IMSAloquium 2018

Student Inquiry & Research

April 2018

Dear IMSA Students, Faculty, Staff, and Friends:

This is IMSA's 31st year of leading in educational innovation and the 30th year of the Student Inquiry and Research Program (SIR)! Welcome to another year of profound investigation and discovery! In these pages, you will find exciting abstracts on a variety of fantastic studies done by IMSA's great minds. Our students are carrying out studies on topics including Alzheimer's Disease, the Soviet Great Terror, genetic "switches" for cancer, epidemiology, genetics, environmental pollution, engineering energy, climate change, high energy physics, supersymmetry, market dynamics, water filtration, machine learning, diabetic pain, black holes, neural networks, and many more! These subjects reflect our students' diverse interests and the broad research community that supports them.

These studies have all happened during the past year in a variety of laboratories, real or virtual, on and off campus. Students were asked to not only learn a great deal about complex topics, but to contribute to them in meaningful ways. The presentations you hear today reflect the various stages of their work on a myriad of projects.

This work could not happen without the tireless work of the many Research Mentors in the Student Inquiry and Research program. The mentors, whether they come from IMSA or external institutions, give their time and resources to the cause of aiding our students' growth. Many also involve their research teams in the mentoring and molding of our students. Their efforts directly working with students, as well as supporting the scheduling, negotiation, and execution of the SIR program, are invaluable. We are deeply grateful for their dedication and generosity.

We would also like to express our gratitude to the SIR team, without whom this program could not possibly come together. These professionals are Dr. Vandana Chinwalla, Dr. M. Ross Alexander, Mrs. Asheli Mann-Lofthouse, and Mr. Ray Urbanski. This team rolled its sleeves up and dug in to enable our students' transformational work.

Please join us in learning about and celebrating the fantastic work the students and research teams have done this year!

Sincerely,

Sanza T. Kazadi, Ph.D.	Robert Hernandez, Ed.D.	José M. Torres, Ph.D.
Director of SIR, IMSA	Principal, IMSA	President, IMSA

Table of Contents

Schedule Overview

Research Talk Schedule

Session	Begin	End		Description	Location
Registration	8:00	8:30			Front Entrance
Keynote	8:30	9:30		Keynote Talk by Dr. Nancy Zeleznik-Le	Auditorium (Streaming: Lecture Hall, IN2)
Session 1	9:40	10:25		Research Talks	Varied (see map)
Session 2	10:35	11:20		Research Talks	Varied (see map)
Lunch	11:30	12:30		Lunch	West Gym
Session 3	12:40	1:25		Research Talks	Varied (see map)

Workshop Schedule

Session	Begin	End	Description	Location
Workshop 1	10:20	11:35	Long Workshops	Varied (see map)
Workshop 2	11:45	12:30	Short Workshops	Varied (see map)
Workshop 3	1:00	2:15	Long Workshops	Varied (see map)

Photo credit: Katya Bezugla, IMSA class of ’18. 2018. Back Cover.

Please note:

Workshops require advance registration.

Each session features 2-4 presentations. IMSA Faculty/Staff Researchers will present at the beginning of Session 1. Attendees are asked to stay for the whole session and not to walk in and out during or between presentations out of respect for the presenters.

Keynote

Professor Nancy Zeleznik-Le

Nancy Zeleznik-Le is a professor of Hematology and Oncology at the Loyola University Medical Center and the Interim Director of the Oncology Research Institute at Loyola University Medical Center.

Professor Zeleznik-Le graduated from the Ohio State University where she earned a Bachelor of Science in Microbiology and Immunology. She continued her education at Duke University, completing her PhD in Immunology, Cellular and Molecular Biology. She did her Postdoctoral work at the University of North Carolina, Lineberger Cancer Center where she studied MHC Class II gene regulation.

Professor Zeleznik-Le began her career at the University of Chicago where she held a position of a Research Associate and then an Assistant Professor. In 1999 she moved to Loyola University where she took a position as an Assistant Professor in the Department of Medicine. In 2003 she received tenure and became an Associate Professor. By 2009, she became a full Professor. Since 2013, she has been a program leader in the Epigenetics and Gene Regulation Program of Loyola's Oncology Research Institute and since 2016 she has been the Co-Director of the Oncology Research Institute

Professor Zeleznik-Le has focused her research work on mixed-lineage-leukemia (MLL) leukemogenesis (meaning the generation, development, and progression of leukemia). This work seeks to understand, characterize, and determine therapeutic targets for leukemia. MLL is a human gene that plays a role in leukemia. Professor Zeleznik-Le has carried out a variety of studies which investigate the wildtype MLL/MLL fusion partner proteins and MLL leukemia. These studies included functionally important interactions with polycomb group repressive proteins. More recently, Professor Zeleznik-Le has pursued structure-informed functional studies that could lead to novel therapeutics.

Workshops

The workshops are intended as direct introductions to the work that individual researchers are doing on campus. Students can participate in hands-on activities intended to better communicate the meaning of the research work under-way in the lab. Participation in workshops requires prior registration.

Workshop Session 1: 10:20 am – 11:35 am

A Floating Axle-Based Vertical Axle Wind Turbine

Location: A129
Workshop Organizer: Dr. Sanza Kazad, IMSA
Workshop synopsis:

Wind turbines have been a part of human energy acquisition for millennia. In recent decades, a flurry of activity in wind power has driven a rapid growth in the use of wind mills in generating electrical power. Among recent improvements are the shape of the blades, the required start-up torque, and a transition to a direct drive system. Most wind turbines are the horizontal axis, meaning that the turbine rotates around a horizontal axle.

Recently, a levitating axle was developed that enables a virtually friction free wind turbine that has a vertical axis. This axle uses magnetic repulsion to stabilize one end while the other end is mechanically stabilized. Careful balance of the weight against the magnetic repulsion can lead to very small frictional forces, enabling virtually limitless operation. Participants will apply this to the construction of a wind turbine, and will build and take home a virtually frictionless wind turbine.by recording how they perform on these tests as compared to the control flies. At the end, there will be open discussion in which all students can participate.

Workshop includes student presentation:

Elimination of Cogging Torque for a Levitating Wind Turbine.
Presenters: Noah Krouse, Shayna Provine, and Alexander Romanov
Research Mentor: Dr. Sanza Kazadi, IMSA
Abstract:
Humans have been harnessing energy from the wind for millennia. Wind turbines specifically capture the kinetic energy in wind, either using it directly or converting it again into electrical power. Conventional horizontal axis wind turbines (HAWT) utilize a horizontal main axle. Vertical axis wind turbines (VAWT), which use a vertically oriented main axle, also date back from antiquity, but are less common as electrical power generators. Recent development of a vertical axis levitating axle has allowed for design of nearly frictionless machinery, with only one point of contact. This axle has the potential to enable virtually frictionless wind generator design. A significant problem with this kind of wind turbine derives from the cogging torque in generator design. We intend to integrate a zero cogging torque generator on a floating axle wind turbine, enabling electrical power generation with very low wind speeds. Our resulting

wind turbine design is expected to exhibit little wear over significant duty periods, enhanced stability in high speed winds, and electrical power generation in extremely low wind conditions.

Maximal Number of Participants: 15

Introduction to Knot Theory

Location: A131
Workshop Organizer: Professor Louis H. Kauffman, University of Illinois Chicago
Workshop synopsis:

This workshop is devoted to providing a hands-on experience with knots and how to make accurate mathematical models for their topological properties. Participants will be supplied with rope and we will give instructions for making knots, unknots, rope tricks, and topological demonstrations. We will show how the topological phenomena seen in rope are precisely modeled by the use of the combinatorics of graphs and knot diagrams.

Maximal Number of Participants: 30

Workshop Session 2: 11:45 am – 12:30 pm

On the hunt for a truly distributed global supercomputer

Location: Grainger Center for Inquiry and Innovation (B131)
Workshop Organizer: Dr. Sanza T. Kazadi, IMSA
Workshop synopsis:

Large scale computing is an important and growing part of modern life. It has applications in many areas including the rendering of videos, analysis of data about extraterrestrial life, design of proteins, discovery of cryptocurrency, simulation of physical or engineering systems, and a myriad of other applications. Most large scale computing platforms are limited to one general model. In this model, a single actor controls large amounts of computational resources. Users submit jobs to the resource, which then manages the actual allocation of computation to the job. Large scale services like Amazon or Google computing centers use this model.

In this workshop we will discuss this computational model and compare it to an alternative swarm-based model. A swarm may be thought of as a communicating group of agents whose capabilities together exceed those of the individual agents, even when acting individually in parallel. A swarm-based fully distributed computational model has many advantages over centralized models. Students will explore these advantages through an interactive activity.

Maximal Number of Participants: 20

Workshop includes student presentation:

Generating a Truly Global Swarm-Based Supercomputer
Presenters: Isaiah Crews, Andy Lennox, Lucien Putnam, and Vaishnavi Vanamala
Research Mentor: Dr. Sanza Kazadi, IMSA
Dr. Suranga Hettiarachchi, University of Indiana Southeast

Abstract:
Distributed computational platforms typically utilize a centralized model in which a central controller schedules and manages computations carried out on multiple independent processing units. This model is generally implemented in not only physical supercomputers but also in largely distributed computational networks. A second model is a fully distributed computational platform made up of potentially heterogeneous processors of vastly different capabilities in which computations can be initiated and scheduled by any participating processor. We propose the construction of this second distributed computational model. We will demonstrate, theoretically and in practice that such a computational platform can approach optimality and can enable adaptive distributed use across a variety of platforms and user needs. In the coming year, a prototype of Eximius will be completed and be used to test network optimization in the aspects of speed, and fault management and security. We will prototype Eximius according to results achieved through these tests.

Workshop Session 3: 1:00 pm – 2:15 pm

Analyzing Data from CERN's CMS Collaboration

Location: A121
Workshop Organizer: Dr. Peter Dong, IMSA
Workshop synopsis:
This workshop will introduce participants to the basic concepts of high-energy physics as performed at particle colliders in general and at the Compact Muon Solenoid experiment at the Large Hadron Collider in particular. Participants will look at some of the basic principles of particle physics, accelerator physics, and detector physics, and start to understand some of the meaning behind the hoopla that sometimes surrounds the field. This also serves as a preview of work that will be going on in the IMSA-CMS research group in cooperation with Fermilab. A good opportunity for anyone interested in particle physics research!
Maximal Number of Participants: 35

Student Presenters: Ayush Agarwal, Grant Dexter, Audrey Gallier, Kaushal Gumpala, Madison Hahamy, Matthew Hokinson, Timothy Mou, Rebecca Osar, Lily Pan, Chetan Reddy, Jay Reiter, Harry Smith, Emily Springer, Srivinay Tummarakota, Akshaya Raghavan, Anisha Sharma, Abigail Vanderploeg, and John Woods

Ceramic Water Filter Creation & Testing

Location: B145
Workshop Organizer: Dr. Mark Carlson, IMSA and Professor Manny Hernandez, Northern Illinois University
Workshop synopsis:

Participants will experience firsthand the activities that go into creating and testing ceramic water filters infused with silver nanoparticles. All participants will mix clay with other ingredients and press new filters which can later be retrieved as souvenirs. Participants may also witness and possibly participate in treating filters with silver, synthesizing silver nanoparticles, measuring filter flow rates, plating bacteria, and counting bacterial colonies. The trade-offs that exist between flow rate and killing percentage will be discussed and participant suggestions solicited.

Maximal Number of Participants: 21

Targeted Neuroplasticity Training: A Novel Approach to Improving Mental Performance and Addressing the Excellence Gap

Location: A129
Workshop Organizer: Drs. Adrienne Coleman, IMSA and John Kennedy
Workshop synopsis:
Neuroplasticity is the ability of our brains to change from stimulation including what we do and even what we think. Targeted Neuroplasticity Training uses special exercises which target the mental processes critical to Executive Function. The result is faster mental processing speed, better focus and improved working memory. Thousands of people have experienced significant improvements in performance as a result, including students. This is because the exercises make the brain work progressively harder causing it to respond by increasing post synaptic receptors and stimulating Long Term Potentiation which is critical to learning and memory.

In this workshop students will learn how the brain works to make this possible as well as a new mental performance model which will help them understand how the things they do impact their lives. The best part is that students will experience one of the Targeted Neuroplasticity Training exercises themselves which they can keep to use on their own! Students will also learn about a wonderful opportunity to be part of a Student Inquiry and Research Project focused on minimizing the achievement gap using Targeted Neuroplasticity Training.

