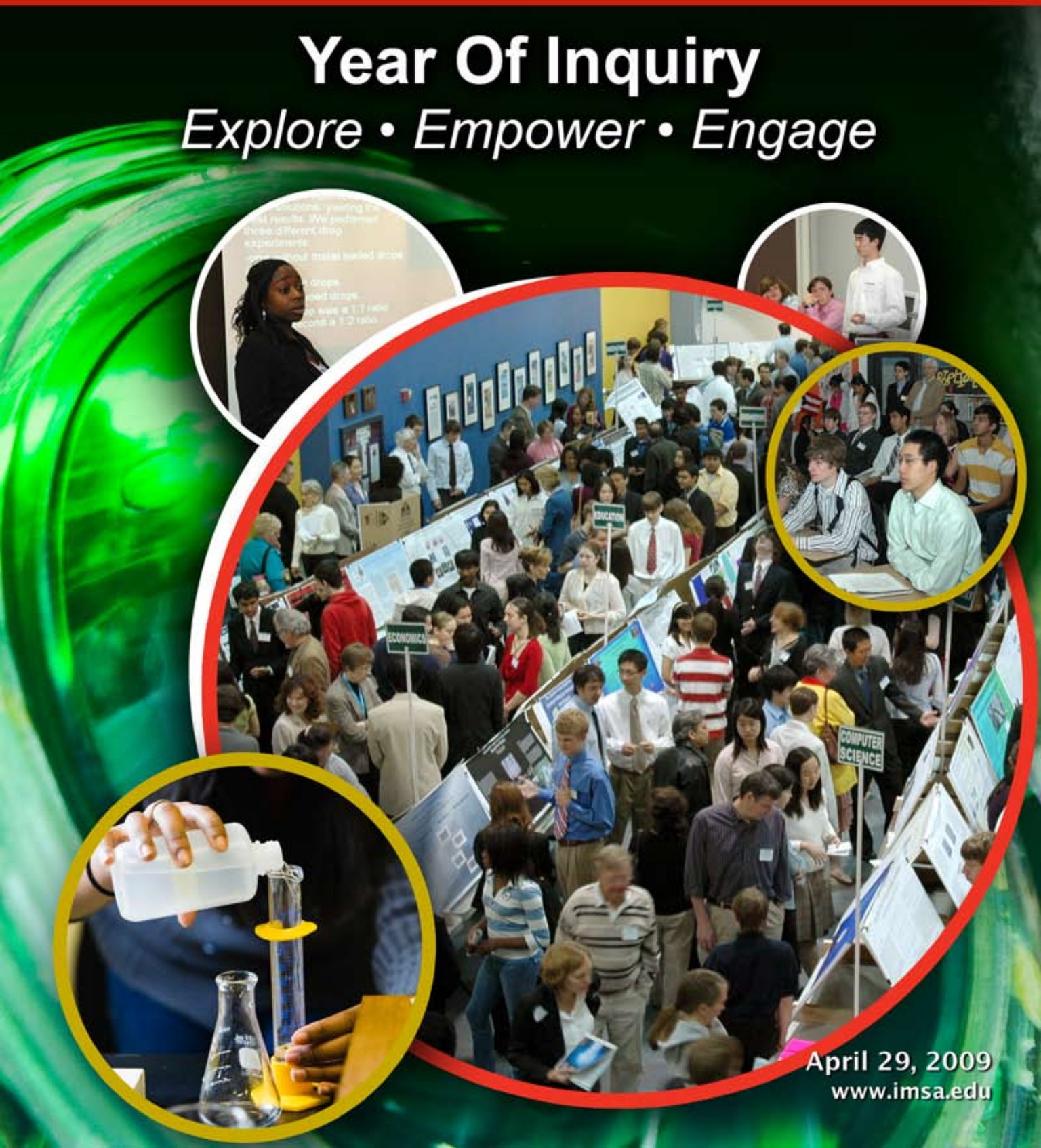
IMSAloquium

STUDENT INVESTIGATION SHOWCASE

Year Of Inquiry

Explore • Empower • Engage



April 29, 2009

www.imsa.edu

IMSAloquium
STUDENT INVESTIGATION SHOWCASE

April 2009

Dear IMSA Friends:

IMSA's Student Inquiry and Research Program (SIR) is a powerful expression of the Academy's mission, "to ignite and nurture creative ethical minds that advance the human condition." SIR enables students to pursue solutions to problems that challenge our global community through partnerships with distinguished professionals at colleges and universities, research institutions, businesses, and museums. Research is life-changing for the students and, in many cases, they have already contributed to our mission.

Working with world-class scholars and advisors, students have contributed to advances in such fields as diagnostics for cancer, nanotechnology-based therapeutics, the rehabilitation of stroke patients, and the search for the Higgs Boson. This work is shared through presentations, publications, and collaborations with other students, scholars, artists, and inventors throughout the world. Evidence of our students' excellence is found within this proceedings book of our twenty-first IMSAloquium.

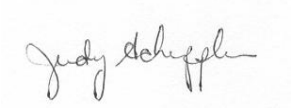
Through innovative programs, such as SIR, IMSA strives to stimulate excellence in mathematics and science teaching and learning across Illinois and beyond. We aspire to become "the world's leading teaching and learning laboratory for imagination and inquiry." Toward this end, we are aggressively delivering services around the State for teachers and students to assist with developing the "next generation" of talent and leadership in science, technology, engineering, and mathematics.

As the *Year of Science* is celebrated and explored throughout Illinois and the United States, we join this national movement by honoring our extraordinary young investigator's *Year of Inquiry*. These students exemplify a tradition of excellence. We set high expectations for our students, and we believe that you will find that IMSA students far exceed these expectations for accomplishments and contributions to society. They are well-prepared to solve the challenges that we will face in the future.

Thank you for celebrating our students' successes with us!

Sincerely,

Glenn "Max" McGee, Ph.D.
President



Judith A. Scheppler, Ph.D.
Coordinator of Student Inquiry & Research

Illinois Mathematics and Science Academy
The World's Leading Teaching and Learning Laboratory for Imagination and Inquiry

Twenty-first Annual IMSAloquium
April 29, 2009

Table of Contents

Cover and IMSAloquium designer is Irene Norton, IMSA staff member.
The images used to compose the cover were taken by Craig Watson, Irene Norton, and Prestige Portraits by Lifetouch.

IMSAloquium logo design by Stephanie Chang and Hon Lung Chu (IMSA Class of 2007).

Student Inquiry and Research

The Student Inquiry and Research (SIR) program has been an integral part of student personalized learning at IMSA since the 1989 academic year. Since its inception with seven students, SIR has grown into a program that encompasses all disciplines and participation by 80% of the class of 2009. Our students' accomplishments have flourished. They do not have to wait until they graduate from college to begin to make significant contributions to science, mathematics, the humanities, and the world around them. IMSA's young apprentice investigators open our eyes to what is possible, and the World is paying attention. Accomplishments by students participating in Student Inquiry and Research are numerous!

Authorship or Co-authorship in Publications (partial list)

- *Biographies of the Citizens of Lee County Illinois: Through the Years*
- *Learning and Leading with Technology*
- *Nature*
- *NCSSSMST Journal*
- *The Science Teacher*

Portraits of Great American Scientists (2001, Prometheus Books) contains biographies of fifteen American men and women motivated to excel in diverse fields of science. This book was the collaborative student effort of fifteen participants in IMSA's Student Inquiry and Research Program.

"Student Inquiry at the Illinois Mathematics and Science Academy," authored by Judith A. Scheppler, Donald Dosch, Susan Styer, and Steve Rogg, is among only fifteen high school models in the nation to have chapters in the National Science Teachers Association book, *Exemplary Science in Grades 9-12* (2005, NSTA Press).

"**Student Inquiry and Research: Developing Students' Authentic Inquiry Skills**" authored by Judith A. Scheppler, Susan Styer, Donald Dosch, Joseph Traina, and Christopher Kolar, is among only eighteen inquiry-based programs nation-wide to have a chapter in the National Science Teachers Association book *Inquiry: The Key to Exemplary Science* (2009, NSTA Press).

Presentations (partial list)

- American Society of Cell Biology
- American Society of Microbiology
- History of the Atomic Age - Chicago Historical Society
- Illinois Section of the Mathematics Association
- Junior Academy of Science at AAAS
- National African American Studies Conference
- National Association of Biology Teachers
- NCSSSMST Student Research Symposium
- Sakharov Readings
- Society for Integrative and Comparative Biology
- 2009 Innovations in Medical Education Conference

Competitions (partial list)

- Junior Science and Humanities Symposium
- National History Day Competition
- Neuroscience Research Prize
- Neuroscience Creativity Prize
- Intel Science Talent Search
  - 29 semi-finalists and 10 finalists since 1989
  - Finalists have placed first (1993), fifth (1998), third (1999), and second and sixth (2005)
- Siemens Westinghouse (established 1998-99)
- 32 regional semi-finalists resulting in 5 regional finalists and 1 national semi-finalist
- Young Epidemiology Scholars

2008-2009 Student Recognition

Please join us in the Academic Pit, at 12:30, for our Student Recognition Ceremony

Hosted By
Dr. Leon Lederman, Nobel Laureate and IMSA Resident Scholar
And
Dr. Glenn "Max" McGee, IMSA President

Stephanie Brandt: A Measurement of Dijet Azimuthal Decorrelation at Forward Rapidities
Advisor: Don Lincoln, Fermi National Accelerator Laboratory
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Luis Carbajal: Real-Time Imaging of the Cellular Redistribution of HSP27-CFP and HSP70-GFP Fusion Proteins in Cardiovascular Smooth Muscle Cells to Assess Actin Cytoskeletal Remodulation
Advisor: Jody Martin, Loyola University
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Matthew Castillon: Analysis of Contained Muon Events in the MINOS Far Detector
Advisor: Maury Goodman, Argonne National Laboratory
Siemens Competition semi-finalist

Grace Chan: The Effects of Pioglitazone on Glucose Uptake in C6 Glioma Cells
Advisor: Douglas Feinstein and Anthony Sharp, University of Illinois at Chicago
Fifth International Students Science Fair

Hyunjii Cho: Detecting the Difference between Normal and Cancerous Stem Cells Through Analysis of Morphology, Gene Expression, and Effects of Dichloroacetate (DCA)
Advisors: Morris Kletzel and Marie Olszewski, Childrens Memorial Hospital
Siemens Competition semi-finalist

Kevin Crews: Comparison of Substrate Mimetic Inhibitors of PKB
Advisor:
Siemens Competition semi-finalist

David Derry: The Applicability of Magnetic Quantum Cellular Automata as an Alternative to Transistors
Advisors: Vitali Metlushko and Josh Sautner, University of Illinois at Chicago
Illinois Junior Academy of Sciences competitor[*]

Anamaria Filipac: Understanding the Origin of Murine Thymic Natural Killer Cells
Advisors: Markus Boos and Barbara Kee, University of Chicago
Siemens Competition semi-finalist

Shravanthy Gumidyala: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
Illinois Junior Academy of Sciences competitor[*]

Ray Gu: Sewage Off-Gas-Driven fuel Cells to Stimulate Rural Electrification
Advisor: Herek Clack, Illinois Institute of Technology
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Jennifer Hu: Melanoma Associated Antigens as T Cell Targets In Lymphangioleiomyomatosis
Advisor: Caroline LaPoole, Loyola University Medical Center
Abstract submitted: LAMposium 2009: International LAM Research Conference

Yifei Huang: Chemical Sensing based On Optical Interference of Modified Anodized Aluminum Oxide Surfaces
Advisor: Hsien-Hau Wang, Argonne national Laboratory
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Yaseen Jamal: IL-10 Inhibits Inflammation Mediated Cardiac Dysfunction Post-Myocardial Infarction
Advisors: Rajasingh Johnson, Raj Kishore, Prasanna Krishnamurthy and Erin Lambers, Northwestern University Feinberg School of Medicine
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair, Siemens Competition Regional Finalist (second place), Chicago-area Junior Sciences and Humanities Symposium finalist[+], Illinois Junior Academy of Sciences competitor[*]

Janel Jin: The Effects of Pseudo-Phosphorylation on Tropomyosin Conformation and Interaction with the Thin Filament
Advisor: Brandon Biesiadecki, University of Illinois at Chicago
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Sushma Kola: Characterization of Copolymer Hydrogels for Oral Insulin Delivery
Advisors: Eric Brewer, F. Michael Marks, and Anthony Lowman, Drexel University
2009 sanofi-aventis International BioGENEius Challenge: Illinois State finalist, Junior Science and Humanities Symposium competitor (third place), Illinois Junior Academy of Sciences competitor[*]

Anusha Kumar: The Role of PS-1 in Adult Neurogenesis
Advisor: Orly Lazarov, University of Illinois at Chicago
Illinois Junior Academy of Sciences competitor[*]

Kelsey Lawhorn: Weak Lensing Mass Estimates of Low Redshift Galaxy Clusters
Advisors: James Annis, Donna Kubik, Jeffrey Kubo, Huan Lin and Albert Stebbins, Fermi National Accelerator Laboratory
Siemens Competition Regional-finalist

Bob Lee: Treatment of Breast Cancer using an Oncolytic Adenovirus to Inhibit the Transforming Growth Factor- . Signaling Pathwar
Advisors: Janhavi Gupta and Prem Seth, Evanston Northwestern Healthcare Research Institute
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair, Siemens Competition semi-finalist, Fifth International Students Science Fair

Yize Leng: Effect of Rosiglitazone on Transforming Growth Factor- - Induced Fibroblast Activation and Migration During Wound Healing
Advisor: Ashish Ghosh, Northwestern University
Siemens Competition semi-finalist

Jimmy Liu: Detecting the Difference Between Normal and Cancerous Stem Cells Through Analysis of Morphology, Gene Expression, and Effects of Dichloroacetate (DCA)
Advisors: Morris Kletzel and Marie Olszewski, Childrens Memorial Hospital
Siemens Competition semi-finalist

Jonathan Loucks*:* An Analysis of Illinois Public Schools: An Examination of Factors that Contribute to the Narrowing of the Socioeconomic Achievement Gaps
Advisor: Glenn "Max" McGee
Illinois Junior Academy of Sciences competitor[*]

Travis Mui: Analysis of Contained Muon Events in the MINOS Far Detector
Advisor: Maury Goodman, Argonne National Laboratory
Siemens Competition semi-finalist

Peter Nebres: The Applicability of Magnetic Quantum Cellular Automata as an Alternative to Transistors
Advisors: Vitali Metlushko and Josh Sautner, University of Illinois at Chicago
Illinois Junior Academy of Sciences competitor[*]

Sammy Nguyen: Sewage Off-Gas-Driven fuel Cells to Stimulate Rural Electrification
Advisor: Herek Clack, Illinois Institute of Technology
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Jonathan Park: Determining the Mechanisms of Herpes Simplex Virus Type 1 Ocular Cell Infection
Advisor: Christopher O'Donnell and Deepak Shukla, University of Illinois at Chicago
Junior Sciences and Humanities Symposium competitor

Suganya Rajendran: The NICHE (Non-Invasive Cardiac Hemodynamic Evaluation) Study
Advisor: Antony Kim, University of Chicago
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair, Siemens Competition semi-finalist

Jamie Ray: Search for a Fermiophobic Higgs Boson Decaying into Diphotons at CDF
Advisors: Craig Groups, Ray Culbertson, Fermi National Accelerator Laboratory
Presentation: American Physical Society, May 2-5, 2009

Hannah Reiser: Predicting Medical School Success in 60 Minutes
Advisors: Jonathan Muraskas, Adrian Jones, and LaDonna Norstrom, Loyola University
Presentation: *2009 Innovations in Medical Education Conference, March 14-15, 2009*

Shyam Saladi: Sedimentation in Pervious Concrete
Advisor: Brian Lutey, Ozinga Brothers, Inc
Illinois Junior Academy of Sciences competitor[*]

Jonathon Schwarzbauer: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
Illinois Junior Academy of Sciences competitor[*]

Jenny Shao: A Comprehensive Mathematical Model of Tumor-Immune Dynamics
Advisor: Dr. Bin Shao
Intel Science Talent Search semi-finalist, Junior Sciences and Humanities Symposium competitor[*]

Eric Shyu: Luminescent Cadmium Cordination Polymers with Deverse Structural Morphologies
Advisor: Robert LaDuca, Michigan State University
Intel Science Talent Search National Finalist, Siemens Competition semi-finalist
Publication: Robert L. LaDuca and Eric Shyu, Divalent metal succinate/perchlorate coordination polymers incorporating a kinked hydrogen-bonding capable diimine: Chains, layers and a (5,6)-connected binodal network featuring alternating rectangular and hexagonal grids, *Polyhedron* 28(4): 825-834.

Edward Song: Identification of Dicer-1 and Dicer-2 Binding Proteins
Advisor: Erik Sontheimer, Northwestern University
Siemens Competition semi-finalist

Jessina Thomas: Mechanism of Primordial Follicular Death and the Regulation of Ovulation
Advisor: Teresa Woodruff, Northwestern University
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Karthik Vantakala: IL-10 Inhibits Inflammation Mediated Cardiac Dysfunction Post-Myocardial Infarction
Advisors: Rajasingh Johnson, Raj Kishore, Prasanna Krishnamurthy and Erin Lambers, Northwestern University Feinberg School of Medicine
*Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair, Siemens Competition Regional Finalist, Illinois Junior Academy of Sciences competitor**

Eva Yuan: Particulate Matter Causes Endothelia Cell Barrier Disruption and Induces acute Lung Damage in a Murine Model of Asthma: Physiological and Genomic Contributions
Advisors: Joe Garcia, Liliana Moreno and Ting Wang, University of Chicago
Fourth International Students Science Fair/Sixth Japan RITS Super Science Fair

Anthony Yunker: Weak Lensing Mass Estimates of Low Redshift Galaxy Clusters
Advisors: James Annis, Donna Kubik, Jeffrey Kubo, Huan Lin and Albert Stebbins, Fermi National Accelerator Laboratory
Siemens Competition Regional-finalist

Weili Zheng: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
*Illinois Junior Academy of Sciences competitor**

Amy Zhou: New Battles against Complex Infections: Synergy Studies Against Methicillin-Resistant *Staphylococcus aureus*
Advisor: Bill Kabat and Rajeswari Pitchumani, Children's Memorial Hospital
Fifth International Students Science Fair

Johannes Zhou: Determination of Effectiveness of Leading Antacid Brands
Advisor: Peter Dong, Illinois Mathematics and Science Academy
Junior Sciences and Humanities Symposium competitor

+ JSHS National Competition April 29 – May 3
* Illinois Junior Academy of Sciences Region V competition April 4; state competition is May 8-9, 2009

ILLINOIS MATHEMATICS AND SCIENCE ACADEMY
The World's Leading Teaching and Learning Laboratory for Imagination and Inquiry

IMSAloquium:
Student Investigation Showcase
April 29, 2009

SCHEDULE OF SESSIONS

8:00 - 9:00 a.m.	Poster Session
9:10 - 9:25 a.m.	IMSAloquium Session 1
9:35 - 9:50 a.m.	IMSAloquium Session 2
10:00 - 10:15 a.m.	IMSAloquium Session 3
10:25 - 10:40 a.m.	IMSAloquium Session 4
10:50 - 11:05 a.m.	IMSAloquium Session 5
11:15 - 11:30 a.m.	IMSAloquium Session 6
11:30 - 12:30 p.m.	Lunch
12:30 - 12:45 p.m.	IMSAloquium Session 7
12:55 - 1:10 p.m.	IMSAloquium Session 8
1:20 - 1:35 p.m.	IMSAloquium Session 9
1:45 - 2:00 p.m.	IMSAloquium Session 10
2:10 - 2:25 p.m.	IMSAloquium Session 11

IMSAloquium Poster Session

Biochemistry

A01	Oluwakemi Aladesuyi Arogundade
A02	Cecilia Chang
	Zack Maril
A03	Hyun Cho
A04	Yize Leng
A05	Grant Rotskoff
A06	Bani Saluja
A07	Rital Shah
A08	Yiru Tao
A09	Eva Yuan

Bioengineering

B01	Susan Chen
	Jasmine Kwasa
B02	Frederick Damen
B03	Hendrik Dewald
B04	Nicole Howard
B05	Velin Tchalakov
B06	Karthik Vantakala

Biology

C01	Dimple Adatia
	Linna Guan
C02	Erika Bongen
C03	Jessica Burash
	Elizabeth Murphy
C04	Anna Chen
C05	Anna Chen
C06	Hannah Dada
C07	Anamaria Filipac
C08	Bernice Fokum
	Ruijie Zhang
C09	Alexandra Hizel
C10	Janel Jin
C11	Akash Kumar
C12	Kaitlyn Kunstman
C13	Sheng-Ting Lin
C14	Xuxuan Liu
C15	Jonathan Park
C16	Varun Pilla
C17	Dana Robinson
C18	Jasmine Shah
C19	Shailee Shah
C20	Caroline Shin
C21	Isaiah Tan
C22	Jessina Thomas
C23	Anil Vaitla
C24	Stephanie Vanchipurakal
C25	Shirley Xiao

Business

D01	Spencer Andrews
D02	Kaijia Chen
	Anita Parikh
D03	Nicholas Higgins
D04	Yoonjung Koh
	Sabrina Song
D05	You Na Oh
D06	Michael Reinhart
	Feiyang Ye

Chemistry

E01	Abigail Chao
E02	Catherine Crawford
	Jessica Durden
E03	Jonathan Czerwonka
E04	Seohyun Kim
E05	Rachael Lambert
E06	Max McKittrick
E07	Christine Pak
E08	Ruhiyyeh Turner

Computer Science

F01	Alexander Drummond
	Kyle Hanson
F02	Cathy Li

Earth Science

G01	Matthew Brian McDermott
	Kelly Wu

Economics

H01	Robert Cheung
	Sharada Dharmasankar
	Dong Kwak
H02	Mari Crook
H03	William Getz
	David Lorentzen
H04	Nina Gnedin
	Meaghan Pachay
H05	Brandan Matthews
H06	Michael Mirski
	John Wang
H07	Zehua Sun

Education

I01	Mariam Alaka
	Leslie Martin
I02	Elizabeth Awoyemi
	Issurah King
I03	Mehmet Badur
	Cora Goldston
	Colin Phillips

Education continued

I04	Duncan Baker
	Troy Makulec
	Thomas Oberhardt
I05	Aaron Bruder
	Stephanie Martinez
	Christopher Stovall
	Mao Yamakawa
I06	Jingsi Fan
	Anjulie Gang
	Seung Heo
I07	Vidya Govind-Thomas
	Anne Pipathsouk
I08	Jonathan Loucks
I09	Sidanth Sapru
I10	Katherine Tu

Engineering

J01	Cameron Breedlove
	Ricardo Gonzalez
	Andrew Heuser
J02	David Contreras
	Jackson Hallauer
J03	David Derry
	Peter Nebres
J04	Jesse Fitzpatrick
	Trevor Hahm
J05	Michael Gleeson
J06	Yifei Huang
J07	Adam Jung
	Lawrence Kim
	Eric Kwan
J08	Adelina Koleva
J09	Ruohan Li
J10	Maria Martinez
J11	Karl Ochmanek
J12	Angad Rekhi
J13	Grant Skudlarek
J14	Terence Zhao

English

K01	Dawna Bagherian
K02	Jennifer Byers
K03	Allison Rodriguez
K04	Elizabeth Zaretsky
K05	Shuang Zhang

Environmental Science

L01	Vashti Aguilar
	Christina Mikulka
L02	Jennifer Bennett
L03	Justin Glasper
	Alisha Vimawala
L04	Judith Hooymans
	Elizabeth Richardson
L05	Kristen Lee
L06	Shyam Saladi

Fine Arts

M01	Kayla Campbell
	Donald Lee-Brown
M02	Daniel (Mac) Nelsen
M03	Nicholos Reid
	Stephanie Williams

History

N01	Elsa Costa
	Guy Macarol
N02	Lauraleigh Heffner

Law

O01	Amanda Cohen
O02	Ana Dumitrescu
O03	Abigail Flynn
	Catrina Kim

Mathematics

P01	Matthew Castillon
P02	Irene Chen
P03	Bonny Jain

Medicine

Q01	Amishi Bajaj
Q02	Amishi Bajaj
Q03	Shelly Bhanot
	Shilpa Topudurti
Q04	Andrea Castaldo
	Ashley Czaplicki
Q05	Brian Chang
Q06	Lakshmi Girijala
Q07	Jennifer Hu
Q08	Sushma Kola
Q09	Pruthvi Kothari
Q10	Benjamin Kyi
Q11	Bob Lee
Q12	Kristen Lee
Q13	Bohao Liu
Q14	Yue Lu
Q15	Harika Nalluri
Q16	Hannah Reiser
Q17	Hannah Reiser
Q18	Sarah Rokosh
Q19	Aldo Rossi
	Isolina Rossi
Q20	Priya Roy
Q21	Evan Schwerbrock
Q22	Joan Steffen
Q23	Lokamitra Veeramasuneni
Q24	Arika Verma
Q25	Mark Xue
Q26	Jing Wang
	Nancy Yu
Q27	Amy Zhou

Neurobiology

R01	Audrey Auyeung
	Kathryn Stromdahl
R02	Aryssa Burton
	Jayanshu Jain
	Michelle Rudolph
R03	Mamatha Challa
	Lucas Delort
R04	Grace Chan
R05	Kevin Chen
	Kevin Lam
R06	Paul Chung
	Siddharth Narayanan
R07	Shravanthy Gumidyala
	Jonathon Schwarzbauer
	Weili Zheng
R08	Sara Johnson
R09	Anusha Kumar
R10	Abraham Lee
R11	Vaisak Nair
R12	Hassan Qureshi
R13	Nirali Shah
R14	Milan Udawatta
R15	Shivam Vedak

Physics

S01	Sara Akgul
S02	Amy Allen
S03	Stephanie Brandt
S04	Vladislav Kontsevoi
S05	Kelsey Lawhorn
	Liana Nicklaus
	Anthony Yunker
S06	Andrew Lee
S07	Zhengzheng Liu
S08	Travis Mui
S09	Alexander Munoz
S10	James Pan
S11	Eric Shinn
S12	Anderson West

Psychology

T01	Siana Aspy
	Emerald Fannin
	Samantha McPeak
T02	Jake Ayala
	Andrew Ericson
T03	Stephanie Bernardo
	Gabriela Cardoso
	Salvador Esparza
T04	Gabriella Heller
T05	Meena Iyer
T06	Ankita Khandai
T07	Alina Kononov
T08	Allison Larrabee
T09	Ranait O'Connor

Psychology continued

T10	Rachel Rasp
T11	Margaret Tu
T12	Vaishali Umrikar

Social Science

U01	Emmaline Conover
	Katherine Evans
	Troy Nelson
U02	Nicacio Corral
	Alejandro Rojas
	Gustavo Ulloa
U03	Kevin Crews
	Jimmy Liu
U04	Robert Dawson
U05	Robert Delaney
U06	Yaseen Jamal
	Jiabo Zheng
U07	Jade Martin
	Youlia Racheva
U08	Laura Thompson

Space Science

V01	Eric Lin
	Nathaniel Simpson
V02	Sapna Patel

Poster Map
Cafeteria

A01	A07 B04	C04 C10	C16
A02	A08 B05	C05 C11	C17
A03	A09 B06	C06 C12	C18
A04	B01 C01	C07 C13	C19
A05	B02 C02	C08 C14	C20
A06	B03 C03	C09 C15	C21

C22	C23	C24	C25	D01	D02	D03	D04	D05	D06	E01	E02	E03	E04
E05	E06	E07	E08	F01	F02	G01	H01	H02	H03	H04	H05	H06	H07

I01	I02	I03	I04	I05	I06	I07	I08	I09	I10	J01	J02	J03	J04	J05	J06	J07	J08
J09	J10	J11	J12	J13	J14	K01	K02	K03	K04	K05	L01	L02	L03	L04	L05	L06	M01

O01	O02	O03	P01	P02	P03	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10

M02
M03
N01
N02

Q11	Q12

Q13
Q14

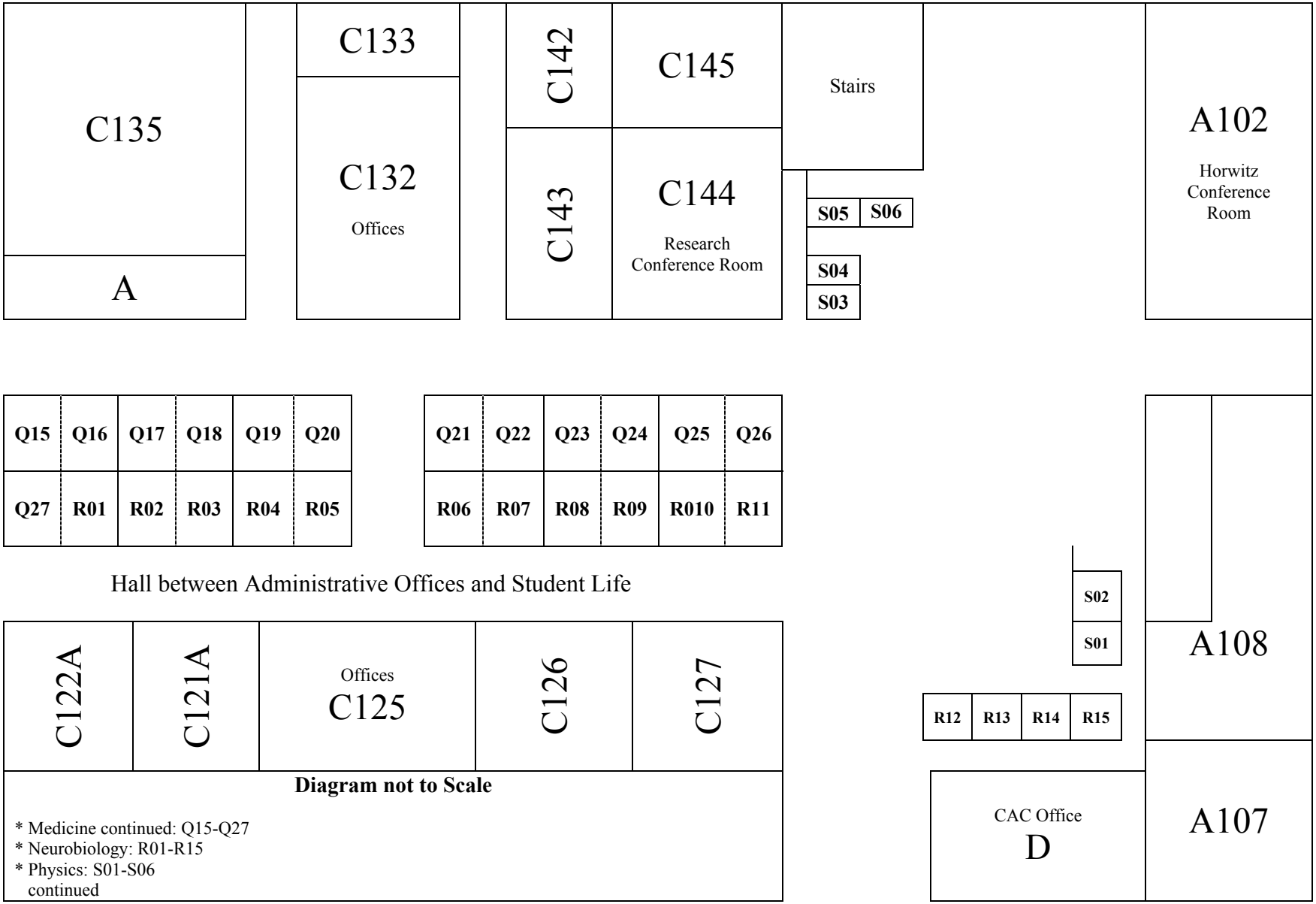
Old Cafeteria/Commons

Diagram Not to Scale

* Biochemistry: A01-A09
* Bioengineering: B01-B06
* Biology: C01-C25
* Business: D01-D06
* Chemistry: E01-E08
* Computer Science: F01-F02
* Earth Science: G01
* Economics: H01-H07
* Education: I01-I10
* Engineering: J01-J14
* English: K01-K05
* Environmental Science: L01-L06
* Fine Arts: M01-M03
* History: N01-N02
* Law: O01-O03
* Mathematics: P01-P03
* Medicine: Q01-Q14

continued

Poster Map


C135
A
C133
C132
Offices
C142
C143
C145
C144
Research
Conference Room
Stairs
S05
S06
S04
S03
A102
Horwitz
Conference
Room
Q15
Q16
Q17
Q18
Q19
Q20
Q27
R01
R02
R03
R04
R05
Q21
Q22
Q23
Q24
Q25
Q26
R06
R07
R08
R09
R010
R11
Hall between Administrative Offices and Student Life
S02
S01
A108
R12
R13
R14
R15
C122A
C121A
Offices
C125
C126
C127
CAC Office
D
A107
Diagram not to Scale
* Medicine continued: Q15-Q27
* Neurobiology: R01-R15
* Physics: S01-S06
continued

Poster Map
Math Study Area

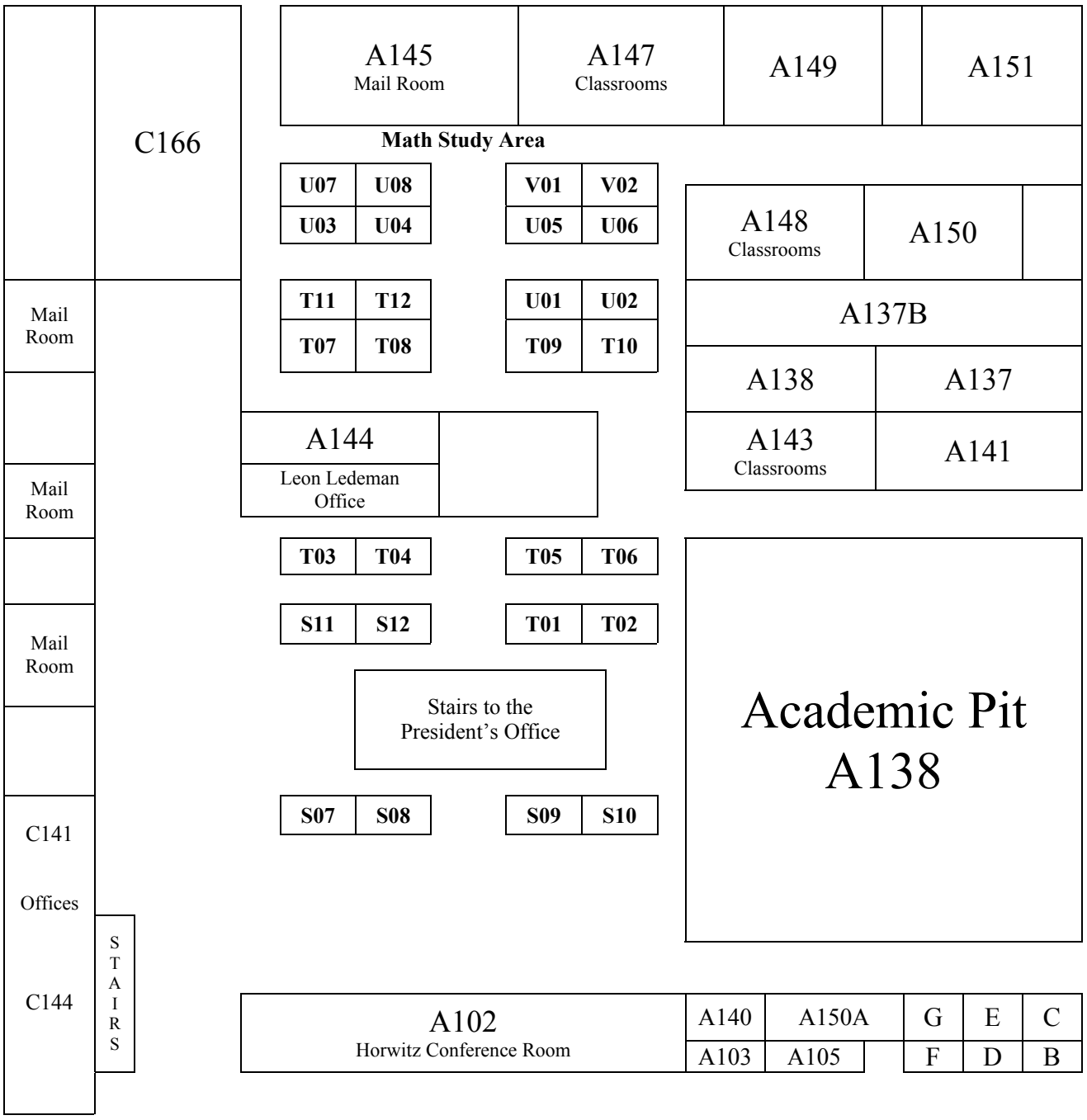


Diagram not to Scale

* Physics continued: S07-S12
* Psychology: T01-T12
* Social Science: U01-U08
* Space Science: V01-V02

Schedule

9:10 - 9:25

Room	ID	
A-113	B06	**Pore Density in PEGDA Hydrogels in Relation to the Proliferation of NIH/ 3T3 and hMSCs** Karthik Vantakala, Mi Suk Bae, Richard Gemeinhart
A-117	Q07	**The Feasibility of Melanoma-Related Immunotherapy Methods in Patients with Lymphangioleiomyomatosis** Jennifer Hu, I. Caroline Le Poole, Mary Reust
A-119	H02	**The Global Food Crisis** Mari Crook, Robert Kiely
A-131	J06	**Field Programmable Gate Arrays Computing for Space Charge Simulation** Yifei Huang, Jin-Yuan Wu
A-133	D02	**Useful Skills for Business Professionals** Kaijia Chen, Anita Parikh, Devi Vallabhaneni
A-135	E01	**Templated Self-Assembly of Gold Nanoparticles** Abigail Chao, Leonidas Ocola
A-147	N01	**The Voynich Manuscript** Elsa Costa, Guy Macarol, Dennis Czerny
A-149	C04	**Expression of Brain-Derived Neurotrophic Factor in the Cerebellum of Stressed Rats** Anna Chen, Lei Zhang
A-151	C22	**Ovarian Cryopreservation as a Fertility Preservation Method for Women with Ovarian Malignancies** Jessina Thomas, Teresa Woodruff
A-155	H03	**Market Microstructure and Liquidity** William Getz, David Lorentzen, Doug Adams
Acad. Pit A-138	J11	**Architectural Design Decisions** Karl Ochmanek, Kate Hauserman
B-110	C06	**The Effect of Locostatin on Wildtype RKIP and Depleted RKIP Mouse Embryonic Fibroblast Cells** Hannah Dada, Marsha Rosner, Anne Shemon
B-116	O03	**The Convention on the Rights of the Child: Investigating Implementation in Chicago** Abigail Flynn, Catrina Kim, Sandra Babcock
B-133	E02	**Nanoscale and Molecular Studies of Advanced Materials: Understanding Anodic Aluminum Oxide and its Applications in Microfiltration** Catherine Crawford, Jessica Durden, Steve Sibener
D-103	B03	**The Effects of a Visual and Haptic Feedback Interface on Stroke Rehabilitation** Hendrik Dewald, Ana Maria Acosta, Jules Dewald

