IMSAloquium

STUDENT INVESTIGATION SHOWCASE

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April 2012

Dear IMSA Friends:

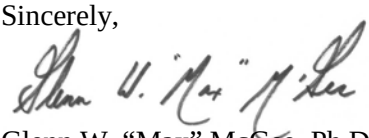
This year, the Illinois Mathematics and Science Academy® (IMSA) is celebrating its twenty-fifth anniversary; encouraging our students to go "Beyond Knowledge" as we strive "to ignite and nurture creative, ethical, scientific minds that advance the human condition." The Student Inquiry and Research (SIR) Program exemplifies what "beyond knowledge" means. Through SIR and its partnerships, IMSA students engage in rich opportunities to pursue compelling questions of interest, conduct investigations, engage with extraordinary advisors, communicate findings, and ultimately impact society. This abstract book reflects our students' infinite potential for exploring their unique passions, pursuing new interests, and both asking and answering profound questions. Their research experiences develop the habits of mind in thinking and learning that prepare them for careers that may well not yet exist.

Through SIR, IMSA provides a mechanism that engages students in personalized learning to pursue solutions to problems and issues that challenge our global community. Partnerships with distinguished professionals at colleges and universities, research institutions, businesses, and museums allow our students to gain experience in real-world problem solving, collaboration, and scholarship. The ability to work with professionals is life-changing for our students. Evidence of our students' excellence, in all fields, is found within this proceedings book of our twenty-fourth annual IMSAloquium. Many of our students have already, in high school, published and presented at local, national, and international venues. These students exemplify a tradition of excellence. We set high expectations for our students, and 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.

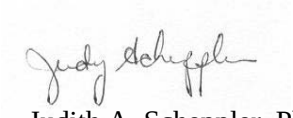
In just twenty-five years, IMSA has become one of the premier institutions of its kind in our state, our nation, and the world. As such, we have a responsibility to share our expertise with others. Toward this end, we are aggressively delivering services around the state for teachers and students to assist with developing the "next generation" of talent and leadership in science, technology, engineering, and mathematics. We host educators from as close as neighboring districts and as far as Australia and China in both formal and informal conversations to advance teaching and learning for the State of Illinois. We look forward to our next twenty-five years going "Beyond Knowledge."

The strength of our Student Inquiry and Research program lies with collaborative partnerships, and we are deeply appreciative of our students' advisors and their institutions. We thank all the experts and leaders who join us in boldly applying innovative ways to nurture learners' talents and guide them as they reach extraordinary levels of achievement. When working together as a collective community, we have the vision, resources, and influence to shape education in ways that truly enable students to "learn how to learn" so they can confront present and future challenges that impact our local and global communities and most certainly "advance the human condition."

Sincerely,



Glenn W. "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-fourth Annual IMSAloquium
April 25, 2012

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IMSAloquium cover designer is Chris Reader, IMSA staff member.
The cover was inspired by *Science* (August 12, 2011).

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 92.5% of the class of 2012. 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)

- *The Astrophysical Journal Letters*
- *Information Processing Letters*
- *Journal of Bone and Mineral Research*
- *Journal of Comparative Neurology*
- *Journal of Experimental Secondary Science*
- *Journal of Physical Chemistry*
- *Nature*

"**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).

"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).

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.

Presentations (partial list)

- American Physical Society
- American Society of Cell Biology
- American Society of Microbiology
- 10th Annual Dabrowski Conference
- Junior Academy of Science at AAAS
- Eighth Annual Lewis Landsberg Research Day at Northwestern University
- NCSSSMST Student Research Symposium
- University of Illinois at Chicago College of Dentistry Clinic and Research Day

Competitions (partial list)

- iBioGENEius
- Intel International Science and Engineering Fair
  - 18 finalists since 2008
  - 1 fourth place (individual) category award, 1 (team) third place category award
- Intel Science Talent Search
  - 41 semi-finalists and 11 finalists since 1989
  - Finalists have placed first (1993), fifth (1998), third (1999), and second and sixth (2005)
- Junior Science and Humanities Symposium
- Neuroscience Research Prize
- Siemens Westinghouse (established 1998-99)
  - 49 regional semi-finalists resulting in 6 regional finalists and 1 national semi-finalist

2011-2012 Student Recognition

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

Hosted By
Dr. Glenn "Max" McGee, IMSA President

Soham Ali: Analysis of Colorectal Cancer Risk Factors in E-Cadherin in Diverse Patient Populations
Advisors: Nathan Ellis, Shilpa Ravella; University of Illinois at Chicago
Presented at the International Student Science Fair, April 30 – May 4, 2012 in Winnipeg, Manitoba, Canada

Courtney Amegashie: Concentration Effect of Chemically-Induced Hypoxia on the Metastasis of High Nitric Oxide Adapted and Non-Adapted Cancer Cells
Advisor: James Radosevich; University of Illinois at Chicago
Presented at the University of Illinois at Chicago College of Dentistry Clinic and Research Day, March 8, 2012 in Chicago, Illinois; DuPage County ACT-SO (Afro-Academic, Cultural, Technological and Scientific Olympics) gold medal winner in biochemistry[4]

Courtney Amegashie: The Comparison of Motility in Parent Versus High Nitric Oxide Adapted Cells
Advisor: James Radosevich; University of Illinois at Chicago
DuPage County ACT-SO (Afro-Academic, Cultural, Technological and Scientific Olympics) Competition gold medal winner in biology[3]

Wendy Bindeman: The Expression of MDS1 and EVI1 Complex Locus in Seven Cancer Cell Lines
Advisor: Don Dosch, Illinois Mathematics and Science Academy
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Yiyun Cao: Regulation and Role of Regulator of G-protein Signaling-1 in Celiac Disease Pathogenesis
Advisors: Bana Jabri, Cezary Ciszewski; University of Chicago
Siemens Competition Regional Semi-Finalist; Intel Science Talent Search semi-finalist; Illinois Junior Academy of Sciences Project Exposition Finalist[1]; Intel International Science and Engineering Fair finalist[2]; Chicago Region Junior Science and Humanities Symposium Finalist: Chicago Region third place winner

Henry Deng: Networks of Ultrasmall Pd/Cr Nanowires as High Performance Hydrogen Sensors
Advisors: Zhi-Li Xaio, Hsien-Hau Wang, and Michael Latimer; Argonne National Laboratory
*Published in ACS Nano, **2011**, 5 (9), pp 7443–7452; Publication Date (Web): August 22, 2011 (Article)*
***DOI:** 10.1021/nn2023717 (Xiao-Qiao Zeng, Yong-Lei Wang, **Henry Deng**, Michael L. Latimer, Zhi-Li Xiao, John Pearson, Tao Xu, Hsien-Hau Wang, Ulrich Welp, George W. Crabtree, and Wai-Kwong Kwok)*
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Sruthi Doniparthi: CDDO Inhibits TGF-Beta-Induced EMT in A549 Lung Epithelial Cells via the P13K/AKT Pathway
Advisors: Jun Wei and John Varga; Northwestern University
Siemens Competition Regional Semi-Finalist; Chicago Region Junior Science and Humanities Symposium Finalist

Johnny Duan: Runx2 Contributes to Murine *Col10a1* Gene Regulation Through Direct Interaction with Its Cis-Enhancer
Advisor: Qiping Zheng; Rush University Medical Center
*Published in Journal of Bone and Mineral Research (2011). 26 (12) pp 2899-2910. (Feifei Li, Yaojuan Lu, Ming Ding, Dobrawa Napierala, Sam Abbassi, Yuqing Chen, **Xiangyun Duan**, Siying Wang, Brendan Lee, and Qiping Zheng)*

Nicholas Fung: The Effect of Poly I:C on Transforming Growth Factor-β (TGFβ)-Induced Fibrotic Responses
Advisors: Feng Fang and John Varga; Northwestern University
*Co-presented at the Eighth Annual Lewis Landsberg Research Day at Northwestern University, April 5, 2012 in Chicago, Illinois (Feng Fang, **Nicholas Fung,** John Varga)*

Annie Guo: Institutional Review Board Unanticipated Problems Involving Risks to Subjects or Others Reports Lack Sufficient Information to Determine Causality
Advisors: Steven Belknap, Debra Tice Gobson, Dennis West; Northwestern University
*Co-author of poster presented at the Eighth Annual Lewis Landsberg Research Day at Northwestern University, April 5, 2012 in Chicago, Illinois (Mai, **Guo,** Belknap, Tice Gibson, West)*

Brinda Gupta: Effect of 1-methyl-4-phenylpyridnium (MPP+) on Dopamine Neuron Loss in LPS Mouse Model of Parkinson's Disease
Advisors: Paul Carvey, Bill Hendey; Rush University Medical Center
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Jennifer Huang: Development of an Improved Soft Agar Method
Advisors: Kim Elseth, Benjamin Vesper, Maaly Bassiony, Bulent Aydrogan, and James Radosevich; University of Illinois at Chicago
*Poster co-presented at the University of Illinois at Chicago College of Dentistry Clinic and Research Day, March 8, 2012 in Chicago, Illinois (**Jennifer Huang, Melissa Kim**, Kim M. Elseth, Benjamin J. Vesper, Maaly Bassiony, Bulent Aydrogan, James A. Radosevich)*

Aadam Ibraham: FTIR in Pharmacology
Advisor: Carol Hirschmugl; University of Wisconsin at Madison
Poster presented at the 2011 Synchrotron Radiation Center Users' Meeting, September 16-17, 2011 at the University of Wisconsin at Madison, Wisconsin

Taylor Imburgia: Examining the Levels of Overexcitabilities of IMSA Sophomores
Advisors: Christopher Kolar, Deb McGrath, Illinois Mathematics and Science Academy
Presentation at the 10th Annual Dabrowski Conference, July 19-21, 2012 in Denver, Colorado

Adam Kalinich: Flipping the Winner of a Poset Game
Advisor: Lance Fortnow; Northwestern University
*Published in Information Processing Letters (2012). 86, pp 86-89. (**Adam Kalinich**)*
Intel Science Talent Search Semi-Finalist and Finalist

Nilesh Kavthekar: Collagen-Hyaluronic Acid Membranes for Tissue Regeneration
Advisor: Justin Liu; Northwestern University
Siemens Competition Regional Semi-Finalist; Illinois Junior Academy of Sciences Project Exposition Finalist[1]; IJAS Region V Special Award: U.S. Army Special Award for Engineering; Intel International Science and Engineering Fair finalist[2]

Emil Khabiboulline: Modeling of Quench Protection Techniques in Superconducting Solenoid Magnets
Advisor: Iouri Terechkine; Fermi National Accelerator Laboratory
Siemens Competition Regional Semi-Finalist; Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Melissa Kim: Development of an Improved Soft Agar Method
Advisors: Kim Elseth, Benjamin Vesper, Maaly Bassiony, Bulent Aydrogan, and James Radosevich; University of Illinois at Chicago
*Poster co-presented at the University of Illinois at Chicago College of Dentistry Clinic and Research Day, March 8, 2012 in Chicago, Illinois (**Jennifer Huang, Melissa Kim**, Kim M. Elseth, Benjamin J. Vesper, Maaly Bassiony, Bulent Aydrogan, James A. Radosevich)*

Jenny Lee: Gold Ion–Angiotensin Peptide Interaction by Mass Spectrometry
Advisor: Bao-Shiang Lee; University of Illinois at Chicago
*Published in the Journal of the American Society for Mass Spectrometry (2012) published online February 2012; Doi: 10.1007/s13361-011-0328-0 (**Jenny Lee**, Lasanthi P. Jayathilaka, Shalini Gupta, Jin-Sheng Huang, Bao-Shiang Lee)*

John Lee: Characterization of Linear-Dendron Based Micelle Formulations
Advisor: Jonathan Paley; Argonne National Laboratory
Presented at the Ninth Annual RITS Super Science Fair, Nov. 19-17, 2011 in Kyoto, Japan

Shelly Li: Thymoquinone Inhibits Cigarette Smoke Extract-Induced SiHa Cell Invasion
Advisor: Kenneth Alexander, University of Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist[1]; IJAS Region V Special Award: Naval Science Award

Xiaoyu Li: Organizational Motifs for Ground Squirrel Cone Bipolar Cells
Advisor: Steven DeVries; Northwestern University
*Published in the Journal of Comparative Neurology. (online February, 2012). Adam C. Light, Yongling Zhu, Jun Shi, Shannon Saszik, Sarah Lindstrom, Laura Davidson, **Xiaoyu Li**, Vince A. Chiodo, William W. Hauswirth, Wei Li and Steven H. DeVries. (DOI: 10.1002/cne.23068)*
Xiaoyu Li: Dopamine Regulation of Cone-Cone Gap Junctions in Ground Squirrel Retina
Advisor: Steven DeVries; Northwestern University
Published in the Journal of Experimental Secondary Science, October 2011

Claire Liang: Modeling Spatial Growth Dynamics of Stem Cell in Tissue Growth and Regeneration
Advisors: Qing Nie and Youfang Cao; University of California at Irvine and University of Illinois at Chicago
Co-author of paper presented at the Illinois Workshop on Regenerative Biology and Tissue Engineering, November 18, 2011; Illinois Junior Academy of Sciences Project Exposition Finalist[1]

Peter Lu: Nonequilibrium Dynamics in Cuprate Superconductors Using Transient Grating Spectroscopy
Advisors: Nuh Gedik and Fahad Mahmood; Massachusetts Institute of Technology
Siemens Competition Regional Semi-Finalist

Rahul Maheswari: IL-10 Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS
Advisor: Nichole Mesnard; University of Illinois at Chicago
Poster presented at the American Association of Anatomists regional meeting, February 25, 2012, Rush University Medical Center, Chicago, Illinois; Second Place Award in the High School Student Poster Competition

