellow students in the lab, Elle Lefebvre and Brad Green. I have discovered that pre-clinical research and medical treatment are inextricably related and that neither would be effective or relevant without the other. It has been rewarding to balance detail orientation in the lab with a concept of the global implications of our work, and so I am inspired to continue to engage in research as I go on to pursue a career as a physician. I am excited to witness the evolution of medical diagnosis and treatment and to have worked in a lab that will contribute to the future of medicine.

Funded by: Elizabeth Nash Foundation

School: Eastern Kentucky University

Mentor: Beate Illek, PhD

Title:
Toward Personalized Medicine for Cystic Fibrosis: Pre-clinical and Clinical Response to a CFTR Potentiator

Introduction:
Over 1000 mutations are known to cause cystic fibrosis (CF). VX-770 (Ivacaftor) is a potentiator drug that improves gating function in defective CFTR proteins present in the cell membrane of airway epithelial cells, effectively treating the cause of CF for patients with certain CF-causing mutations. Personalized medicine in the form of pre-clinical tests using patients' cells could lead to predictions of effective treatment options tailored to individuals. The purpose of the current study is to explore the use of conditionally reprogrammed, patient-derived cells in pre-clinical assays as a predictor of clinical drug response to VX-770.

Hypothesis:
Conditionally reprogrammed cells (CRCs) derived from patients termed responders and non-responders based on sweat chloride in the clinical VX-770 trial will prove to be responders and non-responders respectively in-vitro based on CFTR-mediated chloride ion transport response to VX-770.

Methods:
Primary cells are obtained from nasal epithelium of patients participating in a double-blind, cross-over VX-770 clinical trial. Ussing assays will be used on these cultures to measure CFTR-mediated Cl- ion current response to epithelial ion channel blockers and stimulators including VX-770. In-vitro results will be analyzed using Sigmaplot. Drug effects observed in vitro on CRC cells will be correlated with clinical effects in each.

Anticipated Outcomes:
One patient's cells (genotype: F508/ 1154InsTC) have been tested so far in this study. There was a 1.6-fold significant increase in chloride transport (ΔICl = 1.62 +/-0.24 μA/cm2 to 2.65 +/-.43 μA/cm2; n=6, p=0.003). The baseline chloride current after stimulation with forskolin was 5.9 +/- 0.88 μA/cm2, with VX-770 it was 6.94 +/- 1.03 μA/cm2. This patient was also a clinical responder to VX-770 (sweat chloride levels decreased significantly from baseline). I anticipate that in-vitro responses will correlate to in-vivo results for the majority of patient cells tested.

Conclusions:
If in-vitro results from this pre-clinical assay correlate with clinical drug response, our data will support the use of CRCs in pre-clinical assays to predict clinical drug efficacy. Tests of patient-derived CRC cells in Ussing chambers could ultimately be used in personalized medicine for CF patients.

Acknowledgements:
Brad Green, Elle Lefebvre

Keywords:
cystic fibrosis, Ivacaftor, personalized medicine

Amarjit Bath

I am a returning CHORI intern, working in Palefsky lab at UCSF this summer. Being part of the CHORI program has been a major stepping-stone in my life as I had the opportunity to conduct basic science research for over a year now. CHORI helped me nurture my curiosity and passion for medicine by exposing me to different facets of research.

Funded by: National Institutes of Health

School: California State Universtiy, East Bay

Mentor: Joel Palefsky, MD, MS

Title:
Evaluation of Pseudovirion-based Neutralization Assay and Benefits of the Quadrivalent HPV Vaccine

Introduction:

Human papillomavirus (HPV) is an intracellular pathogen that infects the epithelial cells. According to Ravenda et al, HPV is present in more than 80% of anal cancers and nearly 100% of cervical cancers. Humans with HIV infection are immunocompromised and hence more prone to HPV infection and HPV-related cancers. Vaccination against HPV should therefore be an ideal approach to prevent infection as well as anal/cervical cancers. The U.S. Food and Drug Administration (FDA) has approved a quadrivalent HPV vaccine, Gardasil®, which contains HPV16 and HPV18, the two most common cancer-causing HPV types, and stimulates development of antibodies that prevent the entry of HPV virions into epithelial cells.

Hypothesis:

1. Because the pseudovirion-based neutralization assay (PBNA) presumably measures all neutralizing antibodies, we hypothesize that it will exhibit higher sensitivity compared to the MERCK competitive Luminex immunoassay (cLIA) which measures only antibodies to one dominant epitope.
2. We hypothesize that the PBNA assay will show there will be at least 50% seroconversion and increasing titers of antibodies among HIV-positive women seronegative at baseline for HPV 16 and HPV 18 at 7 months and 12 months after vaccination.
3.

Methods:

The PBNA assay involves cell culture-based production of pseudovirions (PsV) with a reporter gene encoding alkaline phosphatase. When PsV enter epithelial cells, alkaline phosphatase is expressed and can be measured as a marker of epithelial infection. PsV are generated by co-transfecting HPV 16 L1/L2 and HPV 18 L1/L2 plasmids with an alkaline phosphatase-secreting expression plasmid (YSEAP) into 293TT epithelial cells with Lipofectamine. The vector stock is purified with Optiprep Density Gradient Medium and titrated to determine the minimum amount of PsV required for a robust signal in neutralization assays.

Neutralizing antibodies present in patient serum samples prevent the entry of PsV into epithelial cells resulting in corresponding reduction in YSEAP reporter plasmid expression and consequently alkaline phosphatase secretion, which is detected by a chemiluminescence system.

Serum at baseline, 7 months and 12 months post-vaccination from 150 HIV-positive women vaccinated in the AMC 054 study will be used for PBNA assays. Titers will be determined by diluting out each serum sample, with the neutralization titer defined as the reciprocal of the highest dilution of serum that reduced the SEAP activity by at least 50% in comparison with the reactivity in the wells that received PsV but no antibody. The positivity rates and titers using the PBNA assay will be compared with data already generated using the MERCK cLIA assay. Overall positivity rates, titer, PBNA sensitivity and specificity compared with baseline HPV DNA positivity will be determined.

Anticipated Outcomes:
We expect the PBNA assay to exhibit higher sensitivity than the MERCK cLIA assay. We also expect that there will be at least 50% seroconversion and higher titers of antibodies

Keywords:
Pseudovirion-based Neutralization Assay (PBNA), Human Papillomavirus (HPV), Virus-like particles (VLP), Gardasil®,

Lena Bertozzi

My name is Lena Bertozzi, and I am going to be a senior at Berkeley High School. Ever since I can remember, I have had an immense love for science, and the human body. How all the little parts of our bodies come together to create us fascinates me. More recently however, I have become very interested in public health topics, and how our environment can have a drastic effect on our health. I am disappointed in our current medical system that focuses on treatment, and not prevention, so helping a team try to implement prevention has been very rewarding. Working with Dr. Dayna Long for the Too Small to Fail program has been an incredible opportunity because it has allowed me to interact with families from wide ranging backgrounds and try to help them increase the development of their babies brains and hopefully eventually their performance in school. I would like to thank CHORI and everyone else who put so much work into making this amazing program possible, and everyone else in the Talk, Read, Sing program who helped me feel comfortable and does amazing work every day.

Funded by: Volunteer

School: Berkeley High School

Mentor: Dayna Long, MD

Contributing Authors:
Dayna Long, MD, Christine Schudel, MSW

Title:
Too Small to Fail: Staff Survey

Introduction:
Similar to the national trends, there is a wide disparity in the vocabulary acquisition and retention between children under five of low income and high income families living in Alameda county. The Too Small to Fail program "Talking is Teaching: Talk, Read, Sing" is an initiative to try and close that "word gap" in Alameda county, and then throughout the nation. It is executed by enrolling families with children of ages 6 week to 2 years through information from their pediatrician and a tote bag containing books, activities and other items to help spark conversation within the home. As a part of the first phase of the initiative, it is critical to make sure the physicians who are conducting these informatory sessions feel confident in their knowledge about it and ability to teach it to the families.

Objective:
The Too Small to Fail staff survey aims to assess physicians knowledge about the Talking is Teaching initiative, their confidence level in providing initiative information to families, their awareness of the initiative, and how effective they think it is.

Methods:
The current attending pediatricians at the UCSF Benioff Children's Hospital Oakland Primary Care Clinic were asked to fill out a survey asking about their knowledge, confidence, awareness of, and effectiveness of the initiative via hard copy or web-based form. The physicians will have the option to complete the survey online via survey monkey, or fill out a paper version. Following the acquisition of the data, it will be collected and analyzed. Each question will be analyzed with the online survey program Survey Monkey.

Results:
Preliminary results show that 68.75% of attending's feel very knowledgeable in the importance of talking reading and singing, and 75% feel confident or very confident promoting that information. All attending's are familiar with the initiative, and 75% of them think it is effective or very effective in promoting the topic.

Conclusion:
These results suggest the "Talk, Read, Sing" initiative is being conducted and promoted by physicians who feel knowledgeable and comfortable about it.

Acknowledgments:
I would first like to thank Dr. Long for giving me this amazing opportunity and providing such a wonderful experience. I would also like to thank the other Too Small to Fail members including Crystal Gariano, Ana Hernandez, and Rigoberto Del Toro for making me feel welcome and giving me a glimpse into what it is like to perform research.

Keywords:
Word Gap, Child Brain Development, Parental Involvement

Izumi de los Rios Kabara

As a rising senior at Berkeley High School, I am very thrilled to have an opportunity to participate in research. I have been interested in the natural world and the sciences since a young age but my fascination solidified through science courses that included labs and inspiring teachers. I've wanted to expand this interest with research in order to understand the sciences at a hands-on level. I am especially interested in medical research because it can benefit so many people in a very straightforward way. I was placed in the hematology lab under Dr. Frans Kuypers and Sandra Larkin; though their insightful and supportive guidance I have learned about sickle cell disease and research in general in a way which I could never have experienced in a classroom. I graduate from high school next year and I hope to pursue a career in medicine or research science.

Funded by: Volunteer

School: Berkeley High School

Mentor: Frans Kupyers, PhD

Contributing Authors:
Frans Kuypers, PhD, Sandra Larkin, and Alex Gonzalez

Title:
The Kinetics of Sickling and Factors that Affect Sickling in Sickle Cell Anemia Patients

Introduction:
Sickle Cell Anemia is a genetic disease that affects hemoglobin, the red blood cell (RBC) protein that transports oxygen. Under low oxygen the altered hemoglobin S (HbS) forms long polymers in the RBC, and changes the shape of the cell. The abnormal shaped or "sickled" cell can obstruct small vessels leading to a lack of oxygen in tissue. This vaso-occlusive event (VOE) leads to pain and tissue damage in all organs of the patient. Understanding the kinetics of sickling is important to evaluate events and conditions that lead to VOE and develop drugs as anti-sickling agents.

Objective:
This project will improve a new, semi-automated method to measure sickling over time. We aim to add several early time points in the beginning phase of the rapid sickling process to provide a reproducible method to test sickling kinetics of various samples and define environmental effects and drugs on the sickling process.

Methods:
To mimic oxygen exchange between RBC and tissue, blood is spun in a cuvette. Samples are automatically collected and fixed at specific time points by a peristaltic pump and a programmable fraction collector. Morphology will be tested using the AMNIS Image Stream Imaging Flowcytometer at the Gladstone Institute in San Francisco. This instrument takes pictures of every cell and using IDEAS acquisition software calculates length, width, area to distinguish sickled and non-sickled cells of thousands of cells rapidly. The percentage of sickled cells in time are plotted to create a sickling curve. After optimizing the system we will test the effect on the sickling curve by changing environmental conditions (percent oxygen, pH and temperature) as well as a potential antisickling drug.

Anticipated Outcomes:
Preliminary data indicated the potential of this technology and pointed at the need to rapidly and reproducibly collect data points in the beginning phase (first 10 minutes) of the sickling process. The first outcome will be establishment of a protocol to generate appropriate data points in the sickling process. Subsequently we will test sickling under conditions that are known to affect the process and establish statistical sound results. Finally we will test a new compound that is expected to affect sickling kinetics. This compound is in human clinical trials for other reasons, and showing that it affects sickling may make it an ideal compound to test in the sickle cell patient population.

Keywords:
red blood cell, hemoglobin, sickle cell anemia

Sasan Erfan

My name is Sasan Erfan and I am a rising senior at Cupertino High School in Cupertino. Throughout my life thus far, I have been indecisive about whether or not I would want to enter the field of biology and commit to medical studies. This was an important question that my experiences at the CHORI summer program helped answer. I am grateful for my mentor Mahin Azimi who gave me the opportunity to work in her lab on a unique clinical project that developed vital lab skills as a byproduct of the necessary conduct used to complete it. Working at one of the best hemoglobinopathy labs in the country is a huge honor, and being able to study variants of hemoglobin from hundreds of DNA samples within a comfortable, relaxed lab setting is a blessing. To understand the implication of fully delving within the field of science means to become cognizant that science is pursuing and surmising for an objective truth that may never be found: a huge risk and a cautious investment of time that I learned is a worthwhile endeavor from CHORI. Lastly, I would like to thank CHORI on a general note for creating a fantastic program that provides ambitious students of different backgrounds an opportunity to move towards their futures.es here.

Funded by: Volunteer

School: Cupertino High School

Mentor: Mahin Azimi

Contributing Authors:
Mahin Azimi, CLS, Jialing Cui, and Adriane Fung

Title:
Allele Specific PCR Testing of HbS and HbE

Introduction:
Sickle Cell Disease and HbE variant are prevalant in California due to the demographic. These two mutations both originate from two separate hemoglobin mutations: HbS and HbE. The respective mutations occur within the hemoglobin peptide chain in two different locations: HbS occurs within the 6th codon position due to a single nucleotide substitution of A to T leading to glutamic acid to valine, whereas HbE variant develops due to a single nucleotide substitution of G to A at the 26th codon which leads to glutamic acid to lysine. Hemoglobin is the defining protein within red blood cells as it carries oxygen throughout the body. When a sample has a certain variant of hemoglobin, the known phenotype does not always match the genotype. The goal of this project is to use a developed allele specific assay to precisely identify the genotype of an unknown DNA sample.

Objective:
To efficiently classify clinical samples of having SS or EE phenotype as either homozygous HbS (or HbE) or as HbS/ß thalessemia (or HbE/ß thalessemia), then correctly send the heterozygous samples to sequencing.

Methods:
Clinical samples sent to us, which are extracted by the Biorobot M48 to obtain DNA. DNA samples are aliquoted and mixed with a primer solution consisting of magnesium chloride and platinum supermix, which contains dNTPs. After prep, PCR reactions are carried out in the thermocycler where millions of copies of the selected portion of DNA are amplified. Following this, the PCR products are separated on agarose gel.

Anticipated Outcomes: Each gel should have a clear positive control with bands at the correct product size and a negative control with no bands. Clinical samples will be correctly distinguished as heterozygous or homozygous by comparing product sizes with the controls.