9:10 - 9:25 continued

D-107	I10	**A Comparative Look at Education in the United States, China, and India** Katherine Tu, Christopher Schreiber
D-110	A08	**Elucidating Enzyme-Substrate Interactions Through Kinetic Studies of HDAC8 and its Substrates** Yiru Tao, Milan Mrksich
Kids Inst. E-115	J02	**Blending the Needs of All Involved: An Investigation in Architecture** David Contreras, Jackson Hallauer, Austin Dempsey, Victor Dietz, Forrest Nelson, Joel Strassman, Steven Vasilion

9:35 - 9:50

Room	ID	
A-113	U06	**Is There Correlation Between Health-Risk Behaviors?** Yaseen Jamal, Jiabo Zheng, Gene McFadden, Bonnie Spring
A-117	I06	**I<3 Science: A Chemistry Book for Children** Jingsi Fan, Anjulie Gang, Seung Heo, Dave DeVol
A-119	C10	**The Effects of Troponin I Pseudophosphorylation on Conformation and Interaction within the Thin Filament** Janel Jin, Brandon Biesiadecki, R. John Solaro
A-131	R08	**Brain Aging and Soy Consumption** Sara Johnson, Jim Victory
A-133	Q09	**The Effect of Platelet Activating Factor on Nuclear Factor kappa B Dependent Luciferase Activity in vivo in a Mouse Model of Acute Bowel Injury** Pruthvi Kothari, Isabelle De Plaen
A-135	O02	**Improving Romania's Adoption System: Comparative Analysis and Application of Western Adoption Systems** Ana Dumitrescu, Mihaela Raicu
A-147	L01	**Accumulation of Mercury in Lake Michigan and its Effects on Humans** Vashti Aguilar, Christina Mikulka, Robert Kiely
A-149	Q10	**The Effect of Dichloroacetate on Cancer Stem Cells** Benjamin Kyi, Morris Kletzel, Marie Olszewski
A-151	B05	**Hydraulic Conductivity of Collagen I as Found in Bruch's Membrane** Velin Tchalakov, Zdravka Cankova
A-155	C13	**The Effects of Serotonin on the Sympathetic Activity on the Recovery of Hypotensive Hemorrhage** Sheng-Ting Lin, Theresa Kung, Karie Scrogin
Acad. Pit A-138	Q08	**Anti-Cancer Drug Nanoparticles as Carriers of DNA into Cells** Sushma Kola, Richard Gemeinhart
B-110	Q13	**Effects of DNMT3B7, a Truncated DNMT3B Protein Found in Human Tumors, on Murine Lymphomas** Bohao Liu, Lucy Godley, Aparna Vasanthakumar

9:35 - 9:50 continued

B-116	Q21	**Relationship Between Horizontal Reaction Force and Walking Velocity in People Post-Stroke** Evan Schwerbrock, David Brown
B-133	B04	**Development of an o-GlcNAc Transferase Based Therapeutic for Glioblastomas** Nicole Howard, Roger Kroes, Joseph Moskal
D-103	A07	**The Effects of High Fat Diets on Mouse Pancreatic Precancer may be Correlated with Serum PGE2 Levels** Rital Shah, Youngzeng Ding, Paul Grippo
D-107	J07	**Measuring the Performance of Gas Turbine Filters Using Computational Fluid Dynamics** Adam Jung, Lawrence Kim, Eric Kwan, Michael Corbat, Lawrence Ost, Philip Winters
D-110	H07	**Examining the Effects of Nominal Sales** Zehua Sun, John List, Hugo Sonnenschein
Kids Inst. E-115	L05	**IMSA Go Green: Investigating Student Action** Kristen Lee, Christopher Kolar
Lect. Hall B-206	Q14	**All-trans Retinoic Acid induced Reactive Oxygen Species and Cell Death in Mantle Cell Lymphoma Cells** Yue Lu, Amareshwar Singh

10:00 - 10:15

Room	ID	
A-113	I01	**School Improvement Plans: Necessary but not Sufficient** Mariam Alaka, Leslie Martin, Kaziputalimba Joshua, Glenn "Max" McGee
A-117	Q15	**Generating a Dendritic Cell Activating DNA Vaccine for Melanoma** Harika Nalluri, Jared Klarquist, I. Caroline Le Poole
A-119	Q11	**Gene Therapy Treatment of Breast Cancer Involving Transforming Growth Factor-β Inhibition Promoted by Modified Human Telomerase Reverse Transcriptase** Bob Lee, Prem Seth, Zhenwei Zhang
A-131	C01	**The Effects of Cholesterol and Other Sterols on Membrane Fluidity** Dimple Adatia, Linna Guan, Yulia Epshtein, Irena Levitan, Dev Singh
A-133	R10	**The Use of Diffusion Tensor Imaging in Detecting Parkinson's Disease** Abraham Lee, Daniel Corcos, David Vaillancort
A-135	Q18	**The Affect of the Implementation of Computed Tomography on the Negative Appendectomy Rate at Loyola University Medical Center** Sarah Rokosh, John Santaniello
A-147	C05	**Beta-Cell Regeneration in Diabetic Mice Treated with Islet Cell Transplantation and Insulin Tablets** Anna Chen, Anita Chong, Eric Grossman
A-149	U04	**What's in a Name? Investigating the Relationship Between Given Names and Physical Attractiveness** Robert Dawson, Dennis Czerny

10:00 - 10:15 continued

A-151	Q24	**Identification of Molecular Breast Cancer Subtypes using Tissue Microarrays and Digital Microscopy** Arika Verma, Funmi Olopade
A-155	V01	**Technical Feasibility of a Novel Method for Station Keeping** Eric Lin, Nathaniel Simpson, Peter Schubert
Acad. Pit A-138	I05	**Expanding IMSA Outreach to Hispanic Students** Aaron Bruder, Stephanie Martinez, Christopher Stovall, Mao Yamakawa, Vincent Matsko, Jose Palos
B-110	R01	**Searching for the Role of Chemokines in Neuropathic Pain** Audrey Auyeung, Kathryn Stromdahl, Matt Ripsch, Fletcher White
B-116	J13	**Maximizing Palladium Nanowire-Based Hydrogen Sensor Performance Through Diblock Copolymer Pattern Transfer** Grant Skudlarek, Seth Darling
B-133	J12	**A Review of the Design for Six Sigma Literature with a Focus on Tools for Systems Architecture and a Documentation of a Catapult Design Using SysML** Angad Rekhi, Peter Jackson
D-103	L03	**Ethanol Implementation as a Source of Alternative Fuel: IMSA's First Ethanol Powered Engine** Justin Glasper, Alisha Vimawala, Branson Lawrence
D-107	R13	**The Effect of Chronic Stress on Interneurons of the Ventral Tegmental Area** Nirali Shah, Louis Lucas
D-110	Q22	**Determining Postoperative Risks of Preoperative Frailty and Hypoalbuminemia** Joan Steffen, Kathleen Grady, Richard Lee, Michael Yensel
Kids Inst. E-115	H01	**Exploration of Factors that Influence Crude Oil Price** Robert Cheung, Sharada Dharmasankar, Dong Kwak, Jeong Choe-Hwang
Lect. Hall B-206	E06	**Novel Materials in Magnetoelectric Multiferroics** Max McKittrick, Christos Takoudis, Yi Yang

10:25 - 10:40

Room	**ID**	
A-113	A03	**Pretreatment of *Miscanthus* for Biofuel Production** Hyun Cho, Dave DeVol
A-117	J03	**The Applicability of Magnetic Quantum Cellular Automata as an Alternative to Transistors** David Derry, Peter Nebres, Vitali Metlushko, Josh Sautner
A-119	K01	**High Above The Ground and Two Finches: A Study of Autism Through Writing** Dawna Bagherian, Tracy Townsend
A-131	U07	**A Comparison Between John F. Kennedy and Barack Obama** Jade Martin, Youlia Racheva, Jim Victory
A-133	E05	**Optimization of Titanium Dioxide** Rachael Lambert, Christos Takoudis, Qian Tao

10:25 - 10:40 continued

A-135	C20	**The Determination of Alloantibody in Glycosylation** Caroline Shin, Emily Ahmed, Anita Chong
A-147	K03	**Fashion in Films** Allison Rodriguez, Audrey Wells
A-149	H04	**Causes of the 2008 Oil Crisis** Nina Gnedin, Meaghan Pachay, Robert Kiely
A-151	K04	**Sexuality in Eighteenth and Nineteenth Century British Plays** Elizabeth Zaretsky, Michael Hancock
A-155	J09	**The Designing and Testing of a Radio Control Electric Counter-Rotating Rotors Vertical Takeoff and Landing Aircraft** Ruohan Li, Francisco Ruiz
Acad. Pit A-138	R03	**The Neuropsychology of Adolescent Romance** Mamatha Challa, Lucas Delort, David Evenson
B-110	D04	**Apple Inc: Its Marketing Techniques and its Success** Yoonjung Koh, Sabrina Song, Pradeep Chintagunta
B-116	Q16	**Blood Type as a Risk Factor for Necrotizing Enterocolitis in Neonates** Hannah Reiser, Jonathan Muraskas, Sherri Yong
B-133	T12	**The Effect of Orion Filters on Visual Acuity During Dark Adaptation** Vaishali Umrikar, Thomas Sawyer
D-103	S11	**The Effect of Surface Processing on Superconducting Radiofrequency Cavities** Eric Shinn, Camille Ginsburg
D-107	Q19	**A Case Control Study of Polymorphisms in the Matrix Metalloproteinase-9 Gene in Patients with Abdominal Aortic Aneurysms Versus Healthy Controls** Aldo Rossi, Isolina Rossi, William Pearce, Vera Shively
D-110	O01	**Music Copyright and Royalty Laws: The Impact of Technology on the Music Industry** Amanda Cohen, Barry Irwin, Christian Nokkentved
Kids Inst. E-115	A02	**Investigating the Lotus Effect** Cecilia Chang, Zack Maril, Mark Carlson
Lect. Hall B-206	I02	**Facts for Life** Elizabeth Awoyemi, Issurah King, Adrienne Coleman, Robert Hernandez

10:50 - 11:30 double time session

Room	**ID**	
A-119	U03	**An Independent Approach to Health Care: Analysis of the Necessity and Methodology of Comparative Effectiveness** Kevin Crews, Jimmy Liu, Mary Carter, Douglas Saunders, Scott Serota

10:50 - 11:05

Room	ID	
A-113	I03	**Teach Illinois: Reassessment of the Current Illinois K-12 School Funding Model** Mehmet Badur, Cora Goldston, Colin Phillips, Glenn "Max" McGee
A-117	C02	**The Effect of T-bet on the Development of Natural Killer Cells** Erika Bongen, Barbara Kee, Kevin Ramirez
A-131	Q12	**The Effects of Matrix Metalloproteinase Inhibition on Disc Degeneration** Kristen Lee, Hee-Jeong Sampen
A-133	Q26	**Differences Between Wild Type and Knockout Cyclophilin B in the Mammary Gland Development of Mice in Relation to Breast Cancer** Jing Wang, Nancy Yu, Charles Clevenger, Y'vonne Feeney
A-135	Q01	**Pegylated Interferon-Induced Graft Dysfunction After Liver Transplantation: A Multicenter Case Control Study** Amishi Bajaj, Josh Levitsky
A-147	K05	**Writing a Novel About the Shadows of Human Mind** Shuang Zhang, Dennis Czerny
A-149	T05	**Defining Beautiful Within Two Cultures** Meena Iyer, Genna Bebko, Joan Y. Chiao
A-151	Q25	**The Effect of Interleukin-6 on Iron Concentrations and Prostate Cancer Progression** Mark Xue, Andre Kajdacsy-Balla
A-155	F02	**Wireless Ad-Hoc Networks: Along a Cherry Lane** Cathy Li, Peng-Jun Wan
Acad. Pit A-138	U02	**The Unveiling of a New American Perspective: Latino Demographics of the Fifty United States** Nicacio Corral, Alejandro Rojas, Gustavo Ulloa, Isabel Reyes
B-110	D06	**Improving the IIT Stuart School of Business Website** Michael Reinhart, Feiyang Ye, Siva Balasubramanian
B-116	Q05	**Epidemiological Analysis of Methicillin-Resistant *Staphylococcus aureus*** Brian Chang, Bill Kabat, Guorong Liu
B-133	C18	**Characterization of Folate-Conjugated Multi-Arm PEG Polymers As Efficient Nanoparticles for Cancer Drug Delivery** Jasmine Shah, Seungpyo Hong
D-103	M03	**Production of a Twenty-first Century Musical** Nicholos Reid, Stephanie Williams, James Priovolos
D-107	C17	**Screening for acd6-1 Suppressors in Arabidopsis thaliana Plants** Dana Robinson, Jean Greenberg, Jiyoung Lee
D-110	T10	**Parenting Style and a Child's Perception of Parents** Rachel Rasp, Patricia Schacht
Kids Inst. E-115	J14	**Engineering a Durable, Reusable Polycarbonate Water Filter** Terence Zhao, Mark Carlson

10:50 - 11:05 continued

Lect. Hall B-206	H05	**Equal Pay for Equal Work? An Assessment of Teacher Compensation, Experience, and Contractual Mandates** Brandan Matthews, Lisa Barrow

11:15 - 11:30

Room	ID	
A-113	C07	**The Effects of Eomesodermin on the Specification and Commitment of Multipotent Lymphoid Progenitors to the Murine Bone Marrow Natural Killer Lineage** Anamaria Filipac, Barbara Kee, Kevin Ramirez
A-117	S03	**A Measurement of Dijet Azimuthal Angle Decorrelation Over Several Rapidities** Stephanie Brandt, Don Lincoln
A-131	D03	**Let's Play: Developing a Card Game System** Nicholas Higgins, Tracy Townsend
A-133	S12	**The Galfitting of LRG 3-817** Anderson West, Thomas Diehl
A-135	Q02	**Mapping Genes Involved in Chronic Sinusitis** Amishi Bajaj, Jayant Pinto
A-147	S07	**Study of Neutrinos from Active Galactic Nuclei** Zhengzheng Liu, Maury Goodman
A-149	T09	**The Effect of Gender-Priming on Empathy** Ranait O'Connor, Joan Y. Chiao, Vani Mathur
A-151	C09	**A Conditional Knock-Down of the LDH2 Gene in *Toxoplasma gondii*** Alexandra Hizel, Rima McLeod
A-155	S06	**Superconducting Radiofrequency Diagnostics** Andrew Lee, Aseet Mukherjee
Acad. Pit A-138	I07	**IMSA Chicago: Science Curriculum** Vidya Govind-Thomas, Anne Pipathsouk, Michelle Kolar, Glenn "Max" McGee, Sendhil Revuluri
B-110	Q27	**New Battles Against Complex Infections: Synergy Studies Against Methicillin-Resistant *Staphylococcus aureus*** Amy Zhou, Bill Kabat, Rajeswari Pitchumani
B-116	Q17	**Predicting Academic and Clinical Distinction in a 60 Minute Medical School Interview** Hannah Reiser, Jonathan Muraskas
B-133	C25	**The Purification of Ribosomal S6 Kinase 1, RSK1 Kinase Domain-1, and RSK1 Kinase Domain-2 from *E. coli* Cells** Shirley Xiao, Deepti Chaturvedi, Tarun Patel
D-103	M01	**Predicting Fame: Discovering and Applying Today's Popular Music Techniques** Kayla Campbell, Donald Lee-Brown, James Priovolos
D-107	R12	**FALS5 Gene Variants in Amyotrophic Lateral Sclerosis** Hassan Qureshi, Kaouther Ajroud, Faisal Fecto, Teepu Siddique

11:15 - 11:30 continued

D-110	S10	**Development of an Algorithm to Differentiate Between Hadronic Jet and Photon Signatures** James Pan, Sasha Pranko
Kids Inst. E-115	R06	**Predictors of Reactivity to Stress and Cigarette Usage** Paul Chung, Siddharth Narayanan, Harriet de Wit
Lect. Hall B-206	M02	**Films and the Auteur** Daniel (Mac) Nelsen, Audrey Wells

Please join us at 12:30 in the Academic Pit for our Student Recognition session, hosted by Dr. Leon Lederman and Dr. Glenn "Max" McGee.

12:30 - 12:45

Room	ID	
A-117	R14	**If You Want To Learn, Don't Think, and Don't Blink** Milan Udawatta, Deborah Little
A-131	U08	**Addressing the Obstacles that Prevent Nongovernmental Organizations from Spreading Girls' Education to Developing Countries** Laura Thompson, Grace Glass, David Radcliff
A-133	Q23	**Calcium Handling Heterogeneity Within Normal and Failing Myocytes** Lokamitra Veeramasuneni, J. Andrew Wasserstrom
A-147	B01	**Modeling a Hydrocephalic Brain** Susan Chen, Jasmine Kwasa, Sukhraaj Basati, Andreas Linninger
A-149	T11	**Achievement Goals, Effort, Satisfaction, and Personal Performance in Marathon Running** Margaret Tu, Aaron Sackett, Rebecca White, George Wu
A-151	C08	**The Effect of Decitabine on the Methylation Status and Binding of CREB to Gamma Globin Promoter CRE** Bernice Fokum, Ruijie Zhang, Donald LaVelle
A-155	C12	**APOBEC3G and HIV in Lemurs: An Evolutionary Study** Kaitlyn Kunstman, Steven Wolinsky

12:55 - 1:10

Room	ID	
A-113	E07	**Synthesis and Analysis for Multifunctional Microsphere-Nanoparticle Probe Systems for Imaging in Biological Systems** Christine Pak, Ali Jawaid, Preston Snee
A-117	D05	**Marketing Engineering: Understanding Attitudinal Research** You Na Oh, Chaim Ehrman
A-119	A05	**Inducing Chemotherapeutic Sensitivity in Human Cancer** Grant Rotskoff, Glyn Dawson

12:55 - 1:10 continued

A-131	C19	**The Effects of Omega-3 Fatty Acids/Flax Seed on the Steroid Genesis Pathway Factors Critical to the Development of Ovarian Surface Epithelial Cancer** Shailee Shah, Kristine Ansenberger, Dale Buchanan Hales
A-133	R15	**An Innovative Model for Measuring Pain Sensitivity in Chronically Injured Rats** Shivam Vedak, A. Vania Apkarian
A-147	T06	**The Various Effects of Religion on Perception** Ankita Khandai, Donna Jo Bridge, Joan Y. Chiao
A-149	Q03	**The Effects of Different Surfactants, Curosurf and Survanta, on the Survival and Outcome of Infants with Birth Weight Equal to or Less than 1000 Grams from Three Time Periods** Shelly Bhanot, Shilpa Topudurti, Christine Sajous
A-151	P02	**Coordinate-Free Characterization of Homogeneous Polynomials with Isolated Singularities** Irene Chen, Stephen Yau
A-155	C11	**Genetic Mapping of a High Response Psychostimulant Mutant Permanent Midnight** Akash Kumar, Vivek Kumar
B-133	E08	**Diamonds in a Vacuum** Ruhiyyeh Turner, Vicki Burgholzer
D-103	C24	**A Survey of Genetic Modifications and Ethical Implications** Stephanie Vanchipurakal, Sarah O'Leary
D-107	T03	**Are You What You Eat and Do?** Stephanie Bernardo, Gabriela Cardoso, Salvador Esparza, Deborah McGrath
D-110	T02	**The Physiological Effects of Chewing Gum on Human Heart Rate, Reaction Time, Stress Response, and Memory** Jake Ayala, Andrew Ericson, Todd Parrish
Kids Inst. E-115	I04	**IMSA on Wheels: States of Matter, Do They Matter?** Duncan Baker, Troy Makulec, Thomas Oberhardt, Tracy Miller

1:20 - 1:35

Room	**ID**	
A-114	P01	**Application of Different Voting Systems to the 2007 French Presidential Election** Matthew Castillon, Donald Porzio, Eric Smith
A-117	R09	**The Role of PS-1 in Adult Neurogenesis** Anusha Kumar, Orly Lazarov
A-119	A01	**Red Cell Hydration and Sickle Cell Disease: A Study of μ-Calpain Inhibition** Oluwakemi Aladesuyi Arogundade, Richard Labotka
A-131	U05	**A Search for the Importance of Ethics** Robert Delaney, Dennis Czerny

1:20 - 1:35 continued

A-133	T04	**The Effects of Caregiver Input on Narrative Skills in Children with Pre- or Perinatal Brain Injury** Gabriella Heller, Ozlem Ece Demir
A-135	B02	**Comparison of Diffusion MRI Analysis Models** Frederick Damen, Xiaohong Joe Zhou
A-147	Q04	**Patient Safety in Surgery: An Examination of Hand Hygiene and Physician Communication** Andrea Castaldo, Ashley Czaplicki, Timothy McDonald
A-149	T08	**The Effects of Confidence and Self-Esteem on Performance** Allison Larrabee, David Evenson
A-151	R04	**The Effects of Pioglitazone on Glucose Uptake in C6 Glioma Cells** Grace Chan, Douglas Feinstein, Anthony Sharp
A-155	E04	**The Thermodynamic System of Nanoscale Clusters** Seohyun Kim, R. Stephen Berry, Chengju Wang
B-110	E03	**The Study of Physical Properties and Self Assembly of an Amide Ionic Liquid** Jonathan Czerwonka, Millicent Firestone
B-116	Q06	**Cardiovascular Complications of Sickle Cell Disease** Lakshmi Girijala, Louis Cohen, Ankit Desai
B-133	C14	**Screening of Human Fetal Liver cDNA Phage Display Library for Neonatal Hemochromatosis Alloantigen Using Maternal Sera** Xuxuan Liu, Padmini Malladi, Peter Whitington
D-103	C03	**The Diet and Nutrition of an Average IMSA Student** Jessica Burash, Elizabeth Murphy, Sarah OLeary
D-107	L04	**Effect of Restoration on Floristic Quality Index of Kane County Prairies** Judith Hooymans, Elizabeth Richardson, Deborah McGrath
D-110	N02	**Seafaring: Technology, History, and Economics** Lauraleigh Heffner, Claiborne Skinner
Kids Inst. E-115	T07	**The Social Structure of IMSA** Alina Kononov, Susan Styer

1:45 - 2:00

Room	**ID**	
A-113	D01	**The Economics of Virtual Economies: How Real-Life Economic Trends and Factors are Present in MMORPGs** Spencer Andrews, Eric Smith
A-117	C15	**Determining the Mechanisms of Herpes Simplex Virus Type 1 Ocular Cell Infection** Jonathan Park, Christopher O'Donnell, Deepak Shukla
A-119	R05	**Homer Protein Mediation of Abeta-Derived Diffusible Ligand Binding in Alzheimer's Disease** Kevin Chen, Kevin Lam, William Klein, Pascale Lacor
A-131	S05	**Weak Lensing Mass Estimates of Low Redshift Galaxy Clusters** Kelsey Lawhorn, Liana Nicklaus, Anthony Yunker, James Annis

1:45 - 2:00 continued

A-133	S04	**Enhancement of Thermoelectric Properties of Lead Telluride by Doping** Vladislav Kontsevoi, Arthur Freeman, Jung-Hwan Song
A-135	I09	**Self-Efficacy and Academic Success: A Study of AVID Students in the Chicago Public Schools System** Sidanth Sapru, Melanie LaForce
A-147	S09	**The Search for Theta 13** Alexander Munoz, Maury Goodman, Mayly Sanchez
A-149	A09	**Exploring Properties of Protozoan Acetyl-CoA Carboxylase in a Yeast-Based Screening System to Identify New Lead Compounds for Antiparasitic Drugs** Eva Yuan, Piotr Gornicki, Robert Haselkorn, Zi Ye
A-151	K02	**Writing Your Way to a Dystopian Novel: Processes and Production** Jennifer Byers, Daniel Gleason
A-155	R02	**The Effect of GT1061 on Open Field Behavior of Mice** Aryssa Burton, Jayanshu Jain, Michelle Rudolph, Jia Luo, Greg Thatcher
Acad. Pit A-138	I08	**Socioeconomics and Public Education: An Examination of Policies that Narrow the Achievement Gap** Jonathan Loucks, Glenn "Max" McGee
B-110	S02	**Reconstruction of FCNC Top-Antitop Decay** Amy Allen, Datta Mousumi
B-116	J10	**Does Our Current National Bridge Inspection Criteria Need To Be Changed, and if so, How?** Maria Martinez, Richard Kaczkowski
B-133	V02	**The Formation of Supermassive Black Holes** Sapna Patel, Don York
D-103	H06	**Understanding Factors of the Black White Achievement Gap** Michael Mirski, John Wang, Jonathan Hersh, Emily Oster
D-107	J05	**Lower Extremity Motion Characteristics of Adolescent Baseball Pitching** Michael Gleeson, Tasos Karakostas
D-110	R11	**The Effect of Exercise on Sleep** Vaisak Nair, Kathryn Reid
Kids Inst. E-115	J01	**Designing Efficient, Environmentally Friendly, Commercial Supersonic Aircraft** Cameron Breedlove, Ricardo Gonzalez, Andrew Heuser, James Gerry
Lect. Hall B-206	Q20	**The Severity, Causes, and Effects of Sleep Deprivation at IMSA** Priya Roy, Susan Styer

2:10 - 2:25

Room	**ID**	
A-113	A04	**The Abrogation of Canonical Wnt Signaling-Induced Migration and Collagen Synthesis by PPAR-γ Ligand Rosiglitazone** Yize Leng, John Varga, Jun Wei

2:10 - 2:25 continued

A-117	S08	**Observation of Neutrino Disappearance at the MINOS Far Detector** Travis Mui, Maury Goodman
A-119	C21	**Mutagenesis on the *Streptococcus pyogenes* pel Locus and Its Effect on Virulence Gene Regulation** Isaiah Tan, Jenny Chang, Michael Federle
A-131	U01	**After Babelfish: The Art and Science of Translation** Emmaline Conover, Katherine Evans, Troy Nelson, Christopher Colburn, Paavo Husen
A-133	J08	**Analysis into the Preparation of a Ni-Zn Bimetallic Catalyst** Adelina Koleva, Randall Meyer
A-135	C23	**The Role of Neutron and Gamma Radiation in Liver Tumor Development** Anil Vaitla, Tatjana Paunesku, Gayle Woloschak
A-147	R07	**Determining Latencies of Auditory Evoked Potentials Using Gamma Frequency Band Analysis** Shravanthy Gumidyala, Jonathon Schwarzbauer, Weili Zheng, Brent Parris, Vernon Leo Towle
A-149	L06	**Sedimentation in Pervious Concrete** Shyam Saladi, Brian Lutey
A-151	S01	**The Validation of Gap Triggers in the CDF Detector** Sara Akgul, Ricardo Eusebi
A-155	P03	**On the Embedding of Degree Sequences on the Projective Plane and Torus** Bonny Jain, Noah Prince
B-110	J04	**Battery Technology as an Alternative Energy Source in Transportation** Jesse Fitzpatrick, Trevor Hahm, Harold Kung
B-116	C16	**The Prevalence of ESBL *E. coli* with CTX-M in the United States** Varun Pilla, Chao Qi
B-133	A06	**An Alternative Method for Obtaining Mitotic Arrested Mouse Embryonic Fibroblasts Necessary for Human Stem Cell Maintenance** Bani Saluja, Allan Campione, Lon Van Winkle
D-103	L02	**Modeling Idling Reduction Options for Heavy Duty Diesel Trucks: A Comparison of Emissions/Energy Use and Economics** Jennifer Bennett, Linda Gaines
D-107	T01	**The Effects of Music Therapy on Autism** Siana Aspy, Emerald Fannin, Samantha McPeak, Paula Altekruse, MaryBeth McCarthy
D-110	G01	**An Investigation of the Physical Properties of the Atmosphere** Matthew Brian McDermott, Kelly Wu, Geza Gyuk, Mark Hammergren
Lect. Hall B-206	F01	**How To Build a Robot: Evolutionarily Designed Intelligence and its Basis in Modern Biology** Alexander Drummond, Kyle Hanson, Mike Ososky

A01
Red Cell Hydration and Sickle Cell Disease: A Study of μ-Calpain Inhibition

Presenter(s)
Oluwakemi Aladesuyi Arogundade, Illinois Mathematics and Science Academy

Advisor(s)
Richard Labotka, University of Illinois at Chicago

Hope for sickle cell patients increases everyday as innovative research continues to push boundaries on the knowledge of the disease. During the duration of this investigation μ-calpain, a protein inhibitor, was analyzed because of its unique potential to help red blood cells retain water. In sickle cell disease, the hydration of red blood cells greatly affects the concentration of hemoglobin within the cell and, in turn, could positively influence some of the symptoms that manifest due to the sickling cycle of blood cells caused by close hemoglobin proximity. This investigation used pthalate ester density distributions and osmotic fragility tests to see how the physical attributes of sickle red blood cells were affected by μ-calpain inhibition. Over the past year, the best methodology for conducting these experiments has been refined. By changing various conditions such as incubation temperature and the solution the inhibitor was diluted in, μ-calpain's interaction with sickle cell samples has been maximized. It is certain that continued study of μ-calpain and other proteases like it could lead to promising advances in the treatment of sickle cell disease.

A02
Investigating the Lotus Effect

Presenter(s)
Cecilia Chang, Illinois Mathematics and Science Academy
Zack Maril, Illinois Mathematics and Science Academy

Advisor(s)
Mark Carlson, Illinois Mathematics and Science Academy

The lotus effect is created by the interaction between the surface of a water droplet and the nanostructures on the surface of a plant leaf. When the effect is present, the droplet takes on a characteristic shape and moves down slopes at high speeds. Based on observational data, *Colocasia gigantean* (elephant ear) leaves, and *Brassica oleracea* (broccoli) leaves, as well as various types of rose petals all display the characteristic traits of the lotus effect. The *Colocasia* and *Brassica* were both monitored during development, and found to posses the traits as soon the leaves started to mature. We experimented with wax and teflon coatings on wood to see if hydrophobic surfaces could replicate the lotus effect. While crudely similar for water, there were clear differences when using a sticky, viscous liquid like honey. Currently, we are trying to quantify these observations while varying physical parameters such as the angle of incline, the temperature of the water, and the polarity of the liquid. More viable ways of replicating the effect artificially may be found, with a better understanding of the development and mechanics of the lotus effect.

A03
Pretreatment of *Miscanthus* for Biofuel Production

Presenter(s)
Hyun Cho, Illinois Mathematics and Science Academy

Advisor(s)
Dave DeVol, Illinois Mathematics and Science Academy

Over the last few years, there has been a race for alternative fuel sources. There has been a strong interest in fuels derived from plants because the process of making and using the fuel is carbon neutral. Many researchers have looked toward fermenting cellulosic materials to produce fuels such as ethanol and butanol; however, there still needs to be an effective pretreatment of this complex sugar. The purpose of this study was to develop an easy and inexpensive method to break down cellulose in *Miscanthus* into glucose. *Miscanthus* was autoclaved at high temperatures and *Cellulomonas*, a cellulase producing bacteria, was utilized in hopes of decomposing cellulose. The initial heat treatment on the miscanthus resulted in an increase of ~100-300 mg/dL of glucose, increasing in glucose concentration as the dry mass of the plant increased. However, interestingly, following the bacteria treatment, the amount of glucose decreased with increasing dry mass. In the future, more trials will be needed in order to validate these findings; in addition, the study can be furthered by fermenting the resulting glucose to produce biofuels, such as butanol and ethanol.

A04
The Abrogation of Canonical Wnt Signaling-Induced Migration and Collagen Synthesis by PPAR-γ Ligand Rosiglitazone

Presenter(s)
Yize Leng, Illinois Mathematics and Science Academy

Advisor(s)
John Varga, Northwestern University
Jun Wei, Northwestern University

Scleroderma is a complex autoimmune disease characterized by inflammation, vascular injury, and fibrosis in multiple organs. Fibrosis is characterized by overproduction of collagen and other extracellular matrix components by fibroblasts, resulting in excessive accumulation of these macromolecules. Recent studies have shown that Wnt signaling is elevated in fibrosis. Wnt is a family of proteins best known for its roles in embryogenesis and cancer, but is also involved in normal physiological processes like wound healing. The Wnt signaling pathway studied here is the β-catenin-dependent, or canonical, pathway. Canonical Wnt signaling is known to stimulate fibroblasts proliferation and migration, which contributes to fibrosis. It is reported that increased expression of PPAR-γ causes a measurable decrease of β-catenin in mouse pre-adipocytes, and PPAR-γ ligand treatment resulted in an even greater decrease in β-catenin. In this study, we activated PPAR-γ with rosiglitazone in adenovirus-Wnt3a (a Wnt ligand that can activate canonical Wnt signaling) infected human foreskin fibroblasts and then examined collagen expression levels and cell migration. Activation of canonical Wnt signaling by ectopic Wnt3a expression was found to stimulate type I collagen synthesis, and this stimulation was suppressed by rosiglitazone. Rosiglitazone also abrogated Wnt-induced fibroblast migration. Our results suggest the potential use of PPAR-γ ligand rosiglitazone in the therapy of scleroderma.

A05
Inducing Chemotherapeutic Sensitivity in Human Cancer

Presenter(s)
Grant Rotskoff, Illinois Mathematics and Science Academy

Advisor(s)
Glyn Dawson, University of Chicago

Human prostate cancers are notably insensitive to chemotherapy and often lack gap-junction proteins such as connexin 43 (Cx43). Genetically transfecting LNCaP prostate cancer cells with the Cx43 gene increased both the intercellular transport of chemical messengers and drugs. We show that Cx43 dramatically increases the cell-killing ability of PI3 kinase inhibitors (Wortmannin, LY-294,002) and C2 ceramide in the LNCaP cells. The release of small liposomal membrane microdomains, called exosomes, has been shown both in vitro and in vivo to be involved in cell communication. We look at their potential role in chemotherapy by characterizing exosomal lipids content in both human prostate adenocarcinoma (LNCaP) and human oligodendroglioma (HOG), and we show that exosomes are enriched with cholesterol, sphingomyelin, and ceramide, and therefore resemble lipid Raft microdomains, which control messenger proteins. Protein analysis (Western blotting) of exosomes demonstrates that exosomes carry active second messengers, as well as known Raft markers. Thus, increasing intercellular communication has the potential to increase the efficacy of treatment of cancer. While examining intercellular communication, the absorption of theoretical chemotherapies called "chaperones" was examined in human neuroblastoma cells (LAN5). We show that a peptide from the rabies virus glycoprotein assisted in the absorption of chemotherapy in neural cells into the nucleus, thus improving treatment.

A06
An Alternative Method for Obtaining Mitotic Arrested Mouse Embryonic Fibroblasts Necessary for Human Stem Cell Maintenance

Presenter(s)
Bani Saluja, Illinois Mathematics and Science Academy

Advisor(s)
Allan Campione, Midwestern University
Lon Van Winkle, Midwestern University

The presently utilized parameters for growing human embryonic stem cells (hESCs) were determined in 1998. As eleven years have past, we are currently exploring several new different methods in order to reevaluate the optimal conditions for culturing and maintaining hESCs in a pluripotent state. All of our current experiments are being done with mouse embryonic fibroblasts (mEF) to serve as a substrate for future work with hESCs. The 4 different methods we have been experimenting with are UV exposure, X-raying, mitomycin C, and TeSR media. Once the optimum condition is determined, we will be treating the cells with mGlu 5 antagonist to try to induce differentiation. So far, our results have shows that mEFs can be arrested in their mitotic division state and grown successfully using UV wavelengths from 2200 μJ to 3000 μJ, proving UV treated mEFs support the growth of pluripotent stem cells. We have yet to gather results in regards to mytomycin C, X-ray, and TeSR media run experiments. Potentially, we will determine the best technique for growing hESCs and prove glutamic acid may be responsible for helping to maintain hESC in their pluripotent state.

A07
The Effects of High Fat Diets on Mouse Pancreatic Precancer may be Correlated with Serum PGE2 Levels

Presenter(s)
Rital Shah, Illinois Mathematics and Science Academy

Advisor(s)
Youngzeng Ding, Northwestern University
Paul Grippo, Northwestern University

Pancreatic cancer is a lethal disease with poorly understood risk factors due to an incomplete understanding of the relationship between diet and pancreatic cancer development. Polyunsaturated fatty acids including omega-3 (ω-3) and omega-6 (ω-6) can generate high levels of eicosanoids through the arachidonic acid metabolic pathway. Ultimately, these eicosanoids can affect both cells and/or their surrounding environment, leading to enhanced or diminished cancer cell development. To address this relationship, mice that develop pancreatic precancer were fed diets rich in ω-3 and ω-6 fatty acids. We hypothesize that an increase in ω-6 fatty acids would lead to increased PGE2 in these mice, promoting inflammation and carcinogenesis. An enzyme-linked immunosorbant assay is being employed to calculate the amount of PGE2 in mouse sera. We anticipate that the effects of increased levels of PGE2 will be associated with mechanisms related to higher ω-6 fatty acid intake. Although the data for this study has not been collected, other groups have confirmed a similar correlation when using cell culture and mice, though no studies have been published using mice that develop pancreatic precancer. Results that corroborate increased PGE2 as a contributor to precancer development translates into potential therapeutic targets and improved understanding of disease etiology.