Maximal Number of Participants: 25

Trees: They're always watching

Location: A200
Workshop Organizer: Drs. Ross Alexander, IMSA and Christine Rollinson, The Morton Arboretum
Workshop synopsis:

Trees are found in almost every major biome on the planet, have been integral to the development of human civilizations, and are the largest and oldest organisms on the planet. They can provide aesthetic beauty, raw building materials, and food for countless organisms. But did you also know that they are also both a wide spread sensor grid and a time machine? Indeed, trees are more than they appear, and the annual rings they form each year help scientists to understand past people, forests, and climate.

In this workshop we will re-introduce you to trees and work together to learn how scientists gather and analyze tree-ring data to understand the near and distant past. During our time, we will walk through the scientific uses of trees, demonstrate how tree-ring samples are collected and prepared for analysis, and work together to precisely date tree-ring samples from the Chicago region to understand past climate conditions.

Maximal Number of Participants: 15

June's Learning Laboratory: Cultural Competent Students Lend a Helping Hand

Location: B131
Workshop Organizer: David Lundgren, IMSA and Dr. Sowmya Anjur, IMSA
Workshop synopsis:

June's Learning Laboratory (JLL) is our first step to creating a better world by advocating for a more culturally accepting society that appreciates everyone regardless of their abilities. Our innovative curriculum along with 3D printed hands will encourage high school students to have more passion for everyone on our planet.

There are several aspects to JLL that would make positive contributions to the world at large. Students will work together through social media and online resources to provide 3D printed hands to those in need and spread cultural competence to their communities. Students will learn how they can use their own 3D printer to construct hands or any other object they can think of to help other people. The 3D printed hands are from the company Enable whose website has CAD files to be used for printing. Students will develop skills to run a website and social media pages for their local JLL chapter.

JLL chapters will create different teams for students to lead. Students will gain valuable experience learning how to collaborate with others because each team will have student managers and each chapter will have a student director. The goal is to create a student centered experience because they lead each other, seek out individuals who need a hand or other device; JLL chapters will work with other students from around the world. Adults will advise student teams but the goal is to give students 100% ownership of the chapter.

The purpose of this presentation is to promote June's Learning Laboratory. Audience members will have an opportunity to learn about the curriculum and understand the connection to the hand. The audience will explore the website created for JLL. Finally, the audience will have an opportunity to build a finger or hand from 3D printed parts. The eventual outcome is for the audience to understand the connections between the curriculum and hand. Audience members will not keep the extremities built.

Maximal Number of Participants: 30

Research Talks

Session 1: 9:40 am – 10:25 am

Session 1A: Plant Biology and Ecology

Room Auditorium

Hide and go seek with trees in the eastern US
Presenter: Dr. M Ross Alexander, Research Faculty, IMSA
Abstract:
Trees act as a globally distributed sensor network that provides a window into past climate and ecological conditions. Through this window, we can glimpse how climate conditions have evolved over time, how trees interact with one another in a forest, and even how humans have moved across the landscape. Trees have many stories to tell, but we have to ask the right questions. Dendrochronology, the science of tree rings, uses the variability within annually formed tree rings to understand the myriad of factors that influence tree growth. Recent analytical advances are allowing for us to understand how individual trees perceive their environment and how canopy position can affect the climate response recorded by individual species. We are finding that by harnessing the full suite of available species and accounting for differences in canopy status we gain a more complete picture of how forests function during this period of changing climate conditions.

Phenological Comparison of Native and Invasive Plant Types
Presenters: Parth Dhyani and Lucy Liu
Research Mentor: Dr. Christine Rollinson, The Morton Arboretum
Abstract:
When non-native plants are introduced to new communities, they can quickly become invasive, threatening native species and damaging the ecosystem. Understanding how a plant becomes invasive helps us develop more effective ways to manage and prevent ecosystem invasion. Phenology, the study of life cycle events such as leafing and flowering dates, is one lens to examine invasive establishment through. A species' phenological niche affects how much it must compete for resources such as sunlight, and previous studies have shown that phenological strategies help invasives establish themselves. We investigated how the plant type of an invasive species might affect its phenological strategy. From March 2017 to November 2017, weekly phenology observations were collected in a woodland plot at the Morton Arboretum. Results showed that invasive forbs have shorter growing seasons: on average, invasive garlic mustard displayed green leaves for two months less than native white avens. Invasive shrubs, however, kept their leaves for longer than their native counterparts. Both groups of invasives used adjusted phenology to minimize competition for resources, but their phenological strategies differ based on their functional needs. More Midwest phenology data is needed to test these trends on a regional level.

SESSION 1B: MEDICINE / MICROBIOLOGY 1

Lecture Hall

The Effects of Phenol on Locomotor Behavior and Aging on *Drosophila melanogaster*
Presenters: Blair Hu and Chandana Tetali
Research Mentor: Dr. Vandana Chinwalla, IMSA
Abstract:
In today's world, there is a constant threat of environmental pollutants, which negatively affect the daily lives of humans. One of these known pollutants is phenol, found commonly in low concentrations in consumer products such as mouthwash, lotions, and ointments. Phenol has been found to accelerate senescence and decrease lifespan when introduced during early development. This study utilized Drosophila melanogaster, wild-type fruit fly, as a model organism to assess the effects of 0.1% phenol relative to a control group raised on water media. Through assays such as negative geotaxis, and longevity, the instinctual locomotor behavior and lifespan of fruit flies were assessed as they aged. Running a mixed- effects model analysis with treatment and sex as the fixed effects and weeks as the random effect confirmed that there was a significant difference between flies raised on the phenol medium versus the control group ($p< 0.05$). Further research will be performed to counteract the aforementioned negative effects through the introduction of antioxidants or anti-inflammatory substances, such as cranberry extract or curcumin, into the diet of the phenol-exposed flies.

Testing the Effects of Phenol on Drosophila Longevity and Fertility
Presenters: Ben Helmold, Sol Hwangbo, Amit Somalwar, and Trisha Sudhakar
Research Mentor: Dr. Vandana Chinwalla, IMSA
Abstract: Phenol is an environmental pollutant produced through both industrial waste and natural processes. Occupational exposure and the effects of high concentrations of phenol have been well recorded. However, long-term exposure with small concentrations is rather unknown despite the possible negative health effects associated with this exposure. We are working towards understanding the relationship between phenol exposure and health in terms of longevity and fertility by using *Drosophila melanogaster,* the common fruit fly, as our model. Flies are cheap, easy to maintain, and produce large numbers of progeny in short generations. Due to the genetic similarity between flies and humans, the results from these experiments can be correlated to humans. We plan to test if phenol has an adverse effect on fertility and development of fruit flies. To measure fertility, we are counting the number of progeny produced by each pair raised in either water or phenol environments. We plan to record the number of fertilized eggs laid by each pair and follow their development to adulthood, which allows us to record any unusual deaths during development. With the completion of this experiment, we hope to explore the genetic basis of the changes observed due to the exposure to phenol and correlate it to human health.

SESSION 1C: PHYSICS

Academic Pit

Particle physics: Is it worth the money?
Presenter: Dr. Peter Dong, IMSA
Abstract:
Perhaps no field in physics has grown as rapidly as particle physics—going from nonexistence to major budget item in only a few decades. Boosted by the Manhattan Project, particle physics has enjoyed

billions of dollars in federal research support for more than half a century. In an era of skepticism toward government spending and ever-tightening discretionary budgets, it seems reasonable to ask what the return has been on investment in particle physics spending. This talk will give an overview of particle physics experiments, discuss the current state, and explain its relevance today—and how even high school students should be involved in advancing our understanding.

Analyzing the Current Condition of the Muon g-2 Experiment through ROOT Data Analysis
Presenters: Manny Favela and Isabella Ginnett
Research Mentor: Dr. Brendan Kiburg, Fermilab
Abstract:
The g-factor in particle physics represents how a particle couples to a magnetic field. Paul Dirac predicted the g-factor of a muon to be exactly two, however, this prediction did not account for quantum effects which were not known at his time. The combined effects of quantum electrodynamics, quantum chromodynamics, and electroweak interactions slightly increase the g-factor. Considering these effects, theorists calculated the g-factor of a muon to be slightly greater than two, but a study at Brookhaven National Laboratory (BNL) recorded the g-factor of a muon to be between 3.3 to 3.6 standard deviations greater than the theoretical g-factor. This could mean that a new phenomena is creating this significant discrepancy. Currently, the experiment is operational and collects data. This year, we are analyzing the data to find relationships that will allow us to better understand how various parts of the experiment work together. Using ROOT, a C++ based interpreter for data analysis, we can look at recent histograms and plot them together. This, in turn, better visualizes these trends and allows us to assess the condition of individual mechanisms in the experiment and the experiment as a whole.

Session 1D: Social Science

Room IN2

Education and Diversity, Equity and Inclusion
Presenter: Dr. Adrienne Coleman, IMSA
Abstract:

According to the literature there are racial/ethnic inequities that exist in STEM education and careers. Much of the research has examined "how and why certain groups have more or less access, opportunity, and success in the educational trajectories leading to STEM occupations" (Riegle-Crumb & King, 2011). The 2015 U.S. News/Raytheon STEM Index indicates a slow progression in addressing these inequities that are a result of "early bias, discrimination and social expectations". Nationwide, African-American and Latino students are least likely to have access to quality STEM instruction; they're more likely to be saddled with negative cultural stereotypes and assumptions about their lack of intellectual ability in math and science (Hutchinson, 2014).

"We don't want to just increase the number of American students in STEM. We want to make sure everybody is involved," former President Barack Obama said during remarks ahead of the fifth annual White House Science Fair in March. "That means reaching out to boys and girls, men and women of all races and all backgrounds. Science is for all of us. And we want our classrooms and labs and workplaces and media to reflect that."

The National Academy of Sciences suggests that, without the participation of individuals of all racial/ethnic backgrounds and genders, the increasing demand for workers in STEM fields will not be met, potentially compromising the position of the United States as a global leader. This presentation

will discuss an approach to minimize the STEM divide that disproportionately impacts Black and Latino students by providing a 5-step motivation-based process. In addition, this presentation will examine and address the STEM geographic divide that exists, disproportionately impacting rural communities. Furthermore, future studies that focus on the gender STEM divide will be introduced.

An Exploration of the Factors that Motivate Gifted and Talented Rural Students to Engage in STEM
Presenters: Takudzwa George, Robert Luo, Clinton Oshipitan, Amy Wang, and Isabella Baldwin
Research Mentor: Dr. Adrienne Coleman, IMSA
Abstract:
The purpose of this study is to examine rural students at the Illinois Mathematics and Science Academy to identify their motivation to engage in STEM education and investigate the rural STEM divide. Five IMSA students, advised by Dr. Coleman, the Director of Equity/Inclusion at IMSA, conducted this qualitative study. Literature suggests rural students are less likely to attend selective colleges and can lose interest in STEM during the transition from middle to high school. Rural communities face additional obstacles of poorly funded school operations as well as poverty and higher cost of living that impede rural students from engaging in STEM. In order to understand the factors that motivate talented rural students to engage in STEM, this study sought to understand IMSA rural students' motives in pursuing STEM to inform the development of STEM enrichment programs for URP students. A total of 55 people were interviewed, including rural IMSA students, alumni, and parents of current rural students, who talked about their thoughts on STEM motivation. Additional data is being collected from the IMSA faculty perspective. The majority of respondents attributed their motivation for pursuing STEM to family/teacher influence along with STEM passion and the discovery of knowledge.

Session 1E: Engineering

Room D103

Silver-Based Ceramic Water Filters for the Developing World
Presenter: Dr. Mark Carlson, IMSA
Abstract:
The lack of potable water in the developing world will be the focus of this session. The negative impact on people as well as the range of programs and products intended to mitigate it will be briefly surveyed. Silver-based ceramics will be explored in depth. With the help of organizations and individuals, sites of indigenous production for these ceramics have been established in various parts of the world. Prof. Manny Hernandez will share his experiences working in some of these communities. In addition, the ongoing work of IMSA students over the last decade to address the larger issue and also support these efforts will be highlighted.

Optimizing a Silver Nanoparticle Ceramic Filter for Higher Flow
Presenters: Ken Brudnak and Cassandra Parent
Research Mentor: Dr. Mark Carlson, IMSA
Abstract:
We aim to create a porous ceramic water filter that would provide drinkable water for families in developing countries. The performance targets were a bacterial kill rate of 99% and a flow rate of 2 L/hr. Varying amounts of clay (and sometimes sand or grog), sawdust, and water were mixed and hand-pressed into disks (16 cm in diameter and 2 cm thick). After being fired in a kiln, they were painted with a variety of silver nanoparticles suspensions to augment their antibacterial potential. Currently, silver nanoparticles created in the presence of aloe show the best bacterial inhibition in liquid culture suspensions. For testing, the filters were sealed with silicone over a large hole in the bottom of a 5 gallon bucket. A solution of weakened *Escherichia coli* filled the bucket half full or more. From the filtrate, the flow rate was measured and the surviving bacteria plated and counted. Preliminary results show that a filter made from 138 g of sawdust and 462 g of clay mixed (slightly less clay than sawdust by volume) with approximately 550 mL of water yielded a flow rate of up to 3.2 L/hr with kill rates between 95-99.9%.