Acknowledgements:
Dr. Lubin, CHORI

Keywords:
hemoglobin, HbS, HbE, SCD, thalassemia

Berenice Fuentes

My name is Berenice Fuentes and I am a rising senior at Holy Names High School in Oakland. One of my passions in my life has always been helping people in any form possible in the healthcare industry. Volunteering numerous of hours at Children's Hospital and the Sports Medicine Facility since I was a Freshman, allows me to carry the love I have for people to practice. Volunteering and being a Doris Duke Charitable Foundation Summer Student at CHORI has allowed me to excel and grow in my passion for service, which is driven by the love I have for science. I would like to thank CHORI and the Doris Duke Charitable Foundation for giving me, an underrepresented student, the opportunity to have research/clinical experiences to help pursue my passion. Also, I would like to thank my mentor, Dr. Coleen Sabatini, who not only mentored me through this research process, but also exposed me to the world of an orthopedic surgeon (composed by casting opportunities and shadowing physicians). Furthermore, I would like to thank all of the nurses, medical students, and staff of Children's Hospital who gave me advice and experiences to the pathway of becoming a physician. I hope that the research study case that was performed by contributors and myself on a topic that is such a hardship in the world and in the state of California, inspires other physicians or people in the community to come up with solutions to solve such a big burden I leave you with a quote by Helen Keller to ponder and reflect upon, "Alone we can do so little; together we can do so much."

Funded by: Doris Duke Charitable Foundation

School: Holy Names High School

Mentor: Coleen Sabatini, MD

Title:
Access to Orthopedic Care for Spanish speaking Patients in California.

Statement of Hypothesis:
There will be limited availability of orthopedic providers to Spanish speaking patients in California compared to high availability for English speaking patients.

Specific Aims:
1. To better understand the availability of orthopedic providers to Spanish speaking patients in California.
2. Assess the availability of Spanish speaking providers or Spanish interpreters in orthopedic clinics in California.
3. To better understand the impact that being Spanish speaking has on access to care to orthopedic specialists and compare them to the experiences faced by an English speaking patient.
4. To measure the disparities that non English speaking patients face when scheduling for an appointment at an orthopedic clinic.

Anticipated Outcome of Project:
The purpose of this study is to better understand the availability of orthopedic providers to Spanish-speaking patients in California. We sought to better understand the impact that being Spanish speaking has on access to care to orthopedic specialists compared to the English speaking patient population in the state. We anticipated that we would see a disparity between the number of offices willing to see a Spanish speaking patient versus an English speaking patient. In our results, we saw that there was access for Spanish speaking patients similar to English speaking patients. However, in only a few cases were interpreters going to be available to assist with the appointment and even fewer where there was a provider that spoke Spanish. The vast majority of clinics required the Spanish speaking patient to bring someone with them that could interpret or else they would not be seen. Thus, obtaining adequate orthopedic care as a Spanish speaking patient is difficult because of the lack of interpretation services in many orthopedic clinics.

Acknowledgments:
I would like to thank the Doris Duke Charitable Foundation for funding and giving me the opportunity to conduct my own research through the CHORI program. Also, I would like to thank all of the staff and contributors of the CHORI program for allowing my interests to excel through this program and for guidance through workshops and lectures. Furthermore, I would like to give my sincerest gratitude to my mentor, Doctor Sabatini for guiding me through the process and giving me clinical experience.

Alexander Gonzalez

I am currently a rising senior at Jesuit high school in Sacramento. Having the opportunity to participate in a research project at CHORI has strengthened my mindset and my academic goals. It's encouraging to work with people that share similar passions and it is very inspiring to learn from accomplished individuals. I would like to thank Sandra Larkin and Dr. Frans Kuypers for teaching me so much and being open to any questions I have, I am extremely grateful to be working under them. This summer has been eye opening and overall a wonderful experience. The research being done here in the Kuypers lab really makes a difference in people's lives and I am thankful to have gotten to experience that first hand.

Funded by: California Institute for Regenerative Medicine

School: Jesuit High School

Mentor: Frans Kuypers, PhD and Sandra Larkin

Contributing Authors: Sandra Larkin, Frans Kuypers, PhD, Izumi De Los Rios Kobara

Title:
Analysis of Erythrocytes Using Fourier Transforms Infrared Spectroscopy (FT-IR)

Introduction:
Sickle Cell Disease (SCD) is a genetic blood disorder characterized by sickle-shaped red blood cells (RBC). SCD affects hemoglobin, a protein responsible for transporting oxygen in the blood. The mutation in hemoglobin leads to polymerization of the protein under low oxygen conditions. Both molecular interactions in the cytosol and interactions in the RBC membrane are affected by hemoglobin polymerization. The altered shape of the RBC and changes in its membrane surface lead to vaso-occlusion and organ damage. Infrared spectroscopy is a powerful technique to measure molecular interactions of (bio)chemical structures. Little is known on the IR spectroscopic fingerprint of RBC, and no information is available on these characteristics of sickle RBC under different conditions.

Objective:
Develop a novel way to analyze molecular interactions in RBC by Fourier Transform Infrared Spectroscopy (FTIR). FTIR spectra of normal and sickle RBC will be correlated with incubation conditions.

Methods:
We will use a novel instrumental setup to replicate oxygen exchange in RBC. Cells will be fixed at different times and 10µl at a 5% hematocrit is applied to a FTIR crystal interface. Spectra will be collected at different time intervals for 1 minute (approximately 70 scans) while the sample dries. The spectra collected from RBC incubated under different conditions will be analyzed using Mathlab algorithms.

Anticipated Outcomes:
We anticipate that the FTIR spectra of sickle and normal RBC will differ from each other and that incubation conditions can be correlated to changes in the spectra. Ultimately we hope to better understand the changes in molecular interactions in RBC as the result of incubation under low oxygen conditions.

Acknowledgments:
Eric Soupene

Keywords:
Erythrocyte, Infrared Spectroscopy, Fourier Transform Infrared, MIR, Hemoglobin

Bradley Green

I am a rising senior at Colorado College studying economics and biochemistry. Being an economics major, it is often difficult to find science research, so when I heard about this program, I jumped on the opportunity. Working at CHORI this summer has given me an excellent taste of what research is like! Personalized medicine seems to be the future of medicine. Working in Dr. Fischer and Dr. Illek's lab has made research much more tangible. Discovering more about the cystic fibrosis gene and doing drug development projects has allowed me to see how important research is in coming up with individualized prevention therapies and treating diseases. My ultimate goal is to go to medical school, and working in the lab this summer has taught me the importance of patience and troubleshooting. There is no doubt that these skills will help me on the long path of becoming a doctor. I am very grateful for Dr. Fischer and Dr. Illek for opening up their lab to me and providing me with support and encouragement along the way. This has been an invaluable experience, and I know I will be talking about my summer for years to come!

Funded by: Volunteer

School: Colorado College

Mentors: Beate Illek, PhD and Horst Fischer, PhD

Title:
CFTR Inhibitor Development for Diarrheal Disease

Introduction:
Diarrheal disease is an enormous health problem worldwide. Secretory diarrhea is the largest cause of death in the developing world. Each year ~ 2.5 million children younger than the age of five die because of diarrhea. Medication-induced diarrheal side effects are a major concern in patients being treated for HIV/AIDS and breast cancer as these patients often stop taking treatment medications. In the USA, more than 1.1 million people 13 years and older are living with HIV infections and more than 2.8 million people are affected by breast cancer. An estimated 50%–60% of AIDS patients experience diarrheal epidsodes associated with medications such as protease inhibitors. In many cases, less-than-ideal adherence to these medications has resulted in less-than-optimal disease management. This results in a need for innovative alternatives that offset diarrheal side effects with minimal toxicity and drug interference.

Fulyzaq (crofelemer), derived from the red sap of the Croton lechleri plant, is the second botanical prescription drug approved by the FDA. Fulyzaq relieves symptoms of diarrhea in HIV/AIDS patients undergoing antiretroviral therapy.

Hypothesis:
Test compounds with the highest concentration of Croton lechleri tree extracts will have the lowest IC50's representing a higher efficiency of blocking CFTR channel secretions.

Methods:
T84 cells, a human colonic epithelial cell line, were cultured on snapwell inserts for 10 days. Confluent monolayers were inserted into Ussing chambers and used to measure transepithelial chloride ion transport. Forskolin (an adenylate cyclase activator) was added to stimulate CFTR-dependent chloride secretion. After 15 minutes, test compounds were added at step-wise increasing concentrations: 0.3 μM, 1 μM, 3 μM, 5 μM, 10 μM, 30 μM, 50 μM, and 100 μM. CFTR-Inhibitor 172 was added to determine maximal block.

Results:
Kinetic analysis of inhibition of cAMP-stimulated Cl transport by test compounds resulted in the following half-maximal inhibitory constants (IC50). Sample 1 had an IC 50 value of 34.7 μM. Sample 2 had an IC 50 value of 30.0 μM. Sample 3 had an IC 50 value of 15.9 μM. Sample 4 had an IC 50 value of 12.9 μM. Sample 5 had an IC 50 value of 26.0 μM. Sample 6 had an IC 50 value of 6.7μM. Sample 7 was in active. Sample 8 had an IC 50 value of 4.1 μM.

Conclusion:
The samples that contained the highest concentration of Croton lechleri tree extracts had the lowest IC 50 values making them the most effective CFTR chloride channel blockers. This study will help drug companies develop formulations for a more efficient way of inhibiting CFTR secretions and ultimately producing a drug that helps patients manage the symptoms of diarrheal side effects.

Acknowledgements:
Elle Lefebvre, Molly Bates

Keywords:
CFTR, Medication Induced Diarrhea, Crofelemer

Rachelle Hampton

In Fall 2015 I will complete my final semester at Samuel Merritt University to obtain a Bachelor of Science degree in Nursing. Growing up in a neighborhood plagued by socioeconomic and health disparities has greatly influenced my commitment to serve low-income populations. As a nursing student, I have cared directly for patients in settings such as behavioral health, medical-surgical, labor and delivery, intensive care, and pediatrics. Interning at Children's Hospital Oakland Research Institute has given me a greater appreciation for the amount of time and effort that goes into the research process. This experience, while challenging, has been exciting and intellectually stimulating. My future plans include completing the four-year Bachelor of Science in Nursing to Ph.D. program with an emphasis in public health at UCSF. As a nurse researcher, I will be in the unique position of being able to care for patients at the bedside while having the latitude to address health disparities and access to care at the population level.

Funded by: National Institutes of Health

School: Samuel Merritt University

Mentor: Greg Moe, PhD

Contributing Authors:
Greg Moe, PhD

Title:
Visualization of the Activity of TspB using a Lumino Tag

Introduction:
Neisseria meningitidis (Nm) is an obligate human pathogen that can cause rapid onset of life-threatening bacteremia and meningitis. The presence Nm in the nasopharnyx is relatively common in human populations yet disease in industrialized countries is rare. One characteristic of isolates causing invasive disease is the presence of prophage DNA. Our laboratory discovered that a gene carried by prophage DNA coding for a protein called, TspB, is essential for survival of Nm in the blood stream. To understand how prophage DNA and TspB in particular, contribute to Nm pathogenesis, we will replace the wild-type tspB gene with a mutant containing 1 to 3 copies of DNA coding for a 6 amino acid sequence (Lumino tag) that can be specifically modified with a fluorescent dye. The production of Lumino-TspB can then be tracked in real-time during bacterial culture, in human epithelial cell models of colonization, and mouse models of meningococcal pathogenesis by fluorescence microscopy.

Hypothesis:
Lumino tags will not affect expression or functional activity of TspB thereby making it possible to monitor production of the protein in medium, cell culture and mouse models related to various aspects of meningococcal pathogenesis in real-time by fluorescence microscopy.

Specific Aims:
The Specific Aims of this project are to:
1. Clone tspB gene nmbH4476_0681 from Neisseria meningitidis serogroup B strain H44/76 by PCR,
2. Introduce CysCysProGlyCysCys Lumino tags in TspB by ligating oligonucleotides coding for the tag into three unique restriction sites in tspB,
3. Determine whether recombinant mutant TspB is produced in E. coli,
4. Determine whether recombinant Lumino-TspB reacts with the FLASH-EDT2 derivative of fluorescein.

Anticipated Outcomes:
Construct and select a Lumino-TspB derivative that can be used in subsequent experiments to characterize the role of TspB and phage production in the pathogenesis of Nm in human epithelial cell culture and transgenic mouse models.

Acknowledgements:
Greg Moe, PhD and Vianca Vianzon

Talor Johnson

My name is Talor Johnson and I am entering my senior year at Boise State University. I am a Health Science Studies major and plan on attending medical school. If you ask my dad, he'll tell you that he has never had to wonder what career path I would choose; I have always made it clear that my ultimate goal is to become a physician. While I am not sure exactly what kind of doctor I want to be, I know I want to go in to pediatrics. Working at UCSF Children's Hospital Research Center Oakland through the CHORI Summer Research Program has helped to solidify my desire to work with children in health care. Being a part of this program has been such a blessing and working closely with physicians and clinicians in the research side of public health has opened my eyes to the many options available when choosing a career in medicine. I want to thank the CHORI staff, Dr. Treadwell, my peers and all others who helped make summer 2015 so memorable.

Funded by: National Institutes of Health

School: Boise State University

Mentor: Marsha Treadwell, PhD

Contributing Authors:
Wendy Murphy, LCSW, Ashutosh Lal, MD

Title:
Adherence with Iron Chelation Therapies in Thalassemia and Sickle Cell Disease

Introduction:
Patients with thalassemia or sickle cell disease (SCD) recognize that chronic transfusion therapy is life-saving treatment. Iron chelation therapy is often required by patients on chronic transfusions to avoid complications from iron overload. Despite the risks, many patients are not adherent with chelation. Motivational interviewing (MI) is an intervention that allows patients to identify and find their own ways to overcome individual barriers to adherence.

Hypothesis:
Enhancement of self-efficacy regarding adherence will be positively associated with patient participation in monthly MI sessions and will lead to better adherence to iron chelation therapies.

Methods:
Patients with thalassemia or SCD and poor adherence to iron chelation therapies will meet monthly, over the course of a year, with the social worker for MI sessions. Participants will complete questionnaires evaluating health related quality of life (HRQoL), satisfaction, self-efficacy and adherence at baseline, six- months and one-year post study entry. Monthly clinic notes are reviewed for barriers and engagement in MI.

Anticipated Outcomes:
Participation in monthly MI sessions will increase patient self-efficacy and improved self-efficacy will result in greater adherence to iron chelation therapies as measured by patient and staff ratings and liver iron concentration (LIC).

Results:
Participants are 23 youth and adults with thalassemia (n = 18) and SCD (n = 5). On study entry, patients had a mean age of 26 years (SD = 9.2) and were 65% female (n = 15). Participants were on average severely iron overloaded (LIC = 27.7 ± 14.3 mg/g dry weight; serum ferritin = 5305 ± 3077 ng/mL). Higher self-efficacy at baseline and six-months was associated with significantly higher ratings of HRQoL at both times and with higher adherence at baseline ($p < .05$). At six month follow up, there were no significant improvements in self-efficacy or ferritin levels. There were trends toward improvements in patient and staff ratings of adherence ($p = .10$).

Discussion:
With this small sample and short time frame, we were not able to demonstrate improvements in self-efficacy or ferritin levels. Future analyses will consider the level of patient engagement in MI. Results in relation to self-efficacy, HRQoL and adherence are encouraging.

Acknowledgments:
Craig Hutchinson, MPH, Valerie Sydnor, MSW, Center for Sickle Cell Disease and Thalassemia, CHORI Summer Research program, Participating patients and families.