A08
Elucidating Enzyme-Substrate Interactions through Kinetic Studies of HDAC8 and its Substrates

Presenter(s)
Yiru Tao, Illinois Mathematics and Science Academy

Advisor(s)
Milan Mrksich, University of Chicago

Histone deacetylase (HDAC) enzymes are important proteins in gene expression and are associated with a variety of cancers. This enzyme family removes acetyl groups from lysine residues in histone proteins which condenses chromatin and hinders transcription. This study uses a combination of self-assembled monolayers and MALDI-TOF MS (a technique termed SAMDI-MS) to compare the kinetic parameters of the HDAC8 isozyme and acetylated lysine containing peptide substrates derived from Ac-Gly-Arg-AcLys-X-Gly-Cys -NH2 (X = Phe, Tyr). For the substrate X = Phe we found a value for K_m = 56 /- 4 ìM, k_{cat} = 708 /- 32 s^{-1}, and k_{cat} /K_m = 1.2610 M^{-1} s^{-1}. The parameters for X = Tyr are ongoing. These results will demonstrate how certain enzymes interact with specific substrates that provide information on the chemistry around enzyme active site and identifies similarities and differences between isozymes. This can then lead towards the identification of specific HDAC inhibitors, a current goal as targets for cancer therapeutics.

A09
Exploring Properties of Protozoan Acetyl-CoA Carboxylase in a Yeast-Based Screening System to Identify New Lead Compounds for Antiparasitic Drugs

Presenter(s)
Eva Yuan, Illinois Mathematics and Science Academy

Advisor(s)
Piotr Gornicki, University of Chicago
Robert Haselkorn, University of Chicago
Zi Ye, University of Chicago

Parasitic infections affect millions of people globally. Vaccines are ineffective and infectious parasites are becoming drug-resistant. Acetyl-coA carboxylase (ACC) is an essential enzyme of fatty acid metabolism and a potential target for new drugs. Drug screening using live parasites is impractical and expensive, so we used yeast as a surrogate host. After introducing parasitic ACC genes into yeast to replace the native ACC, we used the transgenic strains to screen chemical libraries for inhibitors of parasitic ACC. By yeast complementation, we tested ACC from *L. braziliensis*, *L. major*, and *T. brucei*. We are testing *Cryptospiridium* ACC. *L. major* and *T. brucei* ACC did not complement yeast ACC null mutation. Polymerase chain reaction errors can lead to inactive ACC by introducing amino acid substitutions, but that the substitutions that we found were best explained by haplotype variation. The artificial genes that we tested possibly produced an insufficient amount of active foreign ACC for yeast survival. We will replace GAL10 promoter with a stronger one to drive expression more efficiently. *L. braziliensis* ACC complemented yeast ACC null mutation. The transgenic strain grew slowly, so we selected spontaneous mutants with improved-growth phenotypes. These strains are ready for high throughput screening. Our results improve human condition by increasing chances of curing parasitic infections.

B01
Modeling a Hydrocephalic Brain

Presenter(s)
Susan Chen, Illinois Mathematics and Science Academy
Jasmine Kwasa, Illinois Mathematics and Science Academy

Advisor(s)
Sukhraaj Basati, University of Illinois at Chicago
Andreas Linninger, University of Illinois at Chicago

Our research was focused on a three-dimensional computer model of the brain with hydrocephalus, a condition characterized by swelling of the ventricles. This model was created with MIMICS, image reconstruction software. In order to assess the differences between normal and diseased states of the brain, we investigated the physiology, the surface areas and volumes, of the substructures. Then, our remeshed and smoothened computer model was compared to a real brain to verify accuracy. Our models assumed the expected 30% accuracy for computer modeling. Then, we created an informational video about the following substructures and their associated diseases: the cortex, hippocampus, putamen, cerebellum, thalamus, and the ventricles. This video can now be used as an educational tool in classrooms. Next, we investigated the use of computational software (ADINA) to solve partial differential equations associated with the brain's physical properties and simulate brain dynamics. Finally, we studied the progression of hydrocephalus in the rat brain, which uncovers details about the disease's growth and development. By exploring the brain's substructures and using the MIMICs and ADINA software, we have gained knowledge on brain physiology, which will help maximize the sensitivity of disease sensors for the brain in the future.

B02
Comparison of Diffusion MRI Analysis Models

Presenter(s)
Frederick Damen, Illinois Mathematics and Science Academy

Advisor(s)
Xiaohong Joe Zhou, University of Illinois at Chicago

Diffusion magnetic resonance imaging (dMRI) is used to measure the Brownian motion of water molecules within brain tissue. One application is to elucidate the microstructure of brain tissue to further our understanding of normal brain function, and diseases. This study examined the bi-exponential model commonly used in the dMRI literature as well as a statistical model recently proposed by Yablonskiy. A MATLAB program was created to perform a regression analysis on a dMRI data set obtained from a healthy human brain at 3.0 Tesla. The apparent diffusion coefficient values computed from these regressions were then used to create quantitative maps of the brain. Although both models fit the data well, the statistical model produced very clear and accurate maps while the bi-exponential model produced maps with minor inconsistencies. If these preliminary results can be further substantiated, then this review of models could help with the diagnosis of brain abnormalities.

B03
The Effects of a Visual and Haptic Feedback Interface on Stroke Rehabilitation

Presenter(s)
Hendrik Dewald, Illinois Mathematics and Science Academy

Advisor(s)
Ana Maria Acosta, Northwestern University
Jules Dewald, Northwestern University

The goal of this project is to evaluate the effect of providing visual and haptic feedback based on a computer game compared to an image of the arm during reaching movements in individuals with stroke. The idea behind using a modern video game is to provide a more motivating training environment for stroke rehabilitation. Using the same ACT3D to generate virtual mechanical environments that allow for varied support of the arm and the same air hockey game as last year, we will test multiple subjects according to a strict, yet personalized, protocol. This will consist of both control reaching trials, where the subject will attempt to reach as far as they can in three directions, and work area air hockey trials on three different support levels. Our next step is to gain data to perform proper statistical comparison between the two different types of visual feedback, both in terms of trial work/reach area and surveyed interest. We predict that this data will support the concept that the stroke subject's efforts to increase the workspace of the paretic arm will improve significantly with the application of the video game.

B04
Development of an o-GlcNAc Transferase Based Therapeutic for Glioblastomas

Presenter(s)
Nicole Howard, Illinois Mathematics and Science Academy

Advisor(s)
Roger Kroes, Northwestern University
Joseph Moskal, Northwestern University

The most highly invasive and deadly glioma, glioblastoma multiforme (GBM), are among the most common of primary brain tumors. Previous studies have shown that the expression of certain genes that synthesize critical cell surface oligosaccharide structures is altered in clinical glioblastoma specimens. Alterations in these oligosaccharide structures likely affect the proliferation and invasivity of these tumors, so approaches to modulate the genes that synthesize these structures may have therapeutic potential. The O-GlcNAc Transferase (OGT) mRNA has been shown to be down-regulated in gliomas. The research I have done this year has focused on the development of novel molecular reagents aimed at evaluating the phenotypic effects of increasing the expression of OGT in the U373MG human glioma cell line and monitoring the resultant changes in invasivity and proliferation of those cells. Using standard PCR techniques, the coding region of the human OGT gene was cloned from normal human brain cDNA and a plasmid expression vector containing this gene was created. Introduction of this expression plasmid into U373MG cells via liposomal-mediated transfection and the creation of a panel of stable cell lines are currently in progress. These cell lines will be used for future in vitro and in vivo evaluation of the therapeutic potential of this molecular approach to GBM therapy.

B05
Hydraulic Conductivity of Collagen I as Found in Bruch's Membrane

Presenter(s)
Velin Tchalakov, Illinois Mathematics and Science Academy

Advisor(s)
Zdravka Cankova, Northwestern University

The retina receives its nutrition from the diffusion of substances through Bruch's membrane. However, with age, this membrane can come clogged with lipids, and the retina receives an insufficient amount of nutrition. This may lead to age-related macular degeneration, which causes blindness. Unfortunately, little is known about the structural properties of this membrane. Bruch's membrane is composed of several layers, one of which is mainly composed of collagens. My work at Northwestern University involved finding the hydraulic conductivity of collagen I. Hydraulic conductivity measures how well a fluid can permeate a gel. By performing controlled perfusions, I was able to find the hydraulic conductivity. Previous studies have found a linear relationship, where hydraulic conductivity decreases as pressure increases. However, due to filter resistance variation, I was unable to support these findings. Instead, I was able to conclude that collagen I does create a semi-permeable barrier, which significantly limits the amount of fluid that passes through it.

B06
Pore Density in PEGDA Hydrogels in Relation to the Proliferation of NIH/ 3T3 and hMSCs

Presenter(s)
Karthik Vantakala, Illinois Mathematics and Science Academy

Advisor(s)
Mi Suk Bae, University of Illinois at Chicago
Richard Gemeinhart, University of Illinois at Chicago

Materials that emulate the soft tissues and extracellular matrices have drawn much interest from the biomaterials community. Such materials include hydrogels, which have applications ranging from drug delivery to cell transplantation. However, before these applications are exploited, the nature of cellular interaction with hydrogels must be understood. Hydrogels synthesized from polyethylene glycol diacrylate (PEGDA) are known to hinder cell adhesion. However, based upon the recent discovery that cells, NIH/3T3 cells and human mesenchymal stem cells (hMSCs), adhere to and proliferate on super porous hydrogels (SPHs) formed from PEGDA, we set out to use micropatterned pores created through soft lithography techniques to understand how and why hMSCs and NIH/3T3 retain their ability to adhere on a non-adhesive hydrogel. Controlled pores were artificially created from a polydimethylsiloxane (PDMS) mold at different densities, depths, and size. Seeded NIH/3T3 cells adhered within the pores, however, only at certain pore dimensions. The cells preferred larger and deeper pores. Moreover, a large concentration without over seeding was ideal. The results suggest that NIH/3T3 cells required the cooperation of a multitude of cells to create cell aggregates, which allowed for the proliferation of the cells. The investigation continues to test the interactions of hMSCs under similar conditions.

C01
The Effects of Cholesterol and Other Sterols on Membrane Fluidity

Presenter(s)
Dimple Adatia, Illinois Mathematics and Science Academy
Linna Guan, Illinois Mathematics and Science Academy

Advisor(s)
Yulia Epshtein, University of Illinois at Chicago
Irena Levitan, University of Illinois at Chicago
Dev Singh, University of Illinois at Chicago

Cholesterol is an essential component of cell membranes, as it provides structure and serves as a cell signaling facilitator. However, in excess, cholesterol can cause undue rigidity in the membrane, which may inhibit the function of vital cellular proteins. Liposomes, artificial membranes synthesized from phospholipids 1-Palmitoyl-2-oleoyl-sn-glycero-3-phosphoethanolamine (POPE) and 1-Palmitoyl-2-oleoyl-sn-glycero-3-phosphate (POPG), were used to simulate the cell membrane in determining the effects of various sterols on membrane fluidity. The sterols tested were cholesterol, epicholestrol, and 25-hydroxycholesterol in 10%, 20%, and 30% ratios. Two fluorescent probes, trimethylammoniumdiphenylhexatriene (TMA-DPH) and diphenylhexatriene (DPH) were used for anisotropy measurements. After incorporation of the fluorescent probes in the liposomes, the samples were placed in a spectrofluopolarimeter and illuminated with vertical polarized light at 362nm and fluorescence emission was monitored at 424nm. Fluidity was determined from generated anisotropy values. The data indicated that an increase in the level of membrane cholesterol caused a significant decrease in membrane fluidity. Furthermore, cholesterol was observed to cause noticeably lower fluidity in the membrane than that caused by epicholesterol and 25-hdroxycholesterol. Data collected from both probes showed no substantial differences in fluidity in samples containing epicholesterol and 25-hdroxycholesterol.

C02
The Effect of T-bet on the Development of Natural Killer Cells

Presenter(s)
Erika Bongen, Illinois Mathematics and Science Academy

Advisor(s)
Barbara Kee, University of Chicago
Kevin Ramirez, University of Chicago

Natural killer (NK) cells are white blood cells that are part of the innate immune system. They trigger apoptosis in cancerous and virally infected cells. However, unlike their fellow lymphocytes, T cells and B cells, we do not know the details of their development from hematopoietic stem cells to mature NK cells. T-bet is a gene that promotes the expression of surface protein CD122, which is necessary for NK cell development. We compared the quantity of T-bet RNA found in cells using real time QPCR. We found that T-bet is expressed in significantly greater quantities in NK and NK progenitor cells than in lymphoid progenitors and other kinds of white blood cells. T-bet is first appreciably expressed in NK cell precursor cells (NKP), the first stage where cells are restricted to the NK cell lineage.

C03
The Diet and Nutrition of an Average IMSA Student

Presenter(s)
Jessica Burash, Illinois Mathematics and Science Academy
Elizabeth Murphy, Illinois Mathematics and Science Academy

Advisor(s)
Sarah O'Leary, Illinois Mathematics and Science Academy

Do IMSA students receive enough nutrients according to the Food Guide Pyramid? To find out, we recorded the nutritional value of the food offered at Sodexho for six weeks and we distributed surveys to IMSA students to understand which food and drink choices students usually make when they eat at Sodexho. Then, we compared the nutritional values that the surveyed students usually get at Sodexho to the values that a teenager is supposed to receive. We performed a statistical analysis on the results of the surveys and we determined there is no correlation between the number of times Sodexho served certain foods and the amount of people who said they ate those foods ($r=0.125$, $p=0.05$, $df=36$). The results of the surveys also showed that on average, an average IMSA student consumes more than the daily recommended amount of fat, cholesterol, sugar, and protein. Students also do not receive enough fiber or calcium from their daily food choices. In conclusion, although Sodexo menu offerings often fulfill the nutritional requirements set out by the United States Department of Agriculture, students often do not make the healthiest possible choices.

C04
Expression of Brain-Derived Neurotrophic Factor in the Cerebellum of Stressed Rats

Presenter(s)
Anna Chen, Illinois Mathematics and Science Academy

Advisor(s)
Lei Zhang, Uniformed Services University of the Health Sciences

Posttraumatic stress disorder (PTSD) is a common anxiety disorder found in individuals who have experienced a traumatic event. Past studies have discovered that subjects experiencing stress or depression exhibited a down-regulation of brain-derived neurotrophic factor (BDNF), a protein responsible for neuron growth and maintenance, in several areas of the brain. This investigation tested for the concentrations of BDNF in stressed and control rats killed immediately after tail-shock stressing and seven days after tail-shock stressing. Stressed male rats killed immediately following stress procedures had BDNF concentrations twice that of control males, while stressed female rats killed immediately had concentrations half that of their control counterparts. Stressed male rats killed seven days after their last stressing had significantly lower BDNF concentrations than controls. These results may explain why females are twice as likely as males to be diagnosed with PTSD, and support claims that males and females have different physiological responses to stress. The data also suggests that a biomarker for PTSD involving a BDNF protein count can be developed as long as physicians take into account sex and amount of time passed. A BDNF-centered treatment for PTSD is also possible.

C05
Beta-Cell Regeneration in Diabetic Mice Treated with Islet Cell Transplantation and Insulin Tablets

Presenter(s)
Anna Chen, Illinois Mathematics and Science Academy

Advisor(s)
Anita Chong, University of Chicago
Eric Grossman, University of Chicago

Diabetes mellitus is a metabolic disease affecting approximately 7.6 % of the human population. Type 2 diabetes mellitus (T2DM) is caused by an autoimmune response against insulin-producing beta-cells in the islets of Langerhans located in the pancreas. Recent studies suggest that, contrary to previous opinion, beta-cells are not irreversibly destroyed during the immune response, but merely deactivated, and can be reactivated through restoration of normal insulin production. In this investigation, beta-cell regeneration in pancreata of control mice, treated mice, and healthy mice were compared to examine the effectiveness of various diabetes treatments such as insulin tablets and temporary islet transplantation in restoring native beta-cell function. Images of serially-sectioned pancreata were captured with a Zeiss Axiovert 200M microscope. The area of the organ and beta-cells were measured using OpenLab software. Total cell mass was calculated based on the area ratio between the cells and the pancreas, and the mass of the organ. Data was analyzed using the ANOVA test, with p-value of less than 0.05 indicating statistical significance. Preliminary results suggest that although greater beta-cell regeneration is observed in mice treated with islet cell transplantation, the difference in cell recovery between the two treatments is not statistically significant.

C06
The Effect of Locostatin on Wildtype RKIP and Depleted RKIP Mouse Embryonic Fibroblast Cells

Presenter(s)
Hannah Dada, Illinois Mathematics and Science Academy

Advisor(s)
Marsha Rosner, University of Chicago
Anne Shemon, University of Chicago

Raf-1 kinase inhibitory protein (RKIP) associates to Raf-1 and inhibits epidermal growth factor (EGF)-induced MAPK activation which is part of the ERK pathway. We have recently generated mouse embryonic fibroblast cells (MEF's), which express wildtype RKIP; these cells will be used extensively in this study. In this study, we aim to investigate the effect of locostatin (a drug recently described as an inhibitor of RKIP) on MAPK activity and cell migration in MEF's expressing either wild-type or depleted RKIP. MEF's were depleted of RKIP by transfecting a lentiviral vector containing a short hairpin loop sequence against RKIP. Wild-type and depleted RKIP MEF's were treated with EGF and we observed an increase in MAPK activity in RKIP depleted cells compared to wildtype RKIP. However, in the presence of locostatin there was no change in the EGF-induced MAPK activity in either genotype. Furthermore, we confirmed that locostatin inhibits cell migration, however this was independent of the presence or absence of RKIP. This study indicates that locostatin has no effect on MAPK activity in MEF's, but it impairs cell migration in these cells.

C07
The Effects of Eomesodermin on the Specification and Commitment of Multipotent Lymphoid Progenitors to the Murine Bone Marrow Natural Killer Lineage

Presenter(s)
Anamaria Filipac, Illinois Mathematics and Science Academy

Advisor(s)
Barbara Kee, University of Chicago
Kevin Ramirez, University of Chicago

Natural killer (NK) cells are a form of lymphocyte whose role is to produce inflammatory cytokines or induce cell lysis of malignant, infected, or stressed cells. The development of these cells from hematopoeitic stem cells (HSCs) is much studied; however researchers are still looking at any transcription factors that may be necessary for NK specification and commitment. The transcription factor eomesodermin (eomes) may play a role in NK development. To address this query we performed a quantitative real time polymerase chain reaction, which confirmed that eomes was expressed in all stages of NK development. A retroviral vector containing eomes was then created and used to infect a population of murine hematopoietic stem cells in vitro. Flow cytometry, using the standard antibodies utilized for mature NK receptors, will be used to determine the effects of eomes on their development. These findings will show whether eomes can commit progenitors to the NK lineage.

C08
The Effect of Decitabine on the Methylation Status and Binding of CREB to Gamma Globin Promoter CRE

Presenter(s)
Bernice Fokum, Illinois Mathematics and Science Academy
Ruijie Zhang, Illinois Mathematics and Science Academy

Advisor(s)
Donald LaVelle, University of Illinois at Chicago

Fetal hemoglobin (HbF), comprised of α and γ subunits, inhibits the polymerization of sickle hemoglobin, comprised of α and ß-s subunits. HbF is present at birth but rapidly decreases after infancy. Decitabine, an inhibitor of DNA methyltransferase 1, has been found to increase HbF in vitro and in vivo in baboons. We hypothesized that decitabine increases γ -globin expression partially through the demethylation of CpG sites found throughout the Gγ-promoter. Our goal was to test the effect of decitabine on the DNA methylation status of the cyclic AMP response element binding site found at -1222 on the Gγ-promoter. A chemical-inducer of dimerization (CID)-dependent cell line derived from human ß-globin locus yeast artificial chromosome (ßyac) mice was used. DNA from the ßyac cells was treated with sodium bisulfite, which causes unmethylated cytosine to convert to uracil, without affecting the methylated cytosine. After treatment, the DNA was sequenced. From the sequencing, we discovered that the cells contained the A-Benin sequence at the γ-CRE, which lacks the CpG site needed for methylation. We then focused on the methylation status of the other CpG sites located on the beta locus by developing a process based on DNA digestion with methylation-sensitive restriction enzyme HpaII and its methylation-insensitive isoschizomer, MspI. Currently scientists are unsure of the exact mechanism of action utilized by decitabine. With this experiment, we hope to contribute knowledge.

C09
A Conditional Knock-Down of the LDH2 Gene in *Toxoplasma gondii*

Presenter(s)
Alexandra Hizel, Illinois Mathematics and Science Academy

Advisor(s)
Rima McLeod, University of Chicago

Toxoplasma gondii, a parasite that infects over one-third of the world's population, damages eyes and brain. The bradyzoite stage persists in all infected people and no medicines can eradicate it. In this stage, the gene lactose dehydrogenase 2 catalyzes the reaction of lactate to pyruvate, providing energy to the parasite. The purpose of the investigation is to determine whether this gene is essential for the parasite to persist. If so, this protein would be validated as a molecular target against which medicines can be directed to eliminate latent infections. I am going to create a construct to make a conditional knock-down. To create a conditional knock-down the promoter must be mapped to find a site to add tetracycline response elements in a place that best interrupts expression of the gene. The promoter was mapped and the ideal site identified. One tetracycline operon (tet-o) was successfully added to this region of the promoter. A site-directed mutagenesis strategy was developed to add three more tet-o's because prior studies with other genes had demonstrated that one tet-o was not sufficient. The construct is currently being analyzed to determine whether four tet-o's have been inserted. This conditional knock-down will be used to validate a potential, important, molecular target, as a basis for development of novel medicines to treat toxoplasmosis.

C10
The Effects of Troponin I Pseudophosphorylation on Conformation and Interaction within the Thin Filament

Presenter(s)
Janel Jin, Illinois Mathematics and Science Academy

Advisor(s)
Brandon Biesiadecki, University of Illinois at Chicago
R. John Solaro, University of Illinois at Chicago

The troponin complex, consisting of troponin I (TnI, the inhibitory subunit), troponin C (TnC, the calcium binding subunit) and troponin T (TnT, the tropomyosin binding subunit), plays a crucial role in the regulation of striated muscle contraction. Phosphorylation of TnI is observed at three locations: Ser-23, Ser-24 and Ser-150. TnI phosphorylation (TnI-P) at Ser-23 and 24 results from cAMP-dependent protein kinase activation (PKA) through sympathetic nervous system stimulation induced beta-adrenergic activation in the heart. TnI-P at serine 150 occurs through activation of AMP-activated protein kinase (AMPK) and p21-activated kinase (PAK). This investigation involved in vitro measurements of TnI interactions using recombinant TnI to study the effects of TnI-P at serine 150 on TnI-TnT binding and PKA-induced TnI S23/24 phosphorylation. ELISA solid phase binding assays indicated altered binding of TnI pseudo-phosphorylated at Ser-150 and/or Ser-23/24 to TnT. Furthermore, PKA treatment of human cardiac troponin with and without cardiac TnI Ser-150 pseudo-phosphorylation showed no difference in PKA phosphorylation of TnI Ser-23/24. These results show significant effects of TnI Ser-150 phosphorylation on interactions of TnI within the thin filament, suggesting that TnI-P Ser-150 may play a key role in modulation of cardiac muscle contraction.

C11
Genetic Mapping of a High Response Psychostimulant Mutant Permanent Midnight

Presenter(s)
Akash Kumar, Illinois Mathematics and Science Academy

Advisor(s)
Vivek Kumar, Northwestern University

Addiction is a very complex manifestation of the central nervous system. Although, there is a strong genetic basis for addiction, the genes involved and their function remain under intense study. The mouse *Mus musculus* is an ideal model system to identify genes that mediate response to psychostimulants. A mouse mutant, Permanent Midnight, was identified in a large-scale genetic screen. Permanent Midnight has over one standard deviation higher cocaine response than the wildtype. This project consisted of genetically mapping the mutation in Permanent Midnight. This was done through molecular biology techniques such as polymerase chain reaction (PCR) followed by agarose gel electrophoresis. The scans were completed by using single nucleotide polymorphism and short sequence length polymorphism markers. After genotyping the strain, R/qtl software was implemented to compare the genotypes to respective phenotypes. As a result, chromosomes 4 and 11 were identified as probable areas where addiction-regulating genes could be present. Further inquiries will include conducting detailed and specific scans on chromosomes 4 and 11, along with gaps in previous scans. This will ultimately lead to the discovery of the target gene. The implications of these genes encompass genetically aiding addicts. By genetically targeting addiction, several solutions can be created.

C12
APOBEC3G and HIV in Lemurs: An Evolutionary Study

Presenter(s)
Kaitlyn Kunstman, Illinois Mathematics and Science Academy

Advisor(s)
Steven Wolinsky, Northwestern University

Human and non-human primate cells contain natural mechanisms that work to suppress HIV infection. A group of genes called the APOBEC family of genes has been discovered to interfere in the process of HIV infection by controlling the replication of the virus. These genes have been undergoing positive selection throughout the history of primate evolution. Thus far, APOBEC3G (a member of the APOBEC family) has only been found in humans, New World, and Old World Primates. I endeavored to amplify and sequence the APOBEC3G gene in prosimians, a group of primates that diverged from apes and humans over fifty million years ago, by examining lemur DNA. I tried sequencing APOBEC3G by amplifying each of its exons but was only able to successfully amplify and sequence from control primate DNA. I then tried to amplify the entire gene by reverse transcribing lemur RNA to DNA. I completed this procedure with Rhesus Macaque RNA as a control and was able to sequence the complete rhesus APOBEC3G gene. While this same amplification is proving difficult with the lemur samples, these results could indicate a lack of APOBEC3G in the lemur genome, but more likely indicate a failure of the primers to amplify the lemur APOBEC3G gene sequence.

C13
The Effects of Serotonin on the Sympathetic Activity on the Recovery of Hypotensive Hemorrhage

Presenter(s)
Sheng-Ting Lin, Illinois Mathematics and Science Academy

Advisor(s)
Theresa Kung, Loyola University
Karie Scrogin, Loyola University

In this study we observed how the destruction of hindbrain serotonergic neurons affects mean arterial pressure (MAP), heart rate (HR), and renal sympathetic nerve activity (RSNA) during the recovery from hypotensive hemorrhage in conscious rats. The rats in the experimental group received neurotoxin to destroy the serotonin cells while those in the control group were injected with ascorbic acid. After two weeks recovery, we recorded MAP, HR, and RSNA while the animals were subjected to hypotensive hemorrhage. The staining of the tryptophan hydroxylase (TPH, the rate-limiting enzyme in serotonin production) in hindbrain sections using immunohistochemistry allowed us to find the areas with statistically significant differences in the number of serotonergic cell bodies. To determine if loss of serotonin itself accounts for the suppression of sympathetic recovery, we applied the technique of RNA interference by injecting a virus that silences TPH production into these areas. We will measure the sympathetic activity of these rats during blood withdrawal. If these experiments lead to the same results, we will conclude that serotonin positively mediates recovery of sympathetic activity following hemorrhage. Further research on the role of serotonin in response to blood lost could lead to the development of novel treatments of hypotensive hemorrhage.

C14
Screening of Human Fetal Liver cDNA Phage Display Library for Neonatal Hemochromatosis Alloantigen Using Maternal Sera

Presenter(s)
Xuxuan Liu, Illinois Mathematics and Science Academy

Advisor(s)
Padmini Malladi, Children's Memorial Research Hospital
Peter Whitington, Children's Memorial Research Hospital

Neonatal hemochromatosis (NH) is a rare congenital disorder that affects the fetus in late gestation, clinically defined as severe neonatal liver disease associated with extrahepatic siderosis. There is clinical evidence that suggests NH to be an alloimmune disease. The prognosis of NH is variable and generally poor, usually causing death to the fetus. For my project, a human fetal liver cDNA phage display library was constructed and screened by biopanning using the maternal sera antibodies from mothers that had babies with proven NH. After four rounds of biopanning, the selected phage was plated, and individual plaques were picked and amplified using PCR. In an ongoing effort to identify the NH protein, we have sequenced forty to fifty individual clones. The sequences were searched in the databases in NCBI BLAST for a match with known or unknown genes/proteins. Preliminary results show some putative sequences which may be positive for NH protein. Further tests are being carried out by other researchers in the laboratory. The outcomes of this study will be geared to provide a complete understanding and diagnosis of NH.

C15
Determining the Mechanisms of Herpes Simplex Virus Type 1 Ocular Cell Infection

Presenter(s)
Jonathan Park, Illinois Mathematics and Science Academy

Advisor(s)
Christopher O'Donnell, University of Illinois at Chicago
Deepak Shukla, University of Illinois at Chicago

Though HSV-1 infection of ocular cells is one of the leading causes of infectious blindness in the world, much is still unknown as to how the virus infects these cells. Infection mechanisms of Herpes simplex Type 1 (HSV-1) into various ocular cells were observed using live cell imaging. The purpose was to discover novel mechanisms for HSV-1 entry and cell-cell fusion. Target cells expressing HSV-1 receptors were infected with either viral particles or viral glycoprotein-expressing cells to study viral entry and HSV-1 induced cell-cell fusion, respectively, during real-time. Viral entry was observed in human corneal epithelial (HCE), corneal fibroblast (CF), and retinal pigment epithelial (RPE) cells. Endocytosis and phagocytosis inhibitors were used to help determine the mode of entry into these cells. Cell-cell fusion was observed in HCE cells through a direct fusion mechanism providing one explanation as to how HSV-1 spreads in the eye. The use of live cell imaging has helped determine some of the aspects of HSV-1 ocular cell infection which will help in the development of agents to inhibit this process.

C16
The Prevalence of ESBL *E. coli* with CTX-M in the United States

Presenter(s)
Varun Pilla, Illinois Mathematics and Science Academy

Advisor(s)
Chao Qi, Northwestern University

Extended spectrum β-lactamase (ESBL) is responsible for multi-drug resistance to the newest generation of antibiotics in gram negative bacteria including *Escherichia coli*. While these ESBLs primarily spread within the hospital environment, a new strain of ESBL *E. coli* limited only to the community is emerging. While the predominant number of isolates of ESBLs has been SHV and TEM types, both confined to the hospital environment, the emerging CTX-M type is the first and only ESBL to be strictly transmitted within the community. This enzyme's emergence and its capability of spreading in the community is a growing concern for our public health. This study investigates the prevalence of ESBL *E. coli* with CTX-M in community-acquired urinary tract infections (UTI) at the Northwestern Memorial Hospital and the identification of the specific type of CTX-M responsible for this emergence. PCR with the universal CTX-M primers was run on the isolates of ESBL *E. coli* from UTIs from 2004-2008. Agar gel electrophoresis determined the existence of the gene in the bacteria after amplification. The specific type of the CTX-M gene is to be identified by running PCR on CTX-M positive isolates with different types of CTX-M primers. The results from the electrophoresis of the ESBL *E. coli* currently suggest the growing frequency of the gene within the community.

C17
Screening for acd6-1 Suppressors in *Arabidopsis thaliana* Plants

Presenter(s)
Dana Robinson, Illinois Mathematics and Science Academy

Advisor(s)
Jean Greenberg, University of Chicago
Jiyoung Lee, University of Chicago

In *Arabidopsis thaliana*, the accelerated cell death gene ACD6 is involved in pathogen defense through regulation of the signal molecule salicylic acid (SA). A gain-of-function mutation of the gene, acd6-1, confers increased resistance to the pathogen *Pseudomonas syringae*. The gene acd6-1 also causes an accumulation of SA, resulting in dwarf phenotype and increased cell death. Our investigation screened for genes involved in the acd6-1 defense pathway by using T-DNA insertion to disrupt random genes. In plants that returned to medium or wild-type phenotype, it was likely that the blocked gene played a role in the pathway. We further tested these candidate genes for decreased cell death and SA level in comparison to acd6-1 plants. We also tested for expression of the pathogen resistance genes PR1 and PR2. We identified eight genes whose disruption seemed to partially suppress the acd6-1 defense signaling pathway. These genes included salicylic acid biosynthetic protein and two zinc finger family proteins.

C18
Characterization of Folate-Conjugated Multi-Arm PEG Polymers as Efficient Nanoparticles for Cancer Drug Delivery

Presenter(s)
Jasmine Shah, Illinois Mathematics and Science Academy

Advisor(s)
Seungpyo Hong, University of Illinois at Chicago

As the perils of cancer continue to affect millions every day, more emphasis is being placed upon the two main methods of cancer therapy: 1) the search for identifying specific molecular markers and targets of cancer and 2) the improvement of drug-delivery systems to target and attack cancer cells more efficiently. Our investigation deals with a recent aspect of anti-cancer nanomedicine as we are striving to find the optimum usage of different aspects of biocompatible polymer conjugates in cancer drug delivery. In this project, we focused upon a polymer called polyethylene glycol (PEG) combined with folic acid (FA) to increase active cancer-cell targeting ability and drug uptake. PEG is chosen because the material is known to be non-toxic, non-immunogenic, and non-fouling. FA is employed as the molecule specifically binds to folate receptor (FR) that is found to be overexpressed a variety of human tumors. In this study, we prepared foue samples: 1) free FA (control); 2) PEG-FA (monovalent polymer); 3) FA-PEG-FA (2-arm polymer); and 4) PEG(FA)4 (4-arm polymer). Using FTIR, we observed a new peak in transmittance assigned to formation of an amide bond, confirming the conjugation reaction. The polymer conjugates were also characterized using UV/Vis and nuclear magnetic resonance spectroscopy. Our long term goal is to achieve controlled, selective targeting of this delivery vectors to enhance therapeutic effect of anti-cancer drug delivery with minimal side effects.

C19
The Effects of Omega-3 Fatty Acids/Flax Seed on the Steroid Genesis Pathway Factors Critical to the Development of Ovarian Surface Epithelial Cancer

Presenter(s)
Shailee Shah, Illinois Mathematics and Science Academy

Advisor(s)
Kristine Ansenberger, University of Illinois at Chicago
Dale Buchanan Hales, University of Illinois at Chicago

Ovarian cancer (OVCA) is the deadliest gynecological malignancy in the United States. Omega-3 fatty acids dietary intervention has shown to be preventative of colon, breast, and prostate cancer and may be critical in suppression and prevention of OVCA. Several proteins including steroidogenic acute regulatory protein (StAR) may play an important role in OVCA development. The purpose of the study is to determine the effect of omega-3 fatty acids on StAR expression in OVCA. The laying hen is one of the only animal models which spontaneously develop surface epithelial cancer similar to that of the human ovarian cancer. Thus, two-hundred 2.5 year-old hens were fed a 10% flax seed enriched diet for one year. Tissue samples were extracted from the hens, fixed, embedded, and used in fluorescent immunohistochemistry. Results showed that there were no significant changes in expression of StAR between hens given a flax diet and hens given a control diet. However, in cancerous samples, StAR was haphazardly present in stromal tissue. In normal cells, StAR expression was limited to the outer epithelial region of the follicles. Higher levels of steroid hormones are found in ovarian cancer cells and detection of StAR may provide information regarding hormone-producing cells in tumors.

C20
The Determination of Alloantibody in Glycosylation

Presenter(s)
Caroline Shin, Illinois Mathematics and Science Academy

Advisor(s)
Emily Ahmed, University of Chicago
Anita Chong, University of Chicago

In transplantation, the development of alloantibodies is correlated with poor graft outcomes and rejection. However, the presence of alloantibodies does not necessarily predict graft outcomes because antibodies are not all equally pathogenic. Antibodies with sialylated constant regions are more anti-inflammatory, while antibodies with fucose residues are more pro-inflammatory. In this investigation, we used the 3-83 Igi B cell receptor knock-in mice, in which all of the antibodies are of the same specificity and alloreactive. Serum was collected from the naïve or pre-sensitized 3-83 mice that had received a heart transplant without immunosuppressant. We determined the glycosylation state of the serum antibodies using the FLISA technique, a modification of the ELISA where a lectin, which recognizes fucose, is bound to an enzyme to catalyze a color-change reaction. We predicted that antibodies in naïve versus pre-sensitized 3-83 mice have different characteristics that correlate with allograft rejection. We hypothesized that the difference would be in the carbohydrate modifications of the antibodies. However, our results showed that there was no difference in alloantibody sialylation or fucosylation in the naïve mice or the transplanted mice. Therefore, in the 3-83 mice model of alloantibodies in transplantation, differential carbohydrate modifications of alloantibodies does not seem to correlate with alloantibody pathogenicity.

C21
Mutagenesis on the *Streptococcus pyogenes* pel Locus and Its Effect on Virulence Gene Regulation

Presenter(s)
Isaiah Tan, Illinois Mathematics and Science Academy

Advisor(s)
Jenny Chang, University of Illinois at Chicago
Michael Federle, University of Illinois at Chicago

Streptococcus pyogenes, commonly referred to as group A beta-hemolytic *Streptococcus* (GAS), is a Gram-positive bacterium known to cause a number of diseases, such as streptoccocal toxic shock syndrome, cellulitis, and necrotizing fasciitis. Existing literature suggests that regulation of virulence factors that enable GAS disease mechanisms may be under control of the pleiotropic effect locus (*pel*). We hope to identify the genetic components within *pel* that enable this regulation by targeting the locus for random mutagenesis. Following mutagenesis, we will screen for differences in a reporter that measures expression of the *sagA* gene promoter. Although no preliminary results can be reported at this time, we have accomplished building a *pel* mutant library on a plasmid using error-prone PCR. Currently, we are in the process of screening this library in GAS by monitoring colonies for aberrant light activity as compared to a control group bearing no *pel* mutations. When more colonies have been screened, and the DNA from colonies of interest is sequenced, our results may point to specific sequences of DNA that control GAS virulence. A successful outcome will provide a better understanding of virulence factor regulation and may improve future treatments against the harmful effects of GAS.