Anuj Marathe: Heat Shock Protein 70 Regulates Interleukin 10 Producing Regulatory T Cells
Advisors: Eugene Chang, Yunwei Wang; University of Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist[1]*; Illinois Junior Academy of Sciences Paper Exposition Finalist*[1]*; Intel International Science and Engineering Fair finalist*[2]*; Chicago Region Junior Science and Humanities Symposium Finalist and Chicago Region runner-up*

Sarah Martin: TNFα Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS
Advisor: Nichole Mesnard; University of Illinois at Chicago
Poster presented at the American Association of Anatomists regional meeting, February 25, 2012, Rush University Medical Center, Chicago, Illinois

Aalap Mehta: The Role of RBP2 in MCF-7 Cancer Cell Drug Resistance
Advisor: Elizaveta Benevolenskaya; University of Illinois at Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist[1]*; IJAS Special Award: Society for In Vitro Biology Award; Illinois Junior Academy of Sciences Paper Exposition Finalist*[1]

Thitipong Mongkolrattanothai: Ranolazine Inhibition of the Late Sodium Ion Current Slows the Progression of Heart Failure, Disorganization of T-tubules, and Hypertrophy of the Heart
Advisors: James Kelly, Amanda Nahhas, Matthew O'Toole, and J. Andrew Wasserstrom; Northwestern University
Presented at the International Student Science Fair, October 8-15, 2011, in Bangkok, Thailand

Laura Napierkowski: R&D for the Tracking Detector for the Muon g-2 Experiment at Fermi National Accelerator Laboratory
Advisor: Mandy Rominsky; Fermi National Accelerator Laboratory
Presented at the American Physical Society April Meeting 2012, March 31 - April 3, 2012, Atlanta, Georgia

Deokgeun Park: Initial Calibration of CCD Images for the Dark Energy Survey
Advisors: H. Thomas Diehl and Douglas Tucker; Fermi National Accelerator Laboratory
Published in the Journal of Experimental Secondary Science, October 2011; Illinois Junior Academy of Sciences Region V Project Exposition participant; IJAS Region V Special Award: U.S. Air Force Special Award; Chicago Region Junior Science and Humanities Symposium Finalist

Shivani Patel: Immunohistochemical Localization of HCN1-4 Channels in the Mouse Brain
Advisor: Dane Chetkovich; Northwestern University
Presented at the International Student Science Fair, April 30 – May 4, 2012 in Winnipeg, Manitoba, Canada

Nishith Reddy: The Effect of Transgenic MA20 on Inflammation of the Intestinal Epithelium
Advisor: David Boone; University of Chicago
Siemens Competition Regional Semi-Finalist; Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Sarah Salameh: Early Events in Herpes Simplex Virus Lifecycle with Implications for an Infection of Lifetime
Advisor: Deepak Shukla; University of Illinois at Chicago
Published in The Open Virology Journal (2012) *Vol. 6, pp 1-6 (**Sarah Salameh, Urmi Sheth**, and Deepak Shukla)*

Urmi Sheth: Early Events in Herpes Simplex Virus Lifecycle with Implications for an Infection of Lifetime
Advisor: Deepak Shukla; University of Illinois at Chicago
Published in the Open Virology Journal (2012) *Vol. 6, pp 1-6 (**Sarah Salameh**, **Urmi Sheth**, and Deepak Shukla)*

Yanchen Shi: A Low-Power Wave Union TDC Implemented in FPGA
Advisor: Jinyuan Wu; Fermi National Accelerator Laboratory
*Co-author of paper presented at the Topical Workshop on Electronics for Particle Physics 2011 (TWEPP-11), September 26-30, 2011 in Vienna, Austria (Jinyuan Wu, **Yanchen Shi, Douglas Zhu**)*

Rose Neiberg Sloan: Stable Expansions of the Integers
Advisor: David Marker; University of Illinois at Chicago
Intel Science Talent Search semi-finalist

Michelle Suh: The Comparison of the Different Radiotherapy Neutron Sources in Various Facilities for the Optimal Result in Neutron Therapy
Advisor: Thomas Kroc; Fermi National Accelerator Laboratory
Presented at the International Student Science Fair, October 8-15, 2011, in Bangkok, Thailand; Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, February 15-19, 2012 in Vancouver, British Columbia, Canada

Shannon Tai: Increased Heterogeneity of Calcium Cycling in Myocytes from Failing Hearts
Advisor: J. Andrew Wasserstrom; Northwestern University
Presented at the Ninth Annual RITS Super Science Fair, Nov. 19-17, 2011 in Kyoto, Japan

Lee Tang: Modulation of the Akt/Protein Kinase B Pathway in Human Neutrophils Through the Inhibition of Phosphatase and Tensin Homolog and PH Domain Leucine-Rich Repeat Protein Phosphatase
Advisor: Xiangdong Zhu; University of Chicago
Illinois Junior Academy of Sciences Paper Exposition participant

Jordan Williams: The Effect of Silver Ion on Sewage Treatment Bacteria
Advisors: Megan Schrementi and Mark Carlson, Illinois Mathematics and Science Academy
Presented at the Ninth Annual RITS Super Science Fair, Nov. 19-17, 2011 in Kyoto, Japan

Summer Wu: Characterization and Manipulation of Nanorods via an Applied Magnetic Field
Advisors: Shih-han Lo, Vinayak Dravid; Northwestern University
Illinois Junior Academy of Sciences Project Exposition Finalist[1];IJAS Region V Special Awards: Mu Alpha Theta Award and Yale Science and Engineering Association, Inc. (YSEA) Science Fair Award; Illinois Junior Academy of Sciences Paper Exposition Finalist[1]; Midwest Research Competition: Positive Impact finalist[4]

Douglas Zhu: A Low-Power Wave Union TDC Implemented in FPGA
Advisor: Jinyuan Wu; Fermi National Accelerator Laboratory
*Co-author of paper presented at the Topical Workshop on Electronics for Particle Physics 2011 (TWEPP-11), September 26-30, 2011 in Vienna, Austria (Jinyuan Wu, **Yanchen Shi, Douglas Zhu**)*

1) The Illinois Junior Academy of Sciences (IJAS) State Paper and Project Expositions are May 5 & 6, 2012 in Champaign, Illinois
2) The Intel International Science and Engineering Fair is May 13-18, 2012 in Pittsburgh, Pennsylvania
3) ACT-SO National Finals will be held at the NAACP National Convention in Houston, Texas July 2012
4) Midwest Research Competition: Positive Impact is April 13, 2012 at Wheeling High School

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

IMSAloquium:
Student Investigation Showcase
April 25, 2012

Schedule of Sessions

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

IMSAloquium Poster Session

	Biochemistry	Title	Start Time	Room
A01	Osazomon Imarenezor	The Effects of Varying Concentrations of Permanent Hair Relaxer Components on Human Fibroblasts Cells	12:55	A-135
A02	Jenny Lee	Gold Ion-Protein Interaction by Mass Spectrometry	10:50	A-133
A03	Nolan Maloney	Mechanism of MYCN Destabilization in Neuroblastoma	1:20	A-119
A04	Madhav Mohandas	Comparative Analysis of Protein Cargo Selection During Intracellular Trafficking Under Normal and Heat Stressed Conditions	9:35	B-110
A05	Kyle Mou	Effects of Modifications to Hsp27 on Viability of Smooth Muscle Cells Under Oxidative Stress	9:35	D-107

	Bioengineering	Title	Start Time	Room
B01	Eaton Guo	Incorporating Apoptosis in a Cell Proliferation Simulation Program	1:20	A-151
B02	Nilesh Kavthekar	Design and Characterization of Three Dimensional Bioplotted Natural Biopolymer Constructs for Tissue Engineering Applications	10:00	A-113
B03	Akram Khaja	Role of the Prefrontal Cortex in Trace Eye-Blink Conditioning	8:45	A-121
B04	Krishna Kudaravalli Ajay Pius	Using the Laser Diode to Determine the Stapedius Reflex	10:25	A-121
B05	John Lee	Micelle Formulations of Dendron-Based Block Copolymers with Various Surface Groups	9:10	A-133
B06	Claire Liang	Modeling Spatial Population Dynamics of Stem Cells in Tissue Growth	12:55	B-148
B07	Nishith Reddy	Microbial Dynamics in Methane Oxidation for Biochar-Amended Landfill Covers	10:50	B-133
B08	Nathan Suek	Effect of Cleaning Methods on Hydrophilicity of Different Thicknesses of TiO_2 Layers	9:35	A-131
B09	Matthew Tsao	Visualization of Functional Group Selection in Creating Hypothetical Metal-Organic Frameworks	11:15	A-135
B10	Nathaniel White Brent Wu	Frequency Detection in Deaf Cats	11:15	A-121

	Biology	Title	Start Time	Room
C01	Soham Ali	Analysis of Colorectal Cancer Risk Factors in E-Cadherin in Diverse Patient Populations	8:45	B-133
C02	Lydia Auch Christine Darabaris	The Effects of Plyometric Strength Training on Running Economy	1:20	A-155
C03	Yiyun Cao	Regulation and Role of Regulator of G-protein Signaling-1 in Celiac Disease Pathogenesis	12:30	A-117
C04	Francis Cocjin Egle Malinauskaite	Bacterial Species Identification Using Polymerase Chain Reaction	10:25	B-148
C05	Shelby Daniel-Wayman	Hypoxia and Starvation Promote Autophagy as a Survival Mechanism	12:55	B-133
C06	Sonya Dave Andrew Ta Aaditya Tolappa	Characterizing Tolerance in Pediatric Food Allergy	1:45	Acad. Pit A-138

	Biology	Title	Start Time	Room
C07	Sruthi Doniparthi	Dimethylfumurate Inhibits Tumor Growth Factor-Beta-Induced Myofibroblast Differentiation in Dermal Fibroblasts via the Nrf2 Pathway	9:10	A-115
C08	Sruthi Doniparthi	CDDO Inhibits TGF-Beta-Induced Epithelial-Mesenchymal Transition in A549 Lung Epithelial Cells via the PI3K/AKT Pathway	8:45	A-115
C09	Nicholas Fung	The Effect of Poly I:C on Transforming Growth Factor-β-Induced Fibrotic Responses	9:35	A-115
C10	Beatrice Go	Functional Central Polypurine Tract Provides Downstream Protection of HIV-1 Genome from Editing by APOBEC3G and APOBEC3F	9:35	A-151
C11	Ashima Gupta	HOXA10 Regulates Transcription of Fibroblast Growth Factor 2 in Myeloid Cells	9:35	B-108
C12	Katherine Havighorst Brooke Kottkamp	A Correlation Between Anticipatory Behaviors and Feeding Times in Captive Animals	1:45	B-108
C13	Dorcas Huang	Action of Estrogen on Tumorigenic and Non-Tumorigenic Rat Prostate Epithelial Progenitor Cells	1:45	A-149
C14	Jennifer Huang Melissa Kim	Biological Properties of Cancer Cells Through Soft Agar Cloning	10:25	A-117
C15	Jimmy Huang	The Effect of the Modified Base m6A on the Splicing of a Pre-mRNA Transcript	10:50	A-131
C16	Seneca Hutson Amanda Magyar	Leaf Variation in *Agathis robusta* as an Indicator of Forest Structure for Fossil Plants	12:55	D-103
C17	Tejas Joshi	Efficiency of Magnetic Bead and Gel Insert Preparation in Vector Cloning	10:00	B-148
C18	Kaylee Karumanchi	Loss of miR-145 in Colon Cancer Upregulates Direct Target ADAM17	10:25	D-107
C19	Jiwon Kim	The Effects of Iodine on the Ghost Shrimp *Palaemonetes kadiakensis*	10:50	B-148
C20	Hannah Koo	The Effects of Cholesterol Level Manipulations in Model Lipid Bilayers	10:25	A-149
C21	Dipen Kumar	The Effect of the Enteric Biome on Lysosomal Hydrolase Activity	1:20	B-133
C22	Vignessh Kumar	Investigation of the Expression Pattern of Thioredoxin Domain Containing 9 in Developing Zebrafish	1:45	D-103
C23	Shannon Kurian Monica Patel	The Role of *SGK1* in Cell Proliferation and Apoptosis in Endometriotic Cells	1:20	A-117
C24	Sarah Lisk	An Examination of Nutritional Stress in a Nineteenth Century Skeletal Population From Peoria, Illinois	8:45	D-110
C25	Christine Liu	Characterizing the Ideal Antibody Isotype Distribution Against Influenza	8:45	B-110
C26	Sirisha Manam	The Effects of HSP70 antibodies in an Anti-Tumor Response	10:25	A-115
C27	Anuj Marathe	Heat Shock Protein 70 Regulates Interleukin 10 Producing Regulatory T Cells	8:45	A-147
C28	Aalap Mehta	The Role of RBP2 in MCF-7 Cancer Cell Drug Resistance	9:35	B-133
C29	Aalap Mehta	Transcriptional Regulation by Retinoblastoma Binding Protein 2	10:00	B-133
C30	Vamsikrishna Naidu	Frequency of Periosteal Reactions in a Nineteenth Century Skeletal Population From Peoria, Illinois	10:50	D-110
C31	Areen Pitaktong	The Glycobiology of Prostate Cancer	11:15	Acad. Pit A-138
C32	Nishith Reddy	The Effect of Vector Backbones on PCR Cloning of Green Fluorescent Protein	11:15	B-133
C33	Sabrina Roberts	How Does the Silencing Mediator of Retinoid and Thyroid Hormone Receptors Affect Glucocorticoid Receptor Action?	1:45	A-121
C34	Sarah Salameh Urmi Sheth	The Role of Protein Vpx in HIV Inhibitor SAMHD1 Degradation	8:45	A-149
C35	Navika Shukla	The Role of the Receptor Nectin-1 in Viral Spread of Herpes Simplex Virus-1	1:20	A-113
C36	Steven Suh	The Selection of Resistance in *E. coli*	9:35	B-148