Keywords:
iron chelation, motivational interviewing (MI), adherence, thalassemia, sickle cell disease, ferritin, SQUID, iron overload

Farmaan Judge

I am Farmaan Judge and I will be an incoming freshman at the University of San Francisco majoring in Biology. My future plan is to become a Pediatric Oncologist. I am very blessed to have gotten to participate in the CHORI Summer Student Program. Previously, I have had the opportunity to do an internship at Stanford University to do stem cell research. Through both my CHORI and Stanford summer experiences, I have realized that a medical career is what I want to pursue in the future. CHORI has helped me develop a stronger academic and scientific confidence. I'd like to thank my mentors Dr. Jennifer Michlitsch, MD, and Dr. Caroline Hastings, MD, for all their guidance and willingness to support me through my project.

Funded by: Volunteer

School: University of California, San Francisco

Mentor: Jennifer Michlitsch, MD and Caroline Hastings, MD

Title:
Are Surveillance CT Scans of the Pelvis Beneficial for Children Who Were Previously Treated for Wilms Tumor or Hepatoblastoma?

Introduction:
Wilms tumor is a rare kidney tumor which primarily affects children, ages 2-5 years. Children with suspected Wilms tumor undergo a history/physical examination, laboratory testing, abdominal ultrasound, chest x-rays, and CT scans of the chest, abdomen and pelvis. After completion of treatment, children are monitored for possible relapse in the abdomen or the lungs. Hepatoblastoma is a rare tumor that starts in the liver. It primarily affects children from infancy to about 3 years of age. After completion of treatment, children are monitored closely with periodic physical examinations, liver function and tumor marker assessments, and imaging.

Hypotheses:
1. The current standard of abdominal/pelvic computed tomography (CT) imaging surveillance after completion of treatment does not impact long term outcomes with patients given the low incidence of relapse and good medical assessments.
2. Decreasing the frequency and/or type of imaging will lead to decreased cost of therapy care and reduce radiation exposure to cancer survivors.

Method:
Patients previously diagnosed for Wilms tumor or Hepatoblastoma from January 1998 to December 2014 were identified and approved by the Institutional Review Board (IRB). Data from the patient's medical record was extracted. Spreadsheets of patients eligible for review was generated. Information was analyzed to evaluate the validity.

Anticipated Outcome:
We hypothesize that results will indicate excessive abdominal/pelvic CT tests being done for off therapy surveillance, which may not be needed. Based on what we know about relapse in both cancers, we may be able to refine the most optimal timing of off therapy CT imaging and limit this to 6 or 12 months, which is the most significant risk period for relapse.

Conclusion:
Relapse of Wilms Tumor and Hepatoblastoma is not as frequent as the protocol for CT scans suggests. The timing of off therapy CT imaging should be limited.

Acknowledgments:
I would like to thank Jennifer Michlitsch, MD, and Caroline Hastings, MD, for their willingness to guide me.

Isabelle Kao

Isabelle graduated from the University of Chicago with a degree in economics. After working in advertising for a few years after college, she decided to pursue her longstanding interest in medicine. She completed a post-bacc program and is now a medical student at State University of New York Downstate.

Funded by: Volunteer

School: State Univerity of New York, Downstate

Mentor: Marsha Treadwell, MD

Contributing Authors: Sara Leibovich MD, Anne Marsh MD, Michael Bell MD

Title:
Improving Emergency Department Care for Pediatric Patients with Sickle Cell Disease: Reducing Time to First Analgesic

Introduction:
Pain from vaso-occlusive episodes (VOEs) is the leading cause of emergency department (ED) visits among patients with sickle cell disease (SCD). Guidelines for the management of VOEs suggest prompt initiation of parenteral opioids, however, patients with SCD often experience delays in and undertreatment for pain. A nursing-driven quality improvement protocol implemented in the UCSF Benioff Children's Hospital Oakland ED improved timely treatment of VOEs. [1]

Hypothesis:
As a follow-up to our ED protocol, we explored the use of intranasal fentanyl to further reduce time to administration of first analgesic. We hypothesized that use of intranasal fentanyl as the first-line medication for VOEs would improve time to first analgesic. We further hypothesized that patients who received intranasal fentanyl would report significant improvements in pain scores from first to third pain assessment.

Methods:
We reviewed ED records for patient visits for VOE from February 2014 through mid-July 2015. Means and standard deviations of times to first analgesic from triage were calculated. We examined records for 56 unique patients using the revised pain management protocol that included intranasal fentanyl. Differences in the pain scores at 1st, 2nd and 3rd assessment were analyzed using paired t-tests. Patient satisfaction surveys were administered to patients/families at follow-up clinic visits.

Results:
The first dose of pain medicine was administered significantly faster for visits receiving intranasal fentanyl (M (SD) =17.2 (11.8) minutes) compared with IV analgesic (M (SD) = 37.1 (11.1) minutes, $p < 0.001$). Patients receiving intranasal fentanyl were average age 17.4 (SD = 6.6) years; 50% female; and 67% HgbSS. Significant decreases ($p < 0.01$) were reported from the first (8.4 out of 10) to the second (6.0), from the second to the third (5.1), and from the first to the third pain assessments for patients receiving intranasal fentanyl. Over 80% of patients/families reported the highest possible satisfaction with ED care received.

Conclusion:
The use of intranasal fentanyl as a first-line treatment for VOE in the ED resulted in significant improvements in time to first analgesic and in pain scores. Further analyses are planned to understand other factors that might contribute to improvements in pain scores.

Acknowledgements:
Craig Hutchinson, MPH, the Comprehensive Sickle Cell Center and Emergency Medicine Department at UCSF Benioff Children's Hospital Oakland, CHORI Summer Research program, participating children and families.

Keywords:
sickle cell, vaso-occlusive episode, pain, pediatric, fentanyl, intranasal, emergency department

[1]Treadwell MJ, Bell M, Leibovich SA, et al. A quality improvement initiative to improve emergency department care for pediatric patients with sickle cell disease. J Clin Outcomes Manage 2014;21:62-70.

Rammeet Kaur

I was born in India and moved to California at age 9. I have just graduated from American High School in Fremont, CA. I have always loved science ever since I learned about DNA in Biology during my freshmen year of high school. However, I never had the chance to explore research until I was chosen to be part of the CHORI summer student program. It is an amazing experience to explore the research aspects of Science in Medicine. I am also excited about the opportunity to shadow a nurse practitioner, as I am considering becoming one in the future. I would like to thank Dr. Fung for teaching me and getting me interested in nutrition and thalassemia. This has inspired me to take my first nutrition class this fall in college. So far, the CHORI summer program experience has made me more confident in my decision about choosing the field of nursing.

Funded by: Doris Duke Charitable Foundation

School: American High School

Mentor: Ellen Fung, PhD

Title:
Nutritional Attitudes and Beliefs held by Patients with Thalassemia

Introduction:
Thalassemia (Thal), a rare genetic blood disorder of abnormal hemoglobin synthesis, affects 1,000 individuals in North America. As health care improves, patients are living longer, though nutritional deficiencies are commonly reported. Given the essential role nutrition plays in overall health and quality of life, we pursued the question, "Do patients with Thal believe that nutrition is important for their overall health?"

Objectives:
To describe nutritional attitudes held by patients with Thal through the use of an online survey tool, define where patients receive nutrition information and if they are receptive to dietary intervention advice.

Methods:
An online anonymous survey was developed that included 23 questions to gather information on what patients understand about nutrition, where they get their nutritional information from, and who influences their decision making. The tool and cover letter were emailed to ~370 patients through the Cooley's Anemia Foundation Listserve. Additionally, the link was posted on the UCSF Benioff Children's Hospital Oakland Thal facebook page and website. The survey was closed after 3 weeks and data downloaded from Surveymonkey into an excel file for analysis. Data were compared to a similar survey [2012 Food & Health] conducted in healthy Americans.

Results:
100 Thal participants completed the survey, of which, 67% were female (age: 18-60 y), 94% transfused, 25% not born in the US. Most patients (86%) rate their diet as healthy to very healthy, compared to only 24% of Non-Thal Americans. However similar to the general population, Thal patients feel that nutrition information in the media is confusing, and choose foods based on taste rather than health claims. Thal patients receive most of their nutrition information from the web or friends (84%). Though thal patients appear to be receiving nutritional messages regarding the importance of vitamin D for bone health, the majority (74%) still believe dietary iron affects their total body iron stores.

Conclusion:
Nutrition seems to be important for Thal patients' overall health; the majority believe their current diet is excellent, but lack key dietary insights that may enhance their health. Overall, they seem willing to take an active role in modifying their diet.

Acknowledgements:
Thanks to Dr. Fung for helping me out and guiding me through this project, also to Cooley's Anemia Foundation and Laurice Levine for helping me recruit participants for the survey.

Keywords:
Thalassemia, nutrition, survey

Cecilia Lee

Medicine and genetics has been a growing passion of mine since my little sister, Lizzy, was diagnosed with chromosome 8p23 deletion. This rare and late diagnosed disorder was the cause of 8 years of my family and me not understanding the root cause of my sister's atrial septal defect, learning disability, autism, and hypotonia. Discovering the answer to Lizzy's diagnosis and prognosis laid in her chromosome was an important milestone in my interest for both medicine and genetics. I chose to research chromosome 8p23 deletion, which helped provide some answers: that the GATA4 and the SOX7 gene are required for atrioventricular valve development and myocardial compartment development, MCDPH1 gene being necessary for forebrain development, and the absence of TNKS gene causing behavioral problems and autism. Researching and understanding my sister and her genetic mutation inspired me to want pursue bridging the gap between research and medicine. Today, I am fortunate to be a part of Dr. Lammer's team identifying genetic and environmental contributions to common major malformations as a researcher in a medical genetics lab. My current research consists of me determining whether risks of selected birth defects from exposures to specific air pollutants are further modified by gene variants in biotransformation enzymes (e.g., NATs, GSTs, CYPH, or NOS3) . Being a part of Dr. Lammer's lab has been an amazing experience, providing me with a strong background in understanding single nucleotide polymorphisms, major causes of birth defect, and provided a great introduction to clinical research. I would like to thank Dr. Lammer, Katherine Shultz, and everyone in the Lammer Lab for the support, patients, camaraderie, and knowledge they have provided over the last few months.

Funded by: Lammer Lab Education Fund

School: University of California, Santa Barbara

Mentor: Ed Lammer, PhD

Title:
Exposures to Air Pollutants, SNPs, and Risk of Birth Defects

Introduction:
In the US, birth defects are the leading cause of pediatric hospitalizations, medical expenditures, and death in the first year of life. There is small literature that suggests exposures to air pollutants may be risk factors for birth defects. We intend to extend the biologic basis of some of these observations by exploring the combined effects of these exposures with genetic susceptibility – such gene-environment studies in this area have not been possible in the past. This project is designed to substantially extend the existing knowledge base of air pollution as risk factors for selected birth outcomes.

Objective:
To determine whether risks of selected birth defects from exposures to specific air pollutants are further modified by gene variants in biotransformation enzymes (e.g., NATs, GSTs, CYPH, or NOS3) .

Methods:
Data pertaining to birth defects that will be used in this project derive from the National Birth Defects Prevention Study. We limit our inquiries to the California study site, which is being conducted in the San Joaquin Valley – an area with demonstrated poor air quality and an area diverse in socioeconomic status and race/ethnic background. For genetic experiments, DNA will be derived from newborn bloodspots or buccal samples. The study population will consist of all births to women residing in the 8 counties around Fresno, California from 2000-2010. We plan to use the geocoded residence in ArcGIS and variables on crime statistics, access to public transportation, green space and land use, alcohol and cigarette outlets, access to healthy food outlets, forest fire areas, proximity to superfund sites and variables from the 2000 and 2010 Census to characterize the built environment surrounding each maternal residence. For quality control, we plan to use Hardy Weinberg Equilibrium (HWE) to find proportions for control data and examine pairwise linkage disequilibrium of each SNP. We will also calculate odds ratios to explore both an association between SNP genotypes and risk of specific birth defects, and to estimate haplotype frequencies as well as to compare those frequencies amongst birth defect cases and healthy controls.

Anticipated Outcomes: We anticipate that some genetic variants will show an interaction with measures of air pollution and alter risk (increased odds ratios) for specific birth defects.

Conclusion: We hypothesize risks of selected birth defects from exposures to specific air pollutants is modified by gene variants in biotransformation enzymes .

Elizabeth Lefebvre

My name is Elle Lefebvre and I am a rising senior at Pacific Ridge School in Carlsbad, California. I am passionate about exploring the nuances of healthcare, such as American health policy and social determinants of health, and plan to study public health as an undergraduate. Eventually, I aspire to enter the field of pediatrics and work with chronically ill children. My experience at CHORI this summer has allowed me to delve deeper into my interest in science, providing a solid foundation of biomedical research experience. As I have a close family connection to cystic fibrosis, it has meant a lot to me to have the opportunity to work in the Fischer/Illek Lab this summer. Personalized medicine truly is the future standard of care for many illnesses, and it has been thrilling to engage in such groundbreaking research. I would like to thank my mentors, Dr. Horst Fischer and Dr. Beate Illek, for allowing me to take part in this amazing opportunity.

Funded by: The Elizabeth Nash Foundation

School: Pacific Ridge School

Mentor: Horst Fischer, PhD and Beate Illek, PhD

Title:
Personalized Medicine and Cystic Fibrosis: A Genotype-Specific Approach to Care

Introduction:
Cystic fibrosis (CF) is a chronic, life-threatening, autosomal recessive disorder characterized by a mutation in the CFTR protein. The disorder impacts chloride secretion and reabsorption in epithelial cells, resulting in mucosal dehydration and acidification. Although 2000 mutations of the CFTR gene have been identified and categorized, F508del is the most commonly displayed mutation, with 90% of patients expressing at least one copy. [1]As each of the six classes of CFTR mutations result in differing functional effects on the protein, recent advances in mutation-specific drug development show potential to significantly improve disease prognosis. Rather than treating cystic fibrosis patients from a traditional symptom-based, trial-and-error perspective, healthcare teams are beginning to tailor medical interventions to given patients' genotypes. In 2012, ivacaftor (VX-770), a CFTR potentiator, was approved by the FDA for the treatment of individuals with the G551D mutation. In July 2015, a combination therapy of ivacaftor and lumacaftor (VX809), a CFTR corrector, was approved for patients who are homozygous for the F508del mutation.

Hypothesis:
VX-809-treated CFNE cells with at least one copy of the F508del mutation will show a statistically significant increase in CFTR chloride transport function in response to acute exposure to VX-770.

Methods:
Conditionally reprogrammed CF nasal brushing cells were obtained from Dr. Dennis Neilson at UCSF and incubated at 37° C for 21-28 days. Untreated controls, DMSO-treated cells, and VX-809-treated cells were mounted on sliders into Ussing chambers. Transepithelial currents were continuously recorded in response to amiloride, forskolin, VX-770, CFTR Inh-172 and ATP.

Anticipated Outcomes:
VX-809-treated cells with at least one copy of the F508del mutation will likely demonstrate a statistically significant increase in CFTR chloride transport function after the addition of VX-770. This would suggest that combination therapy of lumacaftor and ivacaftor may be a valid treatment option for certain patients heterozygous for the F508del mutation.

Conclusions:
The emergence of personalized medicine in the treatment of cystic fibrosis holds great promise for improving patients' clinical outcomes. There is great variation in the genotypes of individuals with CF, which necessitates the development of multiple targeted treatment strategies. Additionally, regardless of patient genotype, cystic fibrosis manifests itself differently in each individual. Thus, in vitro testing of various treatment options on patient epithelial cells prior to clinical implementation has the potential to improve efficacy of care.