C22
Ovarian Cryopreservation as a Fertility Preservation Method for Women with Ovarian Malignancies

Presenter(s)
Jessina Thomas, Illinois Mathematics and Science Academy

Advisor(s)
Teresa Woodruff, Northwestern University

Radiation and chemotherapy are effective treatments for cancer. However, they can have several harmful effects on the body. One of these effects is ovarian failure in the patient receiving treatment. Cryopreservation is a method of fertility preservation in which a section of ovary is removed so that its follicles can be preserved, saving them from the damaging effects of chemotherapy and radiation. Because most of the follicles are killed in ovarian cancer patients before cryopreservation can be performed, doubts have arisen concerning the success of fertility preservation in ovarian cancer patients. Thus, oocyte cryopreservation has been put on clinical hold until further evidence can be found that suggests that women with ovarian cancer have a sufficient reserve of follicles for cryopreservation. In order to determine this, samples of ovarian tissue were gathered from fifty-three patients with ovarian malignancies. Follicle counts were then performed on sections of these samples. After analyzing the data, it was concluded that ovarian cancer patients do not have enough follicles for successful oocyte cryopreservation.

C23
The Role of Neutron and Gamma Radiation in Liver Tumor Development

Presenter(s)
Anil Vaitla, Illinois Mathematics and Science Academy

Advisor(s)
Tatjana Paunesku, Northwestern University
Gayle Woloschak, Northwestern University

Mutations in an organism's DNA which lead to the development of tumors are either the result of spontaneous mutation events or exposure to mutagens. Ionizing radiation (specifically gamma and neutron radiation) is a type of mutagen. When ionizations occur in DNA or other molecules close by, DNA double strand breaks occur. Mutations occur as the cell attempts to repair the double strand breaks. The Janus Experiments were conducted at Argonne National Laboratories in the 1970's to investigate the effects of exposure to gamma and neutron radiation on mice by altering parameters of radiation such as dose rate, total dose, and fractionation. My work uses the data to understand the changes in frequency of liver cancer in mice following exposure to different types of radiation dosage, dose rate, and fractionation. Evaluation of the data set using statistical tests demonstrates the presence of the treatment regime that caused the largest increase in the odds ratios of liver cancer development. This evidence advises for the development of precautions or guidelines by which levels of medical exposure as well as occupational exposure to radiation should be set.

C24
A Survey of Genetic Modifications and Ethical Implications

Presenter(s)
Stephanie Vanchipurakal, Illinois Mathematics and Science Academy

Advisor(s)
Sarah O'Leary, Illinois Mathematics and Science Academy

There is a great deal of controversy surrounding the ethics of genetic modification, and researchers speculate that religiousness, age, gender, level of education, and profession are influential factors in a person's decision on whether genetic modifications are ethical or unethical. A survey was created to test the influence of these factors on an individual's belief that genetic modifications are ethical or unethical. Results of statistical analysis showed that an individual's opinion on the ethics of genetic modification for sex determination in embryos was dependent on the demographic factor for grade in high school ($p= 0.0061$, $df= 2$, $x^2= 4.04$), but not on any other factors. Also, a person's belief that the use of genetic modification to pick out characteristics is ethical was dependent on a person's occupation ($p= 0.04599$, $df= 10$, $x^2= 18.576$). These preliminary results indicate that there is more to the ethics of genetic modification than violation of the set principals of the National Research Act.

C25
The Purification of Ribosomal S6 Kinase 1, RSK1 Kinase Domain-1, and RSK1 Kinase Domain-2 from *E. coli* Cells

Presenter(s)
Shirley Xiao, Illinois Mathematics and Science Academy

Advisor(s)
Deepti Chaturvedi, Loyola University
Tarun Patel, Loyola University

In this study, we are trying to find the binding sites of ribosomal S6 kinase (RSK1) to other kinases and proteins in order to provide a clear understanding of mechanisms of the bindings. RSK1 is an important factor of MAP kinase pathway in response to stimulation. It has 735 amino acids residues containing two non-identical domains that are separated by a linker region of 100 amino acids. The two domains are kinase domain-1 (KD-1, the N-terminal domain) and kinase domain-2 (KD-2, the C-terminal domain). The full length RSK1, KD-1, and KD-2 were expressed and analyzed with SDS-polyacrylamide gel. KD-1 and KD-2 expressed as one clear band, under the induction condition of 0.1mM IPTG for 2h/250rpm at 18^{o}C, was seen on the gel, meaning that they were purified. The full length RSK1 did not express at all at this condition, so another induction condition of 0.1mM IPTG for overnight/250rpm at 18^{o}C was tried. At this condition, the RSK1 expressed as multiple bands with the possibility of contamination and degradation. Further conditions will be tried in order to express the RSK1 in one clear band. The proteins expressed were including full length RSK1 were purified using standard protocol used for GST fusion proteins. My purifications of RSK1, KD-1, and KD-2 would help further in studying along by providing more raw materials to experiment upon.

D01
The Economics of Virtual Economies: How Real-Life Economic Trends and Factors are Present in MMORPGs

Presenter(s)
Spencer Andrews, Illinois Mathematics and Science Academy

Advisor(s)
Eric Smith, Illinois Mathematics and Science Academy

MMORPGs are online games played by millions around the world, and as a result of their large player bases, these games have intricate and complicated economic systems that allow players to sell and transfer goods to each other. In this study, economic theories and trends were studied and then compared to the economic trends of specific MMORPG economies. From this comparison, many similarities were found. Although this study is not completely finished, since there are so many more trends and factors that need to be identified within each economy, this investigation has shown that many games share striking similarities with the European economic system of the fourteenth century. Traditional economical factors including supply and demand and the *skill premium* have been identified in many of the MMORPGs researched. In this study, the system and regulations under which these economies function was also observed to see how economic variables in real-life economies differ from those found in MMORPGs. As a whole, this study has been able to identify economic factors and trends in two of the most popular MMORPGs.

D02
Useful Skills for Business Professionals

Presenter(s)
Kaijia Chen, Illinois Mathematics and Science Academy
Anita Parikh, Illinois Mathematics and Science Academy

Advisor(s)
Devi Vallabhaneni, The Association of Professionals in Business Management

In the United States alone, there are almost two thousand business schools, six hundred MBA programs, and more than seventy thousand full-time MBA students. For any high school student considering a major in business, college student figuring out what field of business they want to study or job-seeker looking for a career in business management, one of the most important questions must be: What exactly do I need to know in order to be successful in my career? Our SIR investigates what business professionals believe to be the vital skills one needs in order to succeed in the business field. We sent an online survey to business professionals around the country. We worked with our mentor, the president and CEO of the Association of Professionals in Business Management, to develop questions pertaining to integral aspects of business management. The survey consists of six hundred questions, all dealing with the importance of topics in business management, such as operations management and marketing management. Our results will let us know whether business professionals agree with our list of skills. Our conclusions will cater specifically to the needs of aspiring business professionals, who can focus their studies on these skill sets. We have learned that legal and medical professions have set universal examinations that test the skills that all professionals in those fields must possess. Currently, the business management field does not have such a test, but the results of our surveys can be of use in developing one.

D03
Let's Play: Developing a Card Game System

Presenter(s)
Nicholas Higgins, Illinois Mathematics and Science Academy

Advisor(s)
Tracy Townsend, Illinois Mathematics and Science Academy

This inquiry was meant to develop a collectible card game with a created setting behind it. This setting would be made of art assets tied to the game rules. The methods used were simple: develop a ruleset and prototype cards, then have my peers and peers of my advisor playtest. I gained feedback from their play. Once a beta set was codified, the characters and setting would follow. The project did not get that far, as the rules never progressed past an alpha period. There were two alphas developed, along with a rules outline created shortly before the SIR's inception. The first alpha required heavy errata before the first playtest and was too confusing for use. A second, trick-taking alpha was developed and universally disliked. As such, they were both discarded. I have learned how to test a market and make changes to a product during and after production. What this means is that designing something that is interesting and ultimately fun is a difficult endeavor, requiring a network of people who are eager, willing, and knowledgeable. It also requires foresight and reasoning as to how multiple pieces interact and how other people can use the resources given.

D04
Apple Inc: Its Marketing Techniques and its Success

Presenter(s)
Yoonjung Koh, Illinois Mathematics and Science Academy
Sabrina Song, Illinois Mathematics and Science Academy

Advisor(s)
Pradeep Chintagunta, University of Chicago

When you look around a typical college scene, you will see students using Apple products ranging from iPods to iMacs. However, why is this company that has the name of a fruit so successful? At the start of the year, we began investigating background information on Apple's past and present marketing techniques and their successes and failures. Through our research, we learned about how Steve Jobs and Steve Wozniak, the two founders of Apple, focuses on the products that will sell successfully in the future, rather than following the footsteps of other companies that sell current popular items. Instead of going into society and actively knocking on people's doors, Apple relies mainly on pull marketing, a passive form of advertisement, which involves heavy advertisement of products through commercials and non-face-to-face interactions. Although the current stock prices of Apple are decreasing, we believe that with the company's focus on customer satisfaction and frequent releases of newer products, the company will get back on it feet in the near future.

D05
Marketing Engineering: Understanding Attitudinal Research

Presenter(s)
You Na Oh, Illinois Mathematics and Science Academy

Advisor(s)
Chaim Ehrman, Loyola University

Marketing engineering is one of the examples of attitudinal research. Based on the data collected from consumer surveys, business firms use various methods to develop new products, predict the success of a test market, allocate advertisement budget, and so forth. This research investigates specifically the process of developing new, appealing products, using theoretical and methodical perspectives. This investigation presents three steps of consumer model theory, based on the model of Lavidge and Steiner: cognitive, attitudinal, and conative. In addition, we examine two different types of consumer models: compositional models and decompositional models. The examples of lexicographic, conjunctive, and linear compensatory models are compensatory. conjoint analysis is the decompensatory model. We use both manual and computer based conjoint analysis; and we will show how decompositional models are more effective than compositional models based on the results and graphs of program-generated conjoint analysis.

D06
Improving the IIT Stuart School of Business Website

Presenter(s)
Michael Reinhart, Illinois Mathematics and Science Academy
Feiyang Ye, Illinois Mathematics and Science Academy

Advisor(s)
Siva Balasubramanian, Illinois Institute of Technology

Previous studies about college websites and internet usage have shown that young adults are adept at utilizing the internet to research colleges and the programs that they offer. Additionally, studies have shown that prospective students that attend summer programs at schools are more likely to apply and attend the school. Our study aims to improve how the Illinois Institute of Technology Stuart School of Business' website communicates with current and prospective students, and also it aims to develop a summer program for the Stuart School of Business. To achieve this, we implemented an online survey for both undergraduate and graduate students at the school and collected data. The survey contained questions about internet usage and asked participants to rate details of the website. After the data is analyzed, we will be able to identify the strengths and weaknesses of the website. This will lead to better communications between young adults and colleges, in particular, the IIT Stuart School of Business.

E01
Templated Self-Assembly of Gold Nanoparticles

Presenter(s)
Abigail Chao, Illinois Mathematics and Science Academy

Advisor(s)
Leonidas Ocola, Argonne National Laboratory

Nanotechnology holds the key for continuing technological advances. This inquiry sought to combine top-down electron lithography and bottom-up colloidal chemical assembly to induce self-assembly among 6nm gold nanoparticles suspended in toluene on hydrophilic and hydrophobic silicon substrates. Electron beam lithography was used to generate arrays of triangles with 200nm, 100nm, and 80nm edges; large squares around these arrays created borders. To deposit a monolayer of nanoparticles, methods such as the Langmuir-Blodgett trough, spin-coating, and a water bead technique were used. Preliminary results show that the hydrophobic surface may be more promising for the Langmuir-Blodgett trough, but formed multiple layers instead of a monolayer. Spin-coating yields consistent, positive results. The water bead technique demonstrates great potential for hydrophilic substrates with a 1:2 or 1:3 ratio of toluene to water. Scanning electron microscope images reveal that, in general, interaction between triangle templates and nanoparticles is limited, but the borders may significantly inhibit the nanoparticles from depositing within the arrays. Another outcome included a method of reusing templates through treatment with oxygen plasma, gold iodine etch. These results suggest that further investigation is necessary to determine the best method of deposition as well as to specify the effects of the different templates.

E02
Nanoscale and Molecular Studies of Advanced Materials: Understanding Anodic Aluminum Oxide and its Applications in Microfiltration

Presenter(s)
Catherine Crawford, Illinois Mathematics and Science Academy
Jessica Durden, Illinois Mathematics and Science Academy

Advisor(s)
Steve Sibener, University of Chicago

In reduced dimensions, materials display characteristics that can be quite different from their behavior in macroscopic dimensions. Anodic aluminum oxide (AAO) is a self-organizing porous oxide film fabricated from an aluminum template. Pores of tunable diameter spanning the range from 20 nm to 60 nm that develop in this oxide layer are arranged in hexagonally packed arrays to allow for the use of AAO as a template for self assembly and, potentially, as a microfilter for water purification. Our research focuses on synthesizing this material and characterizing its topography using atomic force microscopy (AFM) and scanning electron microscopy (SEM). In this investigation, AAO was created through the use of a two-step anodization process in a standard electrolytic cell. Both temperature and voltage of the system were controlled. Inadequate access to clean water is a pervasive issue in many developing countries. Potential solutions include the use of nanomembranes or microfilters to cheaply and effectively address the need for clean water. By fabricating AAO, we can better characterize its structure and test its viability as a microfilter against biological pathogens.

E03
The Study of Physical Properties and Self Assembly of an Amide Ionic Liquid

Presenter(s)
Jonathan Czerwonka, Illinois Mathematics and Science Academy

Advisor(s)
Millicent Firestone, Argonne National Laboratory

Ionic liquids (ILs) are emerging as a new class of polymers due in part to their many unique properties. As ILs become more frequently used in the scientific community and in industry we will need to understand the various aspects involved in the manipulation of ILs. One area of specific interest to our group is means by which to self-assemble ionic liquids into nanostructured materials. Recently, we have synthesized a new amide IL, 1-(2-decanomidoethyl)-3-methylimidazolium chloride [$C_{10}AmC_2MelM$][Cl^-]. The introduction of the amide group provides an alternate site for hydrogen bonding, which further stabilizes a self-assembled nanostructured physical gel. In this work, we present our efforts examining the nature of this interaction using viscometry and thermal analysis (TGA and DSC), nuclear magnetic resonance (NMR), and infrared spectroscopy (IR) and small-angle X-ray scattering to help us understand the chemical characterization of our new amide IL. By comparing the binary mixture of our new amide IL to a binary mixture of the IL without the amide moiety at different percent water content, we discovered that [$C_{10}AmC_2MelM$][Cl^-] has a significantly higher viscosity. This occurs from hydrogen bonding between the water and protons in the amide moiety. Understanding the interactions of water with this new amide IL furthers our knowledge regarding the structural hierarchy of ILs, which we can use to control the architecture of these self-organizing molecules.

E04
The Thermodynamic System of Nanoscale Clusters

Presenter(s)
Seohyun Kim, Illinois Mathematics and Science Academy

Advisor(s)
R. Stephen Berry, University of Chicago
Chengju Wang, University of Chicago

My Student Inquiry and Research (SIR) investigation of 2008-2009 was finding the unique aspects of nanoscale particles in its thermodynamic system, specifically about phase changes and their structures. The investigation was mostly done by computation. Small systems are susceptible to the computational and analytical methods and would be ideal objects for this study. Through the investigation, I have found several facts about nanoscale particles and their thermodynamic systems. First, I have found some small clusters' stable structures and changes of energy during the phase changes. I have created the caloric curves of the small clusters, particle numbers eight, thirteen, and nineteen, in order to find how the energy changes as those clusters go through the phase changes. When there is a phase change, caloric curves have changes such as the change in the slope. Moreover, I have investigated on how the number of the particles and the value of ϱ (the parameter fixing the range of interaction forces) affect the phase changes and the energies of those clusters. Lastly, I was able to animate the changes from one stable structure to another. This investigation shows nanoscale clusters' unique aspects and their thermodynamics. This can further be related to the special characteristics of glass and protein folding.

E05
Optimization of Titanium Dioxide

Presenter(s)
Rachael Lambert, Illinois Mathematics and Science Academy

Advisor(s)
Christos Takoudis, University of Illinois at Chicago
Qian Tao, University of Illinois at Chicago

Inorganic nanotubes have applications in virtually every field, including medicine (drug carriers), electronics (resistors), and even cleaning (self-cleaning coating). However, mass production of nanotubes is difficult because of the care and precision needed during the dedicated fabrication process. The purpose of this investigation was to optimize TiO_2 nanotube fabrication via the atomic layer deposition (ALD) process with a custom-made reactor. The precursors used for the TiO_2 coatings are tetrakis diethylamino titanium and water vapor, which have a reaction temperature between 110ºC and 130ºC. The use of PMMA, poly(methyl methacrylate) has solved previously encountered contamination issues by enabling the reaction temperature to fall in the normal temperature range for the ALD process. The PMMA template also requires a higher calcination temperature for its decomposition than the previous template because of its high melting point. A new furnace for the removal of PMMA from the TiO_2 nanotube was built. The temperature windows for the decomposition of PMMA and calcination of TiO_2 were experimentally derived through fundamental knowledge-driven trial and error by adjusting temperature and time of the processes. Once production parameters are optimized, specific nanotube measurements can be produced, which may then be utilized by other fields of study.

E06
Novel Materials in Magnetoelectric Multiferroics

Presenter(s)
Max McKittrick, Illinois Mathematics and Science Academy

Advisor(s)
Christos Takoudis, University of Illinois at Chicago
Yi Yang, University of Illinois at Chicago

Multiferroics are promising new technologies that have applications in many industries. These are materials that have two or more of the ferroic properties of iron oxides; the most notable three being ferromagnetism, ferroelectricity, and ferroelasticity. When a material is multiferroic any one of these three forces can be applied to change the other ferrous properties of a material. These materials can be used in industries such as the sensor, computing, and data storage industries. Magnetoelectrics, especially, have many applications, one of which is serving as field effect transistors in computers. My lab seeks to develop magnetoelectrics that have large charge capacities for their size, allowing miniaturization. In my project, I deposited multiferroics onto Si microwafers and then proceeded to measure the different growth rates of these compounds at various temperatures and pressures. I used instruments to determine the charge capacitance, purity, and crystal structure of these novel materials as well. By determining which conditions are the most ideal for growth, we can facilitate our growing of bulk-sample specimens to be developed into industrial applications. Before the end of the semester, I hope to identify the ideal growth rate of nickel oxide.

E07
Synthesis and Analysis for Multifunctional Microsphere-Nanoparticle Probe Systems for Imaging in Biological Systems

Presenter(s)
Christine Pak, Illinois Mathematics and Science Academy

Advisor(s)
Ali Jawaid, University of Illinois at Chicago
Preston Snee, University of Illinois at Chicago

Quantum dots are fluorescent nanocrystals that have very unique optical properties that are far superior to organic dyes. Therefore, they are useful in many applications such as biological imaging and labeling. Previously quantum dot coated microscpheres displayed clumping around the microspheres. With novel carbodiimides that have been synthesized in our lab, we tried to coat SiO_2 microspheres covered by amines with quantum dots covered by carboxylic acids. We have successfully attached the quantum dots to the microspheres. However, we did not get good images from the transmission electron microscope of the microspheres. Currently, we are trying to resolve this by increasing the distance between microspheres and quantum dots with polymers. If successful, this would be a vast improvement on coating microspheres with quantum dots. The final product may be used for various imaging mechanisms.

E08
Diamonds in a Vacuum

Presenter(s)
Ruhiyyeh Turner, Illinois Mathematics and Science Academy

Advisor(s)
Vicki Burgholzer, Illinois Mathematics and Science Academy

Chemical vapor deposition (CVD) is a relatively new process for creating diamonds in a low pressure environment that is heated to only 2200^{o} Celsius. In this hot filament chemical vapor deposition, a mixture of hydrogen and methane is decomposed and deposited onto a substrate, where a film of diamond would form. It requires lower temperatures than other methods. I have researched different types of hot filament chemical vapor deposition, designed a reactor after what I found, and have ordered some parts for assembling a CVD reactor. Much of the information I have used has come from some of the pioneers of the hot filament CVD process and the design I came up with is based on theirs. Both designs use a stainless steel vacuum container, with special openings where gas input, output, and heating elements can be placed. My work so far has involved learning about the different methods of chemical vapor deposition, figuring out the type of vacuum equipment to be obtained, and creating order forms to purchase them. My ultimate goal is to create a black powder with the structure of diamond.

F01
How to Build a Robot: Evolutionarily Designed Intelligence and its Basis in Modern Biology

Presenter(s)
Alexander Drummond, Illinois Mathematics and Science Academy
Kyle Hanson, Illinois Mathematics and Science Academy

Advisor(s)
Mike Ososky, Applied Computer Technology

Over the past decades, the question of how to build human-quality artificial intelligence has come under intense scrutiny. How does one truly know if a machine is learning and sentient, or if it is simply emulating these activities? Is there a difference? To answer these questions about the fundamental structures of artificial intelligence, we examined several primary sources of leading biologists, physicists, and computer scientists. These readings, as well as discussions with our adviser, allowed us to analyze a multitude of different theories about the philosophical framework of cognitive intelligence as well as the methods of building artificial intelligence. One of the most intriguing theories is that of the complex adaptive system. Complex adaptive systems consist of agents which process information and are able to adapt to their surrounding environment. Complex adaptive systems provide for combinatorially explosive possibilities, and may be the missing link to developing strong artificial intelligence.

F02
Wireless Ad-Hoc Networks: Along a Cherry Lane

Presenter(s)
Cathy Li, Illinois Mathematics and Science Academy

Advisor(s)
Peng-Jun Wan, Illinois Institute of Technology

A wireless ad-hoc network is a network that relays information from origin to destination through a series of wireless transmitters. Each wireless transmitter has a communication radius and an interference radius. This project looks at three links of six identical transmitters (communication radius ≤ 1, interference radius $r \geq 1$) placed along a strip with height h(r) such that only the midpoint of each link must lie within the strip. The goal is to maximize h(r) and prove that the following is true for all variations in placement: if the two links whose midpoints are on the furthest right and left interfere, then the link that lies between must also interfere with at least one of them. Currently, it has been proven that when interference radius is 1, then h(1) is $\sqrt{(3/4)}$. The general h(r) equation is h(r)=$\sqrt{(r^2-1/4)}$ - cos([π/6] arcsin[1/2r]). This information will help to in further analysis of current wireless system that result in lesser latency and greater efficiency.

G01
An Investigation of the Physical Properties of the Atmosphere

Presenter(s)
Matthew Brian McDermott, Illinois Mathematics and Science Academy
Kelly Wu, Illinois Mathematics and Science Academy

Advisor(s)
Geza Gyuk, Adler Planetarium
Mark Hammergren, Adler Planetarium

In our investigation, we observed various physical properties of the atmosphere such as temperature and wind speeds, from ground level up to nearly 30 km altitude. After gathering this data, were able to form many conclusions about the different layers of the atmosphere and the qualities that they possess. We did this by lofting a command capsule through the different layers of the atmosphere using a large helium balloon. We also developed a flight computer which will record many important statistics relating to the environment and orientation of the payload. It was built using the BASIC stamp microcontroller board, many simple electronics components, several more complicated computer chips, and the computer language BASIC, which we used extensively. At the time of submission of this abstract, we have only been able to complete one initial launch, due to repeatedly inclement weather. The flight computer has not yet been flight tested; however, during all ground tests, the flight computer has successfully recorded the GPS position, acceleration, temperature, and compass heading. Further launches are planned for later in the year, during which this instrument will be tested further in the upper atmosphere.

H01
Exploration of Factors that Influence Crude Oil Price

Presenter(s)
Robert Cheung, Illinois Mathematics and Science Academy
Sharada Dharmasankar, Illinois Mathematics and Science Academy
Dong Kwak, Illinois Mathematics and Science Academy

Advisor(s)
Jeong Choe-Hwang, Illinois Mathematics and Science Academy

Gasoline prices have fluctuated from less than two dollars to over four a gallon within the past year. The aim of this study was to investigate the contributions of various economic factors to the price of crude oil in the United States. Daily data was collected for prices of different commodities and the states of different sectors of the economy. A multiple linear regression model was found to fit the data better than other models, showing an R^2 value of .933. Among the seven variables investigated, four of them showed strong correlations. The model suggested that the significant variables ($p<0.05$) were: natural gas price, the exchange rate of the U.S. dollar, the NASDAQ transportation sector, and the NYSE composite index, with beta values of 0.190, 0.321, -0.595, and 1.325, respectively. Crude oil price was positively associated with the market factors except for the transportation sector of the NASDAQ. This model suggests a way to predict crude oil price depending on different sectors of the market. Additionally, gold price, the Dow Jones composite, and the S&P 500 were shown to have no significant relationship with crude oil price.

H02
The Global Food Crisis

Presenter(s)
Mari Crook, Illinois Mathematics and Science Academy

Advisor(s)
Robert Kiely, Illinois Mathematics and Science Academy

Escalating global food prices threaten accomplishments made in poverty reduction and hold the potential to harm global growth, security, and the health of hundreds of thousands of individuals directly affected. The focus of this inquiry was to uncover the factors that spurred the 2007-2008 global food crisis and find solutions that can alleviate the crisis. The rising cost of oil has increased food prices through increased price of fertilizers, irrigation, and transportation. Biofuel subsidies have diverted corn supplies and again increased food prices. Export restrictions, which sought to curb climbing food prices, have only limited trade supplies causing further rise in the price of rice and wheat. Shifting diets and increased meat consumption have only further diverted corn supplies while cereal production is beginning to stagnate. Population growth, in general, is stretching available grain supply with more and more mouths to feed. Already, thirty nations have experienced food riots and malnutrition plagues third world nations. The failure to change farm policies and properly increase aid to foreign countries has contributed to the current state of affairs. Only through a coordinated global approach to aid, hunger, and global warming, hand in hand with the liberalization of trade and agriculture can we find a long lasting solution to the global food crisis.

H03
Market Microstructure and Liquidity

Presenter(s)
William Getz, Illinois Mathematics and Science Academy
David Lorentzen, Illinois Mathematics and Science Academy

Advisor(s)
Doug Adams, Aardvark Trading

Current economic crises have set markets as a subject of global interest. Our investigation explored market microstructure - the study of markets on a transactional level, where every trading transaction is exposed. Since we had little prior knowledge, we began our investigation by reading a textbook covering applied market microstructure. We applied our knowledge by trading on a simulation market and discussing market functions with professionals in the business. Markets are driven by end users - those who hope to accomplish a purpose outside of trading for profit. Trades primarily occur in exchanges or in over-the-counter (OTC) systems, where trades are directly between two parties. In major exchanges, trade orders are processed using an efficient order matching system. An important aspect of a market, especially on a microstructural level, is liquidity (the ability to quickly trade a large volume without affecting the current price). Liquidity has three dimensions: Immediacy, price, and size. Liquid markets are beneficial for all involved for they enable ease in trading and provide informative prices. Exchange cleared markets are more liquid than OTC markets and are therefore advantageous. This is a matter of current global concern because OTC market trading has lead to the current financial system collapse.

H04
Causes of the 2008 Oil Crisis

Presenter(s)
Nina Gnedin, Illinois Mathematics and Science Academy
Meaghan Pachay, Illinois Mathematics and Science Academy

Advisor(s)
Robert Kiely, Illinois Mathematics and Science Academy

In July of 2008 oil reached a record high of $147 per barrel. This was caused by a combination of problems on both the supply and demand sides of the market Nigeria struggles with governmental corruption, conflicts with oil companies, and sectarian violence, especially in the Delta region. Iraq's oil infrastructure, heavily damaged in the first Gulf War and unrepaired since, has suffered from insurgent attacks responding to the 2003 US invasion. Iran's nuclear proliferation and the United States presence in the Persian Gulf have aggravated the already tense relationship between the two countries. China, India, and Indonesia, among others, have experienced accelerated economic growth, causing their demand for oil to shift out. The collapse of the housing market weakened the dollar, the currency used to determine oil prices. All these problems combined to unsettle oil traders and investors, who drove up prices. Factors directly relating to the US and its foreign policy were analyzed using a combination of news articles and government documents to examine how these issues came about and why they caused oil prices to skyrocket. The recent oil crisis was caused not so much by real changes in supply and demand, though those certainly intensified the problem, but by the apprehension of oil traders.

H05
Equal Pay for Equal Work? An Assessment of Teacher Compensation, Experience, and Contractual Mandates

Presenter(s)
Brandan Matthews, Illinois Mathematics and Science Academy

Advisor(s)
Lisa Barrow, Federal Reserve Bank of Chicago

Throughout Illinois, teachers receive varying amounts of pay depending on the district that they work in and their degrees held. Some districts are more attractive to new teachers for a variety of reasons which range from salary to hours of student contact. This investigation assesses the teaching experience in many high school districts across Illinois. Using contracts from sixty-five Illinois school districts, data was collected that represents the daily obligations of and benefits given to teachers. This data is being analyzed using multivariate regressions. Currently, results are being interpreted to determine if the correlations are conclusive or if different types of analysis will be needed in order to come to a conclusion. While this investigation is still in progress, further data analysis in the coming weeks will show whether or not salary is correlated with job traits. Some job traits assessed were hours of work, periods of student contact, preparation time, extracurricular compensation and insurance benefits. This investigation can aid teacher recruiters by identifying instrumental factors that affect salary which can be used as focal points in attracting teachers to districts.

H06
Understanding Factors of the Black White Achievement Gap

Presenter(s)
Michael Mirski, Illinois Mathematics and Science Academy
John Wang, Illinois Mathematics and Science Academy

Advisor(s)
Jonathan Hersh, University of Chicago
Emily Oster, University of Chicago

Since the 1960s, researchers have found that black students score consistently worse on tests of academic ability than their white counterparts, with little conclusiveness on this robust empirical irregularity. Hypotheses on the nature of its roots range from an inherent cultural bias against academic success held by blacks to lower quality schools. We develop a model that exhibits a static state variation of Neal's intergenerational achievement gap model. We use multivariate regression analysis on survey data previously collected from schools in Philadelphia and Tennessee. Our most significant results demonstrate that school effort (a variable created from survey questions involving motivation, work ethic, and the quality and completion of school work) plays an enormous role in determining the achievement gap. Accompanying this, the study skills (the methods by which students study and learn) of blacks are worse than those of whites, an effect amplified by skewed racial distribution. However, these may be linked to other exogenous variables, such as socioeconomic status or school quality, although the latter variable was found to be trivial in contributing to the achievement gap. Variables such as self confidence were considered and found to be significant, but were most likely influenced by self selection bias.

H07
Examining the Effects of Nominal Sales

Presenter(s)
Zehua Sun, Illinois Mathematics and Science Academy

Advisor(s)
John List, University of Chicago
Hugo Sonnenschein, University of Chicago

My family owns two stores that sell identical products. Between these stores, we wanted to observe the effects of creating a *nominal sale* at one store, where we would increase the non-sale price of a specific good at one store, but place the good on sale so that the effective purchase price would remain unchanged in both stores. For this experiment, we raised the price of bracelets in one store by 25% and took 33% off while keeping the original price of the bracelet at the other store. Prior to beginning, we statistically compared averages with t-test of the bracelets sold at each store and discovered no significant difference between the amounts of bracelets sold (p-> 0.364). Thus, one store could serve as the *no sale* control group and the other the *nominal sale* treatment group. The experiment yielded conclusive results after a month of collecting data from both stores; we ran a robustness test to maintain that our results weren't influenced by external discrepancies between the two stores like economy or location (p-> 0.0697). The store with the nominal sale sold significantly fewer bracelets than the store where the prices had remained constant (p-> 0.0369). The implications of our results are discussed later.

I01
School Improvement Plans: Necessary but not Sufficient

Presenter(s)
Mariam Alaka, Illinois Mathematics and Science Academy
Leslie Martin, Illinois Mathematics and Science Academy

Advisor(s)
Kaziputalimba Joshua, Illinois Mathematics and Science Academy
Glenn "Max" McGee, Illinois Mathematics and Science Academy

Due to the No Child Left Behind Act, schools are required to be accountable for each students learning. However not every school is meeting the national standard. In this study the researchers compare School Improvement Plans, examine survey data from teachers and administrators, and conduct interviews with principals and teachers from schools in Chicago District 299 to determine methods that enable schools to achieve average yearly progress (AYP) or make significant improvement on the Illinois Standards Achievement Test in sixth through eighth grade. Based on research by Richard Elmore and others, our study hypothesizes that schools that adopt a school-wide focus on a small number of clear, measurable school improvement goals will have students with improving test scores and be more likely to make AYP. Our surveys focused on the teaching strategies, environment, and extracurricular activities of each school. These have been sent out but not yet collected. The surveys will determine which interviews will be performed. Once we have analyzed the data we will create a list of methods to enable schools achievement of AYP.

I02
Facts for Life

Presenter(s)
Elizabeth Awoyemi, Illinois Mathematics and Science Academy
Issurah King, Illinois Mathematics and Science Academy

Advisor(s)
Adrienne Coleman, Illinois Mathematics and Science Academy
Robert Hernandez, Illinois Mathematics and Science Academy

IMSA students face the challenge of properly caring for themselves. This challenge could be made easier with the assistance of health education and promotion. Data from the Centers of Disease Control and Prevention was used to identify topics of importance, which include: physical health, mental health, nutrition, healthy relationships, and sex education. An internal audit is underway to reveal whether IMSA faculty and staff perceive the need for a health education program. External audits of programs at residential colleges have opened our eyes to the creative ways that health can be presented to students. Data is being analyzed to divulge the specific health needs of IMSA students. This information is being put to use for a trial health education program, IMSA's Health Corner, which provides students with facts and guidance about health topics. Throughout this year of audits, observation, and statistical analysis a curriculum for a health education and promotion program has been developed, which will strive to assist students in making positive changes to their lifestyles through guidance and use of the resources IMSA provides.

I03
Teach Illinois: Reassessment of the Current Illinois K-12 School Funding Model

Presenter(s)
Mehmet Badur, Illinois Mathematics and Science Academy
Cora Goldston, Illinois Mathematics and Science Academy
Colin Phillips, Illinois Mathematics and Science Academy

Advisor(s)
Glenn "Max" McGee, Illinois Mathematics and Science Academy

The current Illinois K-12 school finance policy is broken; the children of greatest need are continually cast aside and given a second-class education. We investigated the current system of education funding through interviews and empirical data. We identified and focused on four key areas: the current fiscal appropriations model, the tax base that funds this model, efficiency of the system, and oversight and standards. Our proposed model seeks to provide adequate funding through a progressive use of Illinois' wealth and to target new funds in a manner that will substantially narrow the socioeconomic achievement gap. Based on the foundational principles of SB 2288, which provides for increased educational funding and legislates a series of educational reforms, our investigation has led us to draft our own legislation. If successful, our work could give Illinois schools the crucial funding and educational reforms necessary to help all Illinois children succeed.

I04
IMSA on Wheels: States of Matter, Do They Matter?

Presenter(s)
Duncan Baker, Illinois Mathematics and Science Academy
Troy Makulec, Illinois Mathematics and Science Academy
Thomas Oberhardt, Illinois Mathematics and Science Academy

Advisor(s)
Tracy Miller, Illinois Mathematics and Science Academy

IMSA on Wheels: States of Matter, Do They Matter? is a new traveling science show presented to students in grades three through five. The writers created this presentation to observe the use of teaching pedagogies in order to affect the various learning styles of the students in a forty-five minute demonstration of key concepts. The learning theories focused upon were those in the behavioral-constructive-cognitive educational spectrum. The content presented was properties of each state of matter and how matter can change. States of matter demonstrations were designed with the Illinois State Board of Education's Applications of Learning in mind and observation rubrics were used to qualitatively evaluate the various utilization of learning theory. The preliminary results of the research indicate cognition, or building on previous knowledge, as the most prevalent pedagogy for this IMSA on Wheels show.

I05
Expanding IMSA Outreach to Hispanic Students

Presenter(s)
Aaron Bruder, Illinois Mathematics and Science Academy
Stephanie Martinez, Illinois Mathematics and Science Academy
Christopher Stovall, Illinois Mathematics and Science Academy
Mao Yamakawa, Illinois Mathematics and Science Academy

Advisor(s)
Vincent Matsko, Illinois Mathematics and Science Academy
Jose Palos, Illinois Mathematics and Science Academy

Intrigued by the noticeably underrepresented Hispanic minority at IMSA, our group began to research the reasons behind Hispanic struggles with the American educational system. We accessed a wide variety of resources, such as journal articles, books, brochures, and even members of the Hispanic community here in Aurora to aid our research. Subsequently, we wondered how we could apply our knowledge of these cultural and economic difficulties to increase Hispanic participation in IMSA-sponsored academic outreach programs, such as SEAMS and Kids' Institute (KI). Our ultimate goal is to successfully structure a new program for Hispanic students in the Aurora area. In coordination with KI, we investigated various strategies to make the benefit of IMSA programs sound more appealing to Hispanic parents, such as creating updated brochures and English-to-Spanish translations of them, as well as utilizing other means of advertising the various programs. We would also like to advertise our program by visiting schools and informing Hispanic parents one-on-one about our offerings. As for many new programs, the earliest they could commence would be in the fall. We believe these methods will positively impact the utilization of IMSA's outreach programs by the Hispanic community and untimely increase Hispanic enrollment at IMSA.

I06
I<3 Science: A Chemistry Book for Children

Presenter(s)
Jingsi Fan, Illinois Mathematics and Science Academy
Anjulie Gang, Illinois Mathematics and Science Academy
Seung Heo, Illinois Mathematics and Science Academy

Advisor(s)
Dave DeVol, Illinois Mathematics and Science Academy

Chemistry is an abstract science that most students are not exposed to until middle school or high school. The abstract nature of the subject makes it hard for students in grade school to comprehend. Through our research, we found that non-fiction books with many pictures and analogies most effectively interest children. However, most chemistry textbooks just state facts that children do not understand. The objective of this project is to make a chemistry textbook for children of ages around ten. We had honors fourth graders from East View Elementary School in Oswego, Illinois read excerpts and comment on the level of difficulty and the content in general. The students said that they would like to see more pictures and learn more about the characters in the book. Furthermore, they felt that the wording was challenging. We will make further modifications based on their comments and will try to get a second round of feedback. Each of the four chapters focuses on a different aspect of chemistry, and includes original illustrations and fun analogies. The story is based on three children and their teacher learning chemistry from everyday life.