	Biology	Title	Start Time	Room
C37	Shannon Tai	Increased Heterogeneity of Calcium Cycling in Ventricular Myocytes from Failing Hearts	10:50	A-113
C38	Arjun Tambe	An Analysis of the Effects of Azelaic Acid on Principal Gene Expression and Root Growth in *Arabidopsis thaliana*	1:20	A-135
C39	Lee Tang	Modulation of the Akt/Protein Kinase B Pathway in Human Neutrophils Through the Inhibition of Phosphatase and Tensin Homolog and PH Domain Leucine-Rich Repeat Protein Phosphatase	10:00	B-110
C40	Riva Trivedi	Comparison of Drosophila *cmi* and Human MLL/ALR Type 3 PHD Fingers	1:45	A-131
C41	Malia Wenny	Population Structure of Avian Chewing Lice *Brueelia laticeps* on Two Toucan Genera *Andigena* and *Aulacorhynchus*	10:00	A-149
C42	Andrew Wentzel	Phase Behavior in Cell-Free Membrane Vesicles	10:25	A-147
C43	Shannon Tai Shohei Yamakawa Satya Yerrabolu	Triggered Intracellular Ca^{2+} Release in Failing Canine Atrial Myocytes	11:15	A-113
C44	Karthik Yarlagadda	Comparison of the Sutural Morphologies of the Lungfish Taxa Neoceratodus and its Close Relatives	10:50	B-108
C45	Kelly Yom	The Role of the Silencing Mediator of Retinoid and Thyroid Hormone Receptor in Regulating 1,25-Dihydroxyvitamin D Receptor Activity	2:10	A-121
C46	Jeffrey Zhao	CD1-d Expression in Breast Cancer Progression	1:20	B-148

	Business	Title	Start Time	Room
D01	Evan Yin	A Nonlinear Portfolio Building Model in Futures Trading Strategy	8:45	Lect. Hall B-206

	Chemistry	Title	Start Time	Room
E01	Brian Chen	Characterization of Electron Beam-Induced Deposited Nanoparticles in Liquid Medium	10:25	A-155
E02	Sanggyu (Raymond) Chong Michelle Suh	Determining the Global Minimum Binding Energy of the Interaction Between Different Gas Molecules and Functional Groups in Metal-Organic Framework Using Quantum Chemistry Calculations	1:45	A-117
E03	Yan-Yang Feng Mingyang (Jennifer) Li	Comparing the Antioxidant Contents of Blueberries, Grapes, and Acai Berries	2:10	Kids Inst. E-115
E04	Nishita Kumar	An Investigation into Solid Catalysts for Biodiesel Conversion Using Fresh Soy Oil	12:55	D-107
E05	Joshua Lam	Standardization of Chinese Medicinal Herbs by Thin Layer and High Performance Liquid Chromatography	2:10	B-148
E06	Grace Li Lily Lou	Thin Layer and High Performance Liquid Chromatography of Chinese Medicinal Herbs	1:45	B-148
E07	Jingfei Li	Search for an Anti-Bird Flu Agent From Southeastern Asian Plants	8:45	D-107
E08	Ashley Radee	An Investigation into Solid Catalysts for Biodiesel Synthesis from Used Fryer Oil	11:15	D-107
E09	Richard Shen	Spectroscopic Analysis of Chemical Intermediates of Lithium-Air Batteries	1:20	B-108
E10	Yuanhao Wang	Crystallization of Electronic and Magnetic Molecule-Based Materials	10:50	D-103

	Computer Science	Title	Start Time	Room
F01	Brian Chien	Extracting Key Words from News Articles to Find Appropriate Sites	10:25	A-113
F02	Mosab Elagha Ivan Zlatanov	TitanOS: The Student Operating System	1:45	A-147
F03	Joshua Fornek	Modeling the Motions of High Altitude Balloons	9:35	D-103
F04	Jason Lin	Autonomous Flight of an Android Piloted Plane	9:35	A-135
F05	Andrew Wentzel	An Exploration into Artificial Intelligence: The Mind as a Complex, Adaptive System	2:10	Acad. Pit A-138
F06	Matthew Yang	Graphics Processing Unit-Accelerated Proton Collision Modeling in C++ and CUDA	2:10	A-147

	Economics	Title	Start Time	Room
G01	Yusuf Aktan	Analysis of Market-Based Water Conservation Methods in the United States	10:00	B-108
G02	Henry Deng	Modeling and Forecasting the Price of Gold Futures: Comparing the Black-Scholes Equation Against a Multi-Factor Linear Regression Model, Time-Series Analysis, and More Complex Stochastic Models	11:15	A-133
G03	Saarthak Gupta	Combating Corruption and Spreading Financial Services via Technology in Himalayan Economies	10:25	A-135
G04	Irene Jiang	The Great Recession: A Clarification	9:35	D-110
G05	Samuel Kaufman Matthew Tennenhouse	Determining the Value of a Baseball Player	1:20	Kids Inst. E-115

	Education	Title	Start Time	Room
H01	Karina Banda Joscelyn Garcia Mariela Rodriguez	A Case Study Comparing Parent Involvement Indicators and Factors Between Two Elementary Schools of Different Socioeconomic Levels.	10:00	A-147
H02	Morgan Ashley Craft Ashley Washington	The Self-Perceptions of Academic Achievement Amongst Racially Diverse Gifted Students	9:35	Kids Inst. E-115
H03	Margaret Daly Sandy Perez	Preparedness of Ninth and Tenth Grade Mathematics Teachers for Implementing Common Core State Standards	9:10	A-155
H04	Lucija Filipac Sonam Vyas	Improving American Mathematics and Science Education for Global Success Using the Programme for International Student Assessment Results, Surveys, and Interviews	8:45	Acad. Pit A-138

	Engineering	Title	Start Time	Room
I01	Jorge Acosta Ayun Brown	Methods for Reduction of Power Consumption in Display Electronics	11:15	B-108
I02	Paul Bogdan	Development of a Field Programmable Gate Array Block for Real Time Pulse Analysis with Applications in High Energy Physics	8:45	B-148
I03	Gary Chen	The Physical, Structural, and Chemical Properties of Ni_2ZrIn	10:0	A-121
I04	Sanggyu (Raymond) Chong	Finding Hydrophobic Chemical Structure That Enables the Adsorption of Ammonia	2:10	A-117

	Engineering	Title	Start Time	Room
I05	Aditya Karan	Optimizing the Conjugation and Separation of Linear Chains of Polyphosphates	1:45	A-151
I06	Keith Kimberling	Determining the Feasibility of Using Polymer Electrode Membrane Fuel Cells as a Household Power Source	1:45	A-155
I07	Benjamin Kuo	Designing a Water Filter for Developing Nations	11:15	D-103
I08	Byron Mui Justin Sass	Designing a Mixed-Use Facility in a Semi-Urban Environment	1:45	A-119
I09	Zoe Phillips	Properties of the Heusler Alloy Ni_2GaZr	9:35	A-121
I10	Amir Safavi	Improving the Design of a Dual Intermeshing Rotor Helicopter	11:15	A-155
I11	Robert Schurz	A Transimpedance Amplifier Under Cryogenic Temperatures	12:30	A-131
I12	Hyun Jin Song Jennifer Zhang	Changing Cell Fate: A New Method to Treat Colon Cancer Without the Side Effects of Chemotherapy and Radiation Therapy	9:10	A-119
I13	Kyle Stanevich	IMSA Students' Motivations to use Electricity Generating Bikes	12:55	Kids Inst. E-115
I14	Summer Wu	Characterization and Manipulation of Nanorods via an Applied Magnetic Field	11:15	A-117

	English	Title	Start Time	Room
J01	Brianna Collender Karolyn Stromdahl	"The One Sin the Gods Never Forgive Us is That of Being Born Women:" A Study of Women in Popular Modern Fantasy	11:15	A-151

	Environmental Science	Title	Start Time	Room
K01	Mitchell Bieniek Christopher Sartain Samuel Walder	Comparing the Effectiveness of Natural and Chemical Laboratory Waste Water Treatment Methods: An International Collaborative Effort	9:10	Acad. Pit A-138
K02	Ty Bottorff Kenzo Esquivel Olivia Legan	The Plausibility of Creating Green Energy Farms From Blemished Crops	11:15	D-110
K03	Christina Cheng Harsha Jujjavarapu	Energy Efficiency of Hand Dryers Compared to Paper Towels and Their Effect on Energy Consumption on the IMSA Campus	1:20	D-110
K04	Grace DiCecco	The Optimization of Cellulosic Ethanol Production from Corn Stover, Mixed Prairie Plants, and Switchgrass	9:10	B-110
K05	Logan Dodd Bryan Hoffman	The Potential of Vertical Farming	10:00	D-107
K06	Christian Fitzsimmons	Indices of Sustainability	11:15	A-149
K07	Clare Leahy Elaina Zintl	Acceleration and Expansion of Diversity in the Illinois Mathematics and Science Academy Prairie	12:55	Lect. Hall B-206
K08	Ashwin Mitra	The Efficiency of Green Roofs as a Method of Insulation for Urbanized Buildings	1:45	D-110
K09	Hyun Bin Park	Determining Toxicity of Sediment in the North Shore Channel	1:45	A-135

	Fine Arts	Title	Start Time	Room
L01	Carol Gu	Understanding Music Structure and Form with the Intent of Composing Music	2:10	D-110
L02	Henry Ward	Original Analysis of Webern's *Variations for Piano*, Op. 27	9:10	A-113

	History	Title	Start Time	Room
M01	Luis Gomez	French Colonial North America	2:10	D-107
M02	Connor Kasch	The Effect of the Arab Spring on Egypt's Government, Diplomatic Relations, and its Economy	1:45	A-115
M03	Mia Leckie Agnel Philip	The Rise and Fall of Great Powers	1:45	D-107
M04	Caitlin Walczyk	Post World War II German Identity, From Pride to Problem	9:10	D-110

	Law	Title	Start Time	Room
N01	Jennifer Bailey Katia Colin	An Analysis of the Death Penalty Worldwide	9:35	Lect. Hall B-206
N02	Mindy Jian Heidi Warning	Criminal Minds?: A Psychological and Legal Analysis of the Insanity Plea's Credibility	8:45	A-155

	Mathematics	Title	Start Time	Room
O01	Austin Gonzalez Erik Luo	Educating the World with Game Theory	10:00	A-135
O02	David Wang	2- ε Devils Trap an Angel of Power 2	12:55	A-133

	Medicine	Title	Start Time	Room
P01	Courtney Amegashie	Effect of Chemically-Induced Hypoxia on the Metastasis of High Nitric Oxide Adapted and Parent Cancer Cell Microenvironments	9:35	A-117
P02	Courtney Amegashie	The Effect of Insulin-Like Growth Factor 1 Chemotaxis on the Metastasis of Cancer Cell Microenvironments	10:00	A-117
P03	Wendy Bindeman	The Effect of Ccl22 on Regulatory T Cells and Skin Depigmentation in Mice	10:00	A-115
P04	Seth Butcher	Qualitative Assessment of Modern Dental Products	2:10	A-151
P05	Alice Chang Jiachen Wang	An Assessment of the Benefits of a Spinal Surgery Simulator on the Learning and Growth of Neurosurgical Residents	1:20	A-147
P06	Ajay Chatrath	Reducing Radiation from Diagnosing Patients with Suspected Ischemic Stroke	10:25	D-103
P07	Kevin Chong Jackson Michuda	Associations Between HIV Susceptibility and Mutations in the Vif-Associated APOBEC3G Proteasomal Complex	1:20	A-115
P08	Breanna Dachsteiner	A Literature-Based Study on Adolescent Idiopathic Scoliosis	9:10	D-103
P09	Sonya Dave	Investigating Beta-Catenin and Calretinin as Possible Markers for Recurrence or Transformation of Glioneuronal Tumors in Pediatric Patients	12:30	A-147
P10	Annie Guo	Institutional Review Board Unanticipated Problems Involving Risks to Subjects or Others Reports Lack Sufficient Information to Determine Causality	2:10	B-108