Acknowledgements:
Elizabeth Nash Foundation, Molly Bates, Bradley Green

Keywords:
Cystic fibrosis, personalized medicine, epithelial transport, conditionally reprogrammed cells, ussing assay

References:

[1]Ikpa, Pauline T., Marcel J.C. Bijvelds, and Hugo R. De Jonge. "Cystic fibrosis: Toward personalized therapies." The International Journal of Biochemistry and Cell Biology 52 (2014): 192-200. Digital file.

Christine Lopez

Hello, my name is Christine Lopez and I am going into my senior year of high school at College Park High School in Pleasant Hill. Throughout my childhood, I have constantly changed my mind about what I want to do in my life. One day I would want to be a musician, the next week a journalist, and then a few months later a doctor or research scientist. The CHORI program has allowed me to submerse myself in the latter, and see how science and research works in the "real world". The knowledge and support I have received through this program is unlike any other experience I have had and this summer I have been able to push myself beyond what I believed was possible. It was a steep learning curve, with many challenges, but I am now comfortable in the hospital environment and with the many new skills I acquired through this program. I am very thankful for the organizers of this program and my mentor, Dr. Carolyn Hoppe, for providing me with this enriching experience.

Funded by: Doris Duke Charitable Foundation

School: College Park High School

Mentor: Carolyn Hoppe, MD

Title:
Use of the Adolescent Pediatric Pain Tool (APPT) to Assess Pain in Hospitalized Children and Adolescents with Sickle Cell Disease

Introduction:
Sickle cell disease (SCD) is an inherited disorder of red blood cells that leads to complications involving all organ systems. Acute vaso-occlusive pain episodes (VOE) are the hallmark of SCD and the most frequent reason for hospitalization. The pain during these episodes is often multifactorial involving physical, psychological, and social components. The Adolescent Pediatric Pain Tool (APPT) is a validated instrument used to assess the multi-dimensional aspects of pain in patients with SCD. The APPT includes a description of the location, intensity and quality of pain reported by the patient.

Hypothesis:
Use of the APPT in children and adolescents with SCD hospitalized for acute VOE is associated with a reduction in length of stay.

Methods:
This project is a retrospective chart review of patients hospitalized for VOE between 2009 and 2014. Information collected from the chart, including patient name, date of birth, SCD genotype, date of admission/time, date of discharge/time, whether the APPT was ordered and the date in which it was ordered, the number of APPT's and dates completed, and the specific scores on each pain tool, was entered into an Excel spread sheet.

Preliminary Results:
To date, 289 encounters (165 on EPIC and 124 in physical charts) were reviewed. An order for the APPT was found in 154 (53%) and, of these, the APPT was found in only 47 (30%). For those encounters in which the completed APPT was found in the chart, the mean length of hospital stay was 7.03 days. The average length of stay in the 135 encounters without an order was 5.07 days.

Conclusions:
The APPT is not widely used in clinical practice. Its use must be advocated more as an effective pain assessment. Incorporation of the APPT into the electronic medical record may improve clinical utilization as part of pain management for SCD patients with VOE.

Acknowledgements:
I thank the staff in medical records and hospital information services for helping me with this project.

Keywords:
SCD,VOE, APPT

Marco Martinez

My name is Marco Martinez, and I am going to be a senior this fall at Oakland Technical High School in Oakland, CA. In school, I am in the Engineering Academy, which is somewhat of a cult, and focuses on Engineering Principles and how 3D objects interact in space. Despite my school track, my real passion is for medicine, and more specifically for surgery. At the start of the CHORI summer program, I was a little worried that my time spent in the Cardiology department would scare me away from medicine because maybe I was actually afraid of blood or tissue or bone. But the exact opposite happened. My love of medicine has grown exponentially during my time at Children's Hospital, and I feel as though I have grown as a person as well. I was taken in by everyone in the Department, and I was amazed at how kind and friendly they all were. I have never learned more than I have this summer, and it truly was the best summer of my life.

Funded by: Volunteer

School: Oakland Technical High School

Mentor: Hitendra Patel, MD

Title:
Ambient Air and Water Pollution's Effect on Congenital Heart Disease

Introduction:
Congenital Heart Disease (CHD) is one of the most common birth defects, with an incidence rate of 1 in 100 births. Assuming that the genetic pool of all people in Northern California has not changed, it is very likely that environmental factors are contributing to changes in prevalence of the types of CHD presenting for intervention, i.e., surgery or cardiac catheterization. Many studies have been done linking environmental pollutants to CHD, but they either focused too strongly on one type of pollutant, questioned mothers too late, or are severely outdated.

Hypothesis:
Environmental pollutants and contaminants influence the incidence of Congenital Heart Disease (CHD) in Northern California.

Methods:
I used Epic to gather the number of Surgical and Cardiac Catheterization cases pertaining to left side cardiac obstructions, right side cardiac obstructions, Conotruncal defects and Heterotaxy from the past fifteen years. I put that onto a scatter plot, and compared the trends in the different types of CHD cases to the trends in air/water pollution that I extrapolated using data from the EPA. Then, looking for more trends, I will narrow down my search from looking at it year by year to month by month. This may allow me to determine specifically which ambient air and water pollutants are possibly contributing to the numbers in Congenital Heart Disease.

Anticipated Outcomes:
We anticipate that the trends in the procedures for Ventricular Septal Defects (VSD) and Congenital Pulmonary Stenosis will be similar to the trends in Carbon Monoxide (CO). And that the trends in procedures for Tetralogy of Fallot and other cardiac septa malformations will correlate to levels of Nitric Oxide (NO) and Nitrogen Dioxide (NO2).

Acknowledgements:
Dr. Hitendra Patel, Dr. Olaf Reinhartz, Mimi Lee, Susan Turpin, Debra Bartlett

Keywords:
Congenital Heart Disease, Gestation, Pollutants, Northern California

Kate Matsunaga

My name is Kate Matsunaga and I am a rising senior attending the College Preparatory School. This summer I interned at the hematology and oncology clinic and studied the correlation between overconsumption of milk and iron deficiency anemia. I was able to interact with children and seeing them smile back at me was one of the many gifts the CHORI program offered to me. It is my dream to be able to help people for a living and hopefully my study will be used in the future to prevent iron deficiency anemia. I cannot express my gratitude to the staff at CHORI and the hematology and oncology clinic for being so friendly and helpful and my wonderful mentors who have given me a peek into the world of medicine.

Funded by: Volunteer

School: College Preparatory School

Mentors: Alison Matsunaga, MD and Ashutosh Lal, MD

Title:
A Self (parent) Administered Questionnaire to Identify Toddlers at Risk for Iron Deficiency Anemia

Introduction:
Iron deficiency is the most common widespread nutritional disorder in the world, with estimates of anemia mostly due to iron deficiency in up to 30% of the world's population. While iron deficiency (ID) and iron deficiency anemia (IDA) affect many individuals in developing countries, they also have a significant prevalence in even industrialized countries such as the United States. Iron deficiency is known to negatively affect long-term neurological and behavioral development. Severe or prolonged iron deficiency leads to iron deficiency anemia. The American Academy of Pediatrics (AAP) currently recommends that formula and breastfed infants be given iron supplementation at 4-6 months of age unless appropriate iron containing complementary foods have already been started. Whole milk should not be introduced until 12 months of age, and milk consumption should not exceed over 24 oz per day. Despite some decline in prevalence over the past years, iron deficiency remains a common cause of anemia in young children in the United States.

Objective:
In this study, we will utilize a self (parent) administered questionnaire to identify children at risk for severe iron deficiency anemia. Our initial retrospective pilot study will be to determine the validity of this questionnaire and query the medical records of already identified patients with iron deficiency anemia.

Methods:
A review of the medical records of patients seen by the Hematology service at Children's Hospital and Research Center will be conducted to identify patients with iron deficiency anemia. Children with iron deficiency anemia (IDA) have been identified with severe IDA if their hemoglobin is < 7.0 grams/dl or mild IDA with a hemoglobin <10.0 grams/dl, with iron studies confirming iron deficiency. We will query the medical records of the identified patients using our dietary questionnaire.

Anticipated Outcomes:
We hope that a high score on the questionnaire will be associated with a higher risk for severe iron deficiency anemia, proving the effectiveness of the questionnaire. If >75% of patients with severe IDA achieved a high score, then we will consider that the questionnaire is suitable for prospective validation.

Acknowledgements:
I would like to thank Dr. Mary Lesser and Vicki Pan.

Keywords:
Iron Deficiency Anemia, Over Consumption of Milk, Dietary Questionnaire

Miriam Mendoza-Orozco

I am an upcoming fourth-year student majoring in Integrative Biology at the University of California, Berkeley. In the future I intend on attending a medical school with an MD-MPH program. I have been further encouraged to pursue my goals through the experience that CHORI. has provided me. I am grateful for CHORI, for my mentor Alka Kanaya, MD and for the rest of the MASALA. Study research team. This experince has opened my eyes to both the medical and research field.

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Alka Kanaya, MD, MAS

Contributing Authors: Alka Kanaya, MD, Feng Lin, MS, Namratha Kandula, MD, MPH, Sarah Nadimpalli RN, PhD

Title:
South Asian Immigrants' Mental Health: Is Time Since Immigration Associated with Mental Health in the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study?

Introduction:
South Asians are one of the fastest growing minority groups in the United States, but few studies have focused on South Asian immigrants' mental health.

Objective:
Determine if there is an association between years lived in the United States and mental health outcomes in South Asian immigrants; and whether this association differs between men and women.

Methods:
We used data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study, a cohort of South Asians from the San Francisco Bay Area and the greater Chicago area. We conducted a cross-sectional analysis to determine the association between years in the U.S. and mental health outcomes. We used logistic and linear regression models to examine three mental health outcomes: depression (Center for Epidemiologic Studies Depression Scale (CES-D)), anxiety (Spielberger Trait Anxiety Scale), and anger (Spielberger Trait Anger Scale). Final models were adjusted for age, sex, education, income, smoking, alcohol intake, exercise, diabetes, hypertension, psychiatric medication use, perceived discrimination and social support.

Results:
Of the 887 immigrants in the MASALA Study (46% women), the mean age was 56±9 years and the mean years in the U.S. was 27±11 years. The median CES-D score was 6 (interquartile range, 3-11), anxiety score was 16.1 ± 4.4, and anger score was 16.0 ± 3.9. Women had significantly higher CES-D (7.0 in women vs. 6.0 in men, p=0.03) and anxiety (16.4±4.3 in women vs. 15.8±4.5 in men, p=0.004) scores. The relationship between years in the U.S. and each of the outcomes is shown in the figures below. Among women, there was a positive trend for those who lived ≥20 years in the U.S. with higher CES-D scores after adjusting for the confounders (ß =0.16, p=0.13). We also observed a trend towards significance between years in the U.S. and anxiety score (ß=0.03, p=0.06) after full adjustment among all immigrants.

Conclusion:
We found some evidence for higher depressive scores among South Asian women with longer time since immigration, and higher anxiety scores among all immigrants. Healthcare providers should be aware of changing mental health concerns among immigrant populations.

Acknowledgements:
NIH, CHORI, MASALA Study

Keywords:
South Asian, immigrant health, mental health, MASALA Study, length of residence

Figures: The association between time in the U.S. and each mental health outcome.

Janille Miranda

My name is Janille Miranda and I am a new grad, from St. Mary's College of California. I majored in Biology. Over my years spending time in bio classes and labs, I learned about the human body, as well as the chemical and metabolic pathways that occur within it. In the start of my senior of college I started volunteering at Alta Bates Summit Medical Center in Oakland, CA. Volunteering at a hospital made me want to explore health and clinical science before I decided on a specific career path. I was surprised and excited when I was offered to conduct clinical research with Dr. Peters at UCSF. Clinical research directly brings the basic science research and applies it to patients, whether by doing a cohort study, or clinical trails. I am doing a retrospective study, which aims to find out more about the prevalence of metabolic syndrome in chronic Hepatitis B patients, and if the co-existence of these two conditions worsens liver disease in patients. I want to thank Dr. Peters and Dr. Clarke for sharing their wisdom with me and exposing me to a physician's career and life, as well as the CHORI staff for being amazing in all that they do for underrepresented students such as myself. I have found a passion in clinical research, and I hope to conduct clinical research in the future.

Funded by: National Institutes of Health

School: Saint Mary's College of California

Mentor: Marion Peters, MD

Contributing Authors: Marion Peters, MD, William Clarke, MD

Title:
Metabolic Syndrome in Chronic Hepatitis B Patients and its Association with Steatosis in the Liver

Introduction:
Hepatitis B is a viral disease characterized by inflammation of the liver. Chronic Hep B is known to lead to cirrhosis (scarring), and liver cancer. Hep B is highly prevalent among Asian Americans. It's been shown that steatosis (fat) in the liver of Hep C patients leads to worse liver disease, but this isn't known in Hep B. Metabolic syndrome (MS) occurs with three of the five characteristics: High blood pressure, high cholesterol, high triglycerides, obesity, and high fasting glucose. MS may cause non-alcoholic fatty liver disease (NAFLD), and steatosis in the liver. MS has a prevalence of 35% in U.S. adults.

Objectives:
To find how many patients with Hep B in our study sample have MS, and to find how many patients with Hep B have steatosis in their liver and if it is associated with MS.

Methods:
A retrospective study was conducted using data from chronic hepatitis B patients seen by a UCSF hepatologist between 2008 and January 2015. APeX, the EMR system for UCSF was used to collect patient data which were demographics, Hep B viral measurements, abdominal ultrasound reports for steatosis, Hep B/MS medications, as well as the following lab results: Elevated blood glucose (Fasting glucose>130mg), elevated blood pressure (>140/90 mmHg), Reduced high density lipoprotein (men/women <40/50 mg/dL), elevated triglycerides (>150 mg/dl), and obesity (BMI>25/23). If three or more of the above were apparent, it was noted that patient has MS. The sample size of our study was 321 patients.

Anticipated Outcomes:
We anticipate that Hep B patients will have a lower prevalence of metabolic syndrome when compared to the overall prevalence of metabolic syndrome in the U.S. We also anticipate that Hep B patients with MS will show high steatosis in the liver and more than those without MS. Further, Asian patients will exhibit MS at lower BMIs, than White/Caucasians.

Acknowledgements:
NIH foundation, UCSF GI Division

Keywords:
Hepatitis B, Metabolic Syndrome, Steatosis

Kelly Nguyen

I am a first-generation college student, meaning that my brother and I are the first generation of students from our family to attend college. I was born and raised in West Oakland in a Vietnamese household. In high school I interned at Children's Hospital for two and a half years, was a Peer Health Educator in Oakland and Berkeley, and volunteered at Kaiser. With these interests, I chose to attend San Diego State to pursue a degree in Public Health. I will begin my 2nd year in the College of Health & Human Services and the Weber Honors College for my Interdisciplinary Studies minor and will explore research opportunities with Dr. Hovell and Dr. Arredondo upon my return to San Diego.

Funded by: National Institutes of Health

School: California State University, San Diego

Mentor: Christine Shudel, MSW & Mindy Benson, PNP

Title:
Effectiveness of Help Desks in Primary Care Settings

Introduction:
The Family Information & Navigation Desk's (FIND) aim is to provide a holistic health care visit by screening patients and their families for social concerns that may impact the household's health and to improve the health disparities. Navigators provide assistance with basic concrete social needs and then follow patients/families over time to see if those needs are resolved.