Session 1F: Mathematics and Engineering

Room A113

All the Swarms In the World
Presenter: Dr. Sanza T. Kazadi, IMSA
Abstract:
Swarms have been studied for a good long time, with the first studies emerging in the late 1980s and early 1990s. While these and subsequent studies examined the power of artificial swarms and developed ideas about what swarms were beyond simple groups of autonomous agents, no study has yet demonstrated the power of an engineering paradigm that can build swarms *a priori*. Such a paradigm can define the actions of artificial agents carrying out a collective task, yes. Additionally, such a paradigm can lead to the development of a multitude of outcomes including energy systems that draw from the environment, non-command economic systems that don't have inflation, artificial systems with the ability to innovate, and societies whose social ills are engineered out of them. We will discuss how swarm engineering brings us to these outcomes through a walk through these very outcomes.

Brunnian Links and Tricolorability
Presenters: Devika Prasad and Claudia Zhu
Research Mentor: Dr. Louis Kauffman, University of Illinois Chicago
Abstract:
As ropes and other one dimensional extended objects, knots and links can be found in everyday life. In the study of Knot Theory, a knot is an embedding of a circle in three dimensional space and is represented by a diagram in the plane. A link is an embedding of number of disjoint circles and is correspondingly represented by a diagram. Tricolorability is a classifying trait of such graphs. For a knot to be tricolorable, each arc in the diagram is assigned a color according to the following rules (1) each arc in the diagram receives a color, (2) at a crossing either all 3 colors appear, or only one color appears. Non tricolorable links cannot be unlinked! We use this theorem to prove that an infinite class of Brunnian Links are linked. This demonstrates an intriguing inverse method for proving that links are linked via uncolorability. We shall denote a specific Brunnian link of *n* components as an *n*-Brunnian

Link. Such links have the property that the removal of any single component results in a trivial link of n-1 components.

Session 1G: Medicine / Molecular biology

Room A115

Cell-Specific Pallidal Control of Cortical Striatal Input
Presenter: Shubha Verma
Research Mentor: Dr. Harry Xenias, Northwestern University
Abstract:
The basal ganglia is a collection of brain nuclei involved in both the planning and execution of sequenced movements as well as learning successful goal-directed behaviors, but it's still poorly understood. We researched the inhibitory pathway between the external globus pallidus (GPe) and the dorsal striatum (dStr). Over 95% of the cells composing the striatum are two classes of spiny projection neurons (SPNs): direct pathway SPNs (dSPNS) or indirect pathway SPNs (iSPNS), which respectively facilitate or inhibit movement. We used both naïve and 6-OHDA lesioned Npas1-Cre transgenic mice to compare a healthy brain to the Parkinson's model. We used the whole-cell patch clamp technique to inject the SPNs from the dStr with fluorescent dye while electrophysiologically recording the inputs of the GPe to the SPNs. This allowed us to study the synaptic contacts of the inputs by using a confocal microscope. We found that in the naïve model, the GPe input to iSPNs was stronger than the GPe inputs to dSPNs. However, in the lesioned model, the GPe input to the iSPNs and the dSPNs was relatively similar. This work gives us a greater understanding of the pallidostriatal pathway which will help us further comprehend the pathogenesis of Parkinson 's Disease.

Amyloid beta oligomers (AβO) drive morphological shift in microglia in the 5XFAD Mouse Model for Alzheimer's disease and in AβO-injected Simian Models
Presenter: Zach Brahmbhatt
Research Mentor: Drs. Maira Bicca, Kirsten Viola, and William Klein, Northwestern University
Abstract:
Neurodegeneration and cognitive impairment in Alzheimer's disease (AD) are believed to be driven by the accumulation of the Aβ peptide and phosphorylated tau protein. Recent research suggests that in addition to Aβ peptide and phosphorylated tau deposition, neuroinflammation plays a pivotal role in Alzheimer's disease dementia. Microglia are the resident macrophages of the brain's immune system that are responsible for antigen presentation and inflammatory signaling. In the presence of soluble, neurotoxic forms of Aβ, known as Aβ oligomers, microglia have been hypothesized to be activated and differentiated into a more proinflammatory phenotype that drives deleterious AD neuroinflammation. Here, we confirm that microglia are functionally activated using Iba1 antibody immunofluorescent staining of activated microglia in the 5XFAD mouse model and in AβO injected monkey models. However, our results show that the relationship between microglia and Aβ oligomers is more complex than the literature shows, as Aβ oligomers induce morphological changes in microglia. Our analysis of various brain regions exhibits that these morphological changes are regionally specific, but all stimulate an increase in morphologies associated with deadly proinflammatory behavior at later ages in AD brain.

SESSION 1H: MEDICINE / MICROBIOLOGY

Room A117

Creating a Bio-compatible Device for Intravital Culture of Skin Stem Cells and Tissue Regeneration
Presenters: Faris Shaikh and Katie Si
Research Mentor: Dr. Xiaoyang Wu, University of Chicago
Abstract:
We combined polymer synthesis and drug capsule release to create a capsule that will effectively release a drug, allowing for the direct administration and expansion of skin somatic stem cells. The support of these cells on a skin wound effectively accelerates wound healing. The researchers used biocompatible and biodegradable materials to create a hydrogel that will contain a capsule created from a reverse emulsion process. The focus was to develop a timed delayed drug release system that will result in improved drug effectiveness in vivo, reduced side effects, and a tailored dose delivery. The capsule was created with materials that allowed it to slowly degrade. Initially, the capsule release was tested in vitro and after being successfully delayed, the capsule is currently being tested in vivo using mice. This product may serve as a prototype for future treatment of massive skin wounds, preventing the infection, dehydration, and other complications that may occur due to unhealed skin wounds.

Imaging Amyloid β Oligomers by molecular MRI: Diagnosing early-stage Alzheimer's disease
Presenter: Abhay Gupta
Research Mentor: Drs. Kirsten Viola and Dr. William Klein, Northwestern University
Abstract:
Alzheimer's disease is a neurodegenerative disorder characterized by deterioration of memory, visuospatial ability, and executive function. Neurodegeneration associated with Alzheimer's disease is progressive and irreversible, and it is believed that long-term prognosis of patients would be significantly improved with an early diagnosis. Various diagnostic approaches have been developed, including those targeting amyloid fibrils, yet fibrils are not closely linked to the development of the disease. Amyloid-β oligomers are regarded as the putative initiators of disease pathogenesis, triggering tau pathology and instigating the neuronal damage that underlies dementia. Here, we report the development of a sensitive molecular magnetic resonance imaging (MRI) contrast probe that is specific for Aβ oligomers. The probe's robust imaging signal is attributed to the coupling of an oligomer-specific targeting antibody to mixed metal magnetic nanostructures that yield enhanced contrast in MRI. Immunohistological analysis demonstrates that the probe is stable and detects Aβ oligomers on hippocampal cells and brain tissue. Intranasal administration of the probe to an Alzheimer's disease mouse model revealed a pronounced, disease-dependent MRI signal in the hippocampus. The molecular MRI contrast probe shows potential as a freestanding diagnostic that targets Aβ oligomers to identify Alzheimer's disease at its earliest stages when therapeutics are most potent.

Session 1I: Ecology and Computer Science

Room A119

Exploring Nutrient Availability in Tropical Rainforests
Presenters: Amayrani Sanchez and Mary Ashley Tenedor
Research Mentor: Dr. Silvia Alvarez-Clare, The Morton Arboretum
Abstract:
Tropical rainforests have a large impact on global climate because they are responsible for about ⅓ of the carbon dioxide exchange between the atmosphere and the biosphere and store large amounts of carbon (C) as biomass in trees. Soil nutrient availability is an important factor influencing C cycling in forests by controlling tree growth and leaf nutrient concentrations. Our experiment sought to understand how plants respond to changes in soil nutrient availability in a lowland tropical rainforest in Costa Rica. Specifically, we studied how nitrogen (N) and phosphorus (P) additions impact foliar nutrient concentrations in the leaves of the most abundant tree (*Pentaclethra macroloba)* and tree palm (*Socratea exorrhiza*) seedlings. We collected 84 seedlings at EARTH University's EFFEX experiment, where forest plots have been continuously fertilized with N, P, NP, or kept as controls for 11 years. We measured leaf area and herbivory using Image J software and analyzed foliar nutrients using an elemental analyzer. We predict that an increase in edaphic N and P concentrations will increase foliar P.

Recovering Loop Structure from First-Order Functional Programs
Presenter: Advai Podduturi
Research Mentor: Professor John Reppy, University of Chicago
Abstract:
GPUs are able to provide supercomputer-level performance at vastly lower prices and, as a result, have become increasingly popular for general purpose computing, such as machine learning and cryptography. However, GPUs have been historically hard to program. NESL is a first order functional programming language that utilizes *Nested Data Parallelism* (NDP). NDP is the ability to apply any function, even parallel ones, to a set of values. This allows us to raise the level of abstraction for GPU programming, however NESL is not as heavily optimized as CUDA, a parallel programming platform developed by NVIDIA. CuNESL is a compiler that generates CUDA code from a NESL source. This is done through an Intermediate Representation (IR) called λ_{CU}. At the top level of λ_{CU}, the CPU level, we explore how to intelligently determine when it is efficient to convert a tail-end recursive call in NESL into a loop in imperative CUDA. This was done by benchmarking pure CUDA and CuNESL compiled implementations of the same algorithm, k-means clustering.

Session 1J: Physics

Room A121

Decay of Muons into Electrons

Presenters: Micah McBride and Alexander Zhong
Research Mentor: Dr. Thomas Strauss, Fermilab
Abstract:
The Fermilab Mu2e experiment seeks to investigate the decay of muons into electrons. The experiment uses several superconducting magnets to create a complex magnetic field to transport the muons from their production point to the interaction region. To map the magnetic fields, precision 3D Hall probes

are used. The field map requirements demand a calibration of the Hall probes to a precision of 10^{-4} tesla, one order of magnitude better than current industry standard.

In our IMSA project we develop tools to a multidimensional fit to interpolate the Hall probe readings between obtained calibration data points; variables include probe position, probe orientation, ambient temperature, and current magnetic field. A precise field map is needed for the Mu2e experiment to obtain the momentum distribution of decay particles and avoid magnetic traps that could create a background.

In this year we have started to develop a LabVIEW based software to do the interpolation and data saving for the experiment. For the upcoming year we plan to take the data and finish the calibration, resulting in a final presentation or paper to the Mu2e Field Mapping group.

Search for Supersymmetry using the T1bbbb signal in the CMS experiment at the LHC
Presenter: Adhav Arulanandan
Research Mentor: Dr. Richard Cavanaugh, Fermilab
Abstract:
The Compact Muon Solenoid (CMS) Experiment at the CERN Large Hadron Collider (LHC) is a particle detector that is being used to search for supersymmetric particles. The top quark is one of the most important particles in the search for Supersymmetry, and it and its supersymmetric partner, the stop particle, are highly sought after at CMS, as the stop particle is predicted to be the lightest of the supersymmetric particles and thus the easiest to find at the 7 TeV LHC. The T1bbbb signal was studied using data collected at CMS, and based on results will either be included in the overall search or will be used to eliminate from consideration any events of the sort. Two signal points were studied, one with a low delta m and one with a high delta m with regards to the gluino and neutralino produced. For both, cuts were applied on leptonic tracks, and on measured quantities such as missing ET, HT, and MTB, to remove mis-tagged events.

Session 1K: Engineering

Room A129

Building a low-cost UAV-mounted multi-spectral sensor array for measurement of horticultural conditions: an engineering history of DIY devices
Presenter: Dr. Eric Smith, IMSA
Abstract:
The advent of 3D printing and Arduino programming has opened up a new world for hobbyists, entrepreneurs, engineers, and tinkerers. It is now possible to use such technology to solve big problems at relatively low cost. There has long been a need for better horticultural instrumentation for use in both commercial and research settings. These recent technological developments have therefore opened up the possibilities for solving this problem even permitting data collection to render 3D models of trees combining data from a range of instruments.