	Medicine	Title	Start Time	Room
P11	Rachel Hermes	Comparison in the Need for Resuscitation in Spontaneous Vaginal Births Versus Cesarean Sections	9:10	A-151
P12	Rae Hohle Aditi Warhekar	Exploring the Relationship Between Metabolic Acid-Base Status and the Number of Apnea, Bradycardia, and Desaturation Alarms in Infants 27-32 Weeks Gestation in the First Two Weeks of Life	1:45	A-133
P13	Eun Ji Jeong	The Stimulatory Effect of Atractylodiol on the Spontaneous Contractility of Rat Distal Colon	8:45	A-151
P14	Vignessh Kumar	Defining the Sleep and Cardio-Metabolic Phenotypes of Individuals with Age-Related Insomnia	2:10	D-103
P15	Shelly Li	Thymoquinone Inhibits Cigarette Smoke Extract-Induced Invasiveness of Cultured Cervical Cancer Cells	8:45	A-117
P16	Xiaoyu Li	Effect of Laser Photocoagulation Therapy on the General Morphology of Mouse Retina	1:45	A-113
P17	Daniel Matthews Douglas Zhu	Characterizing Recent Patent Activity Related to Diagnostic Genetic Testing	10:50	A-155
P18	Tahir Mohideen	Controlling the Release and Targeting Kinetics to Cancer Cells of a Folic Acid-Targeted Delivery System	10:00	A-133
P19	Viveka Patel	Priming of Alveolar Macrophages by Lipopolysaccharides Augments Inflammatory Response When Stimulated by Anthrax Lethal Toxin	12:30	B-108
P20	Saieesh Rao	Tumor-Associated Mastocytosis in Human Ulcerative Colitis Leading to Colon Cancer	12:55	A-121
P21	Brooke Ray	Comparing Invasive and Non-Invasive Blood Pressure Recordings in Premature Patients Less than Thirty Seven Weeks Gestational Age with Diagnosis of Patent Ductus Arteriosus	1:20	A-121
P22	Mahendra Reddy	Role of Foxc1 and Foxc2 in Differentiation of Embryonic Stem Cells to Vascular Endothelial Cells.	1:45	B-133
P23	Ross Skelly	Characterization of Liver-Detargeted Oncolytic Adenoviruses	9:10	B-108
P24	Nicholas Srivastava	The Effect of Cardiac Reoperation on Ventricular Function	1:20	A-131
P25	Adekore Taiwo	HIV: The Trojan Horse	10:25	Lect. Hall B-206
P26	Rohan Verma	Modulation of Stem Cell Marker (DCAMKL1) Expression During Colon Cancer Chemoprevention	2:10	A-131
P27	Rheanna Vimawala	More Factors Influencing Successful Weaning From Caffeine and Outcomes of Infants Who Failed Weaning From Caffeine	2:10	A-133
P28	Yifu Zhang	Effects of Fatty Acids on Pancreatic Cancer Cells	8:45	A-119

	Neurobiology	Title	Start Time	Room
Q01	Megan Bacani Dhruv Patel	Measuring Cerebrovascular Reactivity in Patients With and Without Brain Disorders	10:25	A-119
Q02	Ashley Chong	Correlation of Hippocampal Asymmetric Index and Nonverbal Memory Performance for Primary Progressive Aphasia Patients	9:10	Lect. Hall B-206
Q03	Zi-Ning Choo Ted Li	Laboratory Techniques for Studying Amyotrophic Lateral Sclerosis	10:00	Acad. Pit A-138
Q04	Zi-Ning Choo Ted Li Areen Pitaktong	Aberrant Alternative Splicing in Amyotrophic Lateral Sclerosis	10:50	Acad. Pit A-138
Q05	Mary Do	Investigation of Language Networks Using fMRI with Auditory and Visual Stimuli	10:50	A-119

	Neurobiology	Title	Start Time	Room
Q06	Mary Do Joan Shang	Water Diffusion as an Effective Biomarker to Evaluate Efficacy of Brain Treatment Performance	11:15	A-119
Q07	Dominic Gentile Previn Kumar	Using Hippocampal Structure to Differentiate Between Mild Cognitive Impairment Types	10:00	Lect. Hall B-206
Q08	Brinda Gupta	The Effects of Methamphetamine and Dopamine Receptor Antagonists on the Neurovasculature	9:10	B-133
Q09	Grant Herrman	Moderate Ethanol Preconditioning Induction of Heat Shock Protein 70 in Non-Primary Neuronal Cell Lines and its Correlation to Neuroprotection	11:15	B-148
Q10	Kevin Hong	Vasogenic Edema as a Mechanism of Transgenic Human Antigen R-Mediated Increase in Ischemic Lesion Size in a Mouse Stroke Model	11:15	Kids Inst. E-115
Q11	Lakshmi s Maura Slattery	Identifying Interesting Genes that Show Difference in Healthy and Diseased Amyotrophic Lateral Sclerosis Transgenic Mice at Different Stages of Disease Progression	10:25	Acad. Pit A-138
Q12	Kathryn Kim	Clustering Depressive Symptoms in Aging: Group Differences and White Matter Correlates	12:55	D-110
Q13	Sooyeon Kim Sidra Salman	Mouse Model for the Study of Axonal Degeneration in Huntington's Disease	9:35	A-155
Q14	Rahul Maheshwari Sarah Martin	IL-10 Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS	1:45	Lect. Hall B-206
Q15	Rahul Maheshwari Sarah Martin	Tumor Necrosis Factor α Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS	2:10	Lect. Hall B-206
Q16	Bindi Patel	Acute Seizure-Induced Microglia Activation in the Hippocampus of Postnatal Day 14 Mice	10:50	A-151
Q17	Shivani Patel	Immunohistochemical Localization of Hyperpolarization-Activated and Cyclic Nucleotide-Gated Nonselective Cation Channels (HCN1-4) in the Mouse Brain	9:10	A-147
Q18	Tonu Pius	Measuring Hemodynamic Response Function in Patients and Healthy Controls	10:00	A-119
Q19	Abhinav Reddy	Characterization of Neuronal Human Antigen-R Protein Expression	12:30	Kids Inst. E-115
Q20	Carrie Sha	Comparing Mathematical and Verbal Semantic Memory in Epileptic Patients Through Invasive Neurophysiologic Brain Mapping	9:35	A-133
Q21	Kalyani Sonarikar	The Development of Arithmetic Skills in an Epileptic Patient	8:45	A-135
Q22	Shruthi Subramanian	Modulation of Calcium Homeostasis on Amyloid-Beta Derived Diffusible Ligand-Treated Astrocytes	12:30	A-151
Q23	Amanda Sul Connie Wang	Using a Drosophila Melanogaster Model to Study ALS	12:30	Lect. Hall B-206
Q24	Rebecca Wu	Effects of Misregulation of *GABRB3* Gene Expression in Relationship to Autism Related Behavior	10:50	A-149
Q25	Vivian Zhang	The Role of Protein X in Eliminating SOD1 in Fibroblasts Derived from SOD1-G93A Transgenic Mice	1:20	Acad. Pit A-138

	Physics	Title	Start Time	Room
R01	Vidya Anjur	Photomultiplier Tube Calibration for the Use of Solid Xenon as a Particle Detector	12:55	A-113
R02	Wesley Beck	Determination of the Future of Neutrino Mass Hierarchy Experiments	9:35	A-149
R03	Emily Camras	Minimizing Electrical Noise in the MicroBooNE Liquid Argon Time Projection Chamber and Developing an Algorithm for Event Classification	2:10	A-113
R04	Kathleen Chinetti	Searching for Dark Matter Using Charge Coupled Devices	2:10	A-155
R05	Jasmine Davila Quinn Gingerevans	The Future Now: Using Developing Rocket Technologies to Create the Ultimate Thrill Ride	1:20	D-107
R06	Arjun Garg	Testing Correlations Between Nuclear Decay Rates and Earth-Sun Distance	12:55	A-155
R07	Ethan Gordon	Searching for the Standard Model Higgs Boson in the WH→WWW→lvjjjj Channel	10:25	A-131
R08	Jimmy Huang	Computer Simulation of Quenching in the High Field Superconducting Accelerator Magnet Made with Nb_3Sn Cable	11:15	A-131
R09	Aadam Ibrahim	Fourier Transform Infrared Imaging in Determining the Effectiveness of Trehalose as a Protectant	2:10	A-135
R10	Aadam Ibrahim	Recycling Carbon Dioxide: Following Algae Response to High Concentration Carbon Dioxide Environments	1:20	D-103
R11	Emil Khabiboulline	Optimization of Focusing Lenses through Computational Modeling and Analysis of Related Quench Protection Issues	8:45	A-133
R12	Akram Khaja	Studying Silicon Annealing Effects on the Collider Detector at Fermilab	9:10	A-121
R13	Jingfei Li	Screening For Contamination From Alpha Particle Decay In Materials for the Cryogenic Dark Matter Search	10:25	B-110
R14	Emily Lindgren	Deflection Studies on the g-2 Vacuum Test Chamber Before and After Adding New Grooves	8:45	A-131
R15	Joshua Love	Developing a Neutrino Interaction Identification Algorithm	10:25	B-108
R16	Peter Lu	A Laboratory Model of Two-Dimensional Granular Collisions	10:50	A-135
R17	Kirti Munjeti	Exploring Alternate Explanations for Dark Matter's Claims: Long Term Activation of Radiated Sodium Iodide Crystal	2:10	A-119
R18	Laura Napierkowski	R&D for the Tracking Detector for Fermilab's Muon g-2 Experiment	9:10	A-131
R19	Deokgeun Park	Analysis of the Globular Cluster NGC1851 Using the Dark Energy Survey Filter Set	10:50	A-117
R20	Savanna Rutas	Measurement of Galaxy Masses via Galaxy-Galaxy Lensing in the Sloan Digital Sky Survey Data	9:35	A-113

	Psychology	Title	Start Time	Room
S01	Wei-en Chu Cherish Kim Alexandra Maffei	IMSA Students' Attitudes Towards Interracial Relationships	8:45	Kids Inst. E-115
S02	Victoria Etherton	Effects of Personality, Gender, and Age on Spatial Relations Ability	1:20	Lect. Hall B-206
S03	Mallory Giger	The Effects of Previous Drug Experience on Responses to 3,4-methylenedioxymethamphetamine	10:00	A-151
S04	Riley Helm	Determination of Factors that Affect the Success of Rumors	9:10	D-107
S05	Corey Hornbeck	Perceptual Learning in Synthetic Speech with Interference	2:10	A-115

	Psychology	Title	Start Time	Room
S06	Taylor Imburgia	Examining the Levels of Overexcitabilities of IMSA Sophomores	1:45	Kids Inst. E-115
S07	Eva Meyer	How Self Perception Differs From Observer Perception in Classmates	10:50	Lect. Hall B-206
S08	Jennifer Ren	Culture and Color: Evidence for Cultural Diversity in Color Perception	11:15	Lect. Hall B-206
S09	Natalie Runkle	The Relationship of Daily Activities to the States of Mind and Academic Performances of Illinois Mathematics and Science Academy Students Enrolled in Physiology and Disease or Biophysics Courses	8:45	D-103
S10	Sydney Tomasko	The Influence of Anticipated Gender-Specific Roles on the Career Aspirations of Female IMSA Students	9:10	Kids Inst. E-115
S11	Jessica Ventenilla	Ways of Discussing Mother Nature: Differences in Sharing Learned Information About the Menstrual Cycle Among Adolescent Girls in Residential Versus Commuter Schools	10:25	Kids Inst. E-115
S12	Kevin Zhang	The Effect of Homelessness on Executive Functions in Homeless Youth	2:10	A-149

	Social Science	Title	Start Time	Room
T01	Michael Atten	Culture Shocked: A Study of How Differences in Cultural Values Impact International Collaboration	9:35	Acad. Pit A-138
T02	Sophia Baramidze	An Examination of the Polish American Experience	1:20	A-149
T03	Sharadyn Ciota	The State of Somalia: The United Nations in Practice and in Theory Since the Decolonization Era	1:20	A-133
T04	Richard Fafara Alexander Stratton	An International Energy Assessment: The Benefits and Pitfalls of Nuclear Power in the Modern Age	12:55	A-115
T05	Inga Gurevich Alexandra Roman	Eurovision, the Ultimate European Song Contest: Talent or Politics?	10:25	D-110
T06	Gina Jung Madison Schroeder	Beauty Advertisement and its Effects on the Body Image of Female IMSA Students	10:00	Kids Inst. E-115
T07	Itzel Lopez Uriel Ramirez	The Significance of the Latino Vote in the Presidential Election of 2012	12:55	A-119
T08	John McGuire	IMSA's Understanding of the Abortion Issue	10:50	Kids Inst. E-115
T09	Perry Nelson	The Representation of Female and Male Cross-Dressing in Popular Culture	9:10	A-149
T10	Maura Slattery Hannah Swerbenski	The Veteran Struggle: Returning to Civilian Life	9:35	A-147
T11	Ian Wilkinson	Invisible Wounds: The Implications of Closed Head Injury Caused by High Explosives	10:50	A-147
T12	Stanley Yuan	Education Systems in China and Their Effect on Leadership Development	10:50	A-115

	Space Science	Title	Start Time	Room
U01	Jose Hernandez	Connection Between Pressure and Molecular Hydrogen in Galaxies	2:10	B-133

Poster Map

Cafeteria

A01	B02 B08	C04 C10	C16
A02	B03 B09	C05 C11	C17
A03	B04 B10	C06 C12	C18
A04	B05 C01	C07 C13	C19
A05	B06 C02	C08 C14	C20
B01	B07 C03	C09 C15	C21

C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35
C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	D01	E01	E02

E03	E04	E05	E06	E07	E08	E09	E10	F01	F02	F03	F04	F05	F06	G01	G02	G03	G04
G05	H01	H02	H03	H04	I01	I02	I03	I04	I05	I06	I07	I08	I09	I10	I11	I12	I13