Hypothesis:
Of those enrolled in the FIND study, those who received the intervention were more likely to report that their initial problems were met compared to control at the 6 week follow-up.

Methods:
Responses from two questions were analyzed: "Today is …" and "When you met with the person at FIND, you identified _____ as your most important concern. Right now, is this still a problem for you?". Two hundred forty seven participants reported answers to the questions during baseline and 6 week follow up. Participants who did not provide responses to the specified survey questions were omitted from the analysis. The data was coded as follows: (Today is … 1 = 211 Day, 2 = Intervention Day ; When you met … 1 = Not a problem, 2 = Slight problem, 3 = Moderate problem, 4 = Remains a problem). Statistical software was used to perform an independent t-test to determine if there was a difference between initial problems being met between the control and intervention group.

Results:
$t(270)$, $p = 0.052474$, although the p-value was not less than 0.05, the p-value suggests a trend towards significance.

Conclusion:
Of those enrolled in the FIND study, those who received the intervention were not more likely to report that their initial problems were met compared to control at the 6 week follow-up. Given a larger sample size, it is likely that a significant result would have been found.

Acknowledgements:
Thank you to FIND Navigators for collecting data for this study. Particular thanks to Suhani Chhatrapati for data collection assistance and Kate Mallula for data analysis instruction.

Keywords:
help desks, social determinants of health, social concerns

Leyna Nguyen

My name is Leyna Nguyen and I will be entering my sophomore year at UC Berkeley in the Fall. Growing up in an immigrant family has made me conscious of the health issues and lack of resources that they, and my family living in Vietnam, have faced. Their experiences have shaped my interests in global health and reducing health disparities. Being given the opportunity to work in clinical nutrition and the CHORI lab this summer has reinforced both my desire to pursue a degree in Public Health and my future goal of going to nursing school. I would like to thank my mentors, Dr. Mary Lesser and Dr. Ellen Fung, for sharing their time with me and for providing me with unending guidance and support!

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Mary Lesser, PhD, RD

Title:
Calcium Absorption in Pregnancy Among Women of Different Ethnicities

Introduction:
The recommendation for calcium has remained at 1000 mg per day, for both pregnant and non-pregnant women, since 1997. Women who begin and continue through pregnancy with calcium intake meeting the DRI may not need additional calcium, but women who have suboptimal intakes may need more than the DRI to meet the needs of both the mother and developing baby. If calcium intake is inadequate, mothers may be at higher risk for gestational or long-term complications. By comparing calcium intake, excretion, and markers of bone resorption in ethnically diverse women, we will be able to investigate whether different dietary patterns of calcium cause subsequent differences in bone health. The results from our study will help determine if there is a need for recommending a different, possibly higher level of calcium intake during pregnancy.

Objective or Hypothesis:
To evaluate the differences in calcium intake, absorption, excretion, and bone resorption between African, Asian, Caucasian, and Hispanic women during late pregnancy.

Methods:
Twenty African, Asian, Hispanic, and Caucasian pregnant women, between 30-36 weeks gestation, will be enrolled. Each participant will complete a calcium FFQ. Participants will have their blood drawn twice and their urine collected over a 24-hour period. Baseline calcium intake, determined from the FFQ, will be compared to calcium excretion and bone resorption. Calcium excretion will be measured utilizing ICP and the bone marker of resorption, CTx, will be measured utilizing an ELISA.

Anticipated Outcomes:
Based on traditional eating patterns of each ethnic group, I anticipate that African, Asian, and Hispanic participants will have lower calcium intakes than the Caucasian participants and, in turn, will likely have higher rates of calcium absorption, lower excretion, and higher measured levels of resorption.

Conclusion:
If a difference in calcium intake, excretion, or bone resorption is observed, there may be a need for additional calcium requirements, above the DRI, for women during pregnancy.

Acknowledgements:
Drs. Lesser and Fung, PCRC Staff, King Lab, Participants

Keywords:
calcium, pregnancy, absorption, excretion, resorption

Danielle Odeh-Ajero

My name is Danielle Odeh-Ajero and I am fortunate to be back at CHORI and the Watson Lab for a second year as part of the Summer Research Program. Returning to the program has been a wonderful learning experience as I worked on a more in-depth project on Smith-Lemli-Opitz Syndrome. As a nursing student it has been interesting to work in laboratory setting rather than a clinical setting, and to be involved in medical research. I hope to carry the knowledge gained here at CHORI with me through my undergraduate and graduate studies, and beyond to my nursing career. I would like to thank everyone in the Watson Lab for your patience and help these past couple of months. A special thanks to Gordon Watson for being a very insightful and supportive mentor and to Saloni Pasta for her detailed explanations and guidance. It has truly been a pleasure working with everyone at CHORI.

Funded by: National Institutes of Health

School: California State University, East Bay

Mentor: Gordon Watson, PhD

Contributing Authors: Saloni Pasta, Gordon Watson

Title:
Gene Therapy using AAV9-DHCR7 in a Mouse Model for Smith-Lemli-Opitz Syndrome (SLOS)

Introduction:
SLOS is a congenital autosomal-recessive disorder caused by mutations in 7-dehydrocholesterol reductase (DHCR7) leading to cholesterol (C) deficiency and accumulation of its precursor 7-dehydrocholestrol (7DHC). Cholesterol is an essential structural and functional component of cells. Individuals with SLOS show delayed growth, development, cognitive impairments, and behavioral characteristics of autism. Current treatment through dietary cholesterol has marginal effects, especially in the brain due to the blood brain barrier (BBB). Gene therapy with an adeno-associated viral vector 9 (AAV9) that can cross the BBB, or fetal treatment before the BBB has formed may serve as a more effective treatment.

Objective:
This project addresses the use of gene therapy, particularly in the central nervous system (CNS), to improve the biochemical effects (ratio of 7DHC/C) and physiological effects (growth rate) in a SLOS mouse model.

Methods:
Mice carrying two different mutations in the DHCR7 gene were crossbred to yield the /T93M genotype, which represents the most severe, yet viable phenotype. Newborn and juvenile D/T93M mice were separated into two groups; half were injected with AAV9 and the rest with PBS as controls. Prior to injection and once a week after, mice were weighed to calculate growth rate. Four weeks post-injection, mice were euthanized and tissues harvested for sterol analysis by GC/MS. Previously injected 14-day old fetuses were analyzed 4 weeks post-birth.

Results and Conclusion:
Injections of sufficient numbers of newborn and juvenile mice are still ongoing, as survival rates of the /T93M pups have been challenging. A possible explanation is that the severity of SLOS among the mice is high enough that they are dying in utero, or shortly after birth. Random fluctuations in mice model populations are also common, and may be the cause of the decreased number of /T93M mice. Currently, five juvenile mice have been injected with either AAV9 or PBS and are in the four-week incubation period. We anticipate injecting eight mice from each group. Tissues from mice that were treated as fetuses are currently being analyzed. We anticipate that treated mice will have better biochemical and physical outcomes than untreated mice. If so, these findings may lead to better treatment options for patients with SLOS.

Keywords:
Smith-Lemli-Opitz Syndrome, gene therapy, AAV9, blood-brain-barrier, central nervous system

Lorena Ortega-Guerrero

The world is full of unanswered questions. This summer I had that chance to discover the answers to some myself. I have always loved science because it allows me to better understand the world around me. For as long as I can remember I have wanted to join the medical field because it would allow me to fulfill my passion for science as well as for helping others. Despite my challenges and limitations placed by my community and family finances, I have worked hard to get my questions answered and dreams reached. Spending the summer doing research in the Oda Lab was something that I never imagined would be possible. I found myself learning about a side of science I had never known and exploring questions that were still unanswered. I was in awe with all I was learning and still had to learn. It was an incredibly rewarding experience that answered many questions including some that I had about myself. I learned that I really do want a career in which I will make a difference in this world such as all the doctors, researchers, and nurses that I greatly admire. I am ready to begin my senior year at Holy Names High School with a new determination and tools I acquired this summer to reach my goals. I am eternally grateful.

Funded by: Doris Duke Charitable Foundation

School: Holy Names High School

Mentor: Michael Oda, PhD

Title:
The Effect of HDL Particle Size on HDL-ApoA-I Exchange Efficiency

Introduction:

High-density lipoprotein (HDL) promotes the efflux of cholesterol from cells, a process thought to be important in the prevention of cardiovascular disease. HDL is highly heterogeneous, with particles exhibiting a range of sizes and densities. Human HDL can be separated by ultracentrifugation into two main subfractions on the basis of density, HDL2 and HDL3, which can be further divided upon non-denaturing gradient gel electrophoresis (NDGGE) in decreasing order of particle diameter. Despite differences in size, the functional status of nearly all HDL is closely linked to its primary protein component, apolipoprotein A-I (ApoA-I). A method has been developed using electron paramagnetic resonance spectroscopy (EPR) to quantify HDL-apoA-I exchange (HAE), which is a critical process in reverse cholesterol transport, allowing HDL to transition to different sizes to accept cholesterol and phospholipids. It has been observed that HAE is markedly reduced when atherosclerosis is present and studies suggest that HAE is a clinically relevant measure of HDL function pertinent to cardiovascular disease. Thus, understanding the role of HDL particle size will help determine potential important factors that promote and/or inhibit HAE in human samples.

Objective:
To determine exchange rates of HDL particles by size, using both reconstituted HDL (rHDL) and human HDL particles.

Methods:
Reconstituted HDL was synthesized and then isolated into five distinct sizes using size exclusion chromatography. Human HDL particles were separated by subclass using sequential ultracentrifugation methods. EPR was used to analyze rHDL and human HDL particles to determine rates of exchange among the different sizes. Assays were performed using a constant apoA-I concentration to eliminate potential differences due to varying protein concentrations. The HDL-apoA-I exchange assay was performed by adding spin-labeled, lipid-free apoA-I to purified HDL samples, and measuring the change in the intensity of the sample peak versus an internal standard peak in the EPR spectrum. HDL particle exchange was also evaluated by adding fluorescently labeled lipid-free apoA-I to HDL particles and evaluating to which subclasses of HDL the fluorescent apoA-I preferentially exchanges using NDGGE.

Results: Our preliminary experiments show that larger rHDL sizes were more efficient in exchanging HDL and ApoA-I. It is anticipated that the human HDL will produce the same outcome and that larger HDL subclasses will more readily exchange apoA-I. Experiments with fluorescent apoA-I are forthcoming.

Acknowledgments:
I would like to thank Mark Borja, Michael Oda,PhD and Kit Ng for their guidance.

Key Words:
HDL (High Density Lipoprotein), ApoA-I(Apolipoprotein A-I), HDL subclasses

Melinda Perez

My name is Melinda Perez. I will be entering as a third year at UC Berkeley in the fall. As an Integrative Biology and Biological Anthropology major, I believe I am attaining skills and the passion to ultimately become a Pediatrician. Coming from both an underrepresented, low-income community and a Student Parent at Cal, I am focused on the health disparities within these communities especially around those of children growing up in a poorly nutritional environment. In addition to my academic years at Cal, I have gained experience in the biomedical field through volunteering at the Oakland Children's Hospital, but having the pleasure of working at CHORI this summer has fueled my passion for a Medical Degree even further. CHORI provided me a primary foundation of research skills to not only provide a service in clinical prevention, but research knowledge to learn deeper, both genetically and socially, how such disparities come into our world. I would like to thank my mentor, Steve Mack and coordinator, Chandra Wright for allowing me the space and consideration of this amazing summer experience, without which I thought I would never attain.

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Steve Mack, PhD

Title:
Automated Updating of the Common and Well-Documented HLA Alleles Catalogue

Introduction:
The IMGT/HLA Database, the repository for HLA allele sequence and nomenclature information, is updated every 3 months and includes new and extended allele names and associated new and revised nucleotide sequences; the current database includes 13,412 alleles. The common and well-documented (CWD) catalogue identifies HLA alleles that have been reported in many studies, and identifies an HLA alleles of known-frequency as being "common"(C), and alleles observed in at least three occurrences in unrelated individuals "well documented"(WD). Currently, 1122 CWD alleles are known.

Objective:
Regularly update the CWD catalogue of HLA alleles (current version 2.0.0), G-groups and P-groups (subsets of HLA alleles that share identical nucleotide (G) or peptide (P) sequences in key regions of the gene or protein) in concert with updates to the IMGT/HLA Database in a completely automated manner.

Methods:
Create a java application to update current and future CWD catalogues as each IMGT/HLA Database release occurs. Each update will depend on four reference datasets (the current list of CWD alleles, the hla_ambigs.xml file, the Allellelist_history.txt file, and the hla_nom_p.txt file) obtained over the internet; a list of pre-determined IMGT/HLA Database to CWD Catalogue version correspondences will be included with the software. The software will generate updated CWD allele, G-group and P-group tables, including source-file, date stamp and versioning documentation.

Anticipated Outcomes:
The data required for are exist in multiple files, which may include errors or idiosyncrasies that confound automation. However, these are maintained by responsive and tractable collaborators, and such errors can be addressed. We anticipate developing both command-line and GUI versions of the CWDUpdate program.

Conclusion:
The CWD catalogue is a community data resource essential to rapid and accurate matching of bone-marrow and kidney transplant patients and potential donors. Regular updates to this catalogue will facilitate patient-donor matching and accelerate the immunogenetic and immunogenomic research.

Keywords:
HLA, Nomenclature, CWD, IMGT/HLA, transplants, G-group, P-group, Java

Isamara Ramirez-Mendez

My name is Isamara Ramirez Mendez, and I will be graduating from Gonzaga University in spring 2016 with a major in Biology and minor in Spanish. This summer thanks to CHORI, I had the privilege in researching human papillomavirus (HPV) at Dr. Palefsky's lab. Aside from practicing laboratory techniques, I also learned many life lessons such as; there are many paths one can take to fulfill their dreams, and asking questions is an essential component for discovery and life. Being part of this research, allowed me to clarify the passion I have for helping people, specifically women. As a future OB/GYN, I want to ensure the health and protection of future mothers who work hard to give their children a better life, just like my mother.

Funded by: National Institutes of Health

School: Gonzaga University

Mentor: Joel Palefsky, MD, MS

Title:
AKC2 a Cell Model for Anal HPV-associated High Grade Dysplasia

Introduction:
Human papillomavirus (HPV) is a common sexually transmitted infection that can lead to a variety of epithelial cancers (e.g. anal, cervical and oral). According to the HPV and Anal Cancer Foundation, about 95% of anal cancers are associated with HPV, 70% with high-risk HPV type 16. The expression of HPV-16 oncogenes (E5, E6 and E7) contributes to the development of cancer, however little is known about the precise role of these oncogenes during cancer progression. To study the effect of HPV oncogene expression on anal cancer progression we are using a HPV-16 positive anal epithelial cell line (AKC2). AKC2 are anal keratinocytes that have been transfected with the whole 8kb HPV-16 genome, and serve as an in vitro cell model that mimics anal high-grade squamous intraepithelial lesions, the pre-cursor stage to anal cancer.

Hypothesis:
The expression of HPV-16 oncogenes in AKC2 cells will lead to a higher cellular proliferation. Decreased expression of HPV-16 E5 oncogene will lead to a decrease in proliferation.