I07
IMSA Chicago: Science Curriculum

Presenter(s)
Vidya Govind-Thomas, Illinois Mathematics and Science Academy
Anne Pipathsouk, Illinois Mathematics and Science Academy

Advisor(s)
Michelle Kolar, Illinois Mathematics and Science Academy
Glenn "Max" McGee, Illinois Mathematics and Science Academy
Sendhil Revuluri, Chicago Public Schools

The process of designing IMSA Chicago has begun. Our project focuses on a science curriculum for a 9-12 residential school model. In our model, the freshman year could be extremely beneficial to the students, as it could be utilized to help students transition and reach the high level of academic excellence expected at IMSA. In order to maintain the integrity of the IMSA curriculum, it would be best to incorporate the Scientific Inquiry (SI) series at the new campus, as their effectiveness has been proven at the Aurora campus. However, it has been acknowledged that the curriculum, and especially the SI's, must be modified in order to best serve the Chicago students. We have created a list of possible modifications of the current SI: Biology curriculum and pedagogy, attempting to maintain the integrity of the program. The suggestions were created after reviewing responses from interviews and surveys of selected teachers and students (those with a Chicago Public School background) of the IMSA campus and student and staff input provided at the IMSA Chicago Intersession.

I08
Socioeconomics and Public Education: An Examination of Policies that Narrow the Achievement Gap

Presenter(s)
Jonathan Loucks, Illinois Mathematics and Science Academy

Advisor(s)
Glenn "Max" McGee, Illinois Mathematics and Science Academy

Standards-based reform, though nearly a decade old came to national attention with the authorization of the federal No Child Left Behind Act. NCLB has sparked great controversy among many teachers and administrators. A primary objection from educators has been that poor, minority student learners have too many disadvantages in their communities and home lives to enable them to meet standards. This investigation challenges this idea, asserting that all students can become successful, regardless of social classes. Research, like that conducted by Rothstein, has revealed that schools enrolling large percentages of minority students from low-income families can excel if certain factors within the school, and even more importantly, within the community, are present. Studies have found that low-income, high performing schools often have visible community support programs, relevant professional development opportunities, and outstanding leadership. This investigation has confirmed previous studies by finding that approximately 75% of variation in the percentage of students meeting standards can be accounted for by quantitative values (such as demographics, budget distributions, and so forth), leaving the other 25% to be accounted for by qualitative variables. This study also shows how one school district has made sustained improvement despite demographic dispositions. Administrators of schools and school districts can use these findings to drive improvement in student achievement.

I09
Self-Efficacy and Academic Success: A Study of AVID Students in the Chicago Public Schools System

Presenter(s)
Sidanth Sapru, Illinois Mathematics and Science Academy

Advisor(s)
Melanie LaForce, University of Chicago

The Chicago Public Schools (CPS) system strives to increase the number of students that graduate from high school and pursue higher education. Unfortunately, however, of the CPS students who aspire to do so, only 41 percent of them actually go on to enroll in a four-year college after graduation. In 2003, the Chicago Public Schools system launched "Advancement via Individual Determination" (AVID), a comprehensive program aimed at increasing college-going rates of students in the "academic middle" who have the desire to go to college but may be falling short of their potential. Students that enroll in AVID learn organization and study skills, work with college tutors, and participate in college exploration and preparation activities. Research has shown that students with high levels of academic self-efficacy typically have stronger academic goals, more academic achievement, and more educational achievement later in life. Little is known, however, about AVID's effects on student academic self-efficacy, and the resulting effects on student achievement and success. This study demonstrated that 2006-2007 AVID students reported overall high levels of academic self-efficacy. Additionally, within AVID students, students with higher reports of academic self-efficacy had significantly higher GPAs - even after demographic and prior achievement characteristics were accounted for.

I10
A Comparative Look at Education in the United States, China, and India

Presenter(s)
Katherine Tu, Illinois Mathematics and Science Academy

Advisor(s)
Christopher Schreiber, Illinois Mathematics and Science Academy

The need to develop the best and the brightest students has led to the creation of different educational strategies. Through interviews and literature review, I was able to compare the strategies utilized by China, India and the United States in public and private high schools. A set of criteria that consisted of both academic and co-curricular factors was used to assess the differences among six schools that consisted of one private and one public school from each nation. Aspects like pre-collegiate education, teacher training, standardized testing, activities, equity and government involvement were considered. The nations exhibited the most differences in the categories of teacher training, standardized testing, and government involvement. The overall curricular intent and structure of education was similar in all three nations, but there were still many small academic differences. For example, China and India both had higher and more expectations of their students. Co-curricular activities offered were also very similar, but participation, structure and emphasis varied. These activities played a bigger part in the lives of American students than in Chinese and Indian students. The results of this study can broaden communication so that students and educators around the world are better informed when facing an increasingly global community.

J01
Designing Efficient, Environmentally Friendly, Commercial Supersonic Aircraft

Presenter(s)
Cameron Breedlove, Illinois Mathematics and Science Academy
Ricardo Gonzalez, Illinois Mathematics and Science Academy
Andrew Heuser, Illinois Mathematics and Science Academy

Advisor(s)
James Gerry, Illinois Mathematics and Science Academy

The main focus of this investigation was to increase our knowledge of aerodynamics and aeronautical engineering associated with supersonic flight. As part of this investigation we found it necessary to research the side affects of supersonic travel on the economy and the environment. Throughout our investigation we explored the requirements of an aircraft capable of supersonic travel. We researched not only the necessary design constraints but also additional design concerns which ease and lessen the impact of supersonic flight. Two of the main design concerns were the dampening of the sonic boom and creation of a supersonic aircraft with the same efficiency, in subsonic flight, as a subsonic aircraft. For sonic boom reduction we researched the theories of high altitude flight as well as artificially blunted leading edge designs. For the requirements associated with efficiency we researched basic aerodynamics. Along with the research for design, we researched the implications of supersonic flight on the current air traffic control systems as well as possible environmental and residential concerns. As part of our SIR we wrote a paper for the NASA Fundamental Aeronautics Competition, which encourages emerging interest in aeronautics.

J02
Blending the Needs of All Involved: An Investigation in Architecture

Presenter(s)
David Contreras, Illinois Mathematics and Science Academy
Jackson Hallauer, Illinois Mathematics and Science Academy

Advisor(s)
Austin Dempsey, Vasilion Architects
Victor Dietz, Vasilion Architects
Forrest Nelson, Vasilion Architects
Joel Strassman, Vasilion Architects
Steven Vasilion, Vasilion Architects

This year, we have been working at Vasilion Architects, learning how an architect combines the interests of all the people involved in the project, into a functional mixed-use building design. We began by researching the city's requirements for the site, learning that zoning determines everything from how many floors a building can have, to the number of parking stalls, to the distance it must be from the street. After researching the restrictions, we met with the owner and city officials to learn their visions for the site. By negotiating and making compromises of the owner's and city's requests, we created a mixed-use four story building which pleased both parties. We decided to take advantage of the change in grade on the site by using underground parking. The two lower levels will be retail, office space, and parking, with the two floors above them consisting of residential units. The residential units will be starter units, in order to maximize their capacity. We have now created AutoCAD blueprints and a three-dimensional rendering of what the final building would look like on the site. At the end of the project, we will have learned the necessary steps in an architectural project to successfully design a building.

J03
The Applicability of Magnetic Quantum Cellular Automata as an Alternative to Transistors

Presenter(s)
David Derry, Illinois Mathematics and Science Academy
Peter Nebres, Illinois Mathematics and Science Academy

Advisor(s)
Vitali Metlushko, University of Illinois at Chicago
Josh Sautner, University of Illinois at Chicago

Transistor technology is reaching its limits. Our goal is to determine if magnetic quantum-dot cellular automata (MQCA) are a reasonable alternative. We used the Object Oriented MicroMagnetic Framework to simulate MQCA with varying shapes. These shapes were then fabricated using photolithography or electron beam lithography with physical metal vapor deposition. The quality of our work was then assessed with observation under an electron microscope. When fully realized, MQCA promises to deliver devices with faster speeds, exceptionally low heat production, resistance to radiation, and substantially reduced power consumption, all at a scale unattainable with transistors. All electronic devices, including laptops and cell phones would be smaller, lighter, faster, and have a much longer battery life.

J04
Battery Technology as an Alternative Energy Source in Transportation

Presenter(s)
Jesse Fitzpatrick, Illinois Mathematics and Science Academy
Trevor Hahm, Illinois Mathematics and Science Academy

Advisor(s)
Harold Kung, Northwestern University

Lithium-ion batteries are recognized as the most efficient type of battery in the field of consumer electronics and in large-scale applications, due to their high energy-to-weight ratios. Their lack of memory-effect and vast room for capacity and cycle improvement make them the most suitable candidates to research. Our research focuses on analyzing how a test cell that uses silicon composites (a silicon based material with higher lithium atom capacitance than graphite, which is typically used) as a replacement material for the anode would affect the energy density of the cell. We found that silicon's ability to hold large amounts of lithium atoms results in a 30%-40% increase in energy density (watt hours per gram of active material) versus the current industry standard. Stabilization of battery performance against cycling degradation will have to be increased, but the initial results are very encouraging. Using batteries exhibiting increases in energy densities, that we have shown to be attainable, we projected their performance and how they would affect the electric vehicle market as well as the environment.

J05
Lower Extremity Motion Characteristics of Adolescent Baseball Pitching

Presenter(s)
Michael Gleeson, Illinois Mathematics and Science Academy

Advisor(s)
Tasos Karakostas, Children's Memorial Research Hospital

The dependency of successful baseball pitching on lower body mechanics has been documented. Our study attempts to relate lower extremity motion characteristics to variables traditionally regarded as dependent on the upper body. Preliminary investigations involved an extensive review of literature on baseball related injuries. The lack of sufficient research on the lower extremity in pitching called for an entirely new method of collecting lower extremity data. We utilized the GAITRite instrumented carpet (CIR Systems Inc., Clifton, NJ) as the primary tool for data collection. To date, four of fifteen pitchers, aged 15-18, pitched off a regulation mound to a target positioned at a regulation distance with the GAITRite placed on top of the mound. The pressure sensitive carpet allowed us to record numerous lower extremity variables, including stride/step lengths, position of the lead foot, and center of pressure in the non-throwing foot. The dependent variables were ball velocity, measured with a radar gun, and accuracy, recorded manually with an accuracy score (1, 4, 7, or 10). Results from initial data showed a statistically significant inverse relationship between in-toeing of the lead foot and accuracy ($p < 0.01$). Successful pitching has been correlated with proper mechanics in previous studies. Our findings may indicate certain lower extremity motion characteristics that may interfere with maximum performance, thus increasing the risk of injury.

J06
Field Programmable Gate Arrays Computing for Space Charge Simulation

Presenter(s)
Yifei Huang, Illinois Mathematics and Science Academy

Advisor(s)
Jin-Yuan Wu, Fermi National Accelerator Laboratory

In accelerator physics, space charge simulation requires a large amount of computing power. In a particle system, each force-pair calculation uses time/resource consuming operations such as multiplication, division, and square root. Because of the flexibility of field programmable gate arrays (FPGAs), we implemented this task with efficient use of the available computing resources and completely eliminated non-calculating operations that are indispensable in regular micro-processors (for example, instruction fetching, instruction decoding, and so forth). We designed and tested a 16-bit demo core to compute Coulomb force in an Altera Cyclone II FPGA device. To save resources, the inverse square-root cube operation was computed using a memory look-up table addressed with ten most significant non-zero bits. At 200MHz internal clock, our demo core reaches a throughput of 200M pairs/s/core, faster than a typical 2GHz micro-processor by about a factor of 10. Power usage and operating temperature of our FPGAs are also lower than those of micro-processors. Fast and convenient, FPGAs can serve as alternatives to micro-processors for computing-intensive scientific simulations.

J07
Measuring the Performance of Gas Turbine Filters Using Computational Fluid Dynamics

Presenter(s)
Adam Jung, Illinois Mathematics and Science Academy
Lawrence Kim, Illinois Mathematics and Science Academy
Eric Kwan, Illinois Mathematics and Science Academy

Advisor(s)
Michael Corbat, Filtration Group
Lawrence Ost, Filtration Group
Philip Winters, Filtration Group

Gas turbine generators require a steady air intake and clean operating environments. Bulky and inefficient air filters disturb the air flow, thereby reducing the performance of the generator. By building the actual filter using computer aided design, and simulating fluid flow through it using the Floworks software suite, we created a model that matched with experimental data from a wind tunnel. Changes can be made to this filter to make it more aerodynamic, to reduce a phenomenon known as pressure drop. After creating 2" bullet-nosed structures on the filter casing, the pressure drop went from 40 pascals to 32 pascals, a 20% increase in performance. Acknowledging the change, we modified the length of the bullet-nose to 4", which showed nearly the same amount of pressure drop. Shortening the length made the pressure drop even higher than no structures at all. Though these modifications seem slight, a small difference in pressure drop can mean a significant impact on the efficiency of the generator. As for the financial impact, an improved filter design could generate thousands per year in additional income from virtually nothing, a commercially viable possibility for people in the gas turbine industry.

J08
Analysis into the Preparation of a Ni-Zn Bimetallic Catalyst

Presenter(s)
Adelina Koleva, Illinois Mathematics and Science Academy

Advisor(s)
Randall Meyer, University of Illinois at Chicago

Nickel-zinc alloy catalysts have been found to be active for the water-gas shift reaction, which produces high-purity hydrogen, important to several industrial applications. Traditionally, catalysts are synthesized through a dry impregnation of metal salt into the pores of a support; however, this method lacks precise control of particle size. The strong electrostatic adsorption method was intended be used for synthesis of a nickel-zinc catalyst. This method allows the oxide surface to be selectively charged in solution by changing the pH around the unique point of zero charge of the support material – allowing the adsorption of metal complexes to be highly controlled. Since complexes failed to form, an alternative method, electroless deposition, was employed. This method utilizes a reducing agent to force the metal precursor onto specific sites on the support surface, allowing for the desired intimate contact between zinc-nickel particles. Preliminary results anticipate that the alternative method will be successful. Current work focuses on optimizing synthesis conditions and catalyst characterization.

J09
The Designing and Testing of a Radio Control Electric Counter-Rotating Rotors Vertical Takeoff and Landing Aircraft

Presenter(s)
Ruohan Li, Illinois Mathematics and Science Academy

Advisor(s)
Francisco Ruiz, Illinois Institute of Technology

This investigation deals with design, construction, testing, and improvement of a new form of flying car that provides the functionality of vertical takeoff and landing (VTOL). In addition to the innovation, this vehicle also retains high stability. Our VTOL is a helicopter design with dual, counter-rotating blades, each powered separately. Tests of our design in X-Plane®, a commercial flight simulator, affirm that this design increases the controlling ability by eliminating gyroscopic precession and the need of a tail rotor. In our prototype, two electric motors are used; each motor is controlled by an electric speed control (ESC) and powered by a seven cell nickel-cadmium battery pack. During the testing, one of the batteries was damaged due to connection problem. By consulting the manufactures we successfully modified our design and powered both ESC's and motors with one battery pack. With independent ESC's, the two motors had trouble achieving identical speeds. Instead, we allowed one ESC to determine the speed. Lift tests were performed on the VTOL to indicate the efficiency of the vehicle. Further study will be conducted in the following months including designing the body for the VTOL.

J10
Does Our Current National Bridge Inspection Criteria Need To Be Changed, and if so, How?

Presenter(s)
Maria Martinez, Illinois Mathematics and Science Academy

Advisor(s)
Richard Kaczkowski, Packer Engineering

My inquiry project consisted of investigating past bridge failures and analyzing the current bridge inspection criteria. The purpose was to determine whether the criteria needed changes to ensure public safety since approximately a quarter of bridge collapses are due to poor maintenance and inadequate inspections. An important component of my investigation was analyzing the current National Bridge Inspection Standards, which currently require bridges to be inspected every twenty-four months regardless of age, design, traffic characteristics, and deficiencies of the bridge. Also, only visual inspections are required for bridges not categorized as deficient, or that do not have fracture critical members (FCM's). An FCM is a member in tension whose failure can cause the collapse of the entire bridge. Even these bridges with presumably higher risk of failure only require an inspection every twenty-four months. My research also shows that inspection results are irreproducible due to the criteria's ambiguity. After studying correlations between the criteria and bridge failures, it is evident improvements need to be made. Such improvements include more detailed inspections with shorter frequency intervals for bridges with FCM's, and, at a minimum, a hands-on inspection for every other bridge.

J11
Architectural Design Decisions

Presenter(s)
Karl Ochmanek, Illinois Mathematics and Science Academy

Advisor(s)
Kate Hauserman, OKW Architects

In this investigation I took a hands-on approach to the design decisions of the modern architect by redesigning the IMSA campus on the same plot of land and with the same demands of a residential high school, but without a budget cap. The main decisions that were covered regarded: the client's needs and demands, context within a community, zoning regulations, climate, geographic context, technological use, sustainability, project budget, and time constraints. For instance, in the proposed campus I laid out separated zones for athletics, residential, and academic use. This was accomplished by designing an accessible athletic area in the west, placing three distinct buildings in the center of campus for academics, and placing a belt of eight residential halls about the southern edges of the academic buildings. This resulted in a campus custom tailored to the purposes of a residential high school, as well as real world experience in the decisions that an architect must make.

J12
A Review of the Design for Six Sigma Literature with a Focus on Tools for Systems Architecture and a Documentation of a Catapult Design Using SysML

Presenter(s)
Angad Rekhi, Illinois Mathematics and Science Academy

Advisor(s)
Peter Jackson, Cornell University

Systems engineering and Design for Six Sigma (DFSS) are two methods of system design currently used in all leading businesses. Knowing the similarities between these two approaches to design is vital to understanding how some companies are able to limit defects in their products to 3.4 parts per million. This inquiry delved into literature on this topic and found that design decomposition and interface mapping, terms often used inconsistently across disciplines, are among the most important similarities between DFSS and systems engineering. This study also concentrated on streamlining the design process through SysML, a systems engineering language, using the simple example of a toy catapult. Currently, the systematization of the catapult design is well underway; use cases are being diagrammed visually. The process is showing positive results since use cases can be created quickly once the first case has already been developed. The ability of SysML to streamline projects implies that its use to design systems may become more prevalent in the future.

J13
Maximizing Palladium Nanowire-Based Hydrogen Sensor Performance Through Diblock Copolymer Pattern Transfer

Presenter(s)
Grant Skudlarek, Illinois Mathematics and Science Academy

Advisor(s)
Seth Darling, Argonne National Laboratory

Due to the global climate crisis, development of low-emission hydrogen vehicles is accelerating. Low -cost, effective sensors will be central in a hydrogen economy. Palladium nanowires have shown great promise as the detection material in these devices due to greater sensitivity and faster response time. However, traditional means of fabricating these nanowires used top-down lithography, where each wire is individually carved from a palladium film - a time-consuming and typically expensive process. With the approach we have been investigating, wires are etched in parallel via a bottom-up methodology. This is accomplished using a self-assembling nanostencil called a diblock copolymer, which can be used to transfer a pattern of parallel cylinders onto a thin film of palladium. We have investigated the self-assembly of several candidate block copolymer films on various surfaces using atomic force microscopy and are in the process of developing a protocol to transfer these arrays into underlying metal layers using a combination of reactive ion etching and ion milling. We are also benchmarking the hydrogen sensing performance of unpatterned palladium films. Once we fabricate a prototype sensor using the block copolymer protocol, its success will be marked by how sensitive it is and by how fast its detection response times are compared to alternative technologies.

J14
Engineering a Durable, Reusable Polycarbonate Water Filter

Presenter(s)
Terence Zhao, Illinois Mathematics and Science Academy

Advisor(s)
Mark Carlson, Illinois Mathematics and Science Academy

We seek to engineer a water filter that is durable, effective, and re-usable. Our current design is a polycarbonate membrane mounted in PVC tubing which can be sealed. With a small pore size of 0.2 microns, the membrane is expected to take out 99% of bacteria. However, issues concerning leakage and unsuccessful sealing pull that percentage down and raise questions about the filter's actual flow rate and effectiveness. Preliminary tests show that pond water flows through a 4 cm diameter filter at about 36 ml/hour. Flow rates for tap water are considerably higher at around 200 ml/hour. In order to provide the 40 liters/day needed to sustain families in the third world, pressurized systems involving evacuation have been considered. A proposed conductivity test, which measures the amount of current flowing through a filter when properly sealed, showed promise at first but may be considered ineffective due to inconclusive results. Lastly, the ability to clean the accumulation of debris after repeated use is crucial to the re-usability of the system. Gentle wiping of the filter's surface has suggested that the membrane can be cleaned by hand. Whether this is a practical solution to ensuring the longevity of such a system is still being investigated.

K01
High Above the Ground and Two Finches: A Study of Autism through Writing

Presenter(s)
Dawna Bagherian, Illinois Mathematics and Science Academy

Advisor(s)
Tracy Townsend, Illinois Mathematics and Science Academy

A writing project in the form of a book was conducted in order to gain knowledge about autism and human interactions through writing. Though laboratory research produces new scientific data, research through writing allows the writer to explore what she already knows, and to strive to better understand her own interactions with autistic individuals. This project also examined methods of integrating scientific data in creative pieces. Experimentation was done with regard to transitions, voice, tense, mechanics, and style. Differences in writing style throughout the year were studied. Writing took the form of short paragraphs on individual topics that came together to form a long, creative piece A first person, casual, stream-of-consciousness style was chosen as optimal, because it allowed for digression, as well as sudden changes in style when switching from scientific to creative writing. It was found that scientific research can fit into creative writing through subtle but direct references to specific studies which support an underlying theme in the piece. Thus far, only a portion of a manuscript has been produced, as style and format were experimented with, but in the coming months, writing is expected to culminate in a full manuscript for a book.

K02
Writing Your Way to a Dystopian Novel: Processes and Production

Presenter(s)
Jennifer Byers, Illinois Mathematics and Science Academy

Advisor(s)
Daniel Gleason, Illinois Mathematics and Science Academy

Literature examines every aspect of society, from personal interactions to scientific revelation, and it provides a creative way to explore possible futures. When constructing literature, an author must examine every aspect of said literature - its implications, character description, and plot details - all while making it snappy, clever, and palatable for an audience. Creating a novel requires writing, and writing requires focus, and focus requires schedule. Writing was conducted under six circumstances for varying times and page limit requirements. By writing a previously started dystopian novel in different manners, the best method of composition can be reached: writing daily in previously scheduled blocks of time. For example, a laissez-faire approach to writing often results in laziness and rushed product, as a weeks worth of composition will be thrown into a mere few hours, whereas a regimented schedule allows the writer to cool and calm down before beginning, focus, and not take on too much work at once. To achieve the best possible novel with the most and best product for the least amount of time, an author should specifically make time for writing and assimilate writing as a part of his or her everyday activity, as I attempted to do while writing the first two hundred pages of my own novel.

K03
Fashion in Films

Presenter(s)
Allison Rodriguez, Illinois Mathematics and Science Academy

Advisor(s)
Audrey Wells, Illinois Mathematics and Science Academy

For my SIR this year, I began by exploring the relationship between fashion, crime, and violence in films, which led me to the film noir genre. After researching and viewing several key films from this genre, both contemporary and classic, I furthered my investigation by focusing on the femme fatale character. Acting usually as the catalyst to a crime, often feigning innocence, and playing on societal expectations of a woman's power to manipulate, this character is an essential component of film noir. Over time, the femme fatale has transformed. The most apparent development has been in aesthetic appearance. From the 1940's until now, women in film seem to be wearing less and less; sex appeal has integrated itself more overtly into the film noir genre. In classic films, the femme fatale is dressed in Oscar de la Renta evening gowns, Burberry trenches, and Chanel suits. Presently, we are accustomed to seeing the women dressed scantily and provocatively, à la the leather-clad women of Old Towne in Frank Miller's *Sin City*. I believe that this shift is a direct reflection on our society. As years have passed, women have become more sexually liberated. They are no longer confined by idealistic images but free to dress and act as they please. The modern femme fatale has transformed, becoming even more independent than her past counterpart. No longer do they need a man's help or affection to reach their goals which are usually self-serving.

K04
Sexuality in Eighteenth and Nineteenth Century British Plays

Presenter(s)
Elizabeth Zaretsky, Illinois Mathematics and Science Academy

Advisor(s)
Michael Hancock, Illinois Mathematics and Science Academy

Between the eighteenth and nineteenth centuries in Britain, sexuality in British plays was dramatically muted. Here, six plays were selected that spanned the two centuries as well as a range of authors, including Oscar Wilde and Richard Sheridan. The plays were dissected in search of mentions of sexuality that supported or contrasted the hypothesis that in the nineteenth century, British authors stuck to a more prudish sense of sexuality when writing. Research into the context of each play and the social background suggests that the shift is due to the rise of the middle class as well as an industrial revolution in the late eighteenth century. In addition, an increase in religion also played a large part in audiences declaring a taboo on characters having affairs, bedroom scenes, and other variables that were present in the eighteenth century plays of my selection.

K05
Writing a Novel About the Shadows of Human Mind

Presenter(s)
Shuang Zhang, Illinois Mathematics and Science Academy

Advisor(s)
Dennis Czerny, Illinois Mathematics and Science Academy

The human mind has many shadows as well as miracles. It is the central that controls all the actions that the body performs, but because of its complexity there can exist many problems that arise within the mind that can affect every aspect of a person's life. In my SIR project, I wrote a novel that contains sorophilia, domestic violence, and schizophrenia. In the story, I tried to implement what I found out in my research about how the characters show symptoms of these abnormal behaviors of the mind. I have learned that mental problems can be very difficult to tell apart from a little mishap. As a result, I have written a novel with two subplots: one to describe the physical world and the other to describe what is happening inside the main character's mind. My goal is to let the readers find out for themselves the "red flags" that other characters should have watched out for to realize that something was wrong. Although this is a creative writing project, I have done research to make the plot as believable as possible with many real-world symptoms of mental dysfunction, and I hope that people can use the knowledge obtained from reading my novel to help someone by realizing their needs.

L01
Accumulation of Mercury in Lake Michigan and its Effects on Humans

Presenter(s)
Vashti Aguilar, Illinois Mathematics and Science Academy
Christina Mikulka, Illinois Mathematics and Science Academy

Advisor(s)
Robert Kiely, Illinois Mathematics and Science Academy

What has been the effect of industrial mercury use on the environment and human health in the Great Lakes region? Mercury is used in many industrial facilities and during medical procedures, however, when not disposed of properly, the mercury ends up contaminating the environment. When this mercury is released into the environment, some of it ends up in lake water, which allows it to accumulate in the tissue of fish. There was 154.82 ng/g of mercury in Lake Michigan trout in 2000, and the following year there was an average of 158.71 ng/g. Through our research we found that as the levels of mercury in fish increased, the number of people with mercury contamination also increased. Through the Clean Water Act and Water Quality Act, implemented in 1977 and 1987, the amount of mercury dumping in Lake Michigan has been reduced. Although levels of mercury are restricted in Lake Michigan, levels in the atmosphere have risen, and they still have access to our lakes. Through this inquiry we have seen the possible harmful effects that mercury can have on humans. It is important that we are aware of mercury contamination, as it could change what the future holds for our generation, and the generations to come.

L02
Modeling Idling Reduction Options for Heavy Duty Diesel Trucks: A Comparison of Emissions/Energy Use and Economics

Presenter(s)
Jennifer Bennett, Illinois Mathematics and Science Academy

Advisor(s)
Linda Gaines, Argonne National Laboratory

Long-haul trucks idling overnight consume more than 838 million gallons of fuel a year. Trucks of all types also idle during the workday while waiting to load or unload, and at bottlenecks like border crossings. The purpose of this investigation was to determine the cost effectiveness of idling reduction technologies in order to compare emissions, energy use, and economics. This part of the analysis concentrated on the costs to the truck owner and estimated savings by using different idling-reduction devices. The costs depend on several variables: technology or combination of technologies, idling frequency, fuel cost, frequency of device use, loan term, interest, and payment. Varying fuel prices and idling hour amounts were used to evaluate current technologies in varying situations. By evaluating minimum value per hour and cost over a five year period, cost-effective technology is shown to be significantly dependant on diesel fuel price and idling hour amount. For instance, we found that if fuel prices are low, it is most cost-efficient for a low idler to idle rather than implement an idling reduction device. But when fuel prices are high or for a high idler, it is considerably more cost effective to implement an idling reduction device. These results should allow a driver to choose the best idling reduction device for their situation.

L03
Ethanol Implementation as a Source of Alternative Fuel: IMSA's First Ethanol Powered Engine

Presenter(s)
Justin Glasper, Illinois Mathematics and Science Academy
Alisha Vimawala, Illinois Mathematics and Science Academy

Advisor(s)
Branson Lawrence, Illinois Mathematics and Science Academy

The energy crisis is one of the most prominent issues in America today. Demand for energy has rocketed in recent years at an average rate of 4.3 percent. The high-energy costs and demand for fuel consumption are negatively affecting America’s economy, pressuring scientists to find innovative solutions to this problem. In recent years, scientists have noted the potential of ethanol as a reliable, energy-efficient, and feasible form of alternative fuel. Thus, in collaboration with the IMSA Energy Center, we have chosen to explore the possibility of using sugarcane-based ethanol as a form of alternative energy on campus. In comparison to corn, sugarcane uses a much simpler method to yield greater amounts of ethanol, making it one of the most effective and economical sources for large-scale production. In our investigation, both ungrounded and grounded sugarcane was fermented with various concentrations of yeast and the alpha amylase enzyme for the breakdown of glucose. The resulting mixture was then distilled using a simple distillation apparatus to separate the alcohol from the mixture. The ethanol produced was then used in various gasoline and ethanol mixtures to power a two-stroke engine. Results of these mixtures are still being investigated.

L04
Effect of Restoration on Floristic Quality Index of Kane County Prairies

Presenter(s)
Judith Hooymans, Illinois Mathematics and Science Academy
Elizabeth Richardson, Illinois Mathematics and Science Academy

Advisor(s)
Deborah McGrath, Illinois Mathematics and Science Academy

Numerous restoration projects throughout the Midwest region have been started in an attempt to protect prairie remnants and revitalize other areas. We investigated how prairie restoration projects in the Kane County area have improved over time. We received data from active restoration sites at Fermi National Accelerator Laboratory in Batavia and Kane County Forest Preserve District LeRoy Oaks G-4 preserve in St. Charles and compared the changes in the floristic quality index (FQI) for each of the prairie plots over time. Our results showed that continued restoration leads to a net increase of at least ten in the FQI value. Additionally, there was a net increase in the number of native species observed, but there was no pattern to the change in the correlation of mean coefficient of conservatism (C) values over time. Four of the twenty Fermilab prairie plots (plots 4, 14, 16, 20) experienced a statistically significant change in the correlation of mean C value ($p = 0.021$, $p = 0.011$, $p = 0.024$, $p = 0.048$). Based on our findings we can conclude that the more time and effort put into restoration leads to increased biodiversity and similarity to remnant prairies.

L05
IMSA Go Green: Investigating Student Action

Presenter(s)
Kristen Lee, Illinois Mathematics and Science Academy

Advisor(s)
Christopher Kolar, Illinois Mathematics and Science Academy

There is substantial research on environmental behavior modeling, yet there is very little research on the environmental actions of students who have an advanced scientific understanding vis-à-vis their choices pertaining to ecology and the environment (for example, recycling, conserving energy). This inquiry examined the environmental behaviors of a diverse group of students from broad ethnic, socio-economic, and geographic locations, all perceived to share a common connection of education. Through individual interviews combined with survey-based questions administered across the student population of the Illinois Mathematics and Science Academy, this study quantified the environmental consciousness of students and the institution. Data analysis is in progress to refute or support how motivators (for example, family, education) are correlated to a passive or active relationship with the environment. The investigation is significant in that the findings may point to certain conditions under which scientific students choose actions within the environmental context.

L06
Sedimentation in Pervious Concrete

Presenter(s)
Shyam Saladi, Illinois Mathematics and Science Academy

Advisor(s)
Brian Lutey, Ozinga Brothers, Inc

Pervious concrete is an alternate paving material that may alleviate many of the environmental and water problems caused by traditional pavements such as downstream non-point pollution and storm water control. Further investigation regarding sedimentation within and below concrete is necessary to better understand the sustainability and lifecycle of this concrete. This study investigates the impact of sedimentation on pervious samples by the artificial introduction of sediment to concrete core samples. Preliminary analysis shows that a negligible amount of sediment is actually trapped within the pores of pervious concrete although experimentation is continuing. Though statistically insignificant, an apparent relationship between the concrete porosity and the amount of sediment held by the concrete after the completion of clogging cycles was observed. Concrete cores were exposed to sediment in a number of cycles to mimic natural conditions that pervious concrete installations would be subjected to. This experiment developed insight as to the effective decrease of porosity of concrete installations for purposes of long-term/lifetime maintenance.

M01
Predicting Fame: Discovering and Applying Today's Popular Music Techniques

Presenter(s)
Kayla Campbell, Illinois Mathematics and Science Academy
Donald Lee-Brown, Illinois Mathematics and Science Academy

Advisor(s)
James Priovolos, Illinois Mathematics and Science Academy

Often regarded as an abstract art, composition of music is in fact quite formulaic. The use of rigidly defined chord progressions, beat patterns, and lyrical structure is particularly evident in the construction of today's popular music. Certain musical elements are more pleasing to a wider audience than others, and any song in the genre of "Pop" usually incorporates several of them. During the first half of this study, a list of today's pop songs was analyzed, and the patterns and structures present in them were distilled out. These patterns include the standard pop beat, basic chord progressions (I-V-vi-IV), common instrumentation (synthesizer presets, guitar modulations), and lyrical structure (AABA). The second half of the study was devoted to using the elements found to compose and produce a song that falls squarely in the genre of popular music. To do so, an initial chord progression and harmony were decided upon, and a melody was composed to fit pre-written lyrics. The final production included recording vocals, instrumentation, and final editing. More so than any other class of music, pop music has defined elements that can be taken and applied towards new pop music compositions.

M02
Films and the Auteur

Presenter(s)
Daniel (Mac) Nelsen, Illinois Mathematics and Science Academy

Advisor(s)
Audrey Wells, Illinois Mathematics and Science Academy

Movies, films, or flicks, or whatever you may call them, demand some creative guidance. The director, who has control over many artistic choices, is like an author of a literary work. In the film world, directors are auteurs, which is French for author. In phase one of my investigation, I studied the films and some criticism of many accomplished auteurs, such as Alfred Hitchcock, Stanley Kubrick, and David Fincher. In doing so, I saw patterns in their works, almost like signatures from each director. After studying several films, my investigation moved to phase two, the production phase. I identified a scene from Truffaut's Fahrenheit 451 and reproduced it three different ways. Taking an almost scientific approach, I wanted to have a control and then two experiments with altered variables. My goal was to get a concrete understanding of the effects of an auteur's choices. The control is a shot by shot (movement and composition) replication of Truffaut's and establishes a standard of quality and content for my experiment. The second keeps the same shots to keep the same visual impact but changes the content (script and props). The third keeps the original content but changes the shots. The results illustrate the effects of camera work on interpretation.

M03
Production of a Twenty-first Century Musical

Presenter(s)
Nicholos Reid, Illinois Mathematics and Science Academy
Stephanie Williams, Illinois Mathematics and Science Academy

Advisor(s)
James Priovolos, Illinois Mathematics and Science Academy

A musical is a play that tells a story through song and dance with many different aspects. Our study of the century musical took place at the Oriental Theater in Chicago while observing from the audience and the backstage production of the musical *Chicago*. We looked at the staging and chorography of the actors, the music, and all of the different technical elements (lighting and costuming) that go into producing a twenty-first century musical. The way an actor is standing and their position on stage says a lot about the character they are portraying while the music and lyrics express the emotions of the character. The style of a song and lighting of a scene let the theatergoer glimpse many aspects of a scene that otherwise may not be portrayed in a tangible way. We accomplished working with the theater world at their speed, which resulted in much frustration on our part, to create a great SIR project. Overall every aspect of a musical, the actors, music, chorography, staging, lighting, and costuming, come together to give the watcher insight into the characters the actors are portraying producing a show that stays with the watcher even after leaving the presence of the stage.

N01
The Voynich Manuscript

Presenter(s)
Elsa Costa, Illinois Mathematics and Science Academy
Guy Macarol, Illinois Mathematics and Science Academy

Advisor(s)
Dennis Czerny, Illinois Mathematics and Science Academy

The Voynich manuscript is one of the most mysterious documents extant, whether it be an alchemical text in an unknown language or a clever fraud. In this inquiry, we research various probable contexts for its existence, its possible history with English mysticism, and carefully analyze its linguistic and cryptographic aspects. We have created a font based on its unusual alphabet and have run basic analyses on passages from the text. We have also examined some of the more interesting aspects of the manuscript, such as why certain letters only appear in the middle of words, or with other letters. Even though the text may, in fact, be meaningless, the question of why such a strict set of guidelines was adopted for a nonsense language is truly baffling. While it is unlikely that we will come across any new possibilities, the manuscript's possible histories are intriguing.

N02
Seafaring: Technology, History, and Economics

Presenter(s)
Lauraleigh Heffner, Illinois Mathematics and Science Academy

Advisor(s)
Claiborne Skinner, Illinois Mathematics and Science Academy

Seafaring evolved to accommodate the needs of the world. In my inquiry, I examined how technology, history, and economics played a role in each of the major ships by reviewing literature and observing the characteristics of each. As civilization expanded into northern Europe, it was discovered that Mediterranean ships could not survive the Atlantic. Vikings developed knorrs and began trading small cargo, such as precious metals, spices and slaves. The cog evolved during the Middle Ages to carry bulk goods, including salt, wool, flour, and iron. Lower shipping costs stimulated the European economy. The cog made this possible. The carrack then expanded this wealth globally allowing Europe to control the trade and wealth between countries. Without carracks providing the cargo capacity, cannons and range, Magellan may not have circumnavigated the world. Next, the caravel sailed beautifully, but could not carry a lot. The galleon, developed by the English, was a compromise between the carrack and caravel. This combination between the sailing, cargo capacity, and military strength changes the entire face of history. Seafaring allowed great explorations, on which, new civilizations formed and science advanced. Without seafaring, we would not have advanced to the civilization we live in today.