K03	K04	K05	K06	K07	K08	K09	L01	L02	M01	M02	M03	M04	N01	N02	O01

I14
J01
K01
K02

O02	P01

P02
P03

Old Cafeteria/Commons

Diagram Not to Scale

* Biochemistry: A01-A05
* Bioengineering: B01-B10
* Biology: C01-C46
* Business: D01
* Chemistry: E01-E10
* Computer Science: F01-F06
* Economics: G01-G05
* Education: H01-H04
* Engineering: I01-I14
* English: J01
* Environmental Science: K01-K09
* Fine Arts: L01-L02
* History: M01-M04
* Law: N01-N02
* Mathematics: O01-O02
* Medicine: P01-P03

continued

Old Cafeteria/Commons

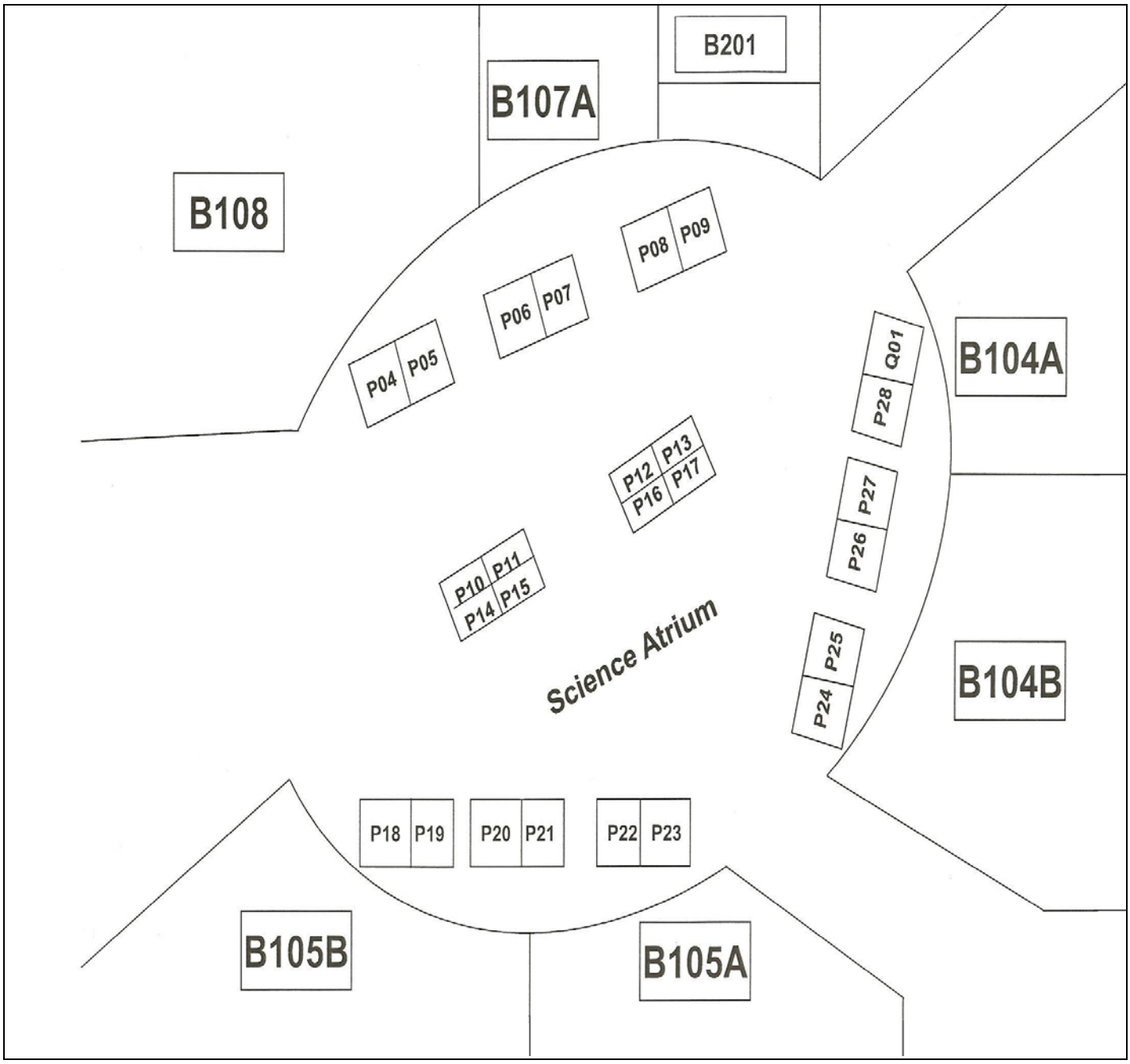

Diagram not to Scale

* Medicine continued: P04-P28
* Neurobiology: Q01
  continued

Poster Map

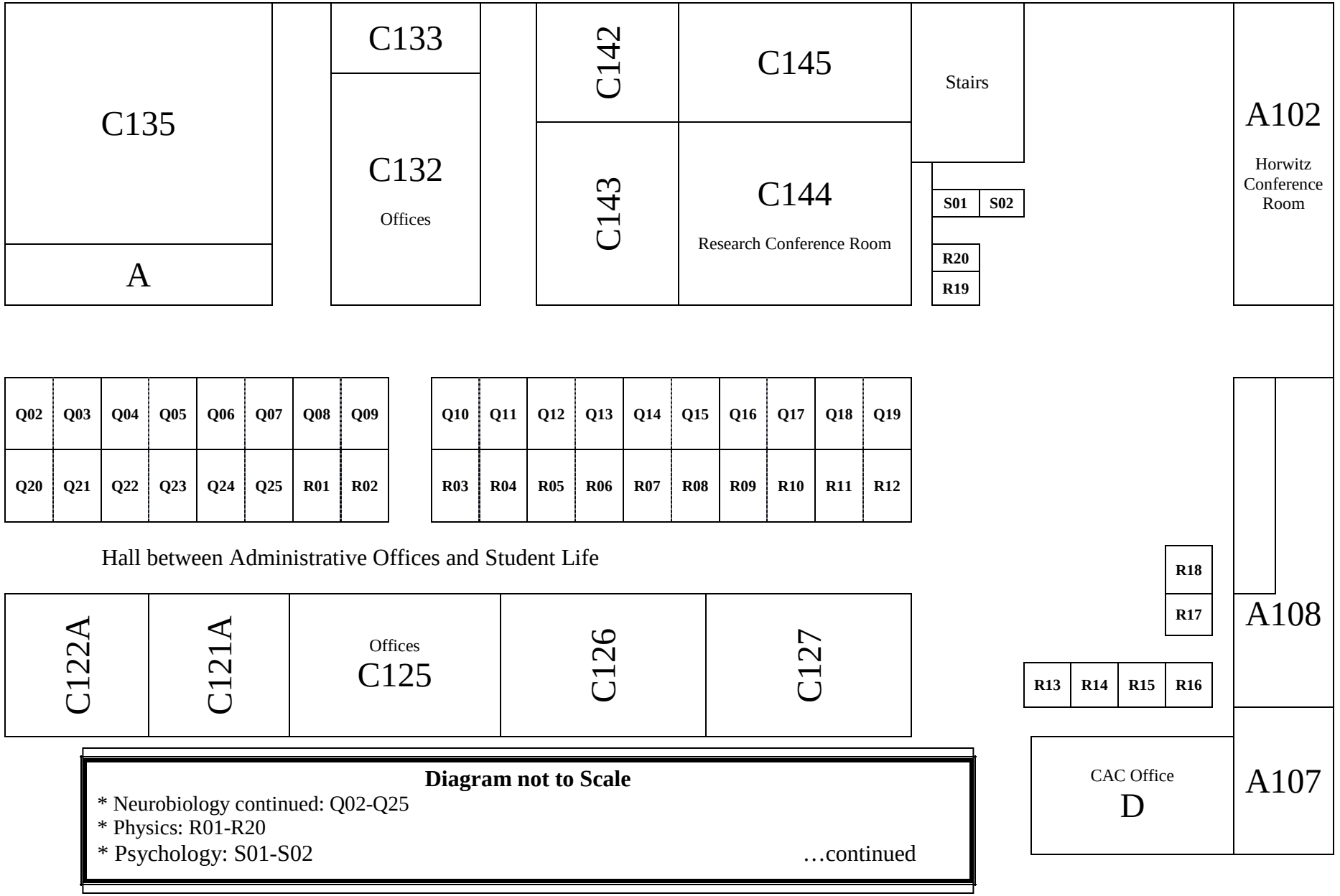

Diagram not to Scale

* Neurobiology continued: Q02-Q25
* Physics: R01-R20
* Psychology: S01-S02

…continued

Poster Map
Math Study Area

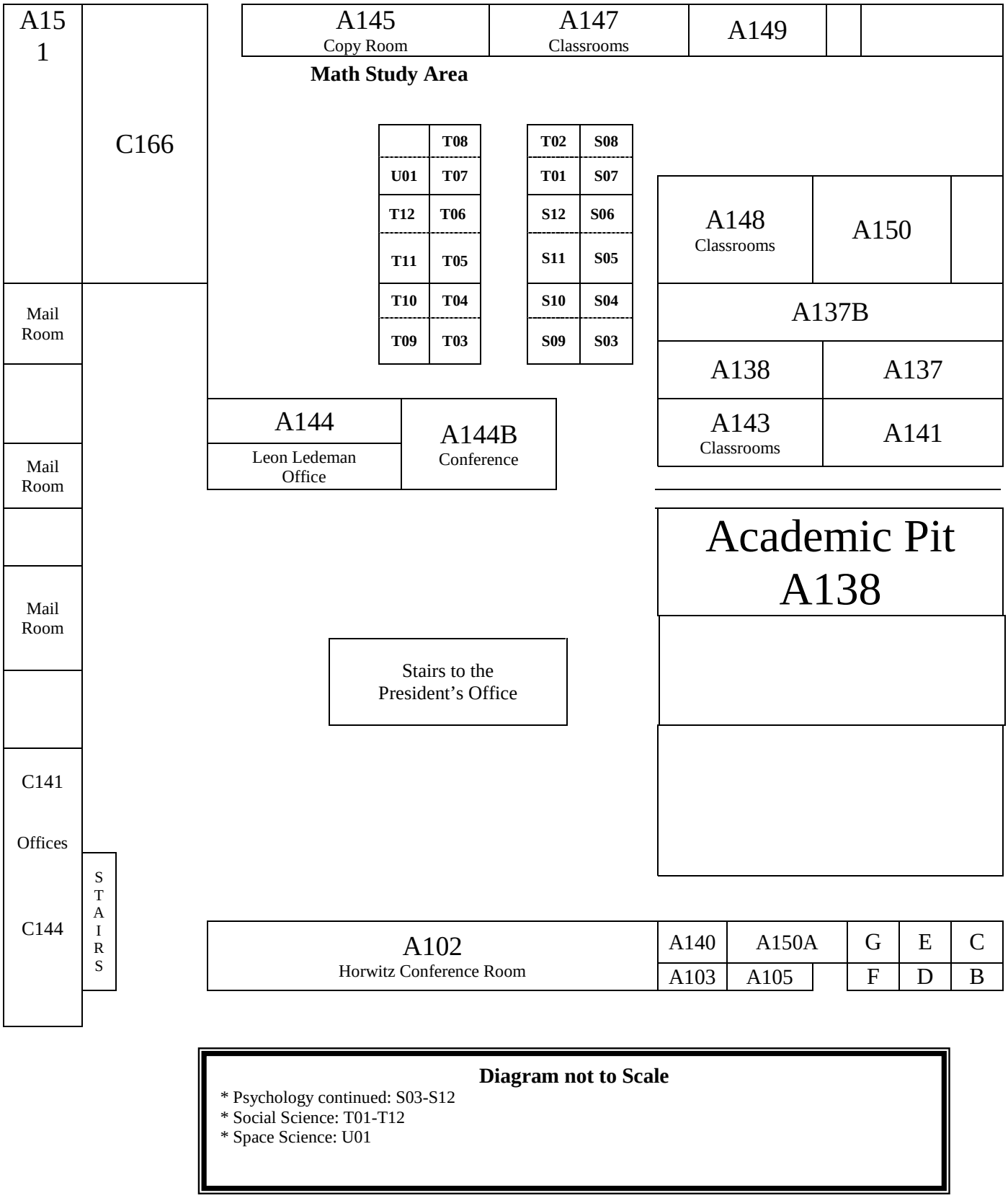

Diagram not to Scale

* Psychology continued: S03-S12
* Social Science: T01-T12
* Space Science: U01

Time and Room Schedule for Presentations

08:45 - 09:00

Room	Poster ID	
A-115	C08	**CDDO Inhibits TGF-Beta-Induced Epithelial-Mesenchymal Transition in A549 Lung Epithelial Cells via the PI3K/AKT Pathway** Sruthi Doniparthi, John Varga, Jun Wei
A-117	P15	**Thymoquinone Inhibits Cigarette Smoke Extract-Induced Invasiveness of Cultured Cervical Cancer Cells** Shelly Li, Kenneth Alexander
A-119	P28	**Effects of Fatty Acids on Pancreatic Cancer Cells** Yifu Zhang, Paul Grippo
A-121	B03	**Role of the Prefrontal Cortex in Trace Eye-Blink Conditioning** Akram Khaja, Craig Weiss
A-131	R14	**Deflection Studies on the g-2 Vacuum Test Chamber Before and After Adding New Grooves** Emily Lindgren, Brendan Casey, Mandy Rominsky
A-133	R11	**Optimization of Focusing Lenses through Computational Modeling and Analysis of Related Quench Protection Issues** Emil Khabiboulline, Michael Tartaglia, Iouri Terechkine
A-135	Q21	**The Development of Arithmetic Skills in an Epileptic Patient** Kalyani Sonarikar, Vernon Leo Towle
A-147	C27	**Heat Shock Protein 70 Regulates Interleukin 10 Producing Regulatory T Cells** Anuj Marathe, Eugene Chang, Yunwei Wang
A-149	C34	**The Role of Protein Vpx in HIV Inhibitor SAMHD1 Degradation** Sarah Salameh, Urmi Sheth, Thomas Hope
A-151	P13	**The Stimulatory Effect of Atractylodiol on the Spontaneous Contractility of Rat Distal Colon** Eun Ji Jeong, KyuYong Jung
A-155	N02	**Criminal Minds?: A Psychological and Legal Analysis of the Insanity Plea's Credibility** Mindy Jian, Heidi Warning, Colin Miller
Acad. Pit A-138	H04	**Improving American Mathematics and Science Education for Global Success Using the Programme for International Student Assessment Results, Surveys, and Interviews** Lucija Filipac, Sonam Vyas, Glenn "Max" McGee
B-110	C25	**Characterizing the Ideal Antibody Isotype Distribution Against Influenza** Christine Liu, Patrick Wilson
B-133	C01	**Analysis of Colorectal Cancer Risk Factors in E-Cadherin in Diverse Patient Populations** Soham Ali, Nathan Ellis, Archana Krish
B-148	I02	**Development of a Field Programmable Gate Array Block for Real Time Pulse Analysis with Applications in High Energy Physics** Paul Bogdan, Mircea Bogdan, Henry Frisch
D-103	S09	**The Relationship of Daily Activities to the States of Mind and Academic Performances of Illinois Mathematics and Science Academy Students Enrolled in Physiology and Disease or Biophysics Courses** Natalie Runkle, Christopher Kolar, Deborah McGrath
D-107	E07	**Search for an Anti-Bird Flu Agent From Southeastern Asian Plants** Jingfei Li, Hongjie Zhang