Methods:
We cultured AKC2 cells, using optimal conditions for cell growth. To measure HPV oncogene expression, we extracted total RNA from AKC2 cells using standard procedures. To detect the presence of HPV-16 oncogenes, we first converted the RNA to cDNA using reverse transcription. We amplified the individual HPV-16 oncogenes by q-PCR using primers specific for each oncogene. We analyzed q-PCR results using SDS software. To visualize the gene expression product we used agarose gel electrophoresis. These results were compared to a negative control (i.e. HPV-negative cell line). To test the effect of the HPV-16 E5 oncogene on AKC2 growth, we reduced the expression of HPV-16 E5 by transfecting AKC2 with E5-specific siRNAs, and compared proliferation levels between E5 siRNA-transfected and control-siRNA transfected cells.

Results:
We found higher E5 expression levels compared with E6 and E7 in AKC2 cells. We anticipate that decreased expression of E5 in AKC2 will lead to a decrease in AKC2 cellular proliferation.

Acknowledgments:
UCSF, Priyanka Kulkarni, PhD, Erin Isaacson Wechsler, PhD, Joel Palefsky, MD, MS

Keywords:
Human papillomavirus (HPV); HPV-16, oncogenes (i.e. E5, E6 and E7), anal keratinocytes, high-grade lesion

Gonzalo Reyes

I have always been fascinated with science as a kid, and growing up I knew I wanted to pursue a career in the field of biology or medicine. This fall I will be transferring to UC Davis as a third year biology major. I have taken courses such as Biotechnology and Microbiology but I could not envision myself working in a lab setting as I was always drawn to working out in the field. However, I am glad I exposed myself to biomedical research here at CHORI because I have discovered exciting new opportunities and met many amazing people during my time here. I want to thank the CHORI program and all of the staff involved for ensuring opportunities like this remain open for a diverse range of students interested in the STEM field.

Funded by: National Institutes of Health

School: University of California, Davis

Mentor: David Killilea

Contributing Authors:
Darryl J. Chow, B.A.

Title:
Flame Retardant Chemicals and Their Toxicity in Human Cells

Introduction:
Flame retardants are a diverse group of chemicals utilized for the purpose of preventing manufactured materials from catching on fire or blocking the spread of fires. California's Technical Bulletin 117 is a flammability standard requiring furniture to be able to withstand exposure to a small flame for a certain period of time without igniting. Flame retardants are used to meet this standard. However, long-term exposure to toxic flame retardant chemicals found in clothing, furniture, plastics, and other sources may cause health problems including abnormal fetal development, altered thyroid function, certain cancers, and neurodegeneration. Unfortunately, there is little research on the consequence of short-term exposures of these compounds at the cellular level.

Hypothesis:
Exposure to toxic flame retardant chemicals found in clothing, furniture, plastics, and other sources will cause toxicity to human cells, which can be prevented by protective compounds like antioxidants.

Methods:
Trypan Blue Assay for Cell Viability: Using a simple counter, we will record the number or viable (transparent) and non-viable (stained blue) cells. This will allow us to ascertain the effects certain flame retardant chemicals have on the human cells, and ultimately provide us with significant data to decide whether or not the flame retardant chemical(s) introduced during cell growth led to their death or not.

CellTiter-Blue Cell Viability Assay:
Viable cells have the ability to metabolically convert Resazurin, a redox dye, into a fluorescent end product, Resorufin. Non-viable cells lose their metabolic abilities and therefore cannot convert the redox dye into the fluorescent end product. The cells are examined using a plate-reading fluorometer or a spectrophotometer.

Annexin Apoptosis Assay:
This particular method marks cells with the protein Annexin A5, which binds to cells undergoing apoptosis. This biomarker placed on apoptopic cells can then be read using flow cytometry to give us an idea of how many cells are undergoing apoptosis due to the flame retardant chemicals.

Anticipated Outcomes:
We anticipate increased concentrations of toxic flame retardants would lead to increased cell death, as would longer incubation periods of cells exposed to the drug. We expect the use of antioxidants to potentially counteract or prevent the effects of cell toxicity. We expect the mechanism of death will be apoptosis.

Acknowledgements:
Darryl Chow, BA
Janet C. King, PhD

Yessenia Reyna

My name is Yessenia Reyna, and I am an upcoming sophomore at UC San Diego currently majoring in Psychology with the intent to minor in Biology. I have been interested in the medical field my entire life. Unfortinatley, I have never had the opportunity to experience several aspects of what this field entails. However, CHORI has changed that. This program has allowed me to learn and experience different aspects of clinical research and just how closely that research impacts the daily care of patients. This program is rare in the fact that it allows students to truly immerse themselves in the medical research field and I am truly honored to have been chosen to experience this. I know none of this would be possible if not for the wonderful coordinators of this program so I would like to thank you all. I would also like to thank my mentor Dr. James Feusner for taking the time to counsel me and help guide my path in practicing medicine.

Funded by: National Institutes of Health

School: Univeristy of California, San Diego

Mentor: James Feusner, MD

Title:
Echocardiograms in Oncology Patients Treated with Cardio-toxic Therapy

Introduction:
ECHOS are frequently used in children with several kinds of malignancies who receive chemotherapy that can adversely affect heart function. However, the efficiency of this practice is unclear when applied to patients who are without symptoms of cardiac dysfunction, especially those patients who are off therapy in long-term follow up.

Hypothesis:
Less than 5% of ECHOS obtained in asymptomatic patients during and after treatment with cardio-toxic agents (chemotherapy or radiation) will lead to a change in the care plan for these patients.

Methods:
Data will be gathered on CHRCO oncology patients receiving cardio-toxic agents for treatment of leukemia or solid tumors (excluding brain tumor patients) diagnosed from 2006 through 2014. We will then correlate abnormal ECHOS with seven characteristics of those affected patients:

1. Hgb at time of Echocardiogram
2. Signs/symptoms of ongoing processes that could affect cardiac function (such as sepsis)
3. Timing of ECHO with last dose of cardio-toxic agent,
4. Total amount of cardio-toxic agent received to that point in the patient's course
5. Any symptoms that could be cardiac in origin
6. Duration of time since diagnosis
7. Modifications of their therapy such as holding treatment until recovery of cardiac function. Finally, we will calculate the total number of ECHOs it takes to find one sufficiently abnormal reading to lead to a change in the patient's treatment and health plan.

Anticipated Outcomes:
Our anticipated outcome is that there will be very few (<5%) patients who have abnormal echocardiogram readings, and even fewer in whom there was no clinical indication of some cardiac problem at the time of their abnormal ECHO. These findings thus would very rarely lead to a change in the patients' treatment plan.

Conclusion:
Results could determine either our current practice of ECHO testing in this patient population is warranted, both in terms of efficiency of detecting true positive results and in terms of time and cost of effectiveness.

Acknowledgements:
Kishor Avasarala, MD

Keywords:
Echocardiograms, Cardiotoxicity, Chemotherapy, Pediatrics

Jorge Ruiz

I graduated from Life Academy of Health and Bioscience which is a school that focuses on health and science related careers. I had attended the CHAMPS program which was here in Children's Hospital and I am glad to now do research at the CHORI research facility. Before science I was always curious about the world, then when I learned about cell biology in 7th grade life science I was on straight path towards a career in science. I have two older sister with disabilities and helping the family was what got me into health careers. I took a medical assisting course at my high school along with the CHAMPS program gave me more interest in a health profession. Research is something I still want to pursue and I am so honoured to be working in lipid research in the Ryan Lab. Learning about proteins and lipids was something new to me since I was interested in genetics. I was not only glad to be exposed to science beyond my interest, but to work with an incredible group of people who care about my success. I will be going to Sonoma State University as Undeclared, but considering Biochemistry as my major. I hope to pursue a career that merges health and research so that I can innovate ways to create a healthier community, such as what I have been learning in the Ryan Lab.

Funded by: California Institute for Regenerative Medicine

School: Life Academy of Health and Bioscience

Mentor: Bob Ryan, PhD

Title:
Effect of Fumagillin Nanodisk on Myeloid Progenitor Cells

Introduction:
In cells Methionine Amino Peptidase (Met AP) can cleave the N- terminal methionine attached to newly synthesized proteins. A drug that inhibits this process is known as fumagillin, which in cells could result in consequences in biological processes. The role of Met AP in mitogenic activity is still unknown. We will use Apolipoprotein (Apo) A1 along with phosphatidylcholine (PC) to create product particles, which are termed nanodisks (ND). Nanodisks will be formulated in the presence of fumagillin promoting its stable incorporation into the product particle. Observing the effects fumagillin ND on myeloid progenitor cell (HL60) will reveal if inhibition of Met AP affects progenitor cell proliferation.

Objective:
Our objective is to use fumagillin, which is insoluble in water, and incorporate it into nanodisks so that it may be soluble in an aqueous solution or environment. Fumagillin nanodisks and control nanodisks will be incubated with HL60 myeloid progenitor cells to determine its effects on cell proliferation. The results will reveal if inhibition of methionine amino peptidase activity alters the fate of these progenitor cells.

Methods:
1. Use recombinant protein expression system to produce Apo A1 protein. Perform SDS-PAGE to ensure we produced the correct protein, (Apo A1 is approximately 28 kDa).
2. Characterize fumagillin using a Spectrophotometer to find the absorbance properties at 341 nanometers.
3. Create Fumagillin ND at a ratio of 2.5 (PC) to 1 (Apo A1) and a control set of empty ND with no fumagillin.
4. Add fumagillin ND at various concentrations to HL60 cell cultures as well as control ND. Perform a MTT assay to measure cell viability of the HL 60 cells.

Anticipated Outcomes:
Successfully creating fumagillin nanodisks to use. Because of fumagillins properties as an inhibitor of MET AP, we will anticipate to see profound consequences on biological processes in the HL60 cell culture.

Acknowledgements:
Jennifer Beckstead, Aparna Krishnamoorthy, Nick Ikon, Robert Ryan

Keywords:
Apolipoprotein, Lipid, Fumagillin, nanodisk, myeloid progenitor cells (HL60), mitogenic

Brittany Russell

My name is Brittany Russell and I will be a senior at Xavier University of Louisiana in New Orleans. I major in Biology Pre-med, and I am pursuing medical school in hopes of becoming a general pediatrician. During my yearly studies, I volunteer in the Neonatal Intensive Care Unit of Ochsner Medical Center in New Orleans and at the Royal Castle Kids Daycare Center. Both of these experiences have fueled my desire to become a pediatrician, and taught me a lot about who I am and the path I want to take. Present experiences with nurses and family has also facilitated my interests in preventative medicine. Listening to my mother, a registered nurse, talk about the "in's and out's" of nursing and the medical sphere, I know that prevention is essential, and I would like to make my impact on the future, children. The CHORI Summer Program has been a great experience and I am so very thankful for the opportunity. I am grateful for the chance to gain a better understanding of the research process and the minds of researchers. I want to thank my mentor, Dr. Marisa W. Medina, and amazing lab members, Dr. Mee J. Kim, Dr. Andrea Dose, and Devesh Naidoo for being so patient, understanding, and supportive in various ways. Additionally, I would like to give a big thanks to my mom, my family, and a group of amazing, hard-working travel nurses, because they have all offered me so much love and support throughout my journey to success. My time at CHORI in the Medina lab has been wonderful, and I am truly grateful for this summer and the connections I have made.

Funded by: National Institutes of Health

School: University of Louisina

Mentor: Marisa Wong Medina, PhD

Title:
The Effects of TMEM55B on AKT in Insulin Signaling

Introduction:
The insulin signaling pathway is an essential part of human metabolism. Disruption of this pathway can lead to metabolic disorders, such as type II diabetes. Normal insulin signaling is mediated by conversion of phosphatidylinositol-4,5-bisphosphate (PIP2) into phosphatidylinositol-3,4,5-triphosphate (PIP3), which leads to phosphorylation and activation of AKT. Transmembrane protein 55B (TMEM55B) is a phosphatase that converts PIP2 into phosphatidylinositol-5-phosphate (PI5P). Others have reported that overexpression of the bacterial ortholog of TMEM55B, as well as incubation of PI5P, alters insulin signaling by stimulating phosphorylation of Akt. Although we recently reported that TMEM55B is a novel lipid-regulatory gene, to date the potential effect of TMEM55B on insulin signal transduction has not been reported.

Objective:
To test the effect of TMEM55B knockdown on insulin-induced AKT activation in a human hepatoma cell line.

Methods:
HepG2 cells (a human hepatoma cell line) were cultured under standard conditions and reverse transfected with one of two siRNAs that target TMEM55B (T1 or T2) or a non-targeting control (NTC). After 24 hours, cells were serum starved overnight and subsequently incubated with or without 100nM insulin (n=6 replicates per condition). Cellular proteins were extracted, and total protein concentration was measured using the Bradford assay. Total AKT, pAKT (Threonine 308), pAKT (Serine 473), and GAPDH (housekeeping protein) were probed by Western blot. Band intensity was visualized by chemiluminescence and quantified by Image J. Total and pAKT levels for each treatment condition were compared to detect changes in the degree of AKT expression levels and phosphorylation. In addition, RNA was extracted from a subset of cells, and TMEM55B transcript levels were quantified by qPCR to assess the degree of TMEM55B knockdown.

Expected Outcome:
We expect that insulin treatment will increase levels of pAKT compared to non-insulin treated samples, but that this effect will be attenuated by TMEM55B knockdown.

Acknowledgments:
Marisa W. Medina, PhD, Mee J. Kim, PhD, Andréa Dosé, PhD, Devesh Naidoo, Children's Hospital Oakland Research Institute, National Institutes of Health

Keywords:
lipid metabolism, insulin signaling pathway, liver

Michael Sharp

My grandmother and my mom left Vietnam and came to the US in 1982, leaving everything that she knew behind to seek a better life for our family. I was born in CA and have been fortunate to enjoy some of the opportunities she was hoping that our family would have. As a young child, my grandmother played an active role in taking care of me. In 2011, when I was a community college student at Diablo Valley College, my grandmother was diagnosed with lung cancer. I took it upon myself to try to help her navigate the health care system. I accompanied her to doctor's visits and served as her interpreter. I got a first-hand glimpse of the challenges that patients that don't speak English or come from different cultural backgrounds face when trying to access medical care. I had the privilege to assist my grandmother as she battled her lung cancer, helping her with activities of daily living such as meals and bathing. I was with her as these activities became increasingly difficult. Just as she took care of me when I was younger, I had the opportunity to take care of her as she became more frail and the cancer progressed. I was struck by how her illness impacted not only her, but her entire network. When I had the opportunity to transfer to UC Berkeley, I decided to pursue a degree in public health. The experiences of family members made me passionate about health and human rights. I am a firm believer that everyone has a right to high quality health care. Through clinical research, I hope to help develop innovations in health care that can improve the lives of many and to work towards policies that ensure access to care for all. Before my grandmother passed away in 2012, I decided that I would pursue a path in medicine in honor of her. I aspire to become a physician that will serve people from linguistically and socioeconomically undeserved communities and do my part to reduce the health disparities I witnessed growing up.

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Lela Bachrach, MD

Contributing Authors: Lela Bachrach, MD, Michael Sharp, Leah Cha

Title:
Finding Workplace Learning Win Wins: Student Scribe Study

Introduction:
The increasing adoption of electronic health records (EHR) in the health care system brings new challenges and opportunities. Many health professionals may find it daunting to try to communicate effectively with patients while typing data into the computer at the same time. The added time burden of inefficient computer workflows can potentially decrease job satisfaction and productivity. Studies have shown that EHR scribes, which are individuals that enter information into the EHR during the patient visit can potentially help increase physician productivity and improve the physician patient interaction. There is also evidence that health coaches, individuals that support and educate patients about healthy lifestyle changes, can be effective in improving patient health outcomes.