Engineering the attachment of a remote sensor and antennae to a drone
Presenters: Alexander Domowicz and Eden Gorevoy
Research Mentor: Dr. Eric Smith, IMSA
Abstract:
Remote sensing of plant vitality and growth has been a major research field since the 1960s, and highly accurate multi-spectral sensors are necessary to provide useful data points for measuring healthy vegetation. Vegetation health and density within a given area is measured by the Normalized Difference

Vegetation Index (NDVI). NDVI determines plant vitality through the measure of chlorophyll activity; live green plants absorb solar radiation in a different manner than dead/less prosperous plants, and through measuring that radiation, remote graphical sensing can discriminate between areas of prosperous versus non-prosperous trees.

In order to create 3D models of these trees and measure their vitality simultaneously, it is necessary to engineer an attachment which will allow a NDVI sensor to move in tandem with a drone's already existing camera. Here we show that there is the potential to create 3D models of trees while measuring their vitality at the same time. While remote sensing on its own has been an important element in ecological research for years, this concurrent data collection – both 3D modeling and NDVI collection – serves to enhance this remote sensing application and increase data analysis in the field.

SESSION 1L: ENGINEERING

Room A131

June's Learning Laboratory: Cultural Competent Students Lend a Helping Hand

Presenter: David Lundgren, IMSA
Dr. Sowmya Anjur, IMSA

Abstract:

June's Learning Laboratory (JLL) is our first step to creating a better world by advocating for a more culturally accepting society that appreciates everyone regardless of their abilities. Our innovative curriculum along with 3D printed hands will encourage high school students to have more passion for everyone on our planet.

There are several aspects to JLL that would make positive contributions to the world at large. Students will work together through social media and online resources to provide 3D printed hands to those in need and spread cultural competence to their communities. Students will learn how they can use their own 3D printer to construct hands or any other object they can think of to help other people. The 3D printed hands are from the company Enable whose website has CAD files to be used for printing. Students will develop skills to run a website and social media pages for their local JLL chapter.

JLL chapters will create different teams for students to lead. Students will gain valuable experience learning how to collaborate with others because each team will have student managers and each chapter will have a student director. The goal is to create a student centered experience because they lead each other, seek out individuals who need a hand or other device; JLL chapters will work with other students from around the world. Adults will advise student teams but the goal is to give students 100% ownership of the chapter.

The purpose of this presentation is to promote June's Learning Laboratory. Audience members will have an opportunity to learn about the curriculum and understand the connection to the hand. The audience will explore the website created for JLL. Finally, the audience will have an opportunity to build a finger or hand from 3D printed parts. The eventual outcome is for the audience to understand the connections between the curriculum and hand. Audience members will not keep the extremities built.

The Effect of Temperature on Contact Angle Hysteresis

Presenter: Albert Lu

Research Mentor: Dr. Sidney Nagel, University of Chicago

Abstract:

When a drop of liquid is set on a solid surface, it forms a contact angle with the surface described by Young's equation with some variance, the magnitude of which is known as the contact angle hysteresis.

Under certain situations, drying drops exhibit an exceptionally large contact angle hysteresis and while there are theoretical explanations for this, they remain unsatisfactory. We plan to study how varying the temperature of the liquid changes the contact angle hysteresis of drying drops. The large contact angle hysteresis is thought to be due to particle deposition on the edge due to varying evaporation rates over the drop so by changing the temperature, we can better understand the mechanism behind contact angle hysteresis. We will do this by using a high-zoom camera to take time-lapse photography of millimeter size liquid drops at varying temperatures. We will then use image processing in Mathematica to calculate the contact angle and thus calculate contact angle hysteresis.

Session 2: 10:35 am – 11:20 am

Session 2A: Plant Biology and Ecology

Room Auditorium

Effects of Fire and Climate on False Ring Formation in Oaks
Presenters: Jessica Oros and Mia Ye
Research Mentor: Dr. Christy Rollinson, The Morton Arboretum
Abstract:
Trees have reliable growth patterns that are visible as annual rings. However, false rings, or irregularities in the transitions between the wood from the start and end of growing seasons, can form as a result of environmental anomalies. Although false rings deviate from normal growth rings, it has not yet been shown if they are detrimental to the development of the tree. Our primary focus was to determine if false ring formation is caused by fire or climate. Oak trees located in various plots within the Morton Arboretum's East Woods were cored, the trees having been subjected to different environmental conditions such as frequency of fires. The occurrence and timing of these false rings were identified and compared against meteorological data and fire data using the computing program R. By finding a correlation between false ring timing and frequency and either frequency of burns or anomalies in climate, we can identify which one contributes more to false ring formation. Distinguishing between climate and burning can indicate whether human interference is making an impact on the growth of trees, changing the way forests are managed to prevent these deviations from regular growth.

Molecular Modeling and Stability Calculations of *Catharanthus roseus*
Presenter: Shivani Sharma
Research Mentor: Dr. Jayaraj Alappat, Ball Horticultural Company
Abstract:
Anthocyanins are pigments produced by flowers, fruits, and leaves of plants that determine the color of plant tissue. These molecules are stabilized by successive glycosylation and acylation reactions that directly correlate to the longevity of the pigments in commercial plants, as studied through the bleaching effect of sunlight on *Catharanthus roseus*, a model organism. However, different combinations of sugars and acyl acids in the aforementioned reactions occur in nature, with some combinations being more stable than others. Using the modeling software Gaussian 16W, all possible combinations of anthocyanidins, sugars, and acyl acids were modeled in 3D, and optimized to the lowest energy level, as lower energy correlates to more stability. Once all the molecules' energies were compiled, a few trends became apparent, including the identification of the most stable sugar, acyl acid, anthocyanidin, and combination of the three as the overall most stable pigment. The information collected through these calculations will be used to test lines of *Catharanthus* to see which ones produce pigments identified as stable. The information will guide the breeders of *Catharanthus roseus*

as to which lines have promise in creating colors that do not lighten in the sun. The results from the molecular orbital calculations will be presented.

Session 2B: Medicine / Microbiology

Lecture Hall

Connecting the Chromatin Remodeler CHD7 in the Regulation of Autism and CHARGE Syndrome
Presenter Neil Wary
Research Mentor: Dr. Kishore K. Wary, University of Illinois Chicago
Abstract:
A strong hypothesis is emerging in connection with the CHD7 protein: dysfunction of this protein might play a key role in CHARGE syndrome, autism, and several cardiovascular diseases. As there is no cellular or animal model system to study the function of CHD7, the goal of this investigation was to create the disease in-a-dish by the use of CRISPR/Cas9 to edit the CHD7 gene in human aortic endothelial cells (hAECs). Accordingly, we generated lentivirus particles encoding CRISPR/Cas9-CHD7 sgRNAs in an all-in-one vector, and transduced hAECs with viral particles. We selected clones that were puromycin resistant. These cells were passaged for 5-6 times in puromycin containing media. DNAs were prepared from these clones, and CRISPR/Cas9 mediated *CHD7* mutations were confirmed by Sanger DNA sequencing. Decreased expression of CHD7 was confirmed by Western blot analyses. We showed that haploinsufficiency of CHD7 mediate decreased expression VEGFR2/FLK1, but increased expression of p53 and p21 cell cycle inhibitors, thereby inducing apoptosis of these cells. These findings indicate that CHD7 protein regulates the expression of VEGFR2/FLK1 in cardiovascular cells, and therefore its downregulation is likely to affect several different cell types, including the fate of neuronal cells that depend on VEGFR2 signaling. We propose that altered CHD7 and VEGFR2/FLK1 function is the key to CHARGE, a subset of autism, and cardiovascular diseases.

Polyploid Hepatocytes and Implications for Liver Cancer
Presenter: Maelee Chen
Research Mentor: Drs. Andrew Duncan and Evan Delgado and Mr. Patrick Wilkinson, University of Pittsburgh
Abstract:
Around 50% of human liver cells and 90% of mouse liver cells are polyploid, containing more than two sets of chromosomes. However, polyploidy's relationship to liver cancer is not yet known. We examined whether polyploidy protects against liver oncogenesis by comparing tumor growth in mostly polyploid and mostly diploid livers. To model loss of polyploid hepatocytes, we used a conditional Cre/lox system to knock out the genes *E2f7* and *E2f8* in mice. These knockout (KO) mice along with wild-type (control) mice were given carcinogens DEN and phenobarbital. At three, six, and nine months, control and KO livers were harvested and paraffin-embedded. Tissue sections were cut and then stained with either glutamine synthetase or hematoxylin and eosin to count tumors and measure tumor area. We also examined the mRNA from WT and KO mice by qRT-PCR prior to tumor induction to determine if KO mice have gene expression differences in enzymes that metabolize DEN or phenobarbital – making KOs potentially more susceptible to tumorigenesis. The Cre/lox system was effective since *E2f8* expression was lower in KO mice than control. As expected, *Cyp2e1* and *Car* had similar expression for WT and KO mice. Interestingly, GS+ tumors were more common than GS- across genotypes. KO livers had a substantially higher tumor burden, both in numbers of GS+ and GS- nodules, as well as larger tumor areas. Therefore, our data supports the idea that polyploidy may help protect against cancer formation in the liver.

SESSION 2C: PHYSICS

Academic Pit

The Search for Hyper-Velocity Stars

Presenters: Katarina (Red) Maier and Tyrone Whitmore

Research Mentor: Dr. William Wester III, Fermilab

Abstract:

A hypervelocity star is a star that travels faster than the escape velocity of the gravity well of the galaxy it originated in. To create stars that travel at these speeds, the stars need to be flung out with a great deal of velocity, typically 1,000 km/s. We wanted to use new data provided by the DES camera in Chile, to attempt to discover new hypervelocity stars. The stars trajectories help scientists refine their estimates for the mass distribution of the galaxy, allowing the location of dark matter and black holes. In order to discover these stars, sites such as the DESDM database were used to acquire data of potential HVSs (hypervelocity stars). Once we had the observed data, we then used TopCAT as launched through Cygwin in order to analyze the various aspects of the data. Through this, we sought to better understand the motion of these stars are identify potential candidates. While we do not currently have any candidates, as we are merely a first-year SIR, we are eagerly searching through both literature and high-density HVS areas in order to find one. We are hopeful that by fall we will have at least one candidate.

Classification of proton treatment plans between SFUD, MFO and hybrid plans

Presenters: Louise Lima and Alice Liu

Research Mentor: Drs. Steven Laub and Aditya Panchal, Northwestern Medicine Chicago Proton Center

Abstract:

We developed a program that reads structure sets and dose grids from radiation treatment plans and outputs field-specific histograms of the number of voxels within the planning target volume that received dose. The program then normalizes each histogram to the percent volume of the target that received each field's contribution of the total dose. It then determines the number of Gaussian distributions in each histogram, which serves as an initial classification metric. The program also calculates additional metrics, including maximum dose in each distribution, the width of each dose distribution, and the rate at which the number of voxels decrease per change in dose. This data is compared to data from a standard Single- Field Uniform Dose (SFUD) treatment plan and assessed for similarity. The program is able to classify hybrid treatment plans by assigning them a score based on calculated metrics that represent their correlation with a standard SFUD treatment plan. The program and percentage it outputs can aid in improved classification and differentiation of hybrid treatment plans to facilitate the precision of patient and target volume positioning.

Session 2D: Social Science

Room: IN2

Preconditions to Modern Genocide
Presenters: Dr. Claiborne Skinner, IMSA
Abstract:
In 1989, Francis Fukuyama proposed in **The End of History** and the **Last Man** that the fall oc communism signaled the end of human history. He postulated that everyone would now rally behind liberal capitalism and there would be nothing left to fight about. Subsequent events have proven Fukuyama to be an extraordinarily bad historian. Communism was a glass-jawed opponent. Facism, however, with its attendant racism, religious bigotry, and genocide seems alive and well. With this in mind, we have sought to identify common patterns of mass murder with an eye toward preventing what may not be cured.

Preconditions to Modern Genocide
Presenters: Aurora Harkleroad and Gary Yang
Research Mentor: Dr. Claiborne Skinner, IMSA
Abstract:
In the past two decades, genocide intervention around the world has reached unanticipated heights. Although the international community is increasingly stepping in to prevent genocide, it too often occurs after most of the damage has already been done. As we approach the 100th anniversary of the first modern genocide, we must reflect: What is the international community's role in curbing genocide? And if there is an obligation to do so, how do we identify the individual factors that cause it? By examining multiple cases of genocide throughout the 20th century, we looked into the various factors identified in genocide and discerned what would in those factors would cause the decision to pursue that route. For reference we specifically investigated the Armenian Genocide, Russian Jewish pogroms, the Holocaust, the Cambodian Genocide, and the Bosnian Genocide. We identified seven factors -- economics, military crises, urban-rural conflicts, cultural differences, education gaps, and territorial claims -- and concluded that these precursors are all commonly combined in the lead-up to genocide and mass violence.