08:45 - 09:00 (continued)

D-110	C24	**An Examination of Nutritional Stress in a Nineteenth Century Skeletal Population From Peoria, Illinois** Sarah Lisk, Anne Grauer
Kids Inst. E-115	S01	**IMSA Students' Attitudes Towards Interracial Relationships** Wei-en Chu, Cherish Kim, Alexandra Maffei, David Evenson
Lect. Hall B-206	D01	**A Nonlinear Portfolio Building Model in Futures Trading Strategy** Evan Yin, Doug Adams

09:10 - 09:25

Room	Poster ID	
A-113	L02	**Original Analysis of Webern's *Variations for Piano,* Op. 27** Henry Ward, Michael Keyton, Mario Pelusi
A-115	C07	**Dimethylfumurate Inhibits Tumor Growth Factor-Beta-Induced Myofibroblast Differentiation in Dermal Fibroblasts via the Nrf2 Pathway** Sruthi Doniparthi, John Varga, Jun Wei
A-119	I12	**Changing Cell Fate: A New Method to Treat Colon Cancer Without the Side Effects of Chemotherapy and Radiation Therapy** Hyun Jin Song, Jennifer Zhang, Vitali Metlushko
A-121	R12	**Studying Silicon Annealing Effects on the Collider Detector at Fermilab** Akram Khaja, Kyle Knoepfel
A-131	R18	**R&D for the Tracking Detector for Fermilab's Muon g-2 Experiment** Laura Napierkowski, Brendan Casey, Mandy Rominsky
A-133	B05	**Micelle Formulations of Dendron-Based Block Copolymers with Various Surface Groups** John Lee, Seungpyo Hong
A-147	Q17	**Immunohistochemical Localization of Hyperpolarization-Activated and Cyclic Nucleotide-Gated Nonselective Cation Channels (HCN1-4) in the Mouse Brain** Shivani Patel, Dane Chetkovich
A-149	T09	**The Representation of Female and Male Cross-Dressing in Popular Culture** Perry Nelson, Daniel Gleason
A-151	P11	**Comparison in the Need for Resuscitation in Spontaneous Vaginal Births Versus Cesarean Sections** Rachel Hermes, Richard Kampanatkosol, Jonathan Muraskas
A-155	H03	**Preparedness of Ninth and Tenth Grade Mathematics Teachers for Implementing Common Core State Standards** Margaret Daly, Sandy Perez, Tracy Miller
B-133	Q08	**The Effects of Methamphetamine and Dopamine Receptor Antagonists on the Neurovasculature** Brinda Gupta, Paul Carvey, Bill Hendey
Acad. Pit A-138	K01	**Comparing the Effectiveness of Natural and Chemical Laboratory Waste Water Treatment Methods: An International Collaborative Effort** Mitchell Bieniek, Christopher Sartain, Samuel Walder, Glenn "Max" McGee, Aracelys Rios
B-108	P23	**Characterization of Liver-Detargeted Oncolytic Adenoviruses** Ross Skelly, Prem Seth
B-110	K04	**The Optimization of Cellulosic Ethanol Production from Corn Stover, Mixed Prairie Plants, and Switchgrass** Grace DiCecco, Margaret Workman

09:10 - 09:25 (continued)

D-103	P08	**A Literature-Based Study on Adolescent Idiopathic Scoliosis** Breanna Dachsteiner, Sowmya Anjur
D-107	S04	**Determination of Factors that Affect the Success of Rumors** Riley Helm, Sarah O'Leary-Driscoll
D-110	M04	**Post World War II German Identity, From Pride to Problem** Caitlin Walczyk, Christian Nokkentved
Kids Inst. E-115	S10	**The Influence of Anticipated Gender-Specific Roles on the Career Aspirations of Female IMSA Students** Sydney Tomasko, David Evenson
Lect. Hall B-206	Q02	**Correlation of Hippocampal Asymmetric Index and Nonverbal Memory Performance for Primary Progressive Aphasia Patients** Ashley Chong, Emily Rogalski, Lei Wang

09:35 - 09:50

Room	Poster ID	
A-113	R20	**Measurement of Galaxy Masses via Galaxy-Galaxy Lensing in the Sloan Digital Sky Survey Data** Savanna Rutas, Huan Lin, Marcelle Soares-Santos
A-115	C09	**The Effect of Poly I:C on Transforming Growth Factor-β-Induced Fibrotic Responses** Nicholas Fung, Feng Fang, John Varga
A-117	P01	**Effect of Chemically-Induced Hypoxia on the Metastasis of High Nitric Oxide Adapted and Parent Cancer Cell Microenvironments** Courtney Amegashie, Kim Elseth, James Radosevich, Benjamin Vesper
A-121	I09	**Properties of the Heusler Alloy Ni_2GaZr** Zoe Phillips, Philip Nash
A-131	B08	**Effect of Cleaning Methods on Hydrophilicity of Different Thicknesses of TiO_2 Layers** Nathan Suek, Christos Takoudis
A-133	Q20	**Comparing Mathematical and Verbal Semantic Memory in Epileptic Patients Through Invasive Neurophysiologic Brain Mapping** Carrie Sha, Vernon Leo Towle
A-135	F04	**Autonomous Flight of an Android Piloted Plane** Jason Lin, Namrata Pandya
A-147	T10	**The Veteran Struggle: Returning to Civilian Life** Maura Slattery, Hannah Swerbenski, James Victory
A-149	R02	**Determination of the Future of Neutrino Mass Hierarchy Experiments** Wesley Beck, Maury Goodman
A-151	C10	**Functional Central Polypurine Tract Provides Downstream Protection of HIV-1 Genome from Editing by APOBEC3G and APOBEC3F** Beatrice Go, Eun-Young Kim
A-155	Q13	**Mouse Model for the Study of Axonal Degeneration in Huntington's Disease** Sooyeon Kim, Sidra Salman, Rodolfo Gatto, Gerardo Morfini
Acad. Pit A-138	T01	**Culture Shocked: A Study of How Differences in Cultural Values Impact International Collaboration** Michael Atten, Glenn "Max" McGee
B-108	C11	**HOXA10 Regulates Transcription of Fibroblast Growth Factor 2 in Myeloid Cells** Ashima Gupta, Elizabeth Eklund, Chirag Shah

09:35 - 09:50 (continued)

B-110	A04	**Comparative Analysis of Protein Cargo Selection During Intracellular Trafficking Under Normal and Heat Stressed Conditions** Madhav Mohandas, Sue Fox, Richard Morimoto, Anan Yu
B-133	C28	**The Role of RBP2 in MCF-7 Cancer Cell Drug Resistance** Aalap Mehta, Elizaveta Benevolenskaya
D-103	F03	**Modeling the Motions of High Altitude Balloons** Joshua Fornek, Mark Subbarao
D-107	A05	**Effects of Modifications to Hsp27 on Viability of Smooth Muscle Cells Under Oxidative Stress** Kyle Mou, Jody Martin, Margaret McShane
D-110	G04	**The Great Recession: A Clarification** Irene Jiang, Lee Eysturlid
Kids Inst. E-115	H02	**The Self-Perceptions of Academic Achievement Amongst Racially Diverse Gifted Students** Morgan Ashley Craft, Ashley Washington, Adrienne Coleman
Lect. Hall B-206	N01	**An Analysis of the Death Penalty Worldwide** Jennifer Bailey, Katia Colin, Sandra Babcock, Delphine Lourtau
B-148	C36	**The Selection of Resistance in *E. coli*** Steven Suh, Donald Dosch

10:00 - 10:15

Room	**Poster ID**	
A-113	B02	**Design and Characterization of Three Dimensional Bioplotted Natural Biopolymer Constructs for Tissue Engineering Applications** Nilesh Kavthekar, Karen Chien, Ramille Shah
A-115	P03	**The Effect of Ccl22 on Regulatory T Cells and Skin Depigmentation in Mice** Wendy Bindeman, Jonathan Eby, Hee-Kap Kang, Caroline Le Poole
A-117	P02	**The Effect of Insulin-Like Growth Factor 1 Chemotaxis on the Metastasis of Cancer Cell Microenvironments** Courtney Amegashie, Kim Elseth, James Radosevich, Benjamin Vesper
A-119	Q18	**Measuring Hemodynamic Response Function in Patients and Healthy Controls** Tonu Pius, Jennie Chen, Todd Parrish, Xue Wang
A-121	I03	**The Physical, Structural, and Chemical Properties of Ni_2ZrIn** Gary Chen, Philip Nash
A-133	P18	**Controlling the Release and Targeting Kinetics to Cancer Cells of a Folic Acid-Targeted Delivery System** Tahir Mohideen, Seungpyo Hong, Suhair Sunoqrot
A-135	O01	**Educating the World with Game Theory** Austin Gonzalez, Erik Luo, Namrata Pandya
A-147	H01	**A Case Study Comparing Parent Involvement Indicators and Factors Between Two Elementary Schools of Different Socioeconomic Levels.** Karina Banda, Joscelyn Garcia, Mariela Rodriguez, Jose Palos, Aracelys Rios
A-149	C41	**Population Structure of Avian Chewing Lice *Brueelia laticeps* on Two Toucan Genera *Andigena* and *Aulacorhynchus*** Malia Wenny, Shannon Hackett, Heather Skeen, Jason Weckstein

10:00 - 10:15 (continued)

A-151	S03	**The Effects of Previous Drug Experience on Responses to 3,4-methylenedioxymethamphetamine** Mallory Giger, Harriet de Wit, Matt Kirkpatrick
Acad. Pit A-138	Q03	**Laboratory Techniques for Studying Amyotrophic Lateral Sclerosis** Zi-Ning Choo, Ted Li, Pembe Hande Ozdinler
B-108	G01	**Analysis of Market-Based Water Conservation Methods in the United States** Yusuf Aktan, Sabina Shaikh
B-110	C39	**Modulation of the Akt/Protein Kinase B Pathway in Human Neutrophils Through the Inhibition of Phosphatase and Tensin Homolog and PH Domain Leucine-Rich Repeat Protein Phosphatase** Lee Tang, Xiangdong Zhu
B-133	C29	**Transcriptional Regulation by Retinoblastoma Binding Protein 2** Aalap Mehta, Elizaveta Benevolenskaya
B-148	C17	**Efficiency of Magnetic Bead and Gel Insert Preparation in Vector Cloning** Tejas Joshi, David Boone
D-107	K05	**The Potential of Vertical Farming** Logan Dodd, Bryan Hoffman, Sarah O'Leary-Driscoll
Kids Inst E-115	T06	**Beauty Advertisement and its Effects on the Body Image of Female IMSA Students** Gina Jung, Madison Schroeder, Amanda Gray, Lauren Lutz
Lect. Hall B-206	Q07	**Using Hippocampal Structure to Differentiate Between Mild Cognitive Impairment Types** Dominic Gentile, Previn Kumar, Kate Alpert, Adam Christensen, Lei Wang

10:25 - 10:40

Room	**Poster ID**	
A-113	F01	**Extracting Key Words from News Articles to Find Appropriate Sites** Brian Chien, Larry Birnbaum, Patrick McNally, Shawn O'Banion
A-115	C26	**The Effects of HSP70 antibodies in an Anti-Tumor Response** Sirisha Manam, Caroline Le Poole, Jeffrey Mosenson
A-117	C14	**Biological Properties of Cancer Cells Through Soft Agar Cloning** Jennifer Huang, Melissa Kim, Kim Elseth, James Radosevich, Benjamin Vesper
A-119	Q01	**Measuring Cerebrovascular Reactivity in Patients With and Without Brain Disorders** Megan Bacani, Dhruv Patel, Jennie Chen, Todd Parrish, Xue Wang
A-121	B04	**Using the Laser Diode to Determine the Stapedius Reflex** Krishna Kudaravalli, Ajay Pius, Claus-Peter Richter
A-131	R07	**Searching for the Standard Model Higgs Boson in the WH→WWW→lvjjjj Channel** Ethan Gordon, Michael Cooke, Ryuji Yamada
A-135	G03	**Combating Corruption and Spreading Financial Services via Technology in Himalayan Economies** Saarthak Gupta, Eric Smith
A-147	C42	**Phase Behavior in Cell-Free Membrane Vesicles** Andrew Wentzel, Adam Hammond
A-149	C20	**The Effects of Cholesterol Level Manipulations in Model Lipid Bilayers** Hannah Koo, Adam Hammond

10:25 - 10:40 (continued)