Objective:
To determine if pre-clerkship medical students can meet educational objectives through EHR scribe training or health coaching while making meaningful contributions to the health care team and improving patient care.

Methods:
A survey will be administered to patients before the actual study begins to determine patient attitudes towards having a scribe or health coach in the room during their visit.

Anticipated Outcomes:
Patients will be open to having a scribe or health coach during their visit. Medical students will be able to serve as scribes or health coaches as a way of meeting their educational objectives.

Suggested Conclusions:
Medical students will find it educational to serve as scribes or health coaches while helping the health care team and improving patient care. For the preparatory patient attitude survey over the summer, it is anticipated that patients and families will be open to having scribes in the clinic.

Acknowledgements:
Celeste Allen, MD, Sasha Narayan, Jessica Chow

Keywords:
Scribe, Electron**ic** Health Record, EHR

Casey Smith

The natural world is an ever changing mystery. I have always wondered why certain events occur, or even why certain chemicals and organisms behave the way they do. I am currently attending Encinal High School, but plan to apply to a four year college in the fall. It is my dream to go to medical school, then pursue a career in the scientific field. Driven by my curiosity, I applied for the CHORI Summer program to gain experience, explore my options for the future, as well as benefit my community. Since middle school I have been interested in neuroscience, but as the program progressed I found that there is so much more to study. I appreciate all of the assistance and guidance I have received from Dr. Ward Hagar, as well as other CHORI staff who have given me the opportunity to see how the medical and research field work.

Funded by: Doris Duke

School: Encinal High School

Mentor: Ward Hagar, MD

Title:
Relationship between Initial Hemoglobin Levels and Outcomes in Acute Chest Syndrome

Introduction:
Acute Chest Syndrome (ACS) is one of the leading causes of death in sickle cell disease patients. Whether clinical parameters at admission can predict the severe ACS (death or intubation) in those who develop ACS is unknown. Hemoglobin levels are known to reflect hemolytic rate in sickle cell disease. Hemolytic rate induces vascular inflammation. We wished to explore whether admission hemoglobin levels and inflammation predict the severity of ACS.

Hypothesis:
We hypothesize that lower hemoglobin levels at admission predict ACS severity in those patients who develop ACS during admission. We wish to further explore the role of inflammation (by WBC and platelets) in predicting severe ACS.

Methods:
Data from the multicenter study of acute chest syndrome will be abstracted for subjects from our center for admission date, date of acute chest syndrome, severity of ACS and laboratory values. Admission laboratory data, when not the same date as the onset of ACS, will be abstracted from the center data base. Other parameters that may allow modeling of factors for ACS will also be collected. If data allows, an ancillary study of pulmonary function comparing recently published ethnically based pulmonary norms will be compared to the data previously published in this cohort.

Anticipated Outcomes:
We hope to determine whether admission laboratory values can help the clinical predict which sickle cell patients will develop severe ACS. Ancillary data collected may help refine these predictions.

Acknowledgements:
Doris Duke Foundation, Ward Hagar, MD, Lynne Neumayr, MD, Elliott Vichinsky, MD, Shanda Robertson, Barbara Vania

Keywords:
Sickle Cell Disease, Severe ACS, Initial Hemoglobin, PFTs, Asthma

Jazmin Stenson

Hello I am Jazmin Stenson. I am originally from East Oakland California. I currently attend Xavier University of Louisiana, located in New Orleans, Louisiana. I am a sophomore Biochemistry major. From a very young age I have always loved science. After thinking about many different career paths I decide to pursue a career in medical research. I like to help people and by getting a job in medical research I can help people while doing what I love. I understand that to get into medical research you first must have experience. Through the CHORI summer research program I was able to get the experience and exposure I needed. Thank you to all the people that made this program possible. I am now proud to say I have gained a summer research experience. I have learned specials skill in the lab that I can keep for a life time. Special thanks to the Dean lab for having me for the summer. Though my work this summer I know I am one step closer to my dream of being a medical researcher.

Funded by: National Institutes of Health

School: Xavier University of Louisiana

Mentor: Deborah Dean, MD, PhD

Title:
Genome Gap cCosure of Chlamydia Trachomatis Reference Strains

Introduction:
Chlamydia trachomatis is a common bacterium that causes sexually transmitted infections (STI). These STIs can lead to a diverse range of health complications in humans. In order to create an effective prevention method, generating complete genomes of all C. trachomatis strains will provide opportunities for comparative genomics and discoveries of target regions for vaccine development or therapeutics.

Objective:
The aim of this project is to close the gaps in the genomes of Chlamydia trachomatis reference strains F and I.

Methods:
To perform gap closure, we must first design DNA primer pairs, one forward and one reverse, that flank each gap region. The primers are diluted to the correct concentration and used in a PCR mixture containing the template DNA and polymerase. The PCR mix will be put in the thermal cycler, with a customized temperature for each primer pair. Once the thermal cycler process is finished, an agarose gel is made, and the PCR product is loaded into the gel along with a molecular weight marker. An electrical current is applied so that electrolysis can occur. The DNA migrates through the gel. The results from the gel can be seen using UV lights where the bands of DNA shine brightly. If the PCR product is of the correct molecular weight, the DNA band will be excised from the gel and the DNA will be purified from the gel matrix. The nanogram amount of DNA per µl will be determined by nanodrop. The DNA will be Sanger sequenced.. Once sequenced, the DNA is aligned to the flanking regions of the gap to determine whether the gap can be closed.

Anticipated Outcomes:
Complete finished genomes of Chlamydia trachomatis genomes for reference strains F and I.

Acknowledgements:
CHORI, the Dean Lab

Keywords:
Chlamydia trachomatis, genomes, Polymerase Chain Reaction, Sequencing, DNA, Sanger sequencing

Tai Taliaoa Jr

I attend Wesleyan University, a liberal arts college in Middletown, CT. I am a double major in Neuroscience & Behavior and Science in Society. Originally, I came to college wanting to major in East Asian Studies and either Government or Philosophy, but as I took a variety of different classes at Wesleyan my interests for the sciences grew. I chose to major in science mainly because of the challenge it offers— I have to study a lot more to understand science than I do with the humanities, but the reward for grasping knowledge in science is very rewarding to me. After college, I would like to do volunteer service for Peace Corps or WOOFING before attending medical school.

Funded by: National Institutes of Health

School: Wesleyan Univeristy

Mentor: Shan Lin, MD

Title:
The Correlation between IOP and Vision following Cataract Surgery in Glaucoma Patients

Background:
Ophthalmologists are searching for a potential treatment to Primary Open Angle Glaucoma (POAG), a progressive eye disease that can lead to blindness if left untreated. POAG currently has no cure and the cause of it is unknown. But some ophthalmologists believe that one option could be effective for this disease—cataract surgery. Little evidence has been provided thus far to prove that cataract surgery could be an effective treatment for POAG. My research project will focus on Dr. Lin's study on determining whether or not cataract surgery could be a viable option in treating POAG patients by reducing their intraocular pressure (IOP) which is the leading risk factor for glaucoma.

Hypothesis:
A reduction in the IOP of POAG subjects following cataract surgery does help to reduce POAG progression, which can be determined through tests such as Tonometry (eye pressure test) and Humphrey Visual Field (HVF) Tests.

Methods:
POAG patients who have had cataract surgery by Dr. Lin and who agreed to participate in his study had their eyes monitored before surgery and up to a year following surgery. Several tests were conducted including: tonometry (applanation), HVF, Snellen Visual Acuity Test, and Gonioscopy. Data on these patient's eyes were inputted into an archive and organized. Changes in IOP, vision, and visual field are then observed and noted.

Anticipated Outcomes/Results:
I would expect that the POAG patients who have had cataract surgery will have a decrease in their IOP and improve or retain their vision and visual field after a year, supporting my belief that cataract surgery is an effective treatment.

Conclusion(s) (Suggested):
Although a decrease in IOP will result in reduced POAG progression after one year, the time period at which this research is conducted is not enough time to make a definitive conclusion. Longer, careful monitoring of POAG subjects is necessary in determining the legitimacy of cataract surgery as an effective treatment for POAG.

Acknowledgements:
CHORI, UCSF Koret Vision Center

Keywords:
Primary Open Angle Glaucoma (POAG), Intraocular Pressure (IOP), Cataract Surgery, Humphrey Visual Field (HVF), Snellen Visual Acuity Test

Sophie Tan

My name is Sophie Tan, and I am honored to be given this opportunity to engage in research at CHORI this summer. I graduated from UC Berkeley in May 2015 with a degree in Molecular Toxicology, and I am currently working towards a career in pharmacy. My interests include pharmacology, disease therapeutics, and healthcare. My future goals include engaging in clinical and translational research towards improving the safety and efficiency of drugs while also using research to help address important issues in healthcare. I am grateful to be offered with so many opportunities at CHORI this summer to better understand what it means to solve problems in health and science. What I have learned and gained from this program is extremely valuable and important to me as both a prospective researcher and health professional. I would like to thank the directors and coordinators of the CHORI Summer Program as well as the Cavigiolio Lab for making my summer experiences possible, and I truly appreciate all the guidance and mentorship they have given me throughout my time here.

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Giorgio Cavigiolio, PhD

Title:
Cellular Cholesterol Release by Differentially Oxidized Apolipoprotein A-I

Introduction:
Apolipoprotein A-I (ApoA-I) blood levels associate with cardiovascular health, whereas impairment of apoA-I biological functions increases the risk of cardiovascular disease. Oxidation of ApoA-I is one of the known pathways to dysfunction that affect the ability of the protein to act as an extracellular recipient of cholesterol from peripheral cells. The foremost factor contributing to apoA-I oxidation is the enzyme myeloperoxidase (MPO), which is strongly implicated in atherosclerosis development. In *vivo*, MPO modifies tyrosines, tryptophans, and methionines, but in circulation, only oxidation of apoA-I methionines is high enough (~20% Met-86, ~9% Met-112, ~12% Met-148) to impact the efficiency of apoA-I-mediated cellular cholesterol release systemically. Thus, it is important to thoroughly investigate how different levels of methionine oxidation impact the efficiency of apoA-I to elicit cholesterol release from cells.

Hypothesis:
Levels of apoA-I methionine oxidation inversely correlate with apoA-I ability to elicit cholesterol release from cells.

Methods:
We used enzymatic (MPO) and chemical (H_2O_2) reactions to produce an array of apoA Is differentially oxidized at the methionine level. Exhaustive oxidation of the three apoA-I methionines was achieved by reaction with a large molar excess of H_2O_2 (1000:1); milder oxidation was obtained by the controlled use of MPO in the MPO-H_2O_2-Cl^- system. The efficiency of the apoA-I samples as extracellular cholesterol acceptors was determined by a method based on fluorescently labeled cholesterol (BODIPY-cholesterol) as cholesterol tracer. Cholesterol released by the murine macrophage cell line J774 to the cell culture medium was measured after 4h incubation in the presence of different acceptors.

Results:
The BODIPY-cholesterol method was validated by producing a dose-response curve using intact apoA-I, which confirmed a maximal cholesterol release capacity at a concentration of ~5 μg/ml. To test the dynamic range of the method, the cholesterol release capacity of exhaustively oxidized apoA-I and intact apoA-I (methionine oxidation ≤5%) were compared. In these conditions, exhaustive methionine oxidation reduced the cholesterol release capacity of apoA-I by 20-30%.

Anticipated Outcomes:
Intermediate levels of methionine oxidation (MPO reaction) significantly impact the cellular cholesterol acceptor function of apoA-I and this reduction is detectable by the BODIPY-cholesterol method.

Keywords:
Apolipoprotein A-I, Lipoproteins, Oxidation; Cellular Cholesterol Release, ABCA1, Fluorescence

Brenda Vega

My name is Brenda Vega. This fall I will be transferring from Contra Costa College to UC Berkeley as a junior in neurobiology. Since a young age, science has fascinated me. As I proceeded with my education I realized that science classes were my favorite classes. Not only where they fun, but they were the courses where I seemed to do the best. My love of science has guided me towards my career goal to become a doctor. I am very grateful to have been part of the CHORI program. I came to this program willing to learn and gain experience which I definitely did. This program reinstated my passion for medicine. Having the opportunity to work along professionals in studies that are meaningful to medicine has inspired me. I would like to thank my mentor Dr. Weyhmiller and all of my professors from Contra Costa College specifically Dr. Sidharta and Dr. Tarp for all of their support and guidance.

Funded by: National Institutes of Health

School: University of California, Berkeley

Mentor: Marcela Weyhmiller, PhD

Title:
Pancreatic Iron Overload by MRI

Introduction:
Transfused thalassemia patients are susceptible to iron overload in the body. Iron overload can cause damage in the pancreas, liver, spleen and heart; therefore an early detection of iron will allow for a more efficient treatment. In MRI scans, fat often hampers tissue iron assessment but is also useful clinical information.

Objective:
The purpose of this study is to validate the protocol to perform clinical quantification of pancreatic iron and fat concentration by MRI-R2* in patients.

Methods:
We will construct mayonnaise-based phantoms with varying amounts of fat concentration (10% to 80%) doped with magnetic material. Phantoms will be scanned at 1.5 T Phillips Intera software version 3232 using a train of opposed and in-phase echoes. Mayonnaise will be used to resemble the fatty microstructure tissue in the pancreas. Manganese (II) chloride tetra hydrate (Sigma-Aldrich) and ferric hydroxide dextran complex (Sigma-Aldrich) will model pancreatic iron. We will be using confocal microscopy (Zeiss Z1 Observer) to ensure the preservation of the fat/water microstructure after mixing.

Anticipated Outcome:
Our goal is to create phantoms, which will simulate varying amounts of pancreatic fat and iron in the MRI. Phantoms will allow us to validate MRI sequences and analysis techniques. We expect to confirm that MRI can be used to accurately measure iron/manganese and fat concentration in phantoms.

Conclusions:
Until recently, measuring iron concentration in the pancreas with MRI has been complicated due to the presence of fat. Not much work has been done to study the relationship between fat, iron and exocrine/endocrine dysfunction in patients. We hope to continue this project and find a correlation that will allow medical professionals to use MRI to quantify critical amounts of pancreatic iron (and fat) in patients.

Acknowledgements:
A special thanks to Kevin Loften for his time and assistance with the MRI scans, as well as to Taylor Chung, MD, Eric Padua, MD, and Horst Fischer, PhD, for allowing us to use his lab and microscope.

Keywords:
Thalassemia, MRI-R2*, iron overload, phantoms, fat, pancreas.

Anjali Walia

I am a rising junior at Irvington High School. My interest in the biological sciences stems from my twin sister's and my own struggle with life threatening food allergies and our "quest" to one day find a cure for the condition. I love using technology to solve problems, so the fusion of computing with the biological sciences is of special interest to me and in college, I would like to do a double major in computer science and biochemistry. I live by my two mottos: "You miss 100% of the shots you don't take" and "Believe you can and you're halfway there".

Funded by: Volunteer

School: Irvington High School

Mentor: Karen Hardy, MD

Keywords:
Asthma Control Test, application, patient record systems, mobile devices, iOS and Android platforms

Title:
Automating the Asthma Control Test

Statement of Hypothesis:
Building an Asthma Control Test (ACT) application for mobile devices and integrating it with patient record systems will improve patient care.