Session 2E: Engineering

Room: D103

Lightweight Reduction Unit
Presenters: Amanda Wong and Eunice Yoon
Research Mentor: Dr. Frank Harwath, North Central College
Abstract:
The number of uses for the harmonic gear are endless: from aerospace devices, to medical equipment, to robotics; the harmonic drive is essential to these devices. Its advantages include having high torque, zero backlash, high reduction ratios and precision, but the harmonic drive is often times expensive and heavy. To improve the design of the harmonic gear, the goal of our study is to create an actuator with the same function and advantages as a harmonic drive with it being more affordable and lightweight. The implementation of such a prototype will contribute to making more affordable and lightweight

actuators that could replace harmonic drives in the future. The proposed prototype will adopt the same function and structure of the harmonic drive (the wave generator, flexspline, and external spline). However, the prototype will be gearless in attempt to implement a unique flexspline. The process to ensure the completion and success of the prototype will follow a continuous cycle of research, design, and revision.

Mechanical Properties of Nb3Sn Films for Superconducting RF Cavities in Particle Accelerators
Presenters: Liana Koleva and Kaleigh O'Brien
Research Mentor: Drs. Sam Posen, Saravan Chandrasekaran, and Yulia Trenkinihova, Fermilab
Abstract:
Particle accelerators are a very useful tool in physics, biology, and materials science, among other fields. The superconducting radiofrequency cavities, which accelerate the particle beam, have certain cryogenic requirements that inflate the cost of operation. The viability of an Nb_3Sn film inside a Nb cavity is relevant to future projects due to its associated benefits. Should the alloy be able to hold up to the stress during the preparation of these cavities, it would increase the efficiency of the accelerator, saving energy and, consequently, money. This would allow for new, previously unfeasible applications in a variety of industries. Our project focuses on the strength of a film of Nb_3Sn on Nb when put under varied levels of stress, specifically the limit at which the stress becomes too much for the alloy and cracks appear. This paper describes the project, its current status, and first results.

SESSION 2F: ENGINEERING

Room A113

Computational Market Modeling for Wireless Services
Presenters: Bharath Sreenivas and Joshua Eberhardt
Research Mentors: Dr. Randall Berry and Ermin Wei, Northwestern University
Abstract:
In the economics world, companies seek to make the most profit from their product sales. When competing companies announce their prices, consumers instantly join the more beneficial company. However, if the effective cost of the product is more than customers are willing to pay, less of the product will be sold. Wireless network providers have strategies in play when selling their products, and these strategies are analyzed in terms of profit and consumer well-being. Using model market scenarios in Python and game theory strategies presented by each competitor, one can simulate the quality of data service received by each consumer and reach a best response for each company regarding profit and consumer well-being. The Bertrand Competition model allows one to predict the equilibrium price reached by two independent companies seeking their own self-interest, accounting for the decrease in demand due to congestion, the overcrowding of users. Using such a model created through python code, we investigated the changes in equilibrium price reached by both companies with changes in the parameters of the demand curve, effects of congestion, and the customer's valuation of price over congestion.

Pedestrian Detection using Convolutional Neural Networks

Presenters: Nathanael Kim, Suchet Kumar, and Tommy Vadakumchery

Research Mentor: Dr. Miles Wernic, Illinois Institute of Technology

Abstract:

The purpose of this investigation was to devise an efficient and accurate algorithm that is capable of detecting pedestrians' positions within frames of live footage. After exploring various models for pedestrian detection and weighing their advantages, we settled on using a convolutional neural network (CNN) as the basis for our algorithm. Using pre-recorded footage from the Chicago Police Department as well as the California Institute of Technology's pedestrian image dataset, we are currently training a CNN to recognize pedestrians within 640 by 480 pixel still images. Currently, the model can predict (with decent time efficiency on a Nvidia GeForce 940M processor) whether a pedestrian is present within the image, but its accuracy rates are concerning due to a lack of pedestrian data from the CPD and the awkward viewing angle of the Caltech footage. We are in the process of transitioning our model to its final stage, which will involve a regional proposal network in conjunction with the convolutional neural network. After training this final model with ample and more suitable data, our final results will be presented at IMSAloquium.

SESSION 2G: MEDICINE / MICROBIOLOGY

Room A115

Characterization of Alzheimer's Disease Associated Amyloid Beta Oligomers and Phosphorylated Tau in the Developing Avian CNS

Presenter: Allen Chen

Research Mentors: Drs. Kirsten Viola and Dr. William Klein, Northwestern University

Abstract:

Animal models have been instrumental in studying the progression, pathology, and symptomology of diseases, and are thus essential to our current understanding of diseases. One particular disease of interest today, Alzheimer's disease {AD), also uses these animal models. It is now accepted that Amyloid Beta oligomers (APOs), soluble derivative aggregates of the Amyloid Beta precursor protein (APP), are responsible for the pathology and neurotoxicity of AD through tau hyperphosphorylation, synaptic deregulation, and reactive oxidative damage. Previous results have demonstrated that phosphorylated tau protein is present in the developing chick brain but drop off in concentration once maturity is reached (Pope, et al. 1993). Our study investigated the roles of APOs and phosphorylated tau protein in central nervous system development, using chick embryos as our animal model due to the almost identical epitopes of APP and tau protein in the avian and human central nervous systems. This research has important therapeutic uses as investigating the role of these proteins in development gives valuable insight into the mechanisms of neurotoxicity and synaptic loss in AD, opening pathways for new treatment methods and early identification protocols.

Mechanisms Leading to Perinatal Brain Injury Using miR21
Presenters: Faith George and Elange Tande
Research Mentor: Dr. Maria Dizon, Northwestern University
Abstract:

Cerebral palsy (CP) is the most common motor disability among children. A major contributor to this disease is hypoxia-ischemia (HI), characterized by deprivation of oxygen to the brain, usually caused by premature birth. HI can have detrimental effects on oligodendrocyte progenitor cells (OPCs), which are crucial to white matter development. Improper development of OPCs during gestation may lead to white matter injuries that potentially manifest as diseases such as CP. A group of molecules called microRNAs (miR) act as potent regulators of gene expression. From past In vivo studies, mir-138, miR-338, and miR-21 have been found to be perturbed in brain as a result of HI. The goal of our project is to determine whether miR-21 regulates the Bone Morphogenetic Protein (BMP) signaling pathway in order to gain insight on mechanisms leading to perinatal brain injury. In vitro techniques to cultivate OPCs, microglia and astrocytes in both normoxia and hypoxia will be used to study changes in miR-21, BMPR1a, BMPR1b, and BMPR2. Results from this study will yield previously unknown information regarding miR regulation of gene expression in perinatal HI. If successful, experiments may provide biomarkers for earlier diagnosis and better treatment for preterm neonates at high risk for CP.

Session 2H: Medicine / Microbiology

Room A117

Snails in Seagrass: Benthic habitat predicts endangered queen conch (Lobatus gigas) abundance in The Bahamas
Presenters: Thomas DeMastri, Sargam Panpaliya, and Kate Rabideau
Research Mentor: Dr. Andrew Kough, Shedd Aquarium
Abstract:
The iconic queen conch is integral to the economy and culture of The Bahamas. Indeed, the majority of Bahamian households consume conch flesh weekly, which has resulted in catastrophic declines in abundance. To reverse the decline, effective protections must take into account conch ecology - specifically conch habitat preferences which are hitherto undescribed. Here, we use a massive dataset of conch counts and undersea imagery to build a statistical model that predicts conch abundance from habitat type. Researchers in the field counted conch and captured tens of thousands of geolocated images of the seafloor while surveying 300 km^2 of The Bahamas. We implemented a hierarchal categorization system to quantify habitat type in the image dataset. The software ImageJ generated random points within images that were then identified as sand, rubble, seagrass, macroalgae, or invertebrate. Statistical software predicted the variable abundance of mature and immature conch relative to factors habitat type [*and depth and location*]. Adult conch were positively associated with deeper depths, seagrass in excess of XX% and negatively associated with bare substrate. Seagrass was negatively related to invertebrate and rubble coverage. Our results suggest that priority areas for conch-servation should include healthy seagrass bed. The correlations that we pulled from that were a negative association between conch (of any age) and bare sand ($R = -0.19$, $p < 0.05$), a positive association between adult conch and macroalgae ($R = 0.4$, $p < 0.0001$), and a positive association between juveniles and seagrass ($R = 0.2$, $p < 0.05$).

T-Tubule Loss Causes Greater Distances for EC Coupling
Presenters: Rishi Modi and Maryam Mufti
Research Mentor: Dr. J. Andrew Wasserstrom, Northwestern University
Abstract:
Heart failure (HF) affects 6 million adults in the United States, with 500,000 new cases reported each year. Nonetheless, the cellular mechanisms that lead to the progression of HF are poorly understood, resulting in difficulties in treatment and prevention. Recent findings suggest that HF cells have a lower T-tubule density than normal cells, which contributes to poor EC coupling. The purpose of the investigation is to measure the changes in T-Tubule density in the onset of HF in atrial and ventricular cells. To measure T-Tubule density, atrial and ventricular cells of HF and normal dog hearts were analyzed using AutoTT software, in which the T-Tubule and cytosolic areas were quantified in the 2D images. Another analysis routine was used to further quantify T-Tubule loss using Nearest Neighbor software which measured the distance from any point to the nearest T-Tubule or cell membrane. The results showed that T-Tubule loss in HF causes greater distances between the calcium trigger and calcium release independent of cell size. This affects EC coupling by increasing the distance calcium must travel to induce cellular contraction.

Session 2I: Medicine / Microbiology

Room A119

Innervation Defects in Taste Buds due to the Loss of Ephrin-A Genes
Presenter: Gloria Huang
Research Mentor: Dr. M. William Rochlin, Loyola University
Abstract:
The targeting of axons in the epithelium of the tongue requires a high level of precision, as taste axons innervate the taste bud, but avoid the surrounding epithelium, while a subset of somatosensory axons does the reverse. The cell-attached signaling molecules Eph and ephrins act as ligands and receptors for one another that trigger growth promotion or repulsion to help guide axons in the nervous system, but little is known about their role in the innervation of gustatory papillae. Ephrin-A's and B's are expressed in the lingual epithelium and repel taste and somatosensory neurites in vitro. I am studying the effects of the loss of ephrin-A in mice on taste bud size and innervation patterns. Preliminary data suggest that taste buds' areas are smaller in *Efna1, 3, 4* triple knockout (TKO) mice. Additionally, innervation breadth increases in embryonic tongues of TKO mice. These data are consistent with the possibility that an innervation defect due to the lack of ephrinA1, 3, and 4 decreases trophic support for the taste bud. Currently, I am further investigating this hypothesis.

Examining TGR as a Drug Target against Human Schistosomiasis
Presenters: Diann George, Mihika Rajvanshi, and Ashley Tin
Research Mentor: Dr. David Williams, Rush University
Abstract:
Schistosomiasis is a waterborne, parasitic disease often found in underdeveloped areas in Africa, Southeast Asia, and South America that affects 260 million people worldwide. Currently, there is only one drug used to treat schistosomiasis, Praziquantel. However, scientists believe the worm may soon evolve resistance to the drug, as proven in a laboratory environment, stressing the need for another form of treatment.

Schistosomes have a parasitic-specific enzyme known as thioredoxin glutathione reductase (TGR) that combines the function of two human enzymes (glutathione reductase and thioredoxin reductase). TGR is critical for parasite survival as it functions as a detoxifying agent, indicating that TGR seems to be a key target for antischistosomal chemotherapy. To identify inhibitors, our investigation aimed to test compounds that have inhibited TGR against human GR (hGR). We ran several different TGR inhibiting assays on the enzyme. Since hGR plays a critical role in metabolism, the identification of compounds that inhibit TGR but not hGR may prove vital for TGR's potential drug development.

Session 2J: Computer Science and Physics

Room A121

Stochastic and Deterministic Multigroup Epidemiology
Presenters: Ananya Yammanuru, Chris Chang, Christoph Gaffud, Mounisha Kouvour, and Lewis Oh
Research Mentor: Dr. Jordan Hasler, Wolfram
Abstract:
To predict the course of an infection, we created both a stochastic and deterministic model. In the deterministic model, we formulated a system of differential equations. We used the models to explore in further detail the effects of infection parameters (numerical descriptors of the infection) on the stability of the system at a disease-free equilibrium using a matrix method which allowed us to find the epidemic threshold. We analyzed the models and found that the spectral radius, a constant that for a set of parameters related to the basic reproduction number in a one-group case and a threshold value in a multigroup case, directly impacts the epidemic threshold. In addition, we investigated the long-term effects of the infection on the system's population and tested the accuracy of our models using data from real infections.