O01
Music Copyright and Royalty Laws: The Impact of Technology on the Music Industry

Presenter(s)
Amanda Cohen, Illinois Mathematics and Science Academy

Advisor(s)
Barry Irwin, Kirkland and Ellis
Christian Nokkentved, Illinois Mathematics and Science Academy

Technological changes have altered the way people obtain and listen to music. Currently, there is legislation, the Performance Rights Act (H.R. 4789 and S. 2500), being considered that will change the way performers are compensated when their music is enjoyed via new and existing technologies. From evaluating the current system that controls when artists get compensation for use of their musical works and the historical rationale behind this system, I believe the existing compensation scheme needs to be modified in the interest of fairness. Although I do not agree that the Performance Rights Act (which provides performers compensation for use of their works on over-the-air radio stations) will completely solve the public performance royalty issues that the United States has faced for decades, I believe the act is a step in the right direction of fair compensation. I have prepared a paper that I will seek to publish, advocating the general principles of the Performance Rights Act, as well as other appropriate compensation schemes. This paper will be sent to Congress with the intention of securing for all artists fair compensation for their musical contributions

O02
Improving Romania's Adoption System: Comparative Analysis and Application of Western Adoption Systems

Presenter(s)
Ana Dumitrescu, Illinois Mathematics and Science Academy

Advisor(s)
Mihaela Raicu, Chitown Law

The adoption system in Romania is an outdated system that started in the communist era and remains inadequate for the present times. Official statistics show that the number of kids in state institutions in Romania is thirty-three thousand, many of which have disabilities and all of which are neglected. This immense number is mostly due to the new legislation passed in 2001 that bans inter-country adoptions due to corruption and inadequacy in the system. In this study, I researched five developed countries' adoption system and state institutions for orphans, specifically examining education. Within these institutions, education and living conditions showed the greatest disparity between Romania and the developed countries. The developed countries do not have orphanages like Romania, but have residential treatment centers that resemble more of a boarding school. Romania's military does have a small program that takes in orphans and educates them. The orphans taken in by the military are in significantly better conditions then those in orphanages. Looking at the research of the developed countries, it is safe to conclude that Romania needs to rid itself of the orphanages and invest in treatment centers. Also, the adoption system needs to be organized like the systems in the developed countries.

O03
The Convention on the Rights of the Child: Investigating Implementation in Chicago

Presenter(s)
Abigail Flynn, Illinois Mathematics and Science Academy
Catrina Kim, Illinois Mathematics and Science Academy

Advisor(s)
Sandra Babcock, Northwestern University

The Convention on the Rights of the Child (CRC) is the most comprehensive document in existence outlining the rights of children as human beings. At present, every nation except the United States and Somalia has ratified the CRC, a fact which President Obama calls an embarrassment to the US government. Human rights advocates hope that local and state-wide support will encourage the national ratification of the CRC. Our work has been focused in Chicago, a "UNICEF child-friendly city." Through research conducted on the state of Chicago's children, we have found the condition of Chicago's children can be improved. Chicago's support of the CRC can provide a common framework for the different arms of Chicago's government to actively consider the needs of its children in its policy decisions, especially in the areas of health, education, and protection against violence. In partnership with law students and professors at Northwestern Law's Bluhm Legal Clinic and a coalition of children's rights organizations, we have worked towards the recent passage of a resolution in support of the CRC in Chicago.

P01
Application of Different Voting Systems to the 2007 French Presidential Election

Presenter(s)
Matthew Castillon, Illinois Mathematics and Science Academy

Advisor(s)
Donald Porzio, Illinois Mathematics and Science Academy
Eric Smith, Illinois Mathematics and Science Academy

France uses a two-round runoff system for their presidential elections. In this system, which is common in elections with more than two viable candidates, voters select their top candidate. If there is no candidate with a majority (50%+1 vote) after this round, then the two candidates with the highest vote totals advance to a second round of voting where the top vote-getter is the winner. In 2007, the center-right candidate, Nicolas Sarkozy, defeated the center-left candidate, Ségolène Royal, in the second round after they had received the two highest totals in the first round. In this investigation, we looked at how different voting systems would have affected the final outcome of the 2007 French presidential election. The systems we examined include plurality, instant-runoff, and Borda count. For rank-order voting systems, we compared candidates and developed a three-dimensional plot based on their political positions in areas of economic, social, and international policy. We then generated hypothetical ballots based on each candidate’s distances from each other. Preliminary results indicate that the centrist, third-place finisher, François Bayrou, would have faired much better in these alternative voting systems. If these preliminary results hold up to be true, then this study can be used to inform those who seek to change any existing constructed electoral system.

P02
Coordinate-Free Characterization of Homogeneous Polynomials with Isolated Singularities

Presenter(s)
Irene Chen, Illinois Mathematics and Science Academy

Advisor(s)
Stephen Yau, University of Illinois at Chicago

Let Δ(a,b,c,d,e) be an 5-dimensional real simplex with vertices at (a,0,0,0,0), (0,b,0,0,0), ... , (0,0,0,0,e), and let P5 be the number of positive integral points found within Δ(a,b,c,d,e). Given these hypotheses, we naturally wonder how P5 can be either bounded or calculated. In this paper, we explore the question of counting the number of integral points in a 5-dimensional simplex and find an upper bound for P5. We prove that 5!*P5 ≤ (a-1)(b-1)(c-1)(d-1)(e-1) - [(e-1)^5 - (e-1)(e-2)(e-3)(e-4)] for a ≥ b ≥ c ≥ d ≥ e ≥ 4.25. Consequently, we have proved the Yau conjecture for n = 5, which is: n!*p ≤ μ - h(v), where p, μ, and v are the geometric genus, the Milnor number of the singularity and the multiplicity, respectively.

P03
On the Embedding of Degree Sequences on the Projective Plane and Torus

Presenter(s)
Bonny Jain, Illinois Mathematics and Science Academy

Advisor(s)
Noah Prince

The degree sequence of a graph is the list of its vertex degrees counted with multiplicity (usually given in nonincreasing order). A graphic realization of a sequence S is a graph with degree sequence S. An embedding of a graph is a drawing of its edges and vertices on a surface such that no edges cross. The problem of determining which degree sequences have the property that every graphic realization is planar was addressed by Prince and Wenger. This raised the question of which degree sequences have every realization embed on other surfaces, namely the projective plane and the torus. In this talk we discuss joint work with Prince regarding the embedding of realizations of degree sequences on the projective plane and torus.

Q01
Pegylated Interferon-Induced Graft Dysfunction after Liver Transplantation: A Multicenter Case Control Study

Presenter(s)
Amishi Bajaj, Illinois Mathematics and Science Academy

Advisor(s)
Josh Levitsky, Northwestern University

Chronic hepatitis C virus (HCV) infection has now become the most common indication for liver transplantation in the United States. Hepatitis C recurrence is virtually universal after liver transplantation; interferon-alpha (INF) has been utilized to delay the progression of recurrent hepatitis C, which causes damage to transplanted livers. In this investigation, the population studied involved ten cases of liver transplant recipients demonstrating evidence of graft dysfunction treated with PEG INF. These patients were compared to a control population of liver transplant recipients without graft dysfunction. Preliminary data collection revealed that HCV allograft dysfunction can be affected by PEG INF therapy; however, as the project continues, a greater number of patients will be enrolled to determine the dose and the duration of this therapy to affect outcome. Potential risk factors to be considered that were identified in analysis ranged from ethnicity to medication dose; these factors could significantly alter the decision-making process regarding which patients to consider for PEG INF treatment. Also, knowledge of management and outcomes would provide useful guidance for physicians treating patients who develop this complication, particularly data regarding HCV recurrence as well as patient and graft survival in those requiring retransplantation.

Q02
Mapping Genes Involved in Chronic Sinusitis

Presenter(s)
Amishi Bajaj, Illinois Mathematics and Science Academy

Advisor(s)
Jayant Pinto, University of Chicago

Chronic sinusitis is an important public health problem causing significant impact on quality of life. Our studies were initiated in the Hutterites, a religious group that practices a communal lifestyle and shares common environmental exposures. We completed a genome-wide screen for genetic variation influencing susceptibility to chronic sinusitis. The largest linkage signal (P=.0023) was discovered on chromosome 7q31, suggesting a role for genetic variation in this region influencing susceptibility to chronic sinusitis in the Hutterites. We sought to expand these results by enlarging the number of subjects in our study through new phenotyping field trips to South Dakota. Approximately three hundred more subjects were studied, and their medical histories were reviewed. Relevant environmental exposures and medical history were obtained, along with relevant testing (allergy and smell). We also reviewed medical records of subjects who presented sinus symptoms. We are in the process of analyzing these data and plan to conduct a genome-wide association study using the enlarged data set to improve upon our prior results. We have concluded that genetic factors affect cause for chronic sinusitis, and as the project continues, we plan to investigate genes demonstrating significant associations in the Hutterites. Ultimately, understanding the molecular pathophysiology of chronic sinusitis may lead to improvements in the diagnosis and treatment of this burdensome disease.

Q03
The Effects of Different Surfactants, Curosurf and Survanta, on the Survival and Outcome of Infants with Birth Weight Equal to or Less than 1000 Grams from Three Time Periods

Presenter(s)
Shelly Bhanot, Illinois Mathematics and Science Academy
Shilpa Topudurti, Illinois Mathematics and Science Academy

Advisor(s)
Christine Sajous, Loyola University Medical Center

In our study, we examined the effects of Curosurf and Survanta on babies weighing 1000 grams or less. Curosurf and Survanta are medications used on premature to aid in respiratory development. Babies from the year 1984 prior to the use of surfactants were compared to those from 1994 and 2004-2006. The overall survival and survival within specific sub-groups, such as race and gender, were observed over the researched time periods. Additional observations included: babies with homecare, discharge type, hearing screen, and the newborns who required laser surgery for severe Retinopathy of Prematurity. We studied these figures to see a possible relationship between the advancement of surfactant, survival rate, and long-term development of premature babies. Our current analysis from our retrospective chart review is underway. A comparison of Curosurf and Survanta will provide a further understanding of the effectiveness of each surfactant which could advance the medical community.

Q04
Patient Safety in Surgery: An Examination of Hand Hygiene and Physician Communication

Presenter(s)
Andrea Castaldo, Illinois Mathematics and Science Academy
Ashley Czaplicki, Illinois Mathematics and Science Academy

Advisor(s)
Timothy McDonald, University of Illinois at Chicago

Developing a safe environment for patients is of utmost concern to hospitals and surgery centers. Appropriate hand hygiene decreases the number of hospital acquired infections. Effective communication between physicians decreases adverse events. Over four months, the hand hygiene habits of physicians and other staff at the University of Illinois Medical Center (UIMC) were measured, establishing a hand washing compliance rate between patient contacts at only 28.7%. After we developed and implemented a program, approved by the Department of Safety and Risk Management, to meet the needs of the Surgicenter at the UIMC, the hand washing compliance rate increased to 63.3%. This effective program included posters, stickers, portable hand sanitizers, and personal interventions. To improve physician communication, a training program for residents was implemented by medical staff at UIMC. This program's effects, currently being observed, are to promote effective communication of patient information during hand-offs of surgery patients between physicians. These preliminary results reveal the potential for significant improvement in patient safety. Through UIMC's willingness to share data and programs that work to improve patient safety, it is hoped that many other medical centers will learn ways to improve patient safety at their institutions and save lives in the process.

Q05
Epidemiological Analysis of Methicillin-Resistant *Staphylococcus aureus*

Presenter(s)
Brian Chang, Illinois Mathematics and Science Academy

Advisor(s)
Bill Kabat, Childrens Memorial Research Center
Guorong Liu, Children's Memorial Research Hospital

A recurring problem throughout health care facilities is the occurrence of nosocomial infections. One bacterium in particular, methicillin-resistant *Staphylococcus aureus* (MRSA) is frequently encountered in hospital settings. Identifying the source of nosocomial infections is complicated because community acquired MRSA must be distinguished from resident hospital strains. In an effort to distinguish between the two, the CDC and others have developed the current USA typing system. This system uses pulsed-field gel electrophoresis (PFGE) patterns as a primary tool for typing. Recently a semi automated typing system, Diversilab, was developed. This study was designed to assess the utility of the Diversilab system in examining strains of community-acquired MRSA and their USA types to compare standard PFGE to Diversilab results. Strains previously characterized by the Diversilab system were tested with PFGE. Next, analysis software determined percent relatedness (using a similarity index) between samples by PFGE. Finally, Kirby Bauer susceptibility tests were used to determine antibiograms to support PFGE results. Strains within USA typing groups as determined by Diversilab show different PFGE patterns and susceptibilities. Our results suggest that the current Diversilab system may not be robust enough to discriminate between community-acquired strains and nosocomial strains of MRSA if found in a hospital setting.

Q06
Cardiovascular Complications of Sickle Cell Disease

Presenter(s)
Lakshmi Girijala, Illinois Mathematics and Science Academy

Advisor(s)
Louis Cohen, University of Chicago
Ankit Desai, University of Chicago

Pulmonary arterial hypertension (PH), the increase in blood pressure in the pulmonary artery, vein, or capillaries, often occurs in patients with Sickle cell disease (SCD). In a survival study of patients with SCD and PH, 70 percent of patients without PH lived through the ten-year study, while the median survival for patients with SCD and PH was 26 months (Castro, 2003). Given this dramatic increase in mortality, this investigation aims to improve the understanding of the pathophysiology of PH in SCD patients by better characterizing their cardiopulmonary complications by utilizing cardiac magnetic resonance (CMR) and trans-thoracic echocardiography (TTE). The study seeks to recruit patients with SCD and perform CMR and TTE on participants, and compare the findings to control patients. Because the IRB proposal approval is pending, researchers have read journal articles and medical textbooks describing normal human anatomy and physiology, SCD, PH, CMR, and echocardiography in order to draw connections between these topics. To summarize the information from the journal readings and discussions, interval reviews were written. From these reviews, the pathophysiology of PH in correlation with SCD and the uses of CMR and echocardiography in identifying SCD complicated PH was drawn. Finally, to obtain the practical background knowledge on these new imaging modalities used in this project, imaging conferences have been attended.

Q07
The Feasibility of Melanoma-Related Immunotherapy Methods in Patients with Lymphangioleiomyomatosis

Presenter(s)
Jennifer Hu, Illinois Mathematics and Science Academy

Advisor(s)
I. Caroline Le Poole, Loyola University
Mary Reust, Loyola University

Lymphangioleiomyomatosis (LAM) is a rare lung disease which is characterized by the hyperproliferation of smooth muscle throughout the lung parenchyma. There are few effective treatments of the disease; however, the expression of certain melanoma-related antigens in LAM suggests that immunotherapy may be a feasible treatment for LAM patients. To test this, we used both single and double immunohistochemistry methods (indirect) to compare the abundance of expression of melanoma-related antigens and immune infiltrates between five LAM, three normal, and three melanoma tissue samples. We found that in partially overlapping subsets of cells in LAM lung tissue samples gp100, MART-1, TRP-1, and TRP-2, all melanoma-associated antigens, were expressed. On the other hand, tyrosinase, also a commonly targeted antigen in melanoma, was not observed. We also found that the presence of T cells in LAM samples was comparable to that in normal tissue and less compared to Melanoma samples. This indicated that although in the LAM samples there was a broad expression of potential target antigens, the immune system was not presenting these antigens to cytotoxic T cells (such as CD8) as well as in Melanoma. The immune response to the melanoma associated antigens in LAM patients still has room for improvement, supporting the feasibility of immunotherapy aimed towards these specific antigens.

Q08
Anti-Cancer Drug Nanoparticles as Carriers of DNA into Cells

Presenter(s)
Sushma Kola, Illinois Mathematics and Science Academy

Advisor(s)
Richard Gemeinhart, University of Illinois at Chicago

A rising number of potential pharmaceuticals are poorly soluble in solutions, leading to abandoned drug development efforts. A promising remedy to this impasse is the use of drug nanoparticles. Nanotechnology-based drug delivery systems have become increasingly important in treating cancer, genetic diseases, and other illnesses. The purpose of this study was to investigate whether drug nanoparticles can interact with DNA to form a potential drug delivery agent. Estradiol (E2) (0, 5, 10, 25 mg/mL) was precipitated from acetone in the presence of DNA (0, 125, 250, 500 ng/mL) to create DNA-coated drug nanoparticles. Fluorescence spectrometry was used to quantify the amount of DNA coating the E2 particles. Following, the effects of varying E2 concentrations on particle appearance were examined using light microscopy. PicoGreen reagent was then added to the suspension of DNA-coated drug nanoparticles which were exposed to a culture of MCF7 cells. As expected, higher concentrations of E2 yielded larger particles. It is anticipated that higher concentrations of DNA will result in a greater degree of DNA transfection. Fluorescence microscopy is underway to determine the quantity of GFP produced by the cells as a result of E2 particle uptake. Results suggest that DNA-coated drug nanoparticles have the potential to serve as quality therapeutic agents for cancer and other diseases.

Q09
The Effect of Platelet Activating Factor on Nuclear Factor kappa B Dependent Luciferase Activity *in vivo* in a Mouse Model of Acute Bowel Injury

Presenter(s)
Pruthvi Kothari, Illinois Mathematics and Science Academy

Advisor(s)
Isabelle De Plaen, Children's Memorial Research Hospital

Necrotizing enterocolitis (NEC) is a serious gastrointestinal illness that causes acute bowel inflammation and necrosis, and occurs predominantly in premature infants. Platelet-activating factor (PAF), an endogenous phospholipid, is thought to play a central role in the development of NEC. When injected systemically into mice, it produces acute bowel injury. Our laboratory has shown that PAF activates nuclear factor-κB (NF-κB), a transcription factor that regulates the transcription of inflammatory genes, in the intestine within 30 minutes of exposure. In this study, we wanted to determine whether PAF induces NF-κB-dependent luciferase activity in vivo in young adult male transgenic mice that produce GFP-luciferase upon NF-κB activation (NGL). Mice were anesthetized and their carotid artery was catheterized for a PAF injection. Luciferin was injected every hour and imagings were performed every 5 minutes for the 4-hour experimental period. We found that the levels of luminescence were highly variable from mouse to mouse and there were no statistically significant differences between PAF-treated animals and controls at the times examined. We will now confirm these findings by performing a luciferase assay on the collected intestinal tissues.

Q10
The Effect of Dichloroacetate on Cancer Stem Cells

Presenter(s)
Benjamin Kyi, Illinois Mathematics and Science Academy

Advisor(s)
Morris Kletzel, Childrens Memorial Hospital
Marie Olszewski, Childrens Memorial Hospital

A unique metabolic characteristic of most cancer cells is glycolysis. Glycolysis shuts down the mitochondria in the cell. The cell's ability to then resist against apoptosis is greatly enhanced. As a result, cells begin to divide uncontrollably which result in what we know today as cancer. The drug tested in this experiment is called dichloroacetate. Dichloroacetate or DCA is a chemical compound which upstarts "sleeping" mitochondrial cells and restart the apoptotic process. In the following experiment, the effect that DCA had on a cancer stem cell line was tested. Two groups of cells were tested: treated groups with 5mM or 10mM DCA. On a weekly basis, cells were run through a viability test and a cell count test. In both tests, cell death was observed. RNA was extracted from the cell group and a RT-PCR test was run on the extracted RNA. By running the RT-PCR, a particular sequence of RNA would be amplified, allowing for the viral sequence to be identified. The results gathered in this experiment strongly supports our prediction that DCA would cause the cancer cells in culture to die. It was observed that the higher the concentration of DCA, the more effective the treatment was.

Q11
Gene Therapy Treatment of Breast Cancer Involving Transforming Growth Factor-β Inhibition Promoted by Modified Human Telomerase Reverse Transcriptase

Presenter(s)
Bob Lee, Illinois Mathematics and Science Academy

Advisor(s)
Prem Seth, North Shore University Health System Research Institute
Zhenwei Zhang, North Shore University Health System Research Institute

This new advancement in the treatment of breast cancer involves gene therapy resulting in the inhibition of the TGF-β signaling pathway. All somatic cells in the body depend on the TGF-β signaling pathway to regulate cellular growth, and the pathway has also been shown to be a major factor promoting the metastasis of cancer cells and bone osteolysis. In earlier investigations, adenoviral vector Ad.sTβRFc, which expresses the sTGFβRIIFc protein that arrests the TGF-β signaling pathway, was constructed. The application of this virus to nude mice bearing xenografted human breast cancer tumors has demonstrated verified results in successfully destroying cancer cells. This investigation focuses on a new development in the experimental treatment, the addition of modified human telomerase, a reverse transcriptase enzyme that assists viral replication with high efficacy in cancer cells, which created adenoviral vector mhTERTAd.sTβRFc. This enzyme allows the adenoviral vector to better target and restrict its TGF-β inhibitory effects to breast cancer cells. Experimental results have shown a 6,000-fold increase in viral production in a 48-hour infection period. The effects of protein TGFβ-1 have been shown to be nullified, preventing downstream SMAD-3 phosphorylation and IL-11 production. Further investigation of using mhTERTAd.sTβRFc as an anti-tumor agent shows much promise.

Q12
The Effects of Matrix Metalloproteinase Inhibition on Disc Degeneration

Presenter(s)
Kristen Lee, Illinois Mathematics and Science Academy

Advisor(s)
Hee-Jeong Sampen, Rush University Medical Center

The matrix metalloproteinase (MMP-13) degrades a critical component of the intervertebral disc (IVD), type II collagen, which can lead to decreased IVD strength. Lower back pain is linked with disc degeneration and at present, treatments center around relieving the symptoms, not the cause. Because activated MMP-13 plays a pathogenic role in IVD, it may be an ideal target for inhibition due to its distribution throughout normal tissue. Direct response to disc degeneration may offer a more direct treatment to LBP. This investigation assessed whether selective inhibitors of MMP-13 activation would prevent collagen degradation and restrain disc degeneration. By treating bovine cells with the anabolic OP-1, catabolic IL-1alpha, a control, and the MMP-13 inhibitor, I attempted to determine if the MMP-13 inhibitor would retard collagen degradation. By conducting a DNA assay, I examined the effects of the fore-mentioned treatments on cell proteoglycan levels, elements of the IVD, normalized to DNA levels. The data yielded inconclusive findings and demanded that the experiment be re-administered or another pathway be taken to determining the effects of an MMP-13 inhibitor on collagen degradation.

Q13
Effects of DNMT3B7, a Truncated DNMT3B Protein Found in Human Tumors, on Murine Lymphomas

Presenter(s)
Bohao Liu, Illinois Mathematics and Science Academy

Advisor(s)
Lucy Godley, University of Chicago
Aparna Vasanthakumar, University of Chicago

Cancer cells display abnormal splicing of the DNMT3B gene, which encodes one of the DNA methyltransferase enzymes. Splicing of this gene in cancer cells commonly produces a truncated protein called DNMT3B7 which causes abnormal methylation. Currently, little is understood about exactly how DNMT3B7 alters DNA methylation. In this study, we tested the effects of DNMT3B7 on EμMyc-induced murine lymphomas. EμMyc and DNMT3B7 transgenic mice were interbred to create EμMyc/DNMT3B7 double transgenic mice. We found that these double transgenic mice exhibit a higher incidence of mediastinal lymphoma formation versus the EμMyc mice. We performed gene expression profiling using microarray technology and found that 227 genes showed differential expression between the EμMyc single transgenic and the EμMyc/DNMT3B7double transgenic mice. We mapped these genes onto the mouse chromosomes and identified a significant number of differentially expressed genes located in clusters on chromosomes three and five. In order to determine how DNMT3B7 causes these alterations, we are analyzing the DNA methylation patterns in selected genes on chromosome five using bisulfite-sequencing of DNA obtained from mediastinal lymphomas. Bisulfite sequencing will allows us to measure the DNA methylation of individual CpG dinucleotides within the promoters of the differentially expressed genes. Our analysis of these DNA sequences may lead the way to understanding how truncated DNMT3B isoforms function in cancer.

Q14
All-trans Retinoic Acid induced Reactive Oxygen Species and Cell Death in Mantle Cell Lymphoma Cells

Presenter(s)
Yue Lu, Illinois Mathematics and Science Academy

Advisor(s)
Amareshwar Singh, Northwestern University

Mantle cell Llymphoma (MCL) is a blood cancer that accounts for 5-10% of all cases of non-Hodgkin's lymphoma. It is a subtype of B-cell lymphoma with a poor response to chemotherapy. In our studies, we have shown that a drug, ATRA, a Vitamin A metabolite, caused the production of reactive oxygen species (ROS), also called as oxygen radicals, in MCL cells. We think that this generation of ROS may have a role in killing MCL cells. Toward this end, we tested the effects of ATRA on apoptosis (programmed cell death) in Granta cells (MCL cells). ATRA used in this study was packaged into nanoscale particles to increase solubilization and delivery into the cells. To determine their effects on apoptosis, Granta cells were incubated with ATRA-ND for 24 hours and apoptosis measured with annexin V/propidium iodide binding and FACS analysis. ATRA-ND significantly induced apoptosis at 24 hours compared to an untreated control. We measured ROS by H_2 DCFDA staining and FACS following incubation of Granta cells with ATRA-ND. At 6 hours, ATRA-ND induced a significant ROS generation in Granta cells. In summary, our data indicate that ATRA-ND stimulated ROS in Granta cells and that this observation is correlated with the induction of apoptosis in Granta cells.

Q15
Generating a Dendritic Cell Activating DNA Vaccine for Melanoma

Presenter(s)
Harika Nalluri, Illinois Mathematics and Science Academy

Advisor(s)
Jared Klarquist, Loyola University
I. Caroline Le Poole, Loyola University

Melanoma, the most deadly form of skin cancer, occurs by malignant transformation of melanocytes. The aim is to induce anti-tumor responses in patients with melanoma by vaccinating them with a DNA construct encoding a fusion protein involving a heat shock protein 70 (HSP70) derived peptide and full-length melanoma-associated antigen recognized by T cells (MART-1). We hypothesize that the 11-mer HSP70 peptide is sufficient to activate dendritic cells, which will efficiently present MART-1 peptides and stimulate an immune response against the melanoma. We isolated RNA from a melanoma cell line and conducted a reverse transcriptase polymerized chain reaction (RT-PCR) with gene-specific primers to obtain full-length 0.354 kB MART-1 cDNA. Additional primers were designed to tag the HSP70 peptide encoding sequence in-frame to either end of the MART-1 sequence. The DNA was inserted into a eukaryotic expression vector and amplified in bacteria. Isolated plasmid was commercially sequenced using the T7 primer annealing site upstream of the open reading frame. Three of the twenty-nine sequenced inserts were 100% homologous with reference sequences and in the correct orientation. The next step is to transfect plasmid DNA into human embryonic kidney cells and to analyze for functional protein synthesis by immunostaining and flow cytometry. The construct will later be tested in functional assays.

Q16
Blood Type as a Risk Factor for Necrotizing Enterocolitis in Neonates

Presenter(s)
Hannah Reiser, Illinois Mathematics and Science Academy

Advisor(s)
Jonathan Muraskas, Loyola University Medical Center
Sherri Yong, Loyola University Medical Center

There are 7,000 cases of necrotizing enterocolitis (NEC) per year, and it is responsible for an increasing number of infectious disease-associated late deaths in low birth weight infants. Numerous studies have examined risk factors in infants for NEC; however, no studies have examined blood type as a risk factor. We have retrospectively analyzed twenty years of medical data for infants that had NEC, specifically analyzing the blood types and NEC occurrence rates and outcomes. We established the control group by inputting data for three hundred infants without NEC in the same setting and time span. We believe blood type is a possible risk factor for infants regarding NEC. Preliminary findings indicate that AB blood type could put infants at risk for a more severe course of NEC. This may be because the O infants have A and B antibodies, where as the AB infants have no antibodies. Conclusive results would indicate that a possible treatment for AB infants to increase survival rates is the intravenous immunoglobulin (IVIG) treatment, which contains IgG immunoglobulins (antibodies) from plasma donors. Being able to identify the infants at highest risk of developing NEC at an earlier point in time may help increase their survival chances.

Q17
Predicting Academic and Clinical Distinction in a Sixty Minute Medical School Interview

Presenter(s)
Hannah Reiser, Illinois Mathematics and Science Academy

Advisor(s)
Jonathan Muraskas, Loyola University Medical Center

Previous studies have shown the medical school interview to be unreliable in predicting success in medical school. Alpha Omega Alpha (AOA) is a national medical school honor society that recognizes the top 15% of a graduating class. Our objective was to determine if a sixty minute interview by a single, experienced interviewer can predict academic distinction in medical school. Between 1987 and 2003, 1190 medical school applicants were interviewed by a single interviewer with a closed file and received a score of: 1-5 with 5 being outstanding. The applicants were cross referenced with the National AOA Registry and their interview score, gender, and AOA status were recorded. We propose twelve insightful components for an interview. Of these 1190 interviewed candidates, 185 were inducted into AOA nationally. Interview scores were significantly higher in AOA inductees ($p < 0.05$). In this cohort, significantly more males than females became AOA inductees ($p < 0.05$). The interview process described is effective in getting to the core of the applicant's character and potential. This process significantly predicted academic and clinical distinction in medical school. The induction of more males than females in this cohort warrants more investigation.

Q18
The Affect of the Implementation of Computed Tomography on the Negative Appendectomy Rate at Loyola University Medical Center

Presenter(s)
Sarah Rokosh, Illinois Mathematics and Science Academy

Advisor(s)
John Santaniello, Loyola University

Out of the roughly 250,000 appendectomies performed each year, about 15%, or 37,500, of these surgeries result in the removal of a healthy appendix, with women far more likely to have a negative appendectomy (25%) compared to men (12%). Until the recent transition from clinical diagnosis to more accurate imaging, physicians relied largely on clinical examinations and lab workups in diagnosis of acute appendicitis. The implementation of CT scans in diagnosis should arguably decrease the number of appendices needlessly removed from the traditionally accepted 15% to a more acceptable 2%. Therefore, I conducted retrospective research over the past six years (2003-2008) to evaluate the significance in the change, if one is observed, in the negative appendectomy (NA) rate at Loyola University Medical Center (LUMC) after the implementation of computed tomography (CT) scans in diagnosis. From these patients' charts, I recorded age, gender, white blood cell count, noteworthy observations in the CT scan, as well as notes on the operative and pathological reports. Data analysis demonstrated that the NA rate at LUMC is 2%, the rate the current medical community is pushing to be the new standard.

Q19
A Case Control Study of Polymorphisms in the Matrix Metalloproteinase-9 Gene in Patients with Abdominal Aortic Aneurysms versus Healthy Controls

Presenter(s)
Aldo Rossi, Illinois Mathematics and Science Academy
Isolina Rossi, Illinois Mathematics and Science Academy

Advisor(s)
William Pearce, Northwestern University
Vera Shively, Northwestern University

Abdominal aortic aneurysm (AAA) is a vascular disease. In AAA, the enzyme, matrix metalloproteinase-9 (MMP-9), weakens the walls of the aorta by degrading structural proteins, which can lead to a fatal rupture. AAAs are most commonly seen in white males over age fifty years, who have a history of smoking. Previous studies have shown that there are increased amounts MMP-9 in AAA tissue specimens. We analyzed a polymorphic portion of the MMP-9 gene; a location on the gene that is known to show natural variation in humans. In our case, we analyzed a single nucleotide polymorphism, or SNP, that is located at position -1562 in the promoter of the gene. A cysteine (C) or thymidine (T) is found at this location. The T allele has been associated with higher transcription rates of the gene. We hypothesize that AAA patients will have more T's at -1562 versus a population of healthy age-matched white male controls. To date, our results do not support this hypothesis. Of the samples we have genotyped, only three of nineteen AAA samples have a T allele, while eight of twenty-four control samples have the T allele.

Q20
The Severity, Causes, and Effects of Sleep Deprivation at IMSA

Presenter(s)
Priya Roy, Illinois Mathematics and Science Academy

Advisor(s)
Susan Styer, Illinois Mathematics and Science Academy

IMSA students often complain that they don't receive an adequate amount of sleep, although the reasons for this remain unclear. While some people attribute this to improper time management, others believe that IMSA's challenging atmosphere forces students to forgo sleep in order to complete schoolwork. To better understand the causes and effects of sleep loss at IMSA, a questionnaire concerning sleep loss and habits was distributed to seventy-five students. Included was the Epworth Sleepiness Scale (ESS), a self-administered questionnaire which assesses sleepiness on a scale of 0-24; a score higher than 10 indicates excessive sleepiness. The average score on the ESS was 10.62. Also included in the questionnaire were questions concerning students' sleep, such as students' time management, sleep hygiene and quality, and the effects of their sleep. These data were used to test the hypothesis that IMSA students receive an inadequate amount of sleep (5.75 hours per night) compared to the recommended nine hours ($t=20.649$, $df=74$, $p=3.318 \times 10^{-32}$). Understanding the severity, causes, and effects of sleep deprivation at IMSA allows for solutions to this growing problem to be utilized, such the improvement of sleep hygiene and later school starting times. Not only would this be beneficial to students' quality of sleep, but their overall lifestyle could also improve.

Q21
Relationship Between Horizontal Reaction Force and Walking Velocity in People Post-Stroke

Presenter(s)
Evan Schwerbrock, Illinois Mathematics and Science Academy

Advisor(s)
David Brown, Northwestern University

Our investigation was to determine and analyze the force-velocity curve in walking motion in both non-impaired and impaired test groups and compare the two. Using the KineAssist robot to collect data and assist in the safety of our experiment, a range of velocities is chosen. The KineAssist's isokinetic testing capabilities are used and subjects must walk against that force with maximal effort all while keeping a natural walking motion. Maximum and average force outputs are recorded. We found that as velocity went up, force output went down. The trends for this decrease can vary. So far, our results indicate strikingly similar trend lines for the stroke survivors (N=3) and control subjects (N=9). The difference, however, is that the stroke survivors have smaller velocity ranges (they are incapable of walking as fast as the control group) and their force outputs plummet much faster (they can't produce as much force at a higher velocity). The force outputs at low velocities however are quite high and similar to those of the control group. In fact, thus far we have found that the theoretical force outputs at 0 m/s (maximal outputs) are not statistically different. This leads us to propose that it would be more beneficial to train stroke survivors at low velocities with heavy resistance in order to stimulate increases in muscle strength.

Q22
Determining Postoperative Risks of Preoperative Frailty and Hypoalbuminemia

Presenter(s)
Joan Steffen, Illinois Mathematics and Science Academy

Advisor(s)
Kathleen Grady, Northwestern University
Richard Lee, Northwestern University
Michael Yensel, Northwestern University

Frailty is a syndrome which is often associated with higher risk of falls, hospitalization, and mortality. The purpose of this investigation is to determine whether frailty and serum albumin levels are preoperative risk factors for post operative morbidity, mortality, and poor quality of life. The sample size for this study was thirty patients. Data were collected through chart review and patient performance and self-report. A dynanometer was used to measure grip strength, a stopwatch was used to time a fifteen foot walk, and the medical outcomes study 36-item short form health survey (SF-36) was used to collect self-report quality of life data. Statistical analyses included the use of descriptive analyses, such as frequencies and measures of central tendency, and correlations. Findings included a significant relationship between pre-operative frailty and post-operative morbidity, mortality, and poorer quality of life. A strong correlation between pre-operative frailty and pre-operative hypoalbuminemia was found. The identification of the relationships between frailty, serum albumin, and post-operative outcomes could aid clinicians in the pre-surgical education of patients regarding post-surgical outcomes. Also, clinicians would be better informed of frailty as a risk factor for post-surgical morbidity, mortality, and poor quality of life and therefore could develop and test interventions to reduce frailty pre-operatively and promote good outcomes post-operatively.

Q23
Calcium Handling Heterogeneity within Normal and Failing Myocytes

Presenter(s)
Lokamitra Veeramasuneni, Illinois Mathematics and Science Academy

Advisor(s)
J. Andrew Wasserstrom, Northwestern University

Ca_2 cycling within the heart regulates the contraction and relaxation cycles that allow blood to circulate throughout the body consistently. However, during congestive heart failure (CHF), many changes occur in this cycling that reduce the heart's performance under resting and elevated heart rates. Our purpose is to compare the heterogeneity in cellular Ca_2 cycling between normal hearts and those in CHF. Ca_2 transients were measured across single cells in two different sets of rats: WKY (control) and aged-matched SHR (spontaneously hypertensive) in CHF using flou-4 fluorescent dye and confocal microscopy. Various transient characteristics were measured under a basal (basic cycle length - 700 ms) and rapid pacing conditions. Preliminary trends include: 1) calcium handling defects occur in CHF that result in prolonged transient duration and decreased transient amplitude; 2) the natural heterogeneity of calcium transients between sarcomeres is exaggerated in heart failure; 3) the initiations of calcium transients has increased heterogeneity in CHF compared to normal hearts. These trends are based upon the preliminary analysis done on four different SHR and WKY rats. Currently, the analysis is still ongoing and in the future a greater scope of trends and the specific changes that occur during CHF are hoped to be found.

Q24
Identification of Molecular Breast Cancer Subtypes using Tissue Microarrays and Digital Microscopy

Presenter(s)
Arika Verma, Illinois Mathematics and Science Academy

Advisor(s)
Funmi Olopade, University of Chicago

Identification of ductal carcinoma *in situ* (DCIS) subtypes and invasive breast cancers (IBCs) through predictive genomic biomarkers followed by statistical analysis of prognosis factors may reveal correlations useful for determining tumor progression in patients. Through the use of Automated Cellular Image Analysis, biomarker status was identified following immunohistochemical staining of four tissue microarray (TMA) whole slide image batches from tumor samples. Five predictive biomarkers used for therapy were identified; estrogen (ER), progesterone (PR), human epidermal growth factor receptor 2 (HER2), epidermal growth factor receptor (EGFR), and cytokeratin 5/6 (CK-5/6). From these protein expression results, hierarchical clustering analysis confirmed cancer subtype identities. Preliminary results show that the DCIS TMA predominantly contains luminal A subtypes, whereas IBC TMAs represent multiple breast cancer subtypes. Statistical analyses were also performed comparing histological grade, race, age, survival rate, tumor size, and lymph node status associated with the prevalence of subtypes between DCIS tumors and those which progressed to IBCs. Significant correlations provided by these analyses may lead to earlier detection of progressively invasive tumors and consequently allow for timely aggressive treatment for these patients.