Specific Aims:
The Asthma Control Test is a self-administered questionnaire used by asthma patients to assess how well their asthma is being controlled. Currently at Children's Hospital Oakland, this test is only available in paper form, and if patients take it at home, doctors do not know the score unless the patient informs them. Additionally, it is difficult to keep track of a patient's asthma control history, as someone will have to manually enter scores in the system in order to do so. Compliance is another issue with take-at-home paper tests because patients must remember to take the test periodically. Since smartphones are ubiquitous and people carry them everywhere, an ACT app has better accessibility than a paper test. The aims of this project include building an Asthma Control Test application, integrate the application with patient record systems, and compare the effectiveness of the application with the existing process.

Anticipated Outcome of Project:
The app is expected to improve patient compliance over paper based methods due to ease of use, ease of sharing data with doctors, the ability to use it anywhere anytime, ready access to a score based action plan, and the reminder function. The app will improve patients' asthma control and management. It will lead to better communication between doctors and patients, and doctors can analyze patients' progress to adjust therapies. They can also understand how often asthmatics need to be monitored depending on the severity of their condition. The app will share data instantaneously, eliminating the lag time that is associated with paper tests. It will also save paper.

Acknowledgements:
I would like to thank Dr. Hardy for the project idea and guidance throughout its development. I would also like to thank Jack Spencer for his support, help, and encouragement.

Anushka Walia

I am a rising junior at Irvington High School in Fremont. I have a strong interest in chemistry, biology, and computer science, especially the intersection between the three fields. Carl Sagan said, "Science is a way of thinking much more than it is a body of knowledge", and this is why I find research so fascinating. I love thinking up new ways to solve problems and performing experiments in my home lab. I hope to major in biochemistry or computational chemistry in college.

Funded by: Volunteer

School: Irvington High School

Mentor: Nancy Keller, PhD

Title:
Prevalence of Pancreatic Autoantibodies in Type I Diabetes Patients as Correlated With Ethnicity, Gender, and Age At Diagnosis

Statement of Hypothesis:
A patient's ancestry, gender, and age at diagnosis can influence the prevalence of any of four autoantibodies commonly present in individuals with type I diabetes.

Specific Aims:
The aim of this study was to determine which factors influence the prevalence of one or all of four autoantibodies commonly found in type I diabetes patients. The autoantibodies under study were directed against insulin (IAA), islet antigen-2 (IA-2), glutamic acid decarboxylase (GAA), and zinc transporter 8 (ZnT8). Clinical data from groups of various ancestries (Asian, Hispanic American, African American, White, and Pacific Islander), gender, and ages (ranging from 2-18) were analyzed, and used to determine whether such influences exist.

Anticipated Outcome:
The anticipated outcome of the study is that one or more of 3 variables, ancestry, gender, or age, will be associated statistically significantly with the prevalence of one or more of these four autoantibodies. Measurement of autoantibody concentrations can predict development of type I diabetes in high-risk patients. The study may indicate that type I diabetes patients with type 1 diabetes have a higher counts of certain antibodies, and screening high-risk individuals that meet such criteria for pancreatic antibodies can lead to earlier diagnosis and cautionary measures before symptoms appear.

Acknowledgements:
UCSF Benioff Children's Hospital

Keywords:
Type I diabetes mellitus, autoantibodies, IAA, IA-2, GAA, ZnT8

Jolene Won

Ever since I was diagnosed with leukemia as a child (for which I was treated here at Children's Hospital Oakland), I've wanted to pursue a career in medicine. Through my work this summer on the risk stratification of febrile neutropenia in pediatric cancer patients, I've been able to expand and apply my knowledge of biostatistics; I've also gained valuable patient care experience from shadowing weekly in the Hematology/Oncology clinic. However, having the opportunity to work alongside the doctors who saved my life sixteen years ago has been the greatest opportunity of all. I would like to thank my mentors, Dr. Caroline Hastings and Dr. Michael Winstead, for their instruction and support, as well as Dr. Barbara Beach and the rest of the CHO Hem/Onc team, without whom I would not be here.

Funded by: Volunteer

School: University of California, Davis

Mentor: Caroline Hastings, MD

All Contributing Authors:
Jolene Won, Caroline Hastings, MD, Michael Winstead, MD, Molly Szuminski, PNP, Anu Agrawal,MD

Title of Your Abstract:
Risk Stratification of Febrile Neutropenia in Children with Cancer

Introduction:
Febrile neutropenia (FN) is a common complication in pediatric oncology; because fevers can be the first and only signal of a serious infection in immunosuppressed patients, FN episodes are usually treated in an inpatient setting until sustained defervescence and hematopoietic recovery occur. However, patients' risk of developing clinical complications varies greatly. As a response, several systems of risk stratification have been developed. The aim of this study is to assess the efficacy of existing FN risk stratification methods through retrospective application of current guidelines and comparison of predicted and actual outcomes.

Objective:
To evaluate current guidelines for risk stratification of febrile neutropenia in children with cancer, and to investigate the etiology, demography, clinical course, and outcomes of febrile neutropenia at UCSF Benioff Children's Hospital Oakland.

Methods:
The charts of patients admitted between 1/1/2009 and 12/31/2014 with a primary cancer diagnosis and an inpatient FN diagnosis were reviewed retrospectively for medical history, clinical risk factors upon presentation (focal infection, hypotension, septic shock, upper respiratory infection, tachypnea, hypoxia, chest X-ray changes, altered mental state, Grade 3 or higher mucositis, abdominal pain, and/or vomiting), complications, and final outcome of the FN episode. Receiver-operating characteristic curves will be generated and specificity and sensitivity calculated using outcomes as predicted by current risk stratification guidelines versus actual outcomes.

Anticipated Outcomes:
Existing standards of risk stratification will accurately predict the outcomes of FN episodes in children with cancer.

Conclusions:
A reliable risk stratification system, by identifying patients' relative risk of serious or clinical complication, could greatly inform doctors' decisions regarding their course of treatment. Reducing the number of hospital days due to FN would not only conserve hospital resources, but also improve quality of life for patients and families by allowing them to spend more time at home instead of in the hospital.

Keywords:
febrile neutropenia, pediatric oncology, risk stratification

Gabrielle Woodland

I fell in love with science and medicine after completing a project on the female reproductive system in my freshman year of high school. It was then that I knew I wanted a career as a physician. Now a rising senior at Oakland Technical High School, I have come a long way toward achieving my goal and my CHORI summer research experience has been an important step in this process. Arriving at CHORI with no medical background, prior research experience or knowledge of the lab environment, this summer has proven to be an eye-opening and educational experience for me. Not only have I learned a great deal about cancer and cancer stem cells, I have also gained an understanding of the research process and various lab techniques. This experience has helped me prepare for college sciences and a career in medicine. For that I am very grateful. I would like to thank my mentor, Dr. Julie Saba, for her time, wisdom, and advice; she has been very influential in my decision to continue to pursue medicine. I would also like to thank everyone in the Saba lab for the counsel, patience, and knowledge they have imparted

Funded by: California Institute for Regenerative Medicine

School: Oakland Technical High School

Mentor: Julie Saba, MD, PhD

Contributing Authors:
Gabrielle Woodland, Ellen Compton, Jesus Zamora-Pineda, Juile Saba, MD

Title:
Characterization of Medulloblastoma Cancer Stem Cell

Introduction:
Cancer stem cells (CSC) are a unique subpopulation of cells in malignant tumors that possess the ability to self-renew and produce differentiated progeny. In this experiment, we used the cell surface marker CD 133 and the intracellular marker aldehyde dehydrogenase (ALDH) to identify CSCs. With high chemotherapy and radiation-resistance, CSCs are thought to be the culprit behind tumor growth and proliferation. We suspect that the genes which are involved in cell growth and proliferation may be expressed differently in CSCs and that they may be involved in conferring their unique characteristics. Therefore, finding differences in the key genes that control growth can be used to tailor new targeting strategies aimed at killing CSCs and reducing tumor recurrence.

Objective:
The goal of my research is to provide more information about pediatric brain tumors that will be useful in developing new cancer treatments. I hypothesize that cancer stem cells from pediatric medulloblastoma cell lines will exhibit different protein expression profiles than non cancer stem cell populations of medulloblastoma.

Methods:
We analyzed the characteristics of transformed cell lines isolated from pediatric medulloblastoma tumors. We then analyzed cells by flow cytometry using methods that allow identification of CSCs based on detection of ALDH and CD 133. Imunofluorescence microscopy was conducted using fluorescent antibodies against ALDH and CD 133 to visualize and quantify the number of CD133+ and ALDH+ cells compared to the total number of cells in the same medulloblastoma cell lines. Finally, Western blots were performed to identify the amounts of the proteins of interest in the CSC populations that were identified by flow cytometry.

Anticipated Outcomes:
As both CD 133 and ALDH have been identified as CSC markers, I expect to find both markers expressed on the isolated CSCs after performing immunofluorescence microscopy. In regard to the protein profiles of the CSCs, I anticipate finding differences in the expression levels of various proteins of interest in CSC versus non CSC populations.

Acknowledgements:
I would like to thank Dr. Julie Saba for allowing me to work in her lab this summer as well as her time and advice. I would also like to thank Julia Weisbrod for her patience and all of the help she has given me. Finally, thanks to everyone in the Saba Lab; you have all contributed to making my experience this summer amazing.

Keywords:
cancer stem cells, CD 133, aldehyde dehydrogenase (ALDH), sphingosine-1-phosphate (S1P), AF1q, sphingosine-1-phosphate lyase (SPL)

California Institute for Regenerative Medicine (CIRM)

Group Includes (left to right): Jorge Ruiz, Jacob Amme, Gabrielle Woodland and Alexander Gonzalez

This group of students was funded by CIRM, as part of their mission to train the next generation of California Stem Cell Scientists.
In addition to the CHORI summer program, these students also attended Improv classes in Berkeley on Tuesday evenings from 7-10 PM to spark their creativity.

They blogged about their research experience on social media outlets and also participated in an all day CIRM focused Symposium on August 7th, in San Mateo.

These high school students were extremely busy!

Doris Duke Charitable Foundation

Group Includes (left to right): Maopeli Ali, Lorena Guerrero-Lopez, Christine Lopez, Casey Smith, Berenice Fuentes, Rammeet Kaur and Naylani Allen

These students were funded by the Doris Duke Charitable Foundations, which focuses on funding high school students interested in pursing future careers in the clinical health care field.

In addition to the CHORI Summer Program, these students also completed separate evaluations for their program and created a detailed individual development plan with the assistance of their mentor.

The IDP, serves as a 5-10 year career plan which can encourage the students as they continue to pursue their dreams.

Elizabeth Nash Foundation

Group Includes: Elizabeth Lefebvre (right), Molly Bates (left)

Elizabeth and Molly have a strong interest to find a cure for cystic fibrosis and learned how to perform biomedical research in the cystic fibrosis research laboratory at CHORI. They are the recipients of the Elizabeth Nash Foundation Cystic Fibrosis Summer Research Award with its mission to provide a short-term and hands-on research training opportunity in the field of cystic fibrosis.
In Addition to the CHORI summer program, these students also participated in an all day National Cystic Fibrosis Family Education Conference by the local Cystic Fibrosis Research Inc. in Palo Alto.

RESEARCH

Children's Hospital Oakland Research Institute

Children's Hospital Oakland Research Institute Children's Hospital Oakland Research Institute (CHORI) is the division of Children's dedicated to translating basic and clinical research into health benefits for children. In 2014, CHORI had more than 384 active grants and contracts, including various partnerships with private research organizations, corporations, universities, and federal sponsors. In addition to conducting research that has saved lives the world over, CHORI and its staff participate in other non-research activities that directly benefit our local community.

Contact: Janet King, PhD ☎ (510) 450-7601 ✉ jking@chori.org

SUMMER STUDENT RESEARCH PROGRAM AND SYMPOSIUM

High school, college, medical, and graduate students who are pursuing or who are interested in pursuing careers in biomedical, clinical, and biobehavioral research have an opportunity to conduct research with CHORI researchers as part of the institute's Summer Student Research Program. At the end of the nine-week program, students present their work to their peers at an all-day symposium. 36 students participated in the program in 2014, its 33rd year.

POSTDOCTORAL RESEARCH FELLOWS

CHORI has a postdoctoral training program in molecular and cell biology with a focus on hematology, immunology, and stem cell biology. The program includes postdoctoral fellows who pursue a career in science as well as medical fellows in training for a medical specialty. The program emphasizes research in the laboratory at CHORI under the tutelage of an experienced scientist.

CHORI Summer Student Research Program

High school and college students who are interested in pursuing careers in biomedical, clinical, and biobehavioral research have an opportunity to participate in CHORI's award-winning Summer Student Research Program. The nine-week summer program involves placement in a research setting under the guidance of a mentor, as well as numerous enrichment activities. The program culminates in a day long CHORI Research Symposium, at which students present their research findings to the faculty, their peers, mentors, friends, and family. About 85 percent of all attendees are students from racial/ethnic groups traditionally underrepresented in the biomedical sciences. Although some students attend university in other states, most have permanent residence in our local community.

The CHORI Summer Student Research Program was founded in 1981 by Children's current CEO, Dr. Bertram Lubin as a way to provide mentored opportunities to students to help them explore and gain exposure to research. The program has steadily grown, serving well over 1000 students since it's founding year, and averaging 45 students per year for the last five years. In 2014, the program celebrated its 33rd year: Thirty-six students participated, 82 percent were female, two-thirds of who performed basic research, and the rest clinical/ behavioral research. Typically 10 students in each cohort are high school students who are recruited primarily from local schools with whom CHORI has partnered.

Contact: Chandra Andrews-Wright ✉ candrewswright@chori.org

STORIES

One student participated in the program for two summers as a rising junior and senior, and continued his work in the mentor's lab during the academic year. His sustained interest and participation recently earned him a first authorship in an article in a peer-reviewed publication. He also presented his research work at numerous national and international conferences, won several competitive awards, co-authored two more papers, and is determined to apply for an MD/PhD program.

Another participant started off as a junior from St. Mary's College of California. She worked on the use of a cyclodextrin derivative for the treatment of Niemann–Pick type C disease and, in 2012, worked on a clinical research project on early consequences of damage to the prefrontal cortex. The summer program helped her in preparing applications for the Rhodes and Fulbright scholarships for the year following her graduation. She was selected for the 2012–2013 J. William Fulbright Foreign Scholarship award to Spain, where she worked in a melanoma lab at the Spanish National Cancer Research Center. The CHORI summer program helped reinforce her research interest.

One African American Undergraduate student participated in the program during the summer of 2013 and submitted his findings from the CHORI summer research internship to the annual meeting for the American Society for Hematology (ASH) in December 2013. The annual ASH meeting typically draws a crowd of close to 20,000 physician scientists. This young freshman was awarded not only a $500 travel scholarship but also the prestigious ASH Abstract Achievement Award for his poster presentation. Of interest, this award is typically granted only to medical fellows and graduate students. The summer program helped reinforce his love for research, and desire to pursue a future degree in emergency medicine.

One recent participant was raised in a working-class Hispanic family. He was the first in his family to attend and graduate from college. Though he loved science from a young age, it wasn't until he was accepted into the CHORI summer internship program that he found his niche and a community of mentors to encourage him. Not only did he thrive during the 9-week summer program, but the lab he worked in also invited him to continue his work with them. He is now utilizing this work towards a Master's degree in Molecular Cell Biology, with a plan towards a PhD.

These are only a couple of the many success stories of this program.

Notes

CHORI summer research symposium 2015

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