Search for Dilepton-Producing Contact Interactions in Proton-Proton Collisions with Center-of-Mass Energy 13 TeV
Presenter: Abdiudaya Bhalla, Eric Hersey, and Charles Hultquist
Research Mentor: Dr. Peter Dong, IMSA
Abstract:
Preons are hypothetical particles that make up quarks and leptons. Contact interactions (CI's) involving such preons would theoretically occur above a characteristic energy scale, denoted Λ. According to the CI model, high-energy interactions at modern accelerators will be affected by preon interactions at energies well below Λ. Using Compact Muon Solenoid (CMS) data, we can determine a lower limit on the energy scale -- an energy below which we are 95% confident that contact interactions do not occur. Our analysis will use CMS diilepton data with center-of-mass energy 13 TeV and a Monte Carlo simulation of contact interactions to set a new lower limit on the energy scale.

Our group is conducting an analysis to determine if evidence of CI's can be detected. We will perform all of the steps of an analysis, including event selection, parameterization of lambda, creation of an invariant mass plot, evaluation of systematic undercertainties, statistical analysis, and limit setting. Monte Carlo generators will provide a simulation specific to the CMS detector of what the Standard Model process should look like. We receive data from the CMS experiment and create graphs using Root, a scientific data processing package, to compare it to the Standard Model. We can thus determine the CI model's agreement with data and set a lower limit on the energy scale Λ.

Session 2J: Medicine / Microbiology

Room A123

The Effect of XBP-1 Splice on Transcription of SHP in the Liver
Presenters: Aliah Shaira De Guzman and Harsha Nalam
Research Mentor: Dr. Richard Green, Northwestern University
Abstract:
Bile acid are synthesized by the liver and act as detergent for lipid absorption. X-box binding protein-1 spliced (XBP1s) is a protective molecule expressed when the liver is under ER stress due to cholestasis or proliferation, which can cause excess unfolded or misfolded proteins. The ER stress activates the unfolded protein response (UPR). The short-heterodimer partner (SHP) plays an active role in various hepatic metabolic pathways, and is a factor in lipid metabolism, prompting the exploration of a connection to the UPR. We hypothesize that transfection of XBP1 into HepG2 cells will increase transcription of the -2Kb SHP promoter, measurable via a luciferase- β-galactosidase reporter assay. Replacing the SHP coding region with a bioluminescent luciferase gene attached 3'prime to the SHP promoter can measure SHP transcription via luminescence. Preliminary testing shows that transfection of XBP1 has a positive effect on SHP transcription. Therefore, we propose to perform five-prime deletional analysis of the SHP-promoter reporter construct by transfecting the construct into HepG2 cells. This will allow us to isolate cis-acting DNA target sequences of the SHP promoter that respond to Xbp1s. Understanding these target sequences will allow us to analyze transcription factors affecting SHP, explaining the connection between UPR and lipid metabolism.

The Population Characterization of Cancer Incidence in Patients
Presenters: James Lichtenstein and Jimmy Ren
Research Mentor: Drs. Yinan Zheng and Lifang Hou, Northwestern University
Abstract:
A population characterization is a table containing the qualities and characteristics of a sample population averaged from different individuals. Characteristics may include BMI, years of cigarette use, or body weight. In our study, we were given data of the characteristics of two populations, one of which was cancer-free while the other had cancer-incidents. Using the data, we compared the demographic and health behavior variables between cancer-free and cancer-incident participants at the baseline. Increased smoking status, alcohol consumption, and BMI lead to increased risks of cancer incident.

Session 2K: Medicine / Microbiology

Room A133

Identifying key functions of EphA1 and EphA2 in the epidermis
Presenter: Michelle Sia
Research Mentor: Professor Bethany E. Perez-White and Nihal Kaplan, and Rosa Ventrella, Northwestern University
Abstract:
Ephrin type A receptor 1 (EphA1) and Ephrin type A receptor 2 (EphA2) are highly related receptor tyrosine kinases that play a role in skin function. We have previously reported that loss of EphA2 severely impairs epidermal differentiation. However, despite high homology, EphA1 cannot restore the

differentiation defect caused by lack of EphA2 suggesting that they have non-redundant functions in skin. Therefore, we hypothesize that EphA1 and EphA2 orchestrate distinct signaling networks in epidermis. To test this hypothesis, we used biotin-identification proteomics to identify proteins associated with EphA1 and/or EphA2.We identified 99 proteins that potentially associated with EphA1 and 196 with EphA2. Bioinformatic analysis using the Kyoto Encyclopedia of Genes and Genomes uncovered differences in the pathways associated with our proteomic interactome datasets for EphA1 and EphA2. Adherens junctions-associated proteins were prominent for EphA1 interacting proteins (FDR = 3.96e-09). While in the EphA2 dataset, endocytosis was seen emerged as the highest represented pathway (FDR = 9.46e-03). This data imply that EphA1 and EphA2 participate in distinct signaling pathways in epidermis.

Session 3: 12:40 pm – 1:20 pm

Session 3A: Plant Biology and Ecology

Room Auditorium

Chemistry guided breeding of *calibrachoa hybrida* for novel and stable flower colors
Presenter: Rebecca Ellington
Research Mentor: Dr. Jayaraj Alappat, Ball Horticultural Company
Abstract:
Three major groups of pigments, anthocyanins, betalains, and carotenoids, are responsible for the brilliant natural display of flower colors. The chemistry (nature, quantity, and the profile) of the pigments determine the observed flower color, diversity and its stability. In the laboratory, systematic analysis of the pigments quantity (by UV/VIS spectrophotometry) and profile (using High Performance Liquid Chromatography) and the communication of analysis results enable the breeder to modulate the color, intensity and the stability of the flower colors they develop. The goal of our study is to predict the stability of flower colors and direct breeders to develop novel shades. Our focus was the orange color in the calibrachoa flower, which is often a challenge to breeders; most shades of orange fade/bleach in the sun over time. We analyzed 43 lines of calibrachoa in the current experiment with the goal to evaluate the role of anthocyanins, anthocyanidins, flavonoids, carotenoids, and the pH in rendering strong and stable orange colors. The pigment and pH analysis are complete and the results from the laboratory work (along with suggestions for optimal crosses) will be presented.

Using Remote Sensing to Quantify Bison Impacts on Plant Communities in a Restored Prairie
Presenters: Patrick Li and Charlie Steenstra
Research Mentor: Dr. Holly Jones, Northern Illinois University
Abstract:
Bison are a keystone species to grasslands, meaning they modulate the species in and functioning of grasslands. There is a wealth of knowledge on how bison impact remnant prairies - those never converted to farmland. However, their exact effects in restored grassland ecosystems are unclear, which is a critical knowledge gap considering that managers are reintroducing bison to restored prairies throughout North America. Recently, drone technology has introduced a new way to collect data, called remote-sensing. Our research seeks to answer how bison grazing and its interaction with fire and restoration age affect productivity (NDVI), plant biomass, and plant diversity using remote sensing. Such information is important because little is known on how human-managed disturbances such as bison reintroduction and fire impact plant communities on a landscape scale. It is particularly important to understand whether remote sensing can be used to ascertain that information. We plan on resuming

data collection in the summer of 2018 over a 2 or 3-month period with the drone, and the data will be processed using Pix4D and R software. We will also participate in ground-truthing data collection in the same time period.

SESSION 3B: MEDICINE / MICROBIOLOGY

Lecture Hall

Effect of diet on the gut bacterial community of 13-lined ground squirrels
Presenters: Hannah Grauer
Research Mentor: Dr. Garret Suen, University of Wisconsin
Abstract:
The gut bacterial community (GBC) plays a vital role in contributing to host health and is sensitive to changes in diet. Previous research in wild caught woodrats found that the GBC of dietary specialists was susceptible to change after introduction to captivity. Although wild caught woodrats brought into captivity lost diversity in their GBC, a significant portion was retained, suggesting that captive woodrat GBCs are representative of wild woodrat microbiotas. However, no such study has looked at the effects of a captive diet on the GBC of wild thirteen-lined ground squirrels (*Ictidomys tridecemlineatus).* To test this, cecum content was collected from wild caught squirrels and wild caught squirrels fed lab chow. DNA was extracted and quantified, and the 16S rRNA V4 region was PCR amplified and sequenced with Illumina MiSeq. We used mothur to analyze the sequences for quality control and classification of bacteria, and the results were statistically analyzed with R. We expect that, compared to captive diet squirrels, wild diet squirrels have a more diverse GBC likely due to a more diverse diet. These results have implications for studying wild animals in captivity, especially for rodents and hibernating animals, and highlight the dynamic nature of the GBC.

The role of Disrupters of BMP9 (DONs) in regulating bone tumor formation from mesenchymal stem cells
Presenters: Scott Du and Akhila Vuppalapati
Research Mentor: Dr. Tong-Chuan He, University of Chicago
Abstract:

It has become increasingly well-known that osteosarcoma is not only a genetic disease, but also a differentiation one that results from an osteoblast differentiation and proliferation imbalance. This study investigated how certain 19-base short regulatory RNAs may disrupt BMP9-induced osteoblast differentiation in mesenchymal stem cells (MSCs). We are interested in determining these effects because they may further explain the development of osteosarcoma.

Dr. He introduced a completely randomized 19-base short RNA Library into MSCs and discovered several short RNA transcripts, which are named as Disruptors of BMP9 (DONs). These DONs were shown to produce osteogenic resistant MSCs. Our candidate DONs are now being tested for their ability to disrupt osteogenic differentiation in MSCs. Within the coming months, we hope to uncover effective DONs and sequence its RNA to determine any up or down regulation of mRNA or lncRNA involved in the pathogenesis of osteosarcoma.

Session 3C: Physics

Academic Pit

Analysis of Datasets in the Search for New Physics in Supersymmetric (SUSY) Top Squarks
Presenters: Bert Cao and Emily Sallenback
Research Mentor: Dr. Rick Cavanaugh, Fermilab
Abstract:

Since the famous discovery of the higgs boson, physicists around the world have been trying to create a new standard model of particle physics.The discovery of the higgs boson revealed flaws in the current standard model, and a new model would revolutionize particle physics. The search for particles predicted by the Supersymmetric (SUSY) model may yield results that prove the SUSY model of physics and find new physics. This current project is one of many data analysis projects in the particle search. This project is an analysis of data retrieved from the University of California, Santa Barbara (UCSB) laboratory, and LHC (Large Hadron Collider) Physics Center (LPC) at Fermilab to see if there is a significant difference between the data analysis of the two labs. Without accurate and agreeing datasets, further data analysis performed by the two joint groups may have fatal errors and inaccuracies. We compare the datasets with graphs such as histograms and ratio plots and analyze the similarity of the graphs in order resolve any differences in classifications in the datasets of each group. We are projected to complete this project before this coming summer, and then will proceed to work on other analysis projects.

Searching for Primordial Black Holes and Other Exotic Dense Objects
Presenters: May Kaur and Mishelle Mironov
Research Mentor: Dr. James Annis, Fermilab
Abstract:

The idea that Primordial Black Holes (PBHs) constitute the majority of dark matter has been revived by LIGO's detection of 30 solar mass merging black holes. We can search for PBHs via microlensing, a phenomena which occurs when a PBH passes in front of a star, forming an Einstein ring and increasing the apparent brightness of the star. We are participating in a Dark Energy Survey (DES) project to detect microlensing in DES data. This project uses DES cadences and data to generate mock microlensing curves for PBHs. PBHs of 10-100 solar masses have microlensing events of time duration t ~ 2.5 years and can be observed in DES. First, we created a clean sample of stars by removing galaxies. We then generated roughly 50,000 light curves per sampled star by using known parameters of stars in the DES and varying unknown parameters of PBHs through microlensing equations. These mock light curves were sent to another team for an analysis of the collaboration's detection efficiency of microlensing events. Calculating the detection efficiency is crucial to predict how many microlensing events we can expect to find in DES. If our observed number of microlensing events is far less than the expected number of microlensing events, we can rule out PBHs as dark matter.