A-155	E01	**Characterization of Electron Beam-Induced Deposited Nanoparticles in Liquid Medium** Brian Chen, Ralu Divan, Leonidas Ocola
Acad. Pit A-138	Q11	**Identifying Interesting Genes that Show Differences in Healthy and Diseased Amyotrophic Lateral Sclerosis Transgenic Mice at Different Stages of Disease Progression** Lakshmi Katta, Maura Slattery, Pembe Hande Ozdinler
B-108	R15	**Developing a Neutrino Interaction Identification Algorithm** Joshua Love, Shulamit Moed Sher
B-110	R13	**Screening For Contamination From Alpha Particle Decay In Materials for the Cryogenic Dark Matter Search** Jingfei Li, Lauren Hsu
B-148	C04	**Bacterial Species Identification Using Polymerase Chain Reaction** Francis Cocjin, Egle Malinauskaite, Donald Dosch
D-103	P06	**Reducing Radiation from Diagnosing Patients with Suspected Ischemic Stroke** Ajay Chatrath, Arun Jagannathan
D-107	C18	**Loss of miR-145 in Colon Cancer Upregulates Direct Target ADAM17** Kaylee Karumanchi, Bruce Bissonnette, Reba Mustafi
D-110	T05	**Eurovision, the Ultimate European Song Contest: Talent or Politics?** Inga Gurevich, Alexandra Roman, Lee Eysturlid, Christian Nokkentved
Kids Inst. E-115	S11	**Ways of Discussing Mother Nature: Differences in Sharing Learned Information About the Menstrual Cycle Among Adolescent Girls in Residential Versus Commuter Schools** Jessica Ventenilla, Sowmya Anjur, David Evenson, Christopher Kolar
Lect. Hall B-206	P25	**HIV: The Trojan Horse** Adekore Taiwo, Minh Dinh

10:50 - 11:05

Room	**Poster ID**	
A-113	C37	**Increased Heterogeneity of Calcium Cycling in Ventricular Myocytes from Failing Hearts** Shannon Tai, Andrew Wasserstrom
A-115	T12	**Education Systems in China and Their Effect on Leadership Development** Stanley Yuan, Robert Kiely
A-117	R19	**Analysis of the Globular Cluster NGC1851 Using the Dark Energy Survey Filter Set** Deokgeun Park, Tom Diehl, Douglas Tucker
A-119	Q05	**Investigation of Language Networks Using fMRI with Auditory and Visual Stimuli** Mary Do, Todd Parrish, Xue Wang
A-131	C15	**The Effect of the Modified Base m6A on the Splicing of a Pre-mRNA Transcript** Jimmy Huang, Joseph Piccirilli
A-133	A02	**Gold Ion-Protein Interaction by Mass Spectrometry** Jenny Lee, Shalini Gupta, Bao-Shiang Lee
A-135	R16	**A Laboratory Model of Two-Dimensional Granular Collisions** Peter Lu, Justin Burton, Sidney Nagel
A-147	T11	**Invisible Wounds: The Implications of Closed Head Injury Caused by High Explosives** Ian Wilkinson, James Victory

10:50 - 11:05 (continued)

A-149	Q24	**Effects of Misregulation of *GABRB3* Gene Expression in Relationship to Autism Related Behavior** Rebecca Wu, Williams Dietz, Laura Herzing
A-151	Q16	**Acute Seizure-Induced Microglia Activation in the Hippocampus of Postnatal Day 14 Mice** Bindi Patel, Patrick Fox, Sookyong Koh, Lauren Mlsna
A-155	P17	**Characterizing Recent Patent Activity Related to Diagnostic Genetic Testing** Daniel Matthews, Douglas Zhu, Brandon Pierce
Acad. Pit A-138	Q04	**Aberrant Alternative Splicing in Amyotrophic Lateral Sclerosis** Zi-Ning Choo, Ted Li, Areen Pitaktong, Pembe Hande Ozdinler
B-108	C44	**Comparison of the Sutural Morphologies of the Lungfish Taxa Neoceratodus and its Close Relatives** Karthik Yarlagadda, Justin Lemberg, Neil Shubin
B-133	B07	**Microbial Dynamics in Methane Oxidation for Biochar-Amended Landfill Covers** Nishith Reddy, Jean Bogner
B-148	C19	**The Effects of Iodine on the Ghost Shrimp *Palaemonetes kadiakensis*** Jiwon Kim, Vicki Burgholzer
D-103	E10	**Crystallization of Electronic and Magnetic Molecule-Based Materials** Yuanhao Wang, John Schlueter
D-110	C30	**Frequency of Periosteal Reactions in a Nineteenth Century Skeletal Population From Peoria, Illinois** Vamsikrishna Naidu, Anne Grauer
Kids Inst. E-115	T08	**IMSA's Understanding of the Abortion Issue** John McGuire, David Evenson
Lect. Hall B-206	S07	**How Self Perception Differs From Observer Perception in Classmates** Eva Meyer, Joan Chiao, Mark Schurgin

11:15 - 11:30

Room	Poster ID	
A-113	C43	**Triggered Intracellular Ca^{2+} Release in Failing Canine Atrial Myocytes** Shannon Tai, Shohei Yamakawa, Satya Yerrabolu, Andrew Wasserstrom
A-117	I14	**Characterization and Manipulation of Nanorods via an Applied Magnetic Field** Summer Wu, Vinayak Dravid, Shih-Han Lo
A-119	Q06	**Water Diffusion as an Effective Biomarker to Evaluate Efficacy of Brain Treatment Performance** Mary Do, Joan Shang, Jennie Chen, Todd Parrish, Xue Wang
A-121	B10	**Frequency Detection in Deaf Cats** Nathaniel White, Brent Wu, Agnella Matic, Claus-Peter Richter
A-131	R08	**Computer Simulation of Quenching in the High Field Superconducting Accelerator Magnet Made with Nb_3Sn Cable** Jimmy Huang, Ryuji Yamada
A-133	G02	**Modeling and Forecasting the Price of Gold Futures: Comparing the Black-Scholes Equation Against a Multi-Factor Linear Regression Model, Time-Series Analysis, and More Complex Stochastic Models** Henry Deng, John Bonie, Eric Smith

11:15 - 11:30 (continued)

A-135	B09	**Visualization of Functional Group Selection in Creating Hypothetical Metal-Organic Frameworks** Matthew Tsao, Randall Snurr, Chris Wilmer
A-149	K06	**Indices of Sustainability** Christian Fitzsimmons, Michael Horn
A-151	J01	**"The One Sin the Gods Never Forgive Us is That of Being Born Women:" A Study of Women in Popular Modern Fantasy** Brianna Collender, Karolyn Stromdahl, Adam Kotlarczyk
A-155	I10	**Improving the Design of a Dual Intermeshing Rotor Helicopter** Amir Safavi, Francisco Ruiz
Acad. Pit A-138	C31	**The Glycobiology of Prostate Cancer** Areen Pitaktong, Roger Kroes, Joseph Moskal, Mary Schmidt
B-108	I01	**Methods for Reduction of Power Consumption in Display Electronics** Jorge Acosta, Ayun Brown, Lucas Sturnfield
B-133	C32	**The Effect of Vector Backbones on PCR Cloning of Green Fluorescent Protein** Nishith Reddy, David Boone
B-148	Q09	**Moderate Ethanol Preconditioning Induction of Heat Shock Protein 70 in Non-Primary Neuronal Cell Lines and its Correlation to Neuroprotection** Grant Herrman, Michael Collins, Donald Dosch
D-103	I07	**Designing a Water Filter for Developing Nations** Benjamin Kuo, Mark Carlson
D-107	E08	**An Investigation into Solid Catalysts for Biodiesel Synthesis from Used Fryer Oil** Ashley Radee, Justin Notestein
D-110	K02	**The Plausibility of Creating Green Energy Farms From Blemished Crops** Ty Bottorff, Kenzo Esquivel, Olivia Legan, Branson Lawrence
Kids Inst. E-115	Q10	**Vasogenic Edema as a Mechanism of Transgenic Human Antigen R-Mediated Increase in Ischemic Lesion Size in a Mouse Stroke Model** Kevin Hong, Agnieszka Ardelt, Randall Carpenter
Lect. Hall B-206	S08	**Culture and Color: Evidence for Cultural Diversity in Color Perception** Jennifer Ren, Joan Chiao

12:30 - 12:45

Room	**Poster ID**	
A-117	C03	**Regulation and Role of Regulator of G-protein Signaling-1 in Celiac Disease Pathogenesis** Yiyun Cao, Cezary Ciszewski, Bana Jabri
A-131	I11	**A Transimpedance Amplifier Under Cryogenic Temperatures** Robert Schurz, Rene Padilla
A-147	P09	**Investigating Beta-Catenin and Calretinin as Possible Markers for Recurrence or Transformation of Glioneuronal Tumors in Pediatric Patients** Sonya Dave, Veena Rajaram
A-151	Q22	**Modulation of Calcium Homeostasis on Amyloid-Beta Derived Diffusible Ligand-Treated Astrocytes** Shruthi Subramanian, William Klein, Pascale Lacor

12:30 - 12:45 (continued)

B-108	P19	**Priming of Alveolar Macrophages by Lipopolysaccharides Augments Inflammatory Response When Stimulated by Anthrax Lethal Toxin** Viveka Patel, Irena Levitan, Johnson Thomas
Kids Inst. E-115	Q19	**Characterization of Neuronal Human Antigen-R Protein Expression** Abhinav Reddy, Agnieszka Ardelt, Randall Carpenter
Lect. Hall B-206	Q23	**Using a Drosophila Melanogaster Model to Study ALS** Amanda Sul, Connie Wang, Xiaoping Chen, Jane Wu, Mengxue Yang

12:55 - 01:10

Room	**Poster ID**	
A-113	R01	**Photomultiplier Tube Calibration for the Use of Solid Xenon as a Particle Detector** Vidya Anjur, Jonghee Yoo
A-115	T04	**An International Energy Assessment: The Benefits and Pitfalls of Nuclear Power in the Modern Age** Richard Fafara, Alexander Stratton, Robert Kiely
A-119	T07	**The Significance of the Latino Vote in the Presidential Election of 2012** Itzel Lopez, Uriel Ramirez, Juan Andrade, Marcos Popovich
A-121	P20	**Tumor-Associated Mastocytosis in Human Ulcerative Colitis Leading to Colon Cancer** Saieesh Rao, Mohammad Khan, Khashayarsha Khazaie
A-133	O02	**2- ε Devils Trap an Angel of Power 2** David Wang, Mark Fischler
A-135	A01	**The Effects of Varying Concentrations of Permanent Hair Relaxer Components on Human Fibroblasts Cells** Osazomon Imarenezor, Anita White
A-155	R06	**Testing Correlations Between Nuclear Decay Rates and Earth-Sun Distance** Arjun Garg, Vadim Rusu
B-133	C05	**Hypoxia and Starvation Promote Autophagy as a Survival Mechanism** Shelby Daniel-Wayman, Laura Dada, Markus Queisser
B-148	B06	**Modeling Spatial Population Dynamics of Stem Cells in Tissue Growth** Claire Liang, Youfang Cao, Qing Nie
D-103	C16	**Leaf Variation in *Agathis robusta* as an Indicator of Forest Structure for Fossil Plants** Seneca Hutson, Amanda Magyar, Kevin Boyce
D-107	E04	**An Investigation into Solid Catalysts for Biodiesel Conversion Using Fresh Soy Oil** Nishita Kumar, Justin Notestein
D-110	Q12	**Clustering Depressive Symptoms in Aging: Group Differences and White Matter Correlates** Kathryn Kim, Mailynn Grajewski, Laura Korthauer, Melissa Lamar
Kids Inst. E-115	I13	**IMSA Students' Motivations to use Electricity Generating Bikes** Kyle Stanevich, Branson Lawrence
Lect. Hall B-206	K07	**Acceleration and Expansion of Diversity in the Illinois Mathematics and Science Academy Prairie** Clare Leahy, Elaina Zintl, Donald Dosch

1:20 - 1:35

Room	Poster ID	
A-113	C35	**The Role of the Receptor Nectin-1 in Viral Spread of Herpes Simplex Virus-1** Navika Shukla, Tibor Valyi-Nagy
A-115	P07	**Associations Between HIV Susceptibility and Mutations in the Vif-Associated APOBEC3G Proteasomal Complex** Kevin Chong, Jackson Michuda, Sudhir Penugonda
A-117	C23	**The Role of *SGK1* in Cell Proliferation and Apoptosis in Endometriotic Cells** Shannon Kurian, Monica Patel, Serdar Bulun, Diana Monsivais
A-119	A03	**Mechanism of MYCN Destabilization in Neuroblastoma** Nolan Maloney, Naohiko Ikegaki, Xao Tang
A-121	P21	**Comparing Invasive and Non-Invasive Blood Pressure Recordings in Premature Patients Less than Thirty Seven Weeks Gestational Age with Diagnosis of Patent Ductus Arteriosus** Brooke Ray, Cristina Vega
A-131	P24	**The Effect of Cardiac Reoperation on Ventricular Function** Nicholas Srivastava, Jia Raman
A-133	T03	**The State of Somalia: The United Nations in Practice and in Theory Since the Decolonization Era** Sharadyn Ciota, Eric Smith
A-135	C38	**An Analysis of the Effects of Azelaic Acid on Principal Gene Expression and Root Growth in *Arabidopsis thaliana*** Arjun Tambe, Nicolas Cecchini, Jean Greenberg
A-147	P05	**An Assessment of the Benefits of a Spinal Surgery Simulator on the Learning and Growth of Neurosurgical Residents** Alice Chang, Jiachen Wang, Aruna Ganju
A-149	T02	**An Examination of the Polish American Experience** Sophia Baramidze, James Victory
A-151	B01	**Incorporating Apoptosis in a Cell Proliferation Simulation Program** Eaton Guo, Jie Liang, Hammad Naveed
A-155	C02	**The Effects of Plyometric Strength Training on Running Economy** Lydia Auch, Christine Darabaris, Steven Sadowsky
Acad. Pit A-138	Q25	**The Role of Protein X in Eliminating SOD1 in Fibroblasts Derived from SOD1-G93A Transgenic Mice** Vivian Zhang, Hasan Arrat, Faisal Fecto, Teepu Siddique
B-108	E09	**Spectroscopic Analysis of Chemical Intermediates of Lithium-Air Batteries** Richard Shen, Hsien-Hau Wang
B-133	C21	**The Effect of the Enteric Biome on Lysosomal Hydrolase Activity** Dipen Kumar, Glyn Dawson
B-148	C46	**CD1-d Expression in Breast Cancer Progression** Jeffrey Zhao, Ming Zhang
D-103	R10	**Recycling Carbon Dioxide: Following Algae Response to High Concentration Carbon Dioxide Environments** Aadam Ibrahim, Mark Carlson, Carolyn Hirschmugl
D-107	R05	**The Future Now: Using Developing Rocket Technologies to Create the Ultimate Thrill Ride** Jasmine Davila, Quinn Gingerevans, Eric Hawker