Q25
The Effect of Interleukin-6 on Iron Concentrations and Prostate Cancer Progression

Presenter(s)
Mark Xue, Illinois Mathematics and Science Academy

Advisor(s)
Andre Kajdacsy-Balla, University of Illinois at Chicago

Iron is an essential element for angiogenesis and aggressive tumor growth. Therefore, it is reasonable to assume that there are higher levels of iron concentration in the recurring prostate cancer tissues than the non-recurring prostate cancer tissues. However, an analysis of the iron concentration in 40 matched-pairs of prostate tissues from subjects with recurring and non-recurring prostate cancer indicated that there was a lower concentration of iron in the recurring prostate cancer tissues than the non-recurring prostate cancer tissues. To investigate this phenomenon, the effect of Interleukin-6 (IL-6) on iron concentration in the prostate cancer tissues was studied. IL-6 is a multifunctional cytokine that is involved in the regulation of immune reaction, proliferative response, and cellular differentiation. In particular, past studies has implicated that high concentrations of IL-6 induces iron deficiency in the human body. Thus, it is hypothesized that there is a higher level of IL-6 in the worse cases of prostate cancer progression tissues, which in turn causes the iron deficiency expressed in those tissues. In addition, we hope to find a correlation between the level of IL-6 present in prostate cancer tissues and the severity of the prostate cancer progression.

Q26
Differences between Wild Type and Knockout Cyclophilin B in the Mammary Gland Development of Mice in Relation to Breast Cancer

Presenter(s)
Jing Wang, Illinois Mathematics and Science Academy
Nancy Yu, Illinois Mathematics and Science Academy

Advisor(s)
Charles Clevenger, Northwestern University
Y'vonne Feeney, Northwestern University

Breast cancer is a leading cause of death in women. Prolactin (PRL) is a protein that promotes cell growth and differentiation in normal and malignant breast tissues. PRL signals through its receptor, the prolactin receptor (PRLr), which in turn sequentially activates the Jak2 tyrosine kinase and the Stat5 transcription factor. Certain genes that promote cell proliferation contain a GAS sequence (TTCNNNGAA) located at the promoter. Stat5 binds to this sequence, which induces transcription of the target gene. The prolyl isomerase CypB serves as an activator of Stat5 activity in the nucleus, by inducing the release of the Stat5 repressor PIAS3. To test the *in vivo* function of CypB, knockout mice—mice lacking expression of CypB, and wildtype mice—mice positive for the expression of CypB, were examined. Mammary glands 4 and 5 were dissected from these two types of mice and preserved in formalin. These mammary glands were stained with carmine alum. Whole mounts, stained mammary gland slides, were observed under a dissection microscope at 10x, 20x, 40x, and 100x. Digital images were taken with an AxioCam CC1 and the images of the alveolar buds and lactiferous ducts were analyzed. There is strong evidence from this investigation to support that CypB plays a major role in the growth of alveolar buds and lactiferous ducts *in vivo*. These results could lead to new methods of limiting CypB expression and aid in the development of new treatments for breast cancer.

Q27
New Battles Against Complex Infections: Synergy Studies Against Methicillin-Resistant *Staphylococcus aureus*

Presenter(s)
Amy Zhou, Illinois Mathematics and Science Academy

Advisor(s)
Bill Kabat, Childrens Memorial Research Center
Rajeswari Pitchumani, Children's Memorial Research Center

Methicillin-resistant *Staphlococcus aureus* (MRSA) is a common bacterium that has developed increasing resistance to many antibiotics used to combat this organism and has been spreading through both hospitals and communities with a high death rate. The objective of this project was to determine the minimum inhibitory concentration (MIC) for twenty-nine different strains of MRSA with each individual drug and then the changes in the MIC when two antibiotics were combined, thus determining if the two drugs were synergistic, additive, partially synergistic, non-synergistic, or antagonistic. The antibiotics used in combination include rifampin with linezolid, bactrim, and levaquin. Preliminary results demonstrated that the most synergistic combination was rifampin and levaquin, which positively influenced the synergy between the two agents and resulted in reduced MICs for eleven of the strains. For other isolates, there were no synergistic effects and one antagonistic effect. The least synergistic combination was rifampin and bactrim, which reduced MICs in nineteen isolates but showed no synergy in nine strains and antagonism in one isolate. Further results will be used to examine the correlation between the effectiveness of the drug combination and the genetic properties of the MRSA isolates.

R01
Searching for the Role of Chemokines in Neuropathic Pain

Presenter(s)
Audrey Auyeung, Illinois Mathematics and Science Academy
Kathryn Stromdahl, Illinois Mathematics and Science Academy

Advisor(s)
Matt Ripsch, Loyola University
Fletcher White, Loyola University

Chemokines are a family of small cytokines known to attract immune cells to sites of inflammation. Chemokines are also expressed in the nervous system, where they play a crucial role in pathological conditions including neuropathic pain. In particular, the chemokine, monocyte chemoattractant protein-1 (MCP-1), increases the excitability of sensory neurons involved in pain and mice deficient in the chemokine receptor for MCP-1, CCR2, do not exhibit neuropathic pain responses that commonly follow nerve injury. A factor known to increase the production of MCP-1in the nervous system is the pro-inflammatory cytokine, interleukin-1beta (IL-1b). Using a Loyola University-approved rodent model of neuropathic pain, we attempted to determine if IL-1b protein is present in the injured nervous system on post-operative day (POD) 7 using enzyme-linked immunosorbent assay (ELISA). Low protein levels of IL-1b were present in all tissues. However, there were not statistically significant differences between injured and sham controls at POD7. We conclude that levels of IL-1b at POD7 are likely not responsible for injury-induced MCP-1. It is possible that IL-1b regulation of MCP-1 following nerve injury may occur at earlier time points. If these chemokines are found to be responsible then new alternative medications could be made in place of opioids.

R02
The Effect of GT1061 on Open Field Behavior of Mice

Presenter(s)
Aryssa Burton, Illinois Mathematics and Science Academy
Jayanshu Jain, Illinois Mathematics and Science Academy
Michelle Rudolph, Illinois Mathematics and Science Academy

Advisor(s)
Jia Luo, University of Illinois at Chicago
Greg Thatcher, University of Illinois at Chicago

The open field test is used to evaluate locomotor activity, exploratory activity, and anxiety in mice or rats. In this test, a mouse is placed inside a square arena for a period of time, and its activity levels and movements are recorded. The test can help determine a drug's effect on the mouse's anxiety and behavior, depending on its activity in the center of the arena. Other experiments have shown that the transgenic Tg2576 mouse, often used to model the effects of Alzheimer's disease, exhibits an elevated amount of locomotor activity. GT1061, a NO mimetic novel nitrate in clinical trials for treatment of Alzheimer's disease, has been proven to enhance cognition after a deficit was induced by scopolamine, but its effects on locomotor activity have yet to be determined. In this experiment, an ANOVA test will determine if results are significantly different, which would indicate that GT1061 affects behavior. Ideal results would show either no statistically significant difference or a significant decrease in time spent on the edges of the arena, indicating reduced anxiety. The results may help bring GT1061 closer to the market, and they may influence the development of this drug or other possible treatments for Alzheimer's disease.

R03
The Neuropsychology of Adolescent Romance

Presenter(s)
Mamatha Challa, Illinois Mathematics and Science Academy
Lucas Delort, Illinois Mathematics and Science Academy

Advisor(s)
David Evenson, Illinois Mathematics and Science Academy

Teenagers everywhere believe they are in love, but a large part of society believes that teen love is merely infatuation. There seems to be no consensus when it comes to the question this inquiry poses: Can an adolescent feel romantic love on a psychological and neurochemical level in the same way as a fully developed adult? Through a thorough literature review, the psychological and neurological processes of adolescent and adult romantic love were defined, with which we carefully compared adults and adolescents. A survey will be used to gauge the presence of various aspects of love in adults and adolescents at IMSA. With this, we will attempt to confirm our conclusion: The same processes defining adult romantic love are present in adolescents. Both adults and teens can feel a deep, exclusive attachment to another human being for emotional and sexual fulfillment. Teens, especially males, tend to focus more on the physical, showing that their tendencies are slightly more primitive and lustful, but the capacity for love is undoubtedly present. These results show that teens need not fear the long held belief that all they are feeling is a temporary infatuation.

R04
The Effects of Pioglitazone on Glucose Uptake in C6 Glioma Cells

Presenter(s)
Grace Chan, Illinois Mathematics and Science Academy

Advisor(s)
Douglas Feinstein, University of Illinois at Chicago
Anthony Sharp, University of Illinois at Chicago

Insulin-sensitizing drugs known as thiazolidinediones (TZDs) are FDA approved for the treatment of diabetes mellitus type II, but they also can cause cell death in brain tumor cells. My project uses the TZD pioglitazone (Pio) to reveal more about how TZDs kill brain tumor cells. The effect of Pio on glucose uptake in rat C6 glioma cells was determined by measuring glucose concentrations in the culture media at varied initial concentrations of glucose and after different time lengths. At low concentrations of glucose (5 and 10 mgs/dL), Pio increased rate of glucose uptake by 6 %; at higher concentrations (50 and 100 mgs/dL), the increase was 57 %. Lineweaver-Burke plots showed that Pio increased the maximal rate of glucose uptake (V_{max}) and the apparent affinity for glucose (K_m). These data show that Pio increases glucose uptake at high substrate concentrations due to an increase in V_{max}. Since Pio has been shown to kill tumor cells, we hypothesize that when glucose levels are low, Pio further reduces uptake and this contributes to glioma cell death.

R05
Homer Protein Mediation of Abeta-Derived Diffusible Ligand Binding in Alzheimer's Disease

Presenter(s)
Kevin Chen, Illinois Mathematics and Science Academy
Kevin Lam, Illinois Mathematics and Science Academy

Advisor(s)
William Klein, Northwestern University
Pascale Lacor, Northwestern University

The discovery of Abeta-derived diffusible ligands (ADDLs), responsible for the development of Alzheimer's disease, has opened a new field of investigation. Studies have shown that ADDLs bind to the synapse of specific neurons, impairing long-term potentiation and reducing synaptic plasticity, yet the mechanisms behind ADDL binding are not fully understood. Our project investigates the roles of Homer, an intracellular scaffolding protein, and the metabotropic glutamate receptors (mGluRs) it anchors to the plasma membrane in determining regions where ADDLs have an affinity to bind. Through dot blots, Western blots, immunofluorescence tagging, and morphometric analysis, we have attempted to visualize and quantify the relationship between these proteins. Our experiments have shown evidence that the aggregation of mGluRs with Homer may affect memory formation due to Homer's ability to target mGluRs to synapses. Similarly, ADDL binding was found to have a high affinity to sites enriched in Homer proteins and metabotropic glutamate receptors. The clustering of Homer proteins we have observed identifies them as a mediator of a novel mechanism that regulates metabotropic glutamate signaling, and ADDL localization.

R06
Predictors of Reactivity to Stress and Cigarette Usage

Presenter(s)
Paul Chung, Illinois Mathematics and Science Academy
Siddharth Narayanan, Illinois Mathematics and Science Academy

Advisor(s)
Harriet de Wit, University of Chicago

Our two part analysis investigated what factors predict stress response and cigarette usage among young adult, light smokers. To quantify stress, the experimenter took measurements of cortisol, a hormone produced by the adrenal cortex, which is released following physical or psychological stressors. In the first part of this experiment, subjects performed TSST - a stressful standardized public speech task. The experimenter measured participants' cortisol level before the stress and at intervals for ninety minutes after. This gave us the baseline cortisol level and the response to stress of every subject. In the second part of the study, the experimenters followed the smoking habits of the subjects from the time of the stress session to a follow-up interview 6 months after the initial tests. The variable of interest was change in the number of cigarettes smoked per month. Two main analyses were conducted with SPSS. First, males had higher baseline cortisol levels than females, and both ethnicity and marijuana use affected stress response. In the second analyses we found that males increased smoking more than females over the six month follow-up.

R07
Determining Latencies of Auditory Evoked Potentials Using Gamma Frequency Band Analysis

Presenter(s)
Shravanthy Gumidyala, Illinois Mathematics and Science Academy
Jonathon Schwarzbauer, Illinois Mathematics and Science Academy
Weili Zheng, Illinois Mathematics and Science Academy

Advisor(s)
Brent Parris, University of Chicago
Vernon Leo Towle, University of Chicago

Epilepsy is a disorder characterized by chronic and unprompted seizures that originate in various areas of the brain, and affects approximately 2.5 million people in the United States. Seizures that occur in certain areas of the brain, such as the hippocampus, can potentially affect a patient's memory. Our study's purpose was to determine the effect of epilepsy on memory by examining the latency of the event-related potentials relating to the recollection of words from a memory paradigm in patients. To observe these effects, subjects underwent verbal memory tasks; brain activity was recorded while the subjects heard, recognized, and recalled different words. The recorded electroencephalogragh (EEG) and electocorticograph (EcoG) files were filtered through the NeuroScan® EDIT module and were used to create power spectrums. The latencies of the event-related potentials resulting from the tasks in epilepsy patients were then compared with those of non-epilepsy patients. We have observed so far that the peak in the power spectrum for recollection of new words is approximately one second after the subject is presented with the word. If our hypothesis proves to be correct, patients with epilepsy will exhibit a higher latency when asked to recall words than patients without epilepsy. Understanding exactly how much epilepsy affects the memory can be particularly useful for improving surgical proceedings by determining which areas not to resect in patients with epilepsy.

R08
Brain Aging and Soy Consumption

Presenter(s)
Sara Johnson, Illinois Mathematics and Science Academy

Advisor(s)
Jim Victory, Illinois Mathematics and Science Academy

In general, soy is thought to be beneficial to health. Yet some studies indicate that soy products may have unhealthy effects on cognitive function. The objective of this project was to discover the effect of nutrition, specifically the effect of soy products, on cognition. I conducted interviews using the Mini Mental State Exam on thirty-two members of the IMSA faculty and staff. Scores from this test as well as observations about subjects were compiled and compared to see if any trends in scores existed as a result of age, diet, body mass index, or soy consumption. Statistical analysis will be performed on the data collected. Knowing about the risk factors that may prompt cognitive impairment can help us avoid them. This knowledge about the relationship between health and diet can help us make the best lifestyle choices.

R09
The Role of PS-1 in Adult Neurogenesis

Presenter(s)
Anusha Kumar, Illinois Mathematics and Science Academy

Advisor(s)
Orly Lazarov, University of Illinois at Chicago

Adult neurogenesis is an individualistic process that produces new neurons in an already developed system. Two major areas (the subventricular zone and dentate gyrus) of the adult mammalian brain contain neural stem cells (NSCs) that differentiate into new neurons and glia throughout life. Commonly in conjunction with familial Alzheimer's disease, mutations in the multi-pass transmembrane protein, presenilin-1 (PS-1), the catalytic core of the cleavage enzyme, gamma secretase has been implicated in alterations of neurogenesis. This individualized process may therefore be influenced by PS-1's cleavage of numerous cell-fate proteins such as Notch I. Our research on the function of PS-1 has been to determine its possible role in cell-fate decision, differentiation, and proliferation of neural progenitor cells. By ablating PS-1 expression, down regulating gamma-secretase activity, and using different techniques such as Western blots, glial differentiation assays and immunohistochemistry, we can quantify these different processes. Since glial cell and neural cell functioning are intertwined, our research holds many implications for the factors involved in adult neurogenesis.

R10
The Use of Diffusion Tensor Imaging in Detecting Parkinson's Disease

Presenter(s)
Abraham Lee, Illinois Mathematics and Science Academy

Advisor(s)
Daniel Corcos, University of Illinois at Chicago
David Vaillancort, University of Illinois at Chicago

Parkinson's disease (PD) is a central nervous system disorder that hinders or reduces one's motor control skills and speech. In patients with Parkinson's disease, there is an evident loss of dopamine and dopaminergic neurons due to damage done to the ventrolateral and caudal substantia nigra in the brain. Although the cause that triggers the depletion of dopaminergic neurons is still unknown, the use of diffusion tensor imaging (DTI) may provide methods to detecting early signs of PD. In my experiment, fourteen control patients and fourteen patients with early PD underwent both a DTI and MRI scan. Using the images from the scans, I analyzed them through DTI software that allowed me to extract the fractional anisotropy (FA), or directional dependency, values and eigenvalues 0, 1, and 2. Due to time constraints, I only extracted FA values and eigenvalues from the putamen and globus pallidus regions of the basal ganglia. It has been hypothesized that the depletion of dopamine levels directly results in lower FA values for PD patients. The preliminary results from my experiment support this hypothesis so far, but we have yet to analyze the effect of a lack of dopamine on eigenvalues 0, 1, and 2.

R11
The Effect of Exercise on Sleep

Presenter(s)
Vaisak Nair, Illinois Mathematics and Science Academy

Advisor(s)
Kathryn Reid, Northwestern University

The focus of this research is to examine the effects of exercise on improving the sleep of chronic insomniacs over the age of fifty-five years. At this point, there are limited effective treatments for older people with insomnia. If positive, the findings from this study could be used by physicians to improve sleep quality. Data is available for seventeen sedentary adults over the age of fifty-five with insomnia. After completing a screening sleep study, the subjects were randomized to one of two sixteen-week intervention groups: exercise and sleep hygiene education or non-physical activity and sleep hygiene education. After the intervention period, the subjects underwent post-treatment testing for three days. Analysis of the data from the wrist activity-monitoring device worn by the subjects showed that there was no significant difference between the objectively recorded sleep latencies of the exercise and non-physical activity groups (p-value greater than 0.05). But there was a significant difference between the subjective sleep latencies of exercise and non-physical activity (p-value= 0.035), which was analyzed from the baseline and post-treatment questionnaire data. The results from this study suggest that while exercise does not significantly improve objective sleep measures, it does improve how the person feels about their sleep. So, the intervention may have clinical significance for the patient. Further study is required to determine whether these findings hold up in a larger sample.

R12
FALS5 Gene Variants in Amyotrophic Lateral Sclerosis

Presenter(s)
Hassan Qureshi, Illinois Mathematics and Science Academy

Advisor(s)
Kaouther Ajroud, Northwestern University
Faisal Fecto, Northwestern University
Teepu Siddique, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a neuromuscular disease characterized by the loss of upper and lower motor neurons primarily in the spinal cord. Approximately 10 % of ALS cases are familial. Typical expression of ALS is accompanied by the presence of protein aggregates in the cell, which cause a toxic gain of function within the cell. These aggregates may be due to the dysfunction of protein degradation pathways. We selected FALS5 as a candidate gene to sequence in ALS because this gene is involved in mediating protein turnover in cells. In this study, we proposed to amplify and sequence fifty patients with ALS and one hundred individual controls for FALS5 using Beckman Coulter's CEQ 8000 Genetic Analysis system, and to perform immunohistochemistry (IHC) on autopsy specimens from ALS patients to look for protein aggregation. The sequence comparison revealed a single missense mutation in our ALS cohort. This change was absent within the control population. The IHC showed FALS5 aggregates in the ALS spinal cord and not in the control sample. These results show that mutations in the FALS5 gene are present in patients with a familial history of ALS and the protein encoded by this gene aggregates in ALS pathology.

R13
The Effect of Chronic Stress on Interneurons of the Ventral Tegmental Area

Presenter(s)
Nirali Shah, Illinois Mathematics and Science Academy

Advisor(s)
Louis Lucas, Loyola University

Chronic stress is a significant factor correlated with heart disease, eating disorders, anxiety, and depression. It can damage one's emotional equilibrium and physical health, thus impairing one's ability to think and function normally. To manage chronic stress, we must first understand how it affects the body, specifically the brain. This project aimed to determine how chronic stress affects gene expression in the brain by using rat models. The rats were stressed by being immobilized two hours a day for eleven days. They were then sacrificed under anesthesia and their brains were removed for analysis. The specific enzyme observed was Tyrosine hydroxylase (TH), a rate limiting enzyme for the synthesis of the neurotransmitter dopamine (DA), which increases in response to stress. The expression of TH was assessed via in-situ hybridization image analysis of exposed x-ray films of brain tissue sections. It was found that the levels of corticosterone, a stress hormone, increased in the stressed vs. non-stressed controls. This supports the hypothesis that the levels of complementary DNA (cDNA) will be increased in the stressed versus non-stressed controls, indicating that there was a greater amount of brain activity in the stressed vs. non-stressed rats. The results of this study will aid in learning how to manage or prevent stress, as it is a daily part of our lives. Ultimately, this project will better the human condition by opening new doors in coping with stress-related illnesses.

R14
If You Want To Learn, Don't Think, and Don't Blink

Presenter(s)
Milan Udawatta, Illinois Mathematics and Science Academy

Advisor(s)
Deborah Little, University of Illinois at Chicago

The purpose of this study was to quantify and qualify the patterns of brain activation as well as the underlying brain regions which support category learning. To accomplish this goal, twenty-five college-aged adults completed two sessions of functional magnetic resonance imaging (fMRI) while performing a category matching task. This task required subjects to view two patterns of dots and determine whether they belong to the same category. Between the first and second fMRI, subjects completed seven hundred and fifty trials of training during which subjects learned to categorize patterns of dots with feedback. During training, half of the subjects saw the patterns for two hundred milliseconds and the other half for five seconds. This method allowed us to test our hypothesis that increased exposure duration or study time should facilitate learning. The behavioral data from the training sessions disproved our hypothesis and demonstrated that exposure duration was inversely related to learning. The imaging data demonstrated that that short duration subjects exhibited an increase in activation in cortical regions such as those involved in memory and problem solving. This finding that study time interferes with category learning contradicts virtually every other type of learning. This may be due to the ecological requirement that categorization must be rapid, easy, and almost automatic.

R15
An Innovative Model for Measuring Pain Sensitivity in Chronically Injured Rats

Presenter(s)
Shivam Vedak, Illinois Mathematics and Science Academy

Advisor(s)
A. Vania Apkarian, Northwestern University

Although methods are currently available for measuring pain sensitivity in chronically injured rats, they can be considered excessively time consuming, especially the von Frey filament test. In the present study, we introduced the combination of illumination and other aversive conditions on the place preference of rats experiencing neuropathic pain as a possible new means of pain measurement. The place preference was assessed over a fifteen minute period in intervals of five minutes in a chamber that contained a dark section with a 40-grit sandpaper surface and a lighted section with a smooth copy paper surface. The two variables create a conflict of interest in the rat. Being nocturnal animals, they naturally prefer the dark, whereas their injury may cause them to avoid the rough surface. Thus, we intended to correlate the degree of pain sensitivity experienced by rats with the amount of time spent in the lighted and smooth-surfaced portion of the chamber out of the fifteen minutes. The results indicate, however, that the rats' aversion of the light, in accordance with their natural instinct, is too great to incline them to avoid the sandpaper. Further adjustments needed to develop the model include removing the illumination variable and repeating the aforementioned test.

S01
The Validation of Gap Triggers in the CDF Detector

Presenter(s)
Sara Akgul, Illinois Mathematics and Science Academy

Advisor(s)
Ricardo Eusebi, Fermi National Accelerator Laboratory

This investigation studies the data that is collected from the so-called Gap triggers in the CDF detector at Fermilab. Gap Triggers utilize parts of the detector that have not been previously used. This research will provide insight on whether or not the data from the gap triggers would be useful in further scientific investigations. Currently, gap trigger data is being collected, but not utilized. In order to use this data, it must first be validated. One way of validating this data is to show that the production rates of Z->mm (a collision event that involves a Z boson decaying into 2 muons.) using gap triggers and the production rates measured with triggers that use other parts of the detector are the same. Production rate values should be independent of the triggers that they come from. Because there is a very large amount of data, we use a computer, and C to process it. We have made these computations, that show that the production rates of Z->mm are equivalent, regardless the detector portion used for triggering. Based on this, we can conclude that gap trigger outputs valid data, and that it should be used in further studies at CDF.

S02
Reconstruction of FCNC Top-Antitop Decay

Presenter(s)
Amy Allen, Illinois Mathematics and Science Academy

Advisor(s)
Datta Mousumi, Fermi National Accelerator Laboratory

This SIR presents the search for rare flavor changing neutral current (FCNC) production of a photon (γ) and charm quark (c) via top-antitop (ttbar) decay using 2.7 fb-1 of CDF Run II data. The Standard Model predicts the rate of FCNC production to be one event in every 10^14 top events. Events are produced in collisions at √s = 1.96 TeV in the Tevatron. Top events where one top quark decays into a bottom quark (b) and a leptonically decaying W and where the other top decays into a γ and c were analyzed in this investigation by requiring events to contain an identified b-jet, an electron or a muon with high transverse momentum, large missing transverse energy, a high PT photon and a high PT jet. Monte Carlo (MC) events were used to model the FCNC ttbar signal events and evaluate signal efficiency. The background events are estimated using data side bands. Selection cuts are optimized based on signal MC and backgrounds to calculate an upper limit. Extraneous signal for this FCNC decay in the CDF detector may indicate that there is something that we do not understand about the Standard Model and the presence of New Physics.

S03
A Measurement of Dijet Azimuthal Angle Decorrelation Over Several Rapidities

Presenter(s)
Stephanie Brandt, Illinois Mathematics and Science Academy

Advisor(s)
Don Lincoln, Fermi National Accelerator Laboratory

The DØ detector at Fermilab measures jets of particles that are produced in proton-antiproton collisions in the Fermilab Tevatron. The theory describing these sorts of collisions, Quantum ChromoDynamics (QCD), describes data well for jets emitted at a polar angle near 90º, but a measurement of the difference in azimuthal angle $\Delta\varphi$, between jets that are emitted with a polar angles nearing 180º have not been measured. This analysis compared data taken by the DØ experiment to leading order and next-to-leading order QCD calculations of $\Delta\varphi$, over a span of transverse momenta and angles. Jet quality cuts were applied to data to ensure that only good collisions were used in the analysis and cut efficiencies were studied to ensure that data was not reshaped as a result of them. Histograms containing $\Delta\varphi$ distributions were created, and binning was chosen so that the width of each bin is twice the $\Delta\varphi$ measurement resolution. A preliminary correction factor was determined that removed instrumental effects from the final measurement. Data and theoretical predictions appear to be in reasonably good agreement, although the theory over-estimates the number of two-jet events. This agrees with expectations, as QCD approximations are truncated after the first two terms, which causes it underestimate the number of events with two large pT events and additional low pT ones.

S04
Enhancement of Thermoelectric Properties of Lead Telluride by Doping

Presenter(s)
Vladislav Kontsevoi, Illinois Mathematics and Science Academy

Advisor(s)
Arthur Freeman, Northwestern University
Jung-Hwan Song, Northwestern University

Thermoelectric materials are promising for the conversion of solar energy or waste heat into usable electricity. These materials' efficiency is determined by their thermoelectric figure of merit, zT: $zT = TS^2\sigma\kappa$, where S is the Seebeck coefficient (or thermoelectric power), σ and κ are the electrical and thermal conductivities, respectively, and T is the absolute temperature. The figure of merit may be increased by means of doping. We investigated the effects of doping supercells of a promising thermoelectric alloy, PbTe, with Na, Li, In, Ge, and Tl by means of computational modeling. Our approach is based on quantum mechanical first principles calculations using the full-potential linearized augmented plane wave method (FLAPW). We first investigated the effects of computation parameters (k-point mesh, plane-wave cutoff, star-function cutoff, inclusion of spin-orbit coupling) on the convergence of our simulation. We showed that dopant atoms create electronic levels in the semiconductor band gap that can be beneficial for improvement of thermoelectric properties. We explored possible enhancement of the Seebeck coefficient of the alloy for certain anion/cation doping schemes as a result of distortion of the electronic density of states at the Fermi level.

S05
Weak Lensing Mass Estimates of Low Redshift Galaxy Clusters

Presenter(s)
Kelsey Lawhorn, Illinois Mathematics and Science Academy
Liana Nicklaus, Illinois Mathematics and Science Academy
Anthony Yunker, Illinois Mathematics and Science Academy

Advisor(s)
James Annis, Fermi National Accelerator Laboratory

Gravitational lensing is the bending of the trajectory of light by mass. Weak gravitational lensing is detected through a statistical analysis of the background galaxies. Mass estimates from lensing depend only on the mass of the object, unlike other methods. Most weak lensing studies use clusters with redshifts of 0.2 or greater because higher redshift involves a smaller area to survey. The Sloan Digital Sky Survey (SDSS), which surveys a large area, allows us to study lower redshift clusters. Last year we obtained mass estimates using SDSS DR6 data for twenty-two low redshift clusters, seven of which were detections. This year, we found mass estimates for low redshift clusters in the Abell cluster catalog, which contains about two thousand galaxy clusters. The analysis includes calculating the shear caused by each cluster using data from the SDSS DR6, fitting a Navarro-Frenk-White shear profile to the observed shear profile and deriving an estimate of the mass within the virial radius. To analyze this many clusters, we had to automate our weak lensing analysis. From preliminary analyses on one hundred clusters, we found that our reasonably significant measurements were above $2x10^{14}$ solar masses and that large scale structure is a significant source of error in our weak lensing measurements.

S06
Superconducting Radiofrequency Diagnostics

Presenter(s)
Andrew Lee, Illinois Mathematics and Science Academy

Advisor(s)
Aseet Mukherjee, Fermi National Accelerator Laboratory

The manufacture of niobium particle accelerator cavities requires the cavity to be perfectly smooth and free of contamination, lest the defects cause sufficient heating to bring the entire system out of its superconducting state. The repair of any cavity defects requires knowledge of the defect locations. We developed cost-effective systems to efficiently troubleshoot cavities on a large scale, as thousands of cavities have to be tested. Expanding on methods initially explored by other research institutions, we used a combination of custom hardware and software to develop all the components of a troubleshooting system. To date we have developed and tested two types of thermometry systems. After some setbacks with the readout component of the first system, we successfully developed and tested a complete diode thermometry system. Additionally, we have successfully built an X-ray flux detector and a single photon detector which works at cryogenic temperatures. The systems we have developed can be used almost immediately to troubleshoot cavities, but work is still in progress to analyze the data and optimize the systems.

S07
Study of Neutrinos from Active Galactic Nuclei

Presenter(s)
Zhengzheng Liu, Illinois Mathematics and Science Academy

Advisor(s)
Maury Goodman, Argonne National Laboratory

Several experiments have searched for evidence of hypothesized and very high energy neutrinos from energetic galaxies called active galactic nuclei (AGN). When scientists are looking for a new phenomenon, they often do not find any signal and, instead, put forth a "limit" using an appropriate variable. So far, no positive evidence for AGN-induced neutrino events has been presented; so experiments have therefore placed limits on the flux. However, one experiment, called Fréjus, has presented such a limit based on faulty logic. Due to inferences heard during public seminars and read from published papers about two other projects, IceCube and Antarctic Muon and Neutrino Detection Array (AMANDA), it was possible that these two projects have also come about their flux upper limit by using faulty logic. The procedures of AMANDA and IceCube have been compared to Soudan 2's correct method and Fréjus' faulty method to determine the accuracy of their own flux upper limit calculating method. The results have revealed that IceCube and AMANDA have correctly come about their flux upper limit. The outcome of this project will help further advance the study and detection of AGN-induced neutrinos by providing confidence in previously published results.

S08
Observation of Neutrino Disappearance at the MINOS Far Detector

Presenter(s)
Travis Mui, Illinois Mathematics and Science Academy

Advisor(s)
Maury Goodman, Argonne National Laboratory

The MINOS experiment looks for neutrino oscillation events, the changing of a neutrino's mixture of mass and flavor eigenstates, by sending a beam of neutrinos from Fermilab's Main Injector to the Far Detector at the Soudan Mine in Minnesota. At the Far Detector, neutrinos interact with the steel and scintillator strips within the detector and the rock surrounding it. During an interaction, a neutrino can either interact and form the corresponding charged particle or remain as a neutrino. Particles from the interaction create scintillation light which is recorded by photomultiplier tubes. Our research investigates these events by categorizing them based upon computer-generated reconstructions of the events, looking for specific characteristics like the presence of charged particle trails and location within the detector. The scanning has categorized a total of about nine hundred events. Approximately two-hundred thirty of these events were charged current, one-hundred ninety were neutral current, and two hundred were rock muons. The ratio of neutral to charged current events as determined from the data set is compared to an expected ratio which will then determine neutrino disappearance. The final results of this work, along with other previous research, will be used to more accurately measure one of the neutrino oscillation parameters and further our understanding of neutrino oscillation.

S09
The Search for Theta 13

Presenter(s)
Alexander Munoz, Illinois Mathematics and Science Academy

Advisor(s)
Maury Goodman, Argonne National Laboratory
Mayly Sanchez, Argonne National Laboratory

Neutrinos, neutrally charged leptons that pass through the earth hardly ever reacting, come in three flavors made up by a mix of the three neutrino masses. In order to determine the amount of mixing if the masses in the flavors, a trigonometric value is found which represents the ratio between two of the masses. Two of these ratios, $\sin^2(2\theta_{23})$ and $\sin^2(2\theta_{12})$, are already known, but a third is needed if we want to understand the origin of matter and antimatter. Thus by limiting the ratio between ν_1 and ν_3, better known as $\sin^2(2\theta_{13})$, we can determine if the mass hierarchy of the neutrinos is inverted or normal. This is being done by finding the probability value that a muon neutrino oscillates and becomes an electron neutrino in a long baseline experiment. This value will be obtained through the analysis of collision data from the MINOS experiment, a neutrino oscillation experiment. I have worked on visually identifying the charged current electron neutrino interactions in the MINOS Far Detector, and separating them from the background neutral current and charged current muon neutrino interactions. This allowed us to measure the probability of these oscillations occurring and thus limit θ_{13}.

S10
Development of an Algorithm to Differentiate Between Hadronic Jet and Photon Signatures

Presenter(s)
James Pan, Illinois Mathematics and Science Academy

Advisor(s)
Sasha Pranko, Fermi National Accelerator Laboratory

In the Collider Detector at Fermilab, photons and hadronic jets are produced in proton anti-proton collisions. Photons are often used in searches for new physics beyond the Standard Model. However, a jet may imitate the signature of a photon by emitting a $\pi 0$ or $\eta 0$ meson which then decays into two photons, faking a prompt photon signature. Given the large production rates of hadronic jets, fake photons from jets can be a significant source of background for measurements involving photon signatures. This makes it more difficult to search for anomalies in the Standard Model. True and fake photons are expected to have different amounts of additional energy deposited in cones around them (isolation cones). In this inquiry the variables concerning the pattern of energy distribution in isolation cones around photon candidates are investigated and the best algorithm for differentiating between the true and fake photon signatures is being sought. Each photon or fake photon isolation cone also has a complementary cone. We searched for correlations between variables of these complementary cones. Some correlations that we found were in the transverse energy and in the Iso24 values.

S11
The Effect of Surface Processing on Superconducting Radiofrequency Cavities

Presenter(s)
Eric Shinn, Illinois Mathematics and Science Academy

Advisor(s)
Camille Ginsburg, Fermi National Accelerator Laboratory

Superconducting RF cavities used in particle physics research experience quenches due to imperfections on the surface of the superconducting cavity. Although processing techniques have been developed to improve their performance, it is difficult to determine how the processing affects the flaw, due to the small size of the flaws and the macroscopic nature of the performance tests. In order to explore the effects of surface processing, I investigated data concerning the position of the initial quench cell in nine-cell cavities and the performance of the cavities after processing. I analyzed the correlation between the probability of a change in position of the quench cell and the amount of material removed in the processing. The probability that the position of the quench cell would move demonstrated a statistically significant correlation with the amount of material removed in the surface treatment. However, analysis of the relationship between the acceleration gradient in the cavities and the amount of material removed did not produce a statistically significant correlation. These results show that while current surface treatments are indeed affecting the flaws of the cavities their effectiveness is questionable. Further study on cavities should focus on the exact effect of processing techniques on their imperfections.

S12
The Galfitting of LRG 3-817

Presenter(s)
Anderson West, Illinois Mathematics and Science Academy

Advisor(s)
Thomas Diehl, Fermi National Accelerator Laboratory

A gravitational lens occurs when light from a distant object bends toward a nearer object to form a path that intersects with the earth. The lens reveals a galaxy hidden behind the nearer object that we would otherwise not have been able to see. To study these lenses we take the raw data from the telescope and remove the error from the telescope and the sky at the time of collection by subtracting bias images and flat images from the raw data. Galfit was used to create models of objects and fitted a total of sixteen objects in and around the gravitational lens and galaxy LRG_3-817. The three bands were fitted separately and had chi squared values of 1.41 for I-band, 1.29 for G-band and 1.88 for R-band. Currently we are creating a three-dimentionional model of the system, we hope to learn about both the lensing and the lensed objects.

T01
The Effects of Music Therapy on Autism

Presenter(s)
Siana Aspy, Illinois Mathematics and Science Academy
Emerald Fannin, Illinois Mathematics and Science Academy
Samantha McPeak, Illinois Mathematics and Science Academy

Advisor(s)
Paula Altekruse, Illinois Mathematics and Science Academy
MaryBeth McCarthy, Illinois Mathematics and Science Academy

This study observed the effects that music therapy has on autistic children and determined if it successfully improves the symptoms of their condition. Reviewing current literature provided the foundation necessary to understand what changes in behavior indicate improvement. Interviews and surveys were also used to gain professional insight. One such interview with a music therapist at Delnor hospital provided information on how music therapy is applicable in other areas of medicine, as with the treatment of pain. At Giant Steps autism center, three music therapy sessions were observed. The therapists used music to teach the children basic abilities, such as socializing with peers, navigating their surroundings safely, and improving fine motor skills. Each student has individualized goals, depending on their needs, and the therapists track their progress over time. The number of times students correctly responded to verbal commands during each session was recorded. This, along with observation, demonstrates that children think of the therapy as a game, even though they are learning valuable skills that are difficult for autistic children. In combination with previous research, there is sufficient evidence to assert that music therapy can be used as an effective tool to improve the symptoms of autism.