Session 3D: Economics / Political Science

Room IN2

Political Institutions Behind the Russian Winter Olympics Cheating Scandal
Presenters: Kyle Campbell and Sibil Shibu
Research Mentor: Dr. Konstantin Sonin, University of Chicago
Abstract:
By 2017, the eighteenth year of Vladimir Putin's rule, the Russia is trapped in a highly inefficient, yet highly stable status-quo. The need for modernizing, forward-looking reforms is well recognized, yet attempts of such reform often end up with disappointing results. The drive to increase the country's standing in winter sports that has accompanied the preparations to 2014 Olympic Winters in Sochi is one such example. While the results seemed to be impressive – the number of gold medals quadrupled in 2014 compared to that number in 2010, the ultimate outcome was far worse than the starting point: almost half of the Russian Sochi athletes were stripped of their medals for doping violations, and the Russian Olympic team and many of its athletes were barred from 2018 Winter Olympics. The doping scandal allows to study structural characteristics of bad governance in state-dominated authoritarian countries in general. We have concluded that developing a theoretical model can be crucial for future nations when experiencing political changes. We will provide a narrative description of the doping case in Russian winter sports and build a theoretical model of strategic interaction, in which the principal chooses a project that results in easily verifiable KPIs.

Simulating the Great Soviet Terror
Presenter: Rain Bravo
Research Mentor: Dr. Christian Nokkentved, IMSA
Abstract:
Simulating the Soviet Great Terror explores the creation and use of an online multiplayer simulation game of the Soviet Great Terror and the Soviet political purges from 1934-1938 in order to test the traditionalist and revisionist interpretations of the Great Terror and explore the use of classroom simulations. To this end, a multiplayer simulation game was used to determine the effects of human agency on the purge's severity and analyze which interpretation more closely predicted live player behavior. The simulation was programmed using C, allowing student players to act as Soviet citizens and make choices in order to fulfill goals relevant to each citizen's position in society. The results of three live games were compared to those of randomized games, with a focus on the overall statistical spread of players sent to the GULAG labor camp system based on player societal role and presence of human agency. The overall result found that human agency did have a significant impact on purge severity, in line with the revisionist interpretation. In addition, the spread of players affected by the purge was influenced by player role in a way that did not correlate with historical data and requires further study.

Session 3E: Engineering

Room D103

High Resolution Tactile Sensors in Robotics
Presenter: Miron Liu
Research Mentor: Dr. Frank Harwath, North Central College
Abstract:
High resolution tactile sensors have many relevant applications in the field of biomedical engineering. Tactile sensing technology has already been applied to the Davinci robotic surgical assistant units, which

allow surgeons to perform minimally invasive surgeries remotely. Tactile sensors can potentially be applied to prosthetics research, giving the possibility of restoring cutaneous sense along with motor function. Current piezoelectric tactile sensors modeled off of skin are composed of multiple tactile sensor units imbedded in a flexible substrate. However, the resolutions of such sensor arrays are restricted by the quantity, dimensions, and spacing of its tactile sensing units. Thus, an optimization of manufacturing processes is necessary to increase resolution. However, as sensor quantity and density increases, the frequency of defects during the manufacturing process also increases while the resolution still remains limited. A solution to this issue is the creation of a tactile sensor that does not rely on a sensor array, and therefore, is not limited by resolution. This SIR focuses on research regarding the creation of a tactile sensor composed of a single resistive layer to circumvent issues with limited resolution.

Sustainable Alternatives to Drywall Using Methylcellulose and Wood Flour
Presenter: Grace Sleyko
Research Mentor: Dr. Frank Harwath, North Central College
Abstract:
We have researched the potential of a sustainable alternative to drywall using methylcellulose and wood flour. It is already known how to make a sponge out of whipped methylcellulose, but we added wood flour to create a stronger material that would replace the gypsum in traditional drywall. After weighing and qualitatively observing different solutions of methylcellulose and water, with and without wood flour, we determined that 5% methylcellulose and 5% wood flour by weight is the ideal solution. We also used layered sugar-cane paper to replace the thick sheets of paper in traditional drywall. Tensile tests have yet to be performed on a combination of the methylcellulose and the paper, to compare the strength of the alternative to the traditional, but they will be once more data is collected.

Session 3F: Physics and Mathematics

Room A113

Applications of Artificial Intelligence in Astrophysics
Presenters: Kathryn Downey and Spoorthi Jakka
Research Mentor: Dr. Brian Nord, Fermilab
Abstract:
Deep sky surveys have the potential to reveal more information about dark matter and dark energy. While sorting through the abundance of data from these surveys can be cumbersome, machine learning algorithms present a more efficient method of doing so. In this project, we aim to develop a computerized method of detecting phenomena, specifically Einstein Rings, in sky surveys.

We start with exploring gravitational lensing to understand the physical explanation of Einstein rings. Einstein Rings are characterized by their near-perfect circular shape, so we created a python program that outputs a random assortment of circles and polygons as image files. We then wrote a program that can distinguish between a circle and a polygon using the Hough Transform, and tested it on the simulated images from the first program. We performed some basic statistical diagnostics – calculating the specificity and sensitivity -- to get an idea of how well the circle detection program worked. We are currently modifying the program accordingly to improve its ability to correctly identify whether circles are present in an image as well as find the centers and radii of any detected circles. The next step is to test the program on images from real sky surveys.

Classifying Symmetric Spaces for SO(3,p)
Presenters: Hanson Hao and Jake Sutter
Research Mentor: Dr. Ellen Ziliak, Benedictine University
Abstract:
Consider a set of three orthogonal (perpendicular) vectors in the finite field of order p, where p is an odd prime, such that the volume of the parallelepiped enclosed by these vectors is one. We investigate the set of all of these vectors which can be considered as 3x3 matrices, in a group called SO(3,p). The size of SO(3,p) is computed both manually, by considering the relationships between each pair of vectors, and also through the use of a C++ program. We also investigate certain functions, termed inner involutions, on these matrices that map a matrix back to itself after two consecutive applications, and we classify them into the *Extended Symmetric Space* **R** and the *General Symmetric Space* **Q**. Conjectures were made for formulas relating the sizes of **R** and **Q** to *p.* We will present several attempts at confirming these conjectures and current progress on the problem. Future directions include verifying our conjectures and generalizing our results to higher matrix dimensions. Applications of our research can be seen in physics, where the SO(3,p) matrices are particularly effective at describing the effects of rotation and spin.

Session 3G: Medicine / Microbiology

Room A115

Uncovering the Role of Tumor-Associated Antigen IL13Ra2 in Glioblastoma Progression
Presenter: Mounisha Kovour
Research Mentors: Drs. Irina V. Balyasnikova and Michael Chastkofsky, Northwestern University
Abstract:
Glioblastoma (GBM) is the most aggressive brain tumor with no cure. GBM is characterized by its invasiveness, rapid growth, and therapeutic resistance. IL13Rα2 receptor is overexpressed in GBM, and its high expression inversely correlates with patient survival. However, the functional role of IL13Rα2 is not known. Our data demonstrated that the partial knockdown of IL13Rα2 with two shRNAs alters the expression of a network of transcription factors. Analysis of a human protein atlas revealed the nuclear and transmembrane localization of IL13Rα2 in glioma cells. We, therefore, focused on the validation of subcellular localization of IL13Rα2 in glioma cells. We utilized PCR, Western blotting, fluorescent and confocal microscopy, cell culture, transfection with plasmid DNA, and cell fractionation to answer this question. Nuclear localization of IL13Rα2 was observed in several glioma cell lines using microscopy. However, cell fractionation and staining of the nuclear fraction for this protein did not confirm the result. Furthermore, analysis of 293T cells transfected with IL13Rα2 tagged with myc protein revealed cytoplasmic, but not nuclear, localization of IL13Rα2. Currently, we are utilizing CRISPR to knock out IL13Rα2 in order to confirm our results obtained with shRNAs and better understand its functional role in GBM.

Plurality of Neurons in the External Globus Pallidus in Parkinson's disease
Presenter: Aryan Walia
Research Mentor: Dr. C. Savio Chan, Northwestern University
Abstract:
Compelling evidence suggests the movement symptoms of Parkinson's disease (PD) share a causal relationship with pathological activity of the external globus pallidus (GPe), a central nucleus in the basal ganglia. While the cellular makeup of the GPe and its heterogeneity have not been fully-investigated,

two novel classes of GPe neurons have recently been identified by our lab. These two distinct populations can be distinguished by their expression of parvalbumin (PV), a calcium binding protein, and Npas1, a transcription factor. Furthermore, PV and Npas1 expressing neurons project primarily to the STN and dorsal striatum, respectively. Based on preliminary data from our lab, PV and Npas1 can be further subdivided. The objective of this study is to scrutinize the GPe neurons against the existing parvalbumin and Npas1 expressing neurons to identify novel subtypes using a combinatorial transgenic and immunohistochemical approach. This study will develop the current understanding of the cellular diversity of the GPe and will provide an improved understanding of how these particular subclasses and their circuit properties are involved in the motor dysfunction of PD.

Session 3H: Medicine / Microbiology

Room A117

Defining the differences in EphA2 signaling networks in early versus late stage differentiation
Presenters: Sivam Bhatt
Research Mentors: Drs. Bethany E. Perez-White and Nihal Kaplan, and Rosa Ventrella, Northwestern University
Abstract:
Skin is a stratified epithelium consisting of several layers of cells in various stages of differentiation. EphA2 receptor tyrosine kinase, a signaling molecule known to facilitate cellular communication and prompt keratinocyte differentiation, has a distinct expression pattern in these different cell layers. Our data show that EphA2 protein has a diffuse, pan-cellular expression pattern in the proliferative layer of epidermis. In contrast, EphA2 localizes at the cellular membrane in the differentiated cells of the upper layers. These observations led us to hypothesize that EphA2 participates in unique signaling pathways in early- versus late-stage epidermal differentiation. We performed biotin-identification proteomics (BioID) to identify the EphA2 interactions at different stages of differentiation. The results from this screen revealed 372 total EphA2-interacting proteins in early stages of differentiation and 192 proteins at later differentiation, of these, 86 were found to be common between both time points. Gene ontology term (GO term) analysis found different biological processes associated with EphA2 at early versus late differentiation. In early differentiation, vesicle mediated transport was the primary biological process. Whereas in late differentiation, regulation of cytoskeleton organization was the top GO term. Based on these results we will further probe the distinct roles EphA2 has during early or late keratinocyte differentiation.

LUBAC-Dependent Epithelial Signaling Regulates TRAIL Expression During Influenza A Virus Infection
Presenters: Zhaozhi (George) Li
Research Mentor: Dr. Laura Dada, Northwestern University
Abstract:
The linear ubiquitin chain assembly complex (LUBAC), consists of three proteins; HOIP, the catalytic unit whose E3-ligase activity is necessary for the formation of “head-to-tail” linear ubiquitin chains, and SHARPIN and HOIL, which provide stability to the complex (Tokunaga et al. 2009). Downstream of inflammatory stimuli, LUBAC is required for the robust activation of NF-κB and subsequent upregulation of NF-kB-regulated inflammatory cytokines (Tokunaga and Iwai, 2012). During Influenza A Virus (IAV) infection, alveolar epithelial cells (AEC) are targeted for viral replication and orchestrate the inflammatory response by producing cytokines, which recruit inflammatory cells (Short et al. 2014). While infiltrating immune cells are necessary for viral clearance, they contribute to the excessive

production of cytokines, which promotes AEC death, damages the alveolar epithelial barrier, and impairs proper lung function (Short et al. 2013). One of the cytokines produced, TNF-related apoptosis-inducing ligand (TRAIL), is expressed by macrophages in response to IAV-induced epithelial signaling (Herold et al. 2008). TRAIL interacts with its receptor, Death Receptor 5 (DR5), on AEC to induce death and enhance morbidity and mortality during influenza infection (Herold et al. 2008). To investigate whether TRAIL expression is driving influenza-induced mortality in mice with an alveolar epithelial specific loss of HOIP (HOIP-KO), IAV-infected wild-type (WT) and HOIP-KO mice were subjected to bronchoalveolar lavage (BAL) at 5 days post infection to obtain a cell pellet of inflammatory cells from which we then isolated RNA using a specialized RNA-binding silica membrane. Eluted purified RNA was then converted into cDNA using a reverse transcriptase and used in an qRT-PCR reaction to quantify TRAIL expression in BAL. We found that the absence of HOIP correlated with increased TRAIL expression, which was detected at nearly sixfold expression levels in cells from HOIP-KO mice as compared to those from WT mice. These results suggest the LUBAC plays a critical role in regulating the total levels of TRAIL expression in the mouse lung during IAV infection.

SESSION 3I: MEDICINE / MICROBIOLOGY

Room A119

The Effects of High Levels of CO_2 on the Proliferation of Skeletal Muscle Stem Cells
Presenters: Eva Liu
Research Mentor: Drs. Emilia Lecuona and Jacob Sznajder, Northwestern University
Abstract:
Patients with chronic obstructive pulmonary disease (COPD) or adult respiratory distress syndrome (ARDS) may develop increased levels of CO_2 in their blood, also known as hypercapnia. Many of these patients also suffer from muscle dysfunction, which decreases their quality of life. We have previously found that there is a direct correlation between hypercapnia and muscle atrophy. The current study focuses on how hypercapnia affects the repair process in the skeletal muscle. In order to effectively repair an injury, skeletal muscle stem cells must proliferate and differentiate, both of which processes were affected by hypercapnia in an *in vitro* model. Cell proliferation requires energy and stem cells usually use glycolysis as a source of energy when proliferating. We hypothesize that cells exposed to high levels of CO_2 have a decreased glycolytic activity. To study this hypothesis, we exposed C2C12 myoblasts to high CO_2 levels for 3 days and analyzed by qPCR key enzymes of the glycolytic pathway. The results will be presented at IMSAloquium. As the investigation continues, its results can allow scientists to better understand the effects of hypercapnia on patients with lung associated skeletal muscle dysfunction.

The Impact of Hypercholesterolemia and Obesity on Wound-Healing
Presenters: Daniel Chen, Joanna Lee, Marisa Patel-O'Conner, and Tanmayee Vegesna
Research Mentors: Dr. Irena Levitan and Yedida Bogachkov, University of Illinois Chicago
Abstract:
Hypercholesterolemia is a common health condition where there is an excess and often dangerously high amount of LDL-cholesterol in the blood that can be diet-related or genetic. When an injury occurs, the body starts the process of wound healing through closure of the wound by the formation of new tissue, which includes fresh extracellular matrix, skin cells, and blood vessels. This study investigates how hypercholesterolemia affects the wound healing process. More specifically, the first part of the study focuses on the effects of hypercholesterolemia on deposition of the extracellular matrix and investigates the presence of lipids. Two mouse are used in this study: (i) ApoE KO, genetically modified

to have excess amount of cholesterol, and (ii) wild type mice fed high fat diet. Both models were compared to age-matched and gender-matched wild type mice fed a normal chow diet. Two models of wound healing were implemented: matrigel plugs and skin punch biopsies. Our results show that in the matrigel assay there was no significant difference in the amount of collagen, a major component of the extracellular matrix between all the mouse models. For the skin punch model, we found that ApoE mice wounds have significantly higher amount of collagen during the wound healing process.

Session 3J: Medicine / Microbiology

Room A123

Targeting MLL Gene Expression using CRISPR/Cas9 to Reverse the Phenotypes of Cancer
Presenters: Sonya Gupta, Goutam Gutta, Daniel Mwangi, Shyam Sai, and Shruthi Sundar
Research Mentor: Dr. Vandana Chinwalla, IMSA
Abstract:
Mixed Lineage Leukemia (MLL) is a gene that is frequently mutated in many forms of childhood leukemias and solid tumors. MLL is a histone methyltransferase and plays an important role in gene expression of downstream targets by modulating chromatin structure. When MLL is mutated, it results in excessive growth and the formation of cancer. Previous research suggests that at least one normal copy of MLL may be required for the formation of tumors and its aggressive nature through its expression. The project utilizes the gene-editing tool CRISPR/Cas9 tool to knock out the MLL gene in MCF-7 (breast cancer) cells to reverse the phenotypes of cancer, starting apoptosis. A MLL-guideRNA construct was designed for the CRISPR/Cas9 mechanism to target the desired gene. Through transfection, the CRISPR construct with guideRNA, and selection markers were introduced into the cells. Our preliminary results showed that knocking out the MLL gene in MCF-7 cells increased cell death. After attempting to recreate our results, our cells underwent apoptosis earlier than expected. This occurred in multiple trials, thus we aim to discover the underlying cause. The effect of MLL knockout will be evaluated in other tumor lines. The applications of this project can lead to major changes in cancer treatment and further research on MLL's and cancer.

Role of MLL (Mixed Lineage Leukemia) in tumorigenesis
Presenters: Miriam Frank, Suhita Irukulla, Prachi Patil, Nayonika Roy, Shvetali Thatte, and Kristin Wolford
Research Mentor: Dr. Vandana Chinwalla, IMSA
Abstract:
The Mixed Lineage Leukemia (MLL) gene is a methyltransferase that aids in the chromatin modification of developmental genes in humans. The presence of the mutated MLL gene has been associated with the development of cancer. Previous research indicates that in every cancer associated with the mutated MLL gene, there is one normal functioning copy of the MLL gene. Our goal in this research is to see if knocking out the MLL gene function decreases tumorigenesis. We will use the CRISPR/Cas9 genome editing system. The MLL gRNA molecules have been designed and will be composed into the correct CRISPR/Cas9 vector. This construct will be used to transfect a variety of human cell lines, starting with lung cancer cells. After the transfection, we will use the microscope to see how many cells are alive. The cells will be analyzed for apoptotic death using an apoptosis assay. This is because based on prior research, knocking out the MLL gene should induce apoptosis. We confirm the knocking out of MLL through genome sequencing. Based on the analysis, we want to see if there is greater apoptotic death in

the cells that were treated with the vector in comparison with the control cells. We hope to use this data/research as a way of developing a MLL-targeted therapy for leukemia and other solid cancers.

Session 3K: Engineering

Room B125

Solar Chimney Optimization for Environmental Energy Absorption
Presenters: Gabriel Bryk, Fred Poddig, and Aidan Steineman
Research Mentor: Dr. Sanza Kazadi, IMSA
Abstract:
A solar chimney comprises two main parts: a solar collector and a largely vertical component. The solar collector absorbs solar energy, converting it to heat, and transfers it to air contained therein. Because the air becomes buoyant, it rises and exits out of the vertical component. As the air leaves the solar chimney, it tends to draw new air into the chimney, resulting in a continual airflow. We examine the design, construction, and performance of a novel solar chimney incorporating the following components: a desiccator that contains a liquid which is dried by the airflow, and a coaxial chimney design enabling solar heating of the chimney. Our research focuses on constructing and characterizing a solar chimney that performs the desiccation task. An evaluation of the fitness of this solution to the energy acquisition step in the entrochemical cycle will be performed.

Schedule at a Glance

Dr. M. Ross Alexander	Auditorium	1
Dr. M. Ross Alexander	A200	W3
Dr. Sowmya Anjur	A131	1
Dr. Sowmya Anjur	A131	W3
Dr. Mark Carlson	D103	1
Dr. Mark Carlson	B145	W3
Dr. Adrienne Coleman	IN2	1
Dr. Adrienne Coleman	A129	W3
Dr. Peter Dong	Ac. Pit	1
Dr. Peter Dong	A121	W3
Mr. Manny Hernandez	D103	1
Mr. Manny Hernandez	B145	W3
Dr. Sanza Kazadi	A113	1
Dr. Sanza Kazadi	A129	W1
Dr. Sanza Kazadi	Grainger Lab	W2
Mr. John Kennedy	A129	W3
Dr. Louis Kauffman	A131	W1
Mr. David Lundgren	A131	1
Mr. David Lundgren	A131	W3
Dr. Christine Rollinson	Auditorium	1
Dr. Christine Rollinson	A200	W3
Dr. Clayborne Skinner	IN2	2
Dr. Eric Smith	A129	1
Ayush Agarwal	A121	W3
Adhav Arulanandan	A121	1
Abhiudaya Bhalla	A121	2
Sivam Bhatt	A117	3
Zach Brahmbhatt	A115	1
Rain Bravo	IN2	3
Ken Brudnak	D103	1
Gabriel Bryk	B125	3
Kyle Campbell	IN2	3
Bert Cao	Ac. Pit	3
Chris Chang	A121	2
Maelee Chen	Lect. Hall	2
Allen Chen	A115	2
Daniel Chen	A119	3
Isaiah Crews	Grainger Lab	W2
Aliah Shaira De Guzman	A123	2
Thomas DeMastri	A117	2
Grant Dexter	A121	W3
Parth Dhyani	Auditorium	1
Alexander Domowicz	A129	1
Kathryn Downey	A113	3
Scott Du	Lecture Hall	3
Joshua Eberhardt	A113	2
Rebecca Ellington	Auditorium	3
Manny Favela	Ac. Pit	1
Miriam Franks	A123	3
Christoph Gaffud	A121	2
Audrey Gallier	A121	3
Takudzwa George	IN2	1
Diann George	A119	2
Faith George	A115	2
Isabella Ginnett	Ac. Pit	1
Eden Gorevoy	A129	1
Hannah Grauer	Lecture Hall	3
Kaushal Gumpala	A121	W3
Abhay Gupta	A117	1
Sonya Gupta	A123	3
Goutam Gutta	A123	3
Madison Hahamy	A121	W3
Hanson Hao	A113	3
Aurora Harkelroad	IN2	2
Ben Helmold	Lecture Hall	1
Eric Hersey	A121	2
Matthew Hokison	A121	W3
Blair Hu	Lect. Hall	1
Gloria Huang	A119	2
Charles Hultquist	A121	2
Sol Hwangbo	Lect. Hall	1
Suhita Irukulla	A123	3
Spoorthi Jakka	A113	3
May Kaur	Ac. Pit	3
Nathanael Kim	A113	2
Liana Koleva	D103	2
Mounisha Kovour	A121	2
Mounisha Kovour (II)	A115	3
Noah Krouse	A129	W1
Suchet Kumar	A113	2
Joanna Lee	A119	3
Andy Lennox	Grainger Lab	W2
Zhaozhi Li	A117	3
James Lichtenstein	A123	2
Louise Lima	Ac. Pit	2
Lucy Liu	Auditorium	1
Patrick Li	Auditorium	3
Miron Liu	D103	3
Alice Liu	Ac. Pit	2

Eva Liu	A119	3
Albert Lu	A131	1
Robert Luo	IN2	1
Katarina (Red) Maier	Ac. Pit	2
Micah McBride	A121	1
Mishelle Mironov	Ac. Pit	3
Rishi Modi	A117	2
Timothy Mou	A121	W3
Maryam Mufti	A117	2
Daniel Mwangi	A123	3
Harsha Nalam	A123	2
Kaleigh O'Brien	D103	2
Lewis Oh	A121	2
Jessica Oros	Auditorium	2
Rebecca Osar	A121	W3
Clinton Oshipitan	IN2	1
Lily Pan	A121	W3
Sargam Panpaliya	A117	2
Cassandra Parent	D103	1
Marisa Patel-O'Conner	A119	3
Prachi Patil	A123	3
Fred Poddig	B125	3
Advai Podduturi	A119	1
Devika Prasad	A113	1
Shayna Provine	A129	W1
Lucien Putnam	Grainger Lab	W2
Kate Rabideau	A117	2
Akshaya Raghavan	A121	W3
Mihika Rajvanshi	A119	2
Chetan Reddy	A121	W3
Jay Reiter	A121	W3
Jimmy Ren	A123	2
Alexander Romanov	A129	W1
Nayonika Roy	A123	3
Shyam Sai	A123	3
Emily Sallenback	Ac. Pit	3
Amayrani Sanchez	A119	1
Faris Shaikh	A117	1
Shivani Sharma	Auditorium	2
Anisha Sharma	A121	W3
Sibil Shibu	IN2	3
Katie Si	A117	1
Michelle Sia	A133	2
Grace Sleyko	D103	3
Harry Smith	A121	W3
Amit Somalwar	Lect. Hall	1
Emily Springer	A121	W3
Bharath Sreenivas	A113	2
Charlie Steenstra	Auditorium	3
Aidan Steineman	B125	3
Trisha Sudhakar	Lect. Hall	1
Shruthi Sundar	A123	3
Jake Sutter	A113	3
Elange Tande	A115	2
Mary Ashley Tenedor	A119	1
Chandana Tetali	Lect. Hall	1
Shvetali Thatte	A123	3
Ashley Tin	A119	2
Srivinay Tummarakota	A121	W3
Tommy Vadakumchery	A113	2
Vaishnavi Vanamala	Grainger Lab	W2
Abigail Vanderploeg	A121	W3
Tanmayee Vegesna	A119	3
Shubha Verma	A115	1
Akhila Vuppalapati	Lect. Hall	3
Aryan Walia	A115	3
Amy Wang	IN2	1
Neil Wary	Lect. Hall	2
Tyrone Whitmore	Ac. Pit	2
Kristin Wolford	A123	3
Amanda Wong	D103	2
John Woods	A121	W3
Ananya Yammanuru	A121	2
Gary Yang	IN2	2
Mia Ye	Auditorium	2
Eunice Yoon	D103	2
Alexander Zhong	A121	1
Claudia Zhu	A113	1
Isabella Baldwin Zurek	IN2	1