T02
The Physiological Effects of Chewing Gum on Human Heart Rate, Reaction Time, Stress Response, and Memory

Presenter(s)
Jake Ayala, Illinois Mathematics and Science Academy
Andrew Ericson, Illinois Mathematics and Science Academy

Advisor(s)
Todd Parrish, Northwestern University

Chewing gum is commonly used as a relaxant. Many people utilize it during stressful situations. A study of the effects of chewing gum on human physiology is presented in this experiment. To assess the physiological effects of chewing gum, data on heart rate variability, memory test accuracy and reaction time, and skin conductance were collected. The experimental procedure consisted of periods of a letter recognition memory test combined with periods of rest and stress with the intervention of chewing gum. Subjects were attached to a heart rate monitor and galvanic skin response electrodes in order to collect data. It was found that during periods with the chewing gum intervention, reaction time was significantly faster, and it was also found that the change in skin conductance (as it relates to stress) decreased during the intervention of gum. Based on these findings, gum can increase reaction speed and reduce stress.

T03
Are You What You Eat and Do?

Presenter(s)
Stephanie Bernardo, Illinois Mathematics and Science Academy
Gabriela Cardoso, Illinois Mathematics and Science Academy
Salvador Esparza, Illinois Mathematics and Science Academy

Advisor(s)
Deborah McGrath, Illinois Mathematics and Science Academy

This investigation explores the connections between an IMSA student's eating and exercising habits with the depressive moods that they may experience. The Youth Risk Behavior Survey was administered earlier this school year in the fall of 2008 to IMSA seniors and sophomores. It addressed questions on their health habits and depressive moods along with questions pertaining to other topics such as drug abuse. We analyzed data from the questions on health habits and depressive moods from the survey to draw conclusions about how a person's health can correlate to how they feel. Some of the questions we addressed pertained to the types of food the students would eat, how often they would exercise, and the kind of emotional behaviors that they would experience. Along with basic analysis of the responses such as summaries of healthy and non-healthy students, we investigated the trends of the three variables in question. Furthermore, the results of several demographics were compared such as their ethnic background and their gender. Modern day studies show that good health habits lead to better moods. How do IMSA students compare to these trends? From taking a look at this investigation, maybe you'll want to re-evaluate your health habits.

T04
The Effects of Caregiver Input on Narrative Skills in Children with Pre- or Perinatal Brain Injury

Presenter(s)
Gabriella Heller, Illinois Mathematics and Science Academy

Advisor(s)
Ozlem Ece Demir, University of Chicago

Children with pre- or perinatal unilateral brain injury (PL) demonstrate remarkable brain plasticity for early developing language skills (e.g. vocabulary, syntax). However, this early plasticity might not extend to later developing, decontextualized language skills. Decontextualized language refers to language that is removed from the current context such as narrative production. The current study aims to examine whether early parental decontextualized language relates to narrative skills in children with PL. We studied both general language input and decontextualized language input by the primary caregivers in spontaneous interactions with their 30 month-old children. General language input was assessed by the caregivers' number of word types. Decontextualized language input was assessed by the caregivers' number of utterances of pretend play, narrative, book reading, functional definition, and explanation. Children's later narrative production and vocabulary comprehension were assessed at four to six years of age. Results show that caregivers' decontextualized language relates to children's later narrative production and vocabulary comprehension, over and above the overall language input. These findings suggest that caregivers' decontextualized language input might have an influence on children with PL's later narrative skill, which is not only an important predictor of academic success, but also a specific area of difficulty for this group of children.

T05
Defining Beautiful Within Two Cultures

Presenter(s)
Meena Iyer, Illinois Mathematics and Science Academy

Advisor(s)
Genna Bebko
Joan Y. Chiao, Northwestern University

Whether or not we choose to admit it, superficiality is prominent within every civilization throughout the world. Because superficiality exists within all cultures, it can be concluded that beauty and attractiveness are always valuable traits to have. Looking at our own American society, people, specifically women, are taking drastic steps to become physically attractive. Statistics from the American Society for Aesthetic Plastic Surgery indicate that there was a record 11.7 million cosmetic procedures performed in the year 2007 alone; 91% of which were performed on women. But what, exactly, is considered beautiful? What makes women want to undergo expensive (and cumbersome) procedures to be attractive? Precedence indicates that the definition of beauty changes from one culture to the next. This study examines a preference between the South Asian culture and Caucasian-American culture. By altering the level masculinity in a series of faces using FaceGen® software, this study tries to determine if there is a certain stereotype for beauty within each culture or if there is a universal definition of attractive.

T06
The Various Effects of Religion on Perception

Presenter(s)
Ankita Khandai, Illinois Mathematics and Science Academy

Advisor(s)
Donna Jo Bridge, Northwestern University
Joan Y. Chiao, Northwestern University

Religion has been a cornerstone of society since ancient history, and over time it has become engrained in the psyches and cultures of many different peoples. Different religions, however, have various effects on cognitive mechanisms and certain behaviors. For example, many studies have found that various Christian denominations differ greatly in terms of prejudice against members outside of their religious group. While many similar experiments have been conducted with other aspects of perception, they have mostly been limited to comparisons within Christianity. This study uses several online surveys to collect preliminary information that can be used to compare various personality traits, behavioral patterns, and cognitive strategies across representative sample populations of Christians (any denomination), Hindus, Muslims, and Buddhists from the Northwestern University community. Differences in time construal, promotion versus prevention, emotional regulation and intrinsic versus extrinsic religiosity will be measured both across religions and within them. Surveys are currently being distributed and analyzed.

T07
The Social Structure of IMSA

Presenter(s)
Alina Kononov, Illinois Mathematics and Science Academy

Advisor(s)
Susan Styer, Illinois Mathematics and Science Academy

Research examining the nature of adolescent peer groups in average school and neighborhood settings has been done, but IMSA is by no means average in either of these two aspects. In my investigation, I will describe the social structure of the IMSA student body in terms of group types, group structure and interactions within and between groups; determine whether it differs from the average structure found in previous investigations, and identify any differences as well as their causes and implications. Responses to modified survey questions from Sussman and Thorkildsen will be analyzed with the chi-square test for independence to identify group types, their boundaries and how they're enforced; chi-square goodness-of-fit and t-tests to compare my results to the norms observed in previous studies; and descriptive statistics to determine which explanations to any differences in IMSA's social structure are most plausible. If the conclusions derived from my data are inconsistent with those proposed in other investigations, the social groups of IMSA students differ from those of other schools, and if not, the social aspect of our school is the same as that of any other's.

T08
The Effects of Confidence and Self-Esteem on Performance

Presenter(s)
Allison Larrabee, Illinois Mathematics and Science Academy

Advisor(s)
David Evenson, Illinois Mathematics and Science Academy

What would you do if you knew you couldn't fail? What would you do differently if you had the key to success? Through research of past investigations, I've sought to develop a course that teaches young children how to be successful by improving their confidence and self-esteem. Confidence is a feeling that one gets from preparedness and certainty. Our goal is to teach young children methods by which they can raise their own confidence and self-esteem. By introducing and developing these techniques, these children can perform well in challenging situations throughout their lives. I have tested elementary students on the effects of verbal encouragement and discouragement in a testing situation. Results are pending. With these results, I can assess how to effectively teach children and increase their self-esteem. I've begun developing a website to spread my knowledge to a greater population and will continue to reach out to schools, teachers, and parents in order to gain interest and support.

T09
The Effect of Gender-Priming on Empathy

Presenter(s)
Ranait O'Connor, Illinois Mathematics and Science Academy

Advisor(s)
Joan Y. Chiao, Northwestern University
Vani Mathur, Northwestern University

Empathy can be defined as a person's vicarious affective response. A common stereotype is that women are more empathic than men; however, psychologists have not confirmed this conclusion. Some researchers believe that empathy is directly affected by socialization, while others maintain that it is dependent upon genetics. We completed two experiments to examine gender effects on empathy. In the first experiment, participants completed behavioral surveys that measured trait level empathy. No significant difference was found between female and male scores, though these results were limited by small sample size and unequal grouping. Given the results and those from Klein and Hodges, which suggest that women are more empathically accurate than men (when aware they are testing for empathy), a second study was designed to examine the effects of gender-role on empathic response. Eighty eight participants were primed with the same or opposite gender. Empathy was measured through ratings in response to pictures of people in pain, the Empathy Quotient and the Independent Reactivity Index. Participants completed the Bem Sex-Role Inventory for gender-role orientation. We are currently analyzing data for this second study.

T10
Parenting Style and a Child's Perception of Parents

Presenter(s)
Rachel Rasp, Illinois Mathematics and Science Academy

Advisor(s)
Patricia Schacht, North Central College

It is a matter of common knowledge that the way our parents raise us has some kind of effect on us as we grow older. An important question, therefore, is how do we come to view our parents after what is likely the first time we are liberated from them in college? This investigation focused on discovering whether or not there exists a correlation between parenting style as set forth in Diana Baumrind's model and children's positive or negative view of their parents later in life. Students at North Central College were asked to fill out four questionnaires designed to determine both the parenting styles used by parents (authoritarian, authoritative, or permissive, based on Baumrind's research) and whether their feelings towards their parents were positive or negative. Analyses will be conducted through SPSS. While previous research believes that authoritative parenting is the best style of parenting and assumes that there will be a positive correlation between a positive view of parents and this style of parenting. We hypothesize that a positive correlation could also exist between authoritarian and permissive styles of parenting and children's positive views of their parents.

T11
Achievement Goals, Effort, Satisfaction, and Personal Performance in Marathon Running

Presenter(s)
Margaret Tu, Illinois Mathematics and Science Academy

Advisor(s)
Aaron Sackett, University of Chicago
Rebecca White, University of Chicago
George Wu, University of Chicago

Do people with goals exert greater effort and obtain higher performance and satisfaction than those without goals? This study attempts to answer this question by examining the highly goal-oriented activity of marathon running, which offers a compelling and real-world context in which marathoners engage in lengthy preparation, construct and modify performance goals, and develop performance expectations. To understand the motivating forces underlying goals, more than one thousand marathon runners from the seven major marathons in 2007 (Chicago, Honolulu, Marine Corps, New York, Philadelphia, Portland, and Twin Cities) completed a series of online surveys regarding their marathon goals, preparation, satisfaction, and performance, both before and after their participation in the actual marathon. Preliminary results indicate that on average, participants with a time goal in mind not only took a shorter amount of time to run the length of the marathon, but were also more likely to beat their last and even best marathon times. Data is currently being analyzed to determine the correlations between goals and other variables, such as training effort, marathon running experience, and so forth. The results of this study may have large-scale implications in today's society, helping everyday people achieve greater efficacy, satisfaction, and performance in their work. A discussion of the effectiveness of goal-setting may stem from the results of this study.

T12
The Effect of Orion Filters on Visual Acuity During Dark Adaptation

Presenter(s)
Vaishali Umrikar, Illinois Mathematics and Science Academy

Advisor(s)
Thomas Sawyer, North Central College

Spectrum Technologies International developed a filter technology designed to lower the dark adaptation time for the human eye. Dark adaptation is the time taken for vision to adjust when moving from high light levels (photopic) to low light levels (scotopic). The company also claims that the filters allow visual acuity to be maintained during dark adaptation. After already testing for the absolute threshold of the filters, our goal was to check the acuity claim made by the company. To do this we created a program in which the letter "E" or "C" showed up in the middle of a screen, varying in size and orientation. Nineteen participants were asked to respond by moving a joystick in the direction that the letter opened up. We expected that the longer a participant wore the experimental lenses, the quicker and more accurate he or she should have been at identifying what direction the letters opened up. Various applications for the filters include usage while night driving, for firefighters, and in military and law enforcement. Pilot results have not shown the expected acuity benefits of the lenses; however, further analyses are being done to confirm this conclusion.

U01
After Babelfish: The Art and Science of Translation

Presenter(s)
Emmaline Conover, Illinois Mathematics and Science Academy
Katherine Evans, Illinois Mathematics and Science Academy
Troy Nelson, Illinois Mathematics and Science Academy

Advisor(s)
Christopher Colburn, Illinois Mathematics and Science Academy
Paavo Husen, Illinois Mathematics and Science Academy

In todayýs global, multilingual society, published work can be distributed at ever-quickening rates. In order to be understood by a global audience, novels, political speeches, and essays must be translated into multiple languages. This investigation examines these methods, their reliability, and their application to the real world. Through reading, discussion, and analysis of our experimental findings, we hope to gain a new outlook and a greater understanding of the field of translation. An experiment was performed in Spanish 4, French 4/5, and German 4/5 classes, who were provided with a brief passage, in said languages, to translate into English. The findings were analyzed for method and compared with official English translations. This investigation shows the methods of translation of students not familiar with the heavily divided field of translation. When analyzing the translations we looked for patterns in word choice, syntactic structures, and how the students handle cultural references. Students provided an explanation of how they translated the text, and we searched for evidence of the methods used by these untrained translators.

U02
The Unveiling of a New American Perspective: Latino Demographics of the Fifty United States

Presenter(s)
Nicacio Corral, Illinois Mathematics and Science Academy
Alejandro Rojas, Illinois Mathematics and Science Academy
Gustavo Ulloa, Illinois Mathematics and Science Academy

Advisor(s)
Isabel Reyes, United States Hispanic Leadership Institute

Currently, the United States is going through one of the most difficult times since the Great Depression. In 2008, America was given the opportunity to elect their next leader who would have to identify the needs of the people in order to take action and improve the nation. Our study specifically focused on the research and creation of Latino demographic profiles for the fifty states of America. In doing so, we were able to discover trends in our data that depicted significant issues addressed by, now President, Barack Obama. Nevertheless, our data ranged far beyond just a couple of variables and eventually allowed us to see the little things that cause the bigger issues. For instance, voter registration for the Latino population increased immensely from the 2004 presidential elections to the 2008 presidential elections. The rate of increase was higher than that of any other race in the United States. This fact does not only speak of the importance the Latino population deserves but rather about the specific issues public officials must consider in order to understand their political view. Therefore, in an attempt to identify and address these issues, we looked at variables such as health care, education, economic status, voting age population, among many others in our profiles.

U03
An Independent Approach to Health Care: Analysis of the Necessity and Methodology of Comparative Effectiveness

Presenter(s)
Kevin Crews, Illinois Mathematics and Science Academy
Jimmy Liu, Illinois Mathematics and Science Academy

Advisor(s)
Mary Carter, Blue Cross and Blue Shield Association
Douglas Saunders, Blue Cross and Blue Shield Association
Scott Serota, Blue Cross and Blue Shield Association

The health care industry now accounts for 16.5% of America's Gross Domestic Product, which has made the industry a national priority. An independent approach to and analysis of the industry has revealed Comparative Effectiveness to be a plausible proposal to address the increasing costs and decreasing quality of care. After conducting a review of literature, we synthesized five key assertions that support the development and implementation of an Independent Comparative Effectiveness Institute. The Institute is envisioned as a consortium of institutions, both public and private, that would test the effectiveness of treatment and imaging techniques, medicines, and diagnostic procedures and then publish the results of the studies for both patients and physicians to use in making treatment decisions. This system would increase the value of the health care dollar in America by eliminating wasteful spending and by increasing the quality of care, which would result in fewer recurring issues. As our country is looking for improvements to the health care system, it is important to consider Comparative Effectiveness because of its multi-stakeholder structure that facilitates cooperation and compromise and leaves no single component of the industry to absorb all of the changes. Ultimately, Comparative Effectiveness will decrease the cost of healthcare and increase the quality.

U04
What's in a Name? Investigating the Relationship between Given Names and Physical Attractiveness

Presenter(s)
Robert Dawson, Illinois Mathematics and Science Academy

Advisor(s)
Dennis Czerny, Illinois Mathematics and Science Academy

When you hear someone's name in conversation, without any other details, do you automatically generate a mental picture of them? You most likely do. Does the name you hear change the image you make? Certain names may sound older to you, or like they belong to a person of a certain ethnicity. Tests on these types of effects have been performed in the past, to see whether people's views of attractiveness were affected by names, and even to see if children felt certain names were popular; both of those surveys found a significant relationship. However, other studies have found the effect insignificant. In my investigation, I sought to determine whether certain names are more frequently paired with people who are more attractive, within a certain population. To do so, I compiled a survey with male and female faces, and names of each gender. I asked participants to rate the faces in order of attractiveness, as well as to match the names with the faces they thought fit the name. This data was collected, and then analyzed to see if there was a significant relationship between the name assigned to a face and attractiveness.

U05
A Search for the Importance of Ethics

Presenter(s)
Robert Delaney, Illinois Mathematics and Science Academy

Advisor(s)
Dennis Czerny, Illinois Mathematics and Science Academy

This investigation examined the necessity of finding a standardized ethical norm in today's global society. The question of what proper ethics are has persisted for millennia, and debate still rages over who is correct. In my study, the goal is to take the focus off of what ethical system to use, and instead focus on the basic necessity of having one universal ethical system. This study began in the Hellenistic period of Greece where scholars first became concerned with universal ethics in the form of cultural relativism. After skipping a few hundred years, the theories of Grotius and his comments on the importance of international law were then examined, along with the ideas of his contemporaries. The study continues, to finally end in today's modern world where the loss of traditional values has lead our world and our nation into what has been deemed, by Dr. Len Marrella, a moral meltdown. After showing the importance of a common ethical system, the necessity to teach this system is addressed. With research and writings from the twentieth and twenty-first centuries, the significance of teaching ethics in schools is addressed, along with a suggested method for doing so. The conclusion found: if we want to improve the condition of our global society, we must improve and standardize our system of ethics first.

U06
Is There Correlation Between Health-Risk Behaviors?

Presenter(s)
Yaseen Jamal, Illinois Mathematics and Science Academy
Jiabo Zheng, Illinois Mathematics and Science Academy

Advisor(s)
Gene McFadden, Northwestern University
Bonnie Spring, Northwestern University

Lifestyle risk behaviors, such as a high saturated fat diet or low physical activity, are the main causes of obesity and other lifestyle-associated diseases. This investigation examined the correlations between these risk behaviors and looked for concurrency. Four specific risk behaviors were identified (high saturated fat intake, low physical activity, low fruit/vegetable intake, and high sedentary behavior) as the most common factors of lifestyle-related diseases. Patients with a history of unhealthy behaviors were selected for data collection and each patient was videotaped for eight hours in a common household setup. Data was obtained by recording all concurrent behaviors that each patient performed throughout their laboratory time. Statistical evaluation of the video data revealed conclusive results about the correlations between specific risk behaviors. More than fifty-percent of the concurrent behaviors showed a link between sedentary activity and saturated fat intake. This shows that there was a significant correlation between engaging in sedentary activity and consumption of foods high in saturated fat. In context, it is apparent that a highly sedentary lifestyle in many Americans is often times paired with a high saturated fat intake, and consequently this correlation may increase the chances of numerous life-style related diseases or obesity.

U07
A Comparison Between John F. Kennedy and Barack Obama

Presenter(s)
Jade Martin, Illinois Mathematics and Science Academy
Youlia Racheva, Illinois Mathematics and Science Academy

Advisor(s)
Jim Victory, Illinois Mathematics and Science Academy

This investigation discusses the similarities and differences between John Fitzgerald Kennedy and Barrack Obama. We compared and contrasted the historical and social environments of each era and how they affected the issues the two candidates emphasized. Throughout the course of our research, we focused on several components of Mr. Kennedy's and Mr. Obama's lives and campaigns. We noted the similarities and differences in the way they grew up and their aspirations in adulthood. We took into consideration the obstacles both men overcame throughout their campaigns. These include religious and racial differences, as well as family backgrounds. Our main interest was comparing Mr. Kennedy's and Mr. Obama's presidential platforms. We analyzed how the candidates' marketing techniques shaped the demographics of their supporters. We also assessed the influence women and young adults (18-24 years-old) had on the presidential races. Our project discusses press coverage and approval ratings during the respective presidential races. From our investigation we concluded that John F. Kennedy and Barrack Hussein Obama are similar in that both had comparable struggles to overcome, were largely defended by the mainstream media, and received support from similar demographic groups. However, the two differed in the issues they emphasized, in that Mr. Kennedy focused on the Cold War and Mr. Obama on domestic issues.

U08
Addressing the Obstacles that Prevent Nongovernmental Organizations from Spreading Girls' Education to Developing Countries

Presenter(s)
Laura Thompson, Illinois Mathematics and Science Academy

Advisor(s)
Grace Glass, Illinois Mathematics and Science Academy
David Radcliff, New Community Project

Countries with gender equality tend to have lower poverty rates, meaning developing nations are often lacking in resources to enable the spread of education to girls. In the past thirty years, a large majority of the responsibility has fallen into the hands of non-governmental organizations. After the fall of the Berlin Wall and the collapse of the Soviet Union, the role of nongovernmental organizations (NGO) was redefined. Suddenly, NGOs were recognized as a legitimate force capable of bringing permanent change. These organizations are now attempting to bring about a sustainable solution to some of the greatest problems facing the world today. However, many complications have arisen. These complications range from specific socioeconomic deprivations to questions rising from the clash of contradictory cultures. The question the Western world now faces is: Does the necessity to preserve all cultures take precedence over the insurance of human rights for all? Before girls can readily receive education and before these developing nations can reap the benefits, this question, among others, needs to be addressed.

V01
Technical Feasibility of a Novel Method for Station Keeping

Presenter(s)
Eric Lin, Illinois Mathematics and Science Academy
Nathaniel Simpson, Illinois Mathematics and Science Academy

Advisor(s)
Peter Schubert, Packer Engineering

To maintain their orbit in space, current satellites rely on hazardous and limited fuel stores as a means of propulsion. In response to this issue, we have performed a technical feasibility study on a novel method of propellant-less station keeping that utilizes laser ablation of slag targets. Lasers mounted on the body of a satellite will fire at targets mounted on the periphery and by Newton's Third Law the impacts will result in a torque that will be able to move the satellite with six degrees of freedom. This study is part of and investigates some issues from a larger project on lunar in situ resource utilization methods already underway, such as the feasibility of using high temperature refractory slag waste from lunar solar cell factories as ablation targets and possible methods of transporting the slag targets and solar cells from the moon to Earth's orbit. We then applied our findings to the concept of space solar power satellite arrays, researched the potential synergy between our propellant-less station keeping method and space solar power, and concluded that this method would be more than sufficient to orient a satellite for its entire operational lifetime.

V02
The Formation of Supermassive Black Holes

Presenter(s)
Sapna Patel, Illinois Mathematics and Science Academy

Advisor(s)
Don York, University of Chicago

For years, the idea of giant black holes seemed more science fictional than something relevant to the real world. Known as the most destructive force in the universe, supermassive black holes (SMBH) did not easily fit into the highly ordered view of the universe. However, astronomers now know that millions of SMBHs are lurking within the universe. The question puzzling astronomers now is how SMBHs form. One possible theory involves black holes of stellar mass, formed from supernovae, merging to form a SMBH. Recently, unusual objects, known as peas, have been discovered which may contain such black holes and also be associated with star formation. This can be confirmed by observing the emission spectra of the peas. Certain emission lines, such as those from hydrogen and oxygen, cannot have been produced unless electrons were moved from hydrogen and oxygen atoms. This can only occur by ultraviolent photons hitting these atoms. There are only a couple sources of UV photons including radiation from hot, young stars and radiation from black hole accretion of gas. The spectra of peas are being searched to prove that stellar mass black holes are present in star forming regions, in high enough numbers to eventually form SMBHs.

2007-2008 Student Accomplishments

The below accomplishments are a summary from the 2007-08 academic year.

Megan Abel: An Epicardial Analysis in the Late Gestational Heart
Advisor: Dr. Robert Dettman, Northwestern University Feinburg School of Medicine
3rd International Students' Science Fair (ISSF) 2007

Dimple Adatia: The Role of Histology in Response to Chemotherapy and Impact of Radiation on Outcome in Pediatric and Adolescent Hodgkin's Lymphoma
Advisor: Dr. James Nachman, University of Chicago
Illinois Junior Academy of Sciences state finalist (gold)

Perry Bradford: Comparison of DNA in Large Breed Bichons With and Without Hip Dysplasia
Advisor: Dr. Susan Styer, Illinois Mathematics and Science Academy
Academic, Cultural, Technological and Scientific Olympics (ACT-SO) Gold Medal Winner and Silver Medal in biology at the national competition

Steven Cai: Studies of the Structures of the Channeled Si and Si/Ge Stressors in a 30-nm Field-Effect Transistor Using Synchrotron X-Ray Diffraction Data System Modeling
Advisor: Dr. Jin Wang, Argonne National Laboratory
Siemens Competition semi-finalist, Intel Science Talent Search semi-finalist

Hyunjii (Justina) Cho: The Detection of Differences Between Normal and Cancerous Stem Cells Through Analysis of Morphology, Gene Expression, And Effects of Dichloracetate
Advisors: Dr. Morris Kletzel and Mrs. Marie Olszewski, Children's Memorial Hospital
Illinois Junior Academy of Sciences state finalist (gold), Best in Category Senior Division for Microbiology, Special Award First Place from the Anti-Vivisection Society, for Humane Research

Lindsey Choi: Targeted Fluconazole Prophylasis for the Prevention of Systematic Candidemia in Extremely Low Birth Weight Infants
Advisors: Dr. Brett Galley and Dr. Jonathan Muraskas, Loyola University
Japan RITS

Yangbo Du: Promoting Bio-Ethanol in the United States by Incorporating Lessons from Brazil's National Alcohol Program
Advisor: Dr. Joshua Linn, University of Illinois and Dr. R. Stephen Berry, University of Chicago
Published in: *National Consortium for Specialized Secondary Schools of Mathematics, Science and Technology Journal. Fall 2007. 13(1): 12-17.*

Zexi J. Fang: Hydrogen Sensors Based on Ultra-thin Palladium Nanobead Arrays on Porous Anodic Aluminum Oxide (AAO) Substrates
Advisor: Dr. Zhili Xiao, Argonne National Laboratory
Intel Science Talent Search semi-finalist

Ray Gu: Sewage Off-Gas-Driven Fuel Cells to Stimulate Rural Electrification
Advisor: Herek Clack, Illinois Institute of Technology
EPA P3 Sustainability Expo April 20-22, 2008 in Washington, DC

Frances Mei Hardin: Weak Lensing Mass Estimates of Low Redshift Clusters of Galaxies
Advisors: Dr. James Annis and Dr. Albert Stebbins, Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences state finalist (gold) and Best in Category Senior Division for Astronomy

Forrest Iandola: Calculating the Accuracy of the Beam Position Monitors in a Fermilab Electron Accelerator
Advisors: Dr. Michael Syphers and Dr. Raymond Filler III, Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences state finalist (gold)

Elizabeth Ikejimba: Microsatellite loci for two East African tree species, *Leptonychia usambarensis* (Sterculiaceae) and *Sorindeia madagascariensis* (Anacardiaceae)
By: Dr. N.J. Cordeiro, Dr. K.A. Feldheim, Ms. E. Ikejimba and Dr H.J. Ndangalasi, Molecular Ecology Resources (in press); research award recipient: The Council for Africa, The Field Museum for "Genetic studies and training of a high school student in The Field Museum's Pritzker Molecular Lab"

Sushma Kola: Overexpression of Aquaporin-1 in Non-Small Cell Lung Cancer
Advisor: Dr. Anjana V. Yeldandi, Northwestern University Feinberg School of Medicine
Illinois Junior Academy of Sciences state finalist (gold), Best in Category Senior Division for Health Science, Special Award Third Place from the Anti-Vivisection Society, for Humane Research; 2008 sanofi-aventis International BioGENEius Challenge: Illinois State finalist, Midwest Region finalist, and International Competition competitor; Intel International Science and Engineering Fair: fourth place in the Cellular and Molecular Biology category and third place special award from the National Anti-Vivisection Society.

Kelsey Lawhorn: Weak Lensing Mass Estimates of Low Redshift Clusters of Galaxies
Advisors: Dr. James Annis and Dr. Albert Stebbins, Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences state finalist (gold) and Best in Category Senior Division for Astronomy

Kristen Lee: The Role of Protein Kinase C in the Degradation of the G-Protein Coupled Receptor CXCR4
Advisor: Dr. Adriano Marchese, Loyola University
Illinois Junior Academy of Sciences Competitor and IJAS Region V special award recipient from the Society for In Vitro Biology

Jimmy Liu: The Detection of Differences Between Normal and Cancerous Stem Cells Through Analysis of Morphology, Gene Expression, and Effects of Dichloroacetate
Advisors: Dr. Morris Kletzel and Mrs. Marie Olszewski, Children's Memorial Hospital
Illinois Junior Academy of Sciences state finalist (gold), Best in Category Senior Division for Microbiology, Special Award First Place from the Anti-Vivisection Society, for Humane Research

Jonathan Loucks: An Analysis of Illinois Public Schools: The Effects of Different Socioeconomic and Environmental Factors on a School's Ability to Meet or Exceed State Standards
Advisor: Mr. Joe Traina, Illinois Mathematics and Science Academy
Illinois Junior Academy of Sciences state finalist (gold) and Best in Category Senior Division for Behavioral Science

Sylwia Matlosz: Gender Based Persecution as a Ground for Asylum: Establishing a Social Group
Advisor: Beatriz Sandovol; Hughes, Socol, Piers, Resnick, Dym Ltd.
Presentation: Annual Social Justice Student Exposition, May 23, 2008 at the University of Illinois at Chicago

Anita Mehta: Exploring the Efficiency of the MINOS Experiment in the Far Detector
Advisor: Dr. Niki Saoulidou, Fermi National Accelerator Laboratory
Japan RITS

Vineet Mohanty: Evaluation of Ultrasensitive p24 Antigen Assay as an Alternative to Standard Viral Load and Antigen Assays in Diagnosis and Patient Treatment Monitoring
Advisor: Mr. Bill Kabat, Children's Memorial Hospital
3rd International Students' Science Fair (ISSF) 2007: Second Honorary Mention (5th) in Oral Presentation in Biology

Jagannath (Sam) Nayak: Magnetic Nanostructures for Biomedicine
Advisor: Dr. Vinayak Dravid, Northwestern University McCormick School of Engineering
Siemens Competition semi-finalist, Intel Science Talent Search semi-finalist

Birce Onal: Identification of a Gene Responsible for Membrane Resistance in *Escherichia coli*
Advisor: Dr. Eric Vimr, University of Illinois at Urbana/Champaign
Siemens Competition semi-finalist

Karan P. Patel: Angiogenic Inhibitors and Inhibitors of Histone Deacetylases - A New Way to Block Tumor Growth and Angiogenesis?
Advisor: Dr. Olga Volpert, Northwestern University
3rd International Students' Science Fair (ISSF) 2007: second place oral presentation in biology, third place (overall) in poster presentation

Sophia Pilipchuk: The Effect of Epigallocatechin-3-Gallate (EGCG), a Green Tea Polyphenol, on HeLa Cell Viability and Proliferation
Advisor: Dr. Don Dosch, Illinois Mathematics and Science Academy
Junior Sciences and Humanities Symposium

Ashima Sarup: Gender Based Persecution as a Ground for Asylum: Establishing a Social Group
Advisor: Beatriz Sandovol; Hughes, Socol, Piers, Resnick, Dym Ltd.
Annual Social Justice Student Exposition, May 23, 2008 at the University of Illinois at Chicago

Shailee Shah: Dietary Implementation of Flax Seed/Omega-3 Fatty Acids in Ovarian Cancer in the *Gallus Domesticus* Laying Hen
Advisor: Dr. Dale Buchanan Hales, University of Illinois at Chicago
Illinois Junior Academy of Sciences state finalist (gold)

Jianning (Jenny) Shao: A Novel Nonlinear Secret Encryption Scheme Generates Escalating Entropy
Advisor: Dr. Bin Shao
Junior Sciences and Humanities Symposium: regional finalist; Illinois Junior Academy of Sciences state finalist (gold), and Best in Category Senior Division for Computer Science; IJAS Region V special award recipient from the Intel Excellence in Computer Science Award

Sarah Shareef: The Response of Oligodendrocytes to Normal Appearing White Matter from Multiple Sclerosis and Control Patients-A Study of the Early Pathology of Multiple Sclerosis
Advisor: Dr. Sara Becker-Catania, Edwards Hines VA Hospital
Siemens Competition semi-finalist, Junior Sciences and Humanities Symposium: regional finalist

Eric Shyu: On a Number-Hiding Game
Advisor: Dr. Mark Fischler, Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences Competitor, IJAS Region V special award recipient: Mu Alpha Theta Award

Sonny Song: The Analysis and Implementation of Live Cell Imaging in the Study of Interactions Between LMP4 and Actin Filament
Advisor: Dr. Teng-Leong Chew, Northwestern University Feinberg School of Medicine
Japan RITS

Anisha Vyas: Using Spectral Absorption Information to Identify Tumors
Advisor: Dr. Xu Li, Northwestern University
Illinois Junior Academy of Sciences state finalist (silver), IJAS Region V special award recipient: Yale Science and Engineering Award, sanofi-aventis International BioGENEius Challenge: Illinois State finalist

Evelyn Wang: A Test of the Hypothesis That Transposon Exclusion Zones (TEZs) in Mammalian Genomes are Associated with Haplo-insufficient Genes
Advisor: Dr. Patrick Venta, Michigan State University
Siemens Competition semi-finalist, Junior Sciences and Humanities Symposium: second place in regional competition, advancing to national competition

Anthony Yunker: Weak Lensing Mass Estimates of Low Redshift Clusters of Galaxies
Advisor: Dr. James Annis, Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences state finalist (gold) and Best in Category Senior Division for Astronomy

Emily Zhao: Correlation Mapping: An fMRI Analysis of the Neural Response to Visual Stimuli
Advisor: Johannes Haushofer, Harvard University
Intel Science Talent Search semi-finalist, Junior Sciences and Humanities Symposium

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* Presentation has a double time block scheduled
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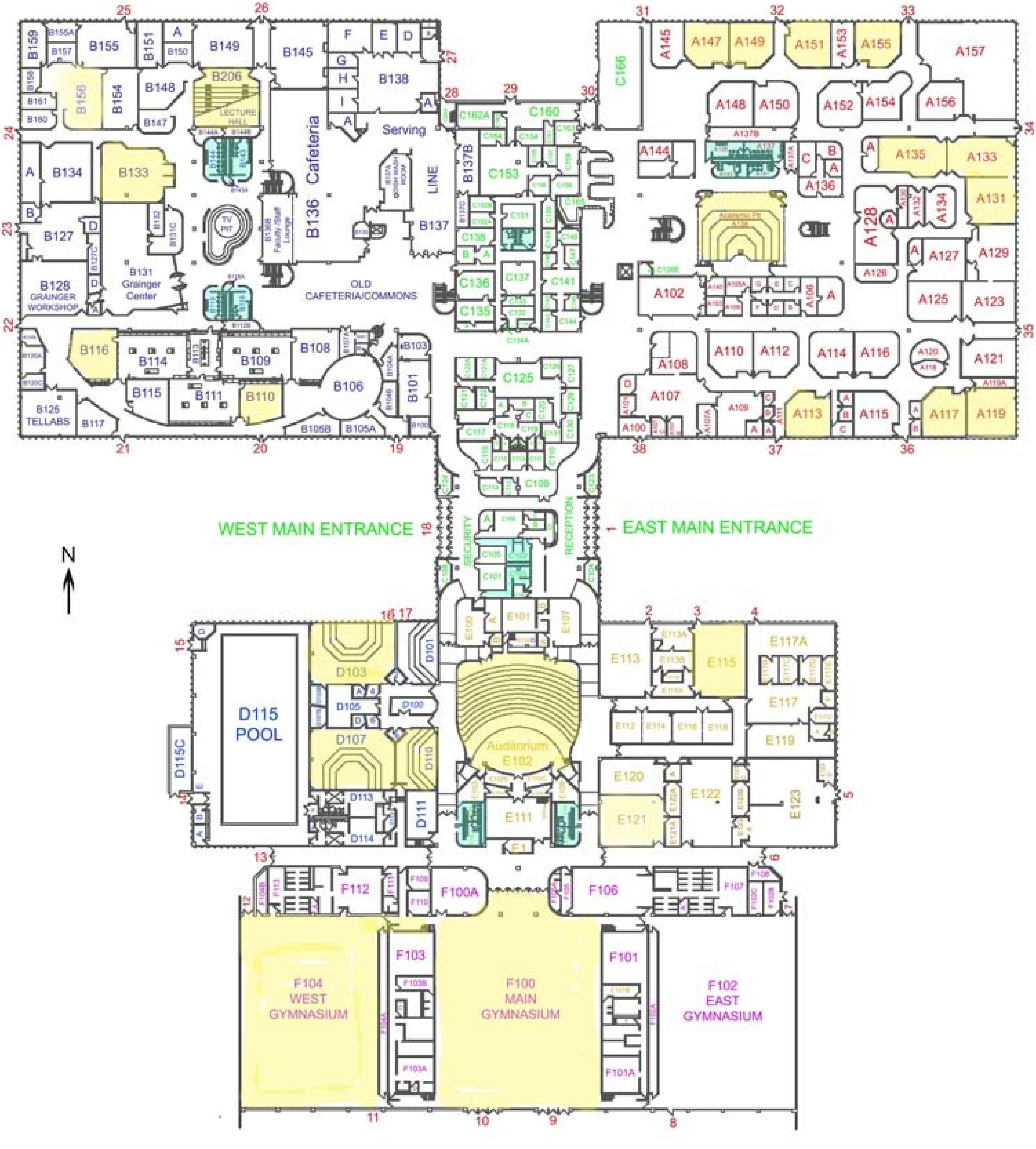
WEST MAIN ENTRANCE
EAST MAIN ENTRANCE
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SECURITY
RECEPTION
B136 Cafeteria
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LECTURE HALL
B206
TV PIT
B131 Grainger Center
B128 GRAINGER WORKSHOP
B125 TELLABS
B159
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B151
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B105B
B105A
C166
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C137B
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A126
A106
D115 POOL
D115C
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D114
E100
E101
E107
Auditorium E102
E111
E113
E115
E117A
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E120
E121
E122
E123
F112
F100A
F106
F107
F103
F101
F104 WEST GYMNASIUM
F100 MAIN GYMNASIUM
F102 EAST GYMNASIUM
F103A
F101A
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REST ROOMS