1:20 - 1:35 (continued)

D-110	K03	**Energy Efficiency of Hand Dryers Compared to Paper Towels and Their Effect on Energy Consumption on the IMSA Campus** Christina Cheng, Harsha Jujjavarapu, Branson Lawrence
Kids Inst. E-115	G05	**Determining the Value of a Baseball Player** Samuel Kaufman, Matthew Tennenhouse, Christopher Kolar
Lect. Hall B-206	S02	**Effects of Personality, Gender, and Age on Spatial Relations Ability** Victoria Etherton, Joan Chiao, Mark Schurgin

1:45 - 2:00

Room	**Poster ID**	
A-113	P16	**Effect of Laser Photocoagulation Therapy on the General Morphology of Mouse Retina** Xiaoyu Li, Xiaorong Liu
A-115	M02	**The Effect of the Arab Spring on Egypt's Government, Diplomatic Relations, and its Economy** Connor Kasch, Robert Kiely
A-117	E02	**Determining the Global Minimum Binding Energy of the Interaction Between Different Gas Molecules and Functional Groups in Metal-Organic Framework Using Quantum Chemistry Calculations** Sanggyu (Raymond) Chong, Michelle Suh, Ki Chul Kim, Randall Snurr
A-119	I08	**Designing a Mixed-Use Facility in a Semi-Urban Environment** Byron Mui, Justin Sass, Steven Vasilion
A-121	C33	**How Does the Silencing Mediator of Retinoid and Thyroid Hormone Receptors Affect Glucocorticoid Receptor Action?** Sabrina Roberts, Ronald Cohen
A-131	C40	**Comparison of Drosophila *cmi* and Human MLL/ALR Type 3 PHD Fingers** Riva Trivedi, Andrew Dingwall, Claudia Zraly
A-133	P12	**Exploring the Relationship Between Metabolic Acid-Base Status and the Number of Apnea, Bradycardia, and Desaturation Alarms in Infants 27-32 Weeks Gestation in the First Two Weeks of Life** Rae Hohle, Aditi Warhekar, Patricia Hummel
A-135	K09	**Determining Toxicity of Sediment in the North Shore Channel** Hyun Bin Park, Jean-Francois Gaillard
A-147	F02	**TitanOS: The Student Operating System** Mosab Elagha, Ivan Zlatanov, James Gerry
A-149	C13	**Action of Estrogen on Tumorigenic and Non-Tumorigenic Rat Prostate Epithelial Progenitor Cells** Dorcas Huang, Dan-Ping (Grace) Hu, Wen-Yang Hu, Gail Prins
A-151	I05	**Optimizing the Conjugation and Separation of Linear Chains of Polyphosphates** Aditya Karan, Ying Liu
A-155	I06	**Determining the Feasibility of Using Polymer Electrode Membrane Fuel Cells as a Household Power Source** Keith Kimberling, Brooke Schmidt, Promod Vohra
Acad. Pit A-138	C06	**Characterizing Tolerance in Pediatric Food Allergy** Sonya Dave, Andrew Ta, Aaditya Tolappa, Ashley Dyer, Ruchi Gupta

1:45 - 2:00 (continued)

B-108	C12	**A Correlation Between Anticipatory Behaviors and Feeding Times in Captive Animals** Katherine Havighorst, Brooke Kottkamp, Debra Kutska, Jason Watters
B-133	P22	**Role of Foxc1 and Foxc2 in Differentiation of Embryonic Stem Cells to Vascular Endothelial Cells.** Mahendra Reddy, Anees Fatima, Tsutomu Kume
B-148	E06	**Thin Layer and High Performance Liquid Chromatography of Chinese Medicinal Herbs** Grace Li, Lily Lou, Chun-Tao Che, Ming Zhao
D-103	C22	**Investigation of the Expression Pattern of Thioredoxin Domain Containing 9 in Developing Zebrafish** Vignessh Kumar, Eric Schroeter
D-107	M03	**The Rise and Fall of Great Powers** Mia Leckie, Agnel Philip, Claiborne Skinner
D-110	K08	**The Efficiency of Green Roofs as a Method of Insulation for Urbanized Buildings** Ashwin Mitra, Branson Lawrence
Kids Inst. E-115	S06	**Examining the Levels of Overexcitabilities of IMSA Sophomores** Taylor Imburgia, Christopher Kolar, Deborah McGrath
Lect. Hall B-206	Q14	**IL-10 Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS** Rahul Maheshwari, Sarah Martin, Nichole Mesnard, Julie Rowin

2:10 - 2:25

Room	**Poster ID**	
A-113	R03	**Minimizing Electrical Noise in the MicroBooNE Liquid Argon Time Projection Chamber and Developing an Algorithm for Event Classification** Emily Camras, Brian Rebel
A-115	S05	**Perceptual Learning in Synthetic Speech with Interference** Corey Hornbeck, Shannon Heald
A-117	I04	**Finding Hydrophobic Chemical Structure That Enables the Adsorption of Ammonia** Sanggyu (Raymond) Chong, Ki Chul Kim, Randall Snurr
A-119	R17	**Exploring Alternate Explanations for Dark Matter's Claims: Long Term Activation of Radiated Sodium Iodide Crystal** Kirti Munjeti, Hugh Lippincott
A-121	C45	**The Role of the Silencing Mediator of Retinoid and Thyroid Hormone Receptor in Regulating 1,25-Dihydroxyvitamin D Receptor Activity** Kelly Yom, Ronald Cohen, Margo Emont, Michael Landeche
A-131	P26	**Modulation of Stem Cell Marker (DCAMKL1) Expression During Colon Cancer Chemoprevention** Rohan Verma, Mart DeLa Cruz, Ramesh Wali
A-133	P27	**More Factors Influencing Successful Weaning From Caffeine and Outcomes of Infants Who Failed Weaning From Caffeine** Rheanna Vimawala, Patricia Hummel, Christine Sajous
A-135	R09	**Fourier Transform Infrared Imaging in Determining the Effectiveness of Trehalose as a Protectant** Aadam Ibrahim, Carolyn Hirschmugl
A-147	F06	**Graphics Processing Unit-Accelerated Proton Collision Modeling in C++ and CUDA** Matthew Yang, Walter Giele, Gerben Stavenga

2:10 - 2:25 (continued)

A-149	S12	**The Effect of Homelessness on Executive Functions in Homeless Youth** Kevin Zhang, Scott Hunter
A-151	P04	**Qualitative Assessment of Modern Dental Products** Seth Butcher, Dean Lodding
A-155	R04	**Searching for Dark Matter Using Charge Coupled Devices** Kathleen Chinetti, Thomas Schwarz
Acad. Pit A-138	F05	**An Exploration into Artificial Intelligence: The Mind as a Complex, Adaptive System** Andrew Wentzel, Mike Ososky
B-108	P10	**Institutional Review Board Unanticipated Problems Involving Risks to Subjects or Others Reports Lack Sufficient Information to Determine Causality** Annie Guo, Steven Belknap, Debra Gibson Tice, Dennis West
B-133	U01	**Connection Between Pressure and Molecular Hydrogen in Galaxies** Jose Hernandez, Robert Feldmann, Nick Gnedin
B-148	E05	**Standardization of Chinese Medicinal Herbs by Thin Layer and High Performance Liquid Chromatography** Joshua Lam, Chun-Tao Che
D-103	P14	**Defining the Sleep and Cardio-Metabolic Phenotypes of Individuals with Age-Related Insomnia** Vignessh Kumar, Hrayr Attarian, Roneil Malkani, Kathryn Reid
D-107	M01	**French Colonial North America** Luis Gomez, Claiborne Skinner
D-110	L01	**Understanding Music Structure and Form with the Intent of Composing Music** Carol Gu, Peter Dong
Kids Inst. E-115	E03	**Comparing the Antioxidant Contents of Blueberries, Grapes, and Acai Berries** Yan-Yang Feng, Mingyang (Jennifer) Li, Deborah Scarano
Lect. Hall B-206	Q15	**Tumor Necrosis Factor α Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS** Rahul Maheshwari, Sarah Martin, Nichole Mesnard, Julie Rowin

A01
The Effects of Varying Concentrations of Permanent Hair Relaxer Components on Human Fibroblasts Cells

Presenter(s)
Osazomon Imarenezor, Illinois Mathematics and Science Academy

Advisor(s)
Anita White, Illinois Mathematics and Science Academy

The damage of permanent hair relaxers, ranging from skin irritation to flesh burns, can vary depending on the chemical and its concentration. This study focuses on the damaging concentrations of commonly used chemicals in these permanent hair relaxers such as sodium hydroxide, ammonium thioglycolate, guanidine hydroxide, and ammonium sulfite. A human fibroblast cell line, M059K, was selected to test the damaging effects of these substances. Cells were incubated with different concentrations of each chemical for different exposure times. Following exposure, cell viability was measured using the methylthiazol tetrazolium assay and neutral red tests. Preliminary results suggest 15 minutes of cell exposure to 2.5% sodium hydroxide is completely toxic to the fibroblast cell line. Further studies will address the effects of lower concentration of sodium hydroxide and the effects of the other chemicals. Our objective is to educate the population on the potential hazards of beauty products.

A02
Gold Ion-Protein Interaction by Mass Spectrometry

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

Advisor(s)
Shalini Gupta, University of Illinois at Chicago
Bao-Shiang Lee, University of Illinois at Chicago

Increased interest in gold containing compounds for cancer treatment and ambiguity over the mechanisms of these drugs have spurred the investigation of gold ion and protein interactions by mass spectrometry. Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry detects singly/multiply charged ions for insulin, myoglobin, carbonic anhydrase, albumin, and Immunoglobulin G, which have molecular weights ranging from 5700-150000 daltons. Cyanogen bromide, trypsin, and V8 digestions of proteins revealed that there are loosely bound and tightly bound gold molecules. Furthermore, the addition of a reducing agent strips the protein of any attached gold, proving that the gold ion-protein reaction is noncovalent. The number of gold ions attached to the protein increases with the size of the protein because there are more available binding sites on larger proteins. Higher gold ion concentration enhances the number of gold molecules attached to the proteins. However, too high of a gold concentration leads to the degradation and/or aggregation of the protein. Collision-induced disassociation experiments of the gold-attached peptide ions for insulin show that the binding sites are in the vicinity of histidine and the basic residue arginine of the ß chain of insulin. Similar findings are also observed in myoglobin, carbonic anhydrase, albumin, and immunoglobulin G.

A03
Mechanism of MYCN Destabilization in Neuroblastoma

Presenter(s)
Nolan Maloney, Illinois Mathematics and Science Academy

Advisor(s)
Naohiko Ikegaki, University of Illinois at Chicago
Xao Tang, University of Illinois at Chicago

Neuroblastoma is one of the most common pediatric cancers. The outcome of neuroblastoma is highly dependent on the levels of MYCN present in the cell, a transcription factor encoded by the *MYCN* proto-oncogene. We have identified three compounds (salinomycin, FCCP, and OSU-03012) that rapidly destabilize MYCN and also lead to growth suppression. Recently, we showed that treatment of neuroblastoma cells with meta-iodobenzylguanidine and metformins, inhibitors of mitochondrial respiration, and combinations of these have an additive effect on *MYCN* and *MYC* expression. The mechanism of action we proposed begins with drug-induced inhibition of mitochondrial functions, leading to production of reactive oxygen species (ROS). ROS are known to hydroxylate proline residues, which are present in high concentration on MYCN. The binding of the Von-Hippel Lindau (VHL) tumor suppressor protein is known to be oxygen-dependent, and thus we have proposed that degradation of MYCN occurs due to a protein-protein interaction between MYCN and pVHL. Our data, generated by Western blot analysis and a pull-down assay suggests that a relationship between MYCN and pVHL exists. By elucidating the mechanism by which drugs suppress neuroblastoma tumor cell growth, this work will lay the foundations for developing additional methods of treatment for neuroblastoma.

A04
Comparative Analysis of Protein Cargo Selection During Intracellular Trafficking Under Normal and Heat Stressed Conditions

Presenter(s)
Madhav Mohandas, Illinois Mathematics and Science Academy

Advisor(s)
Sue Fox, Northwestern University
Richard Morimoto, Northwestern University
Anan Yu, Northwestern University

Recent studies have identified clathrin adaptor (AP) complexes as potential regulators of polyglutamine protein aggregation in *C. elegans*. Protein aggregation is one of the hallmarks of neurodegenerative disorders and leads to the progressive loss of essential cellular functions. The central roles of the AP complexes are to transport proteins between different cellular compartments and across the plasma membrane. Here, we investigate whether under a cellular stress condition such as heat stress, the clathrin AP complex will transport stress-induced protein cargos that may play important roles in regulating stress responses. In this study we use a glutathione-S-transferase fusion protein pull-down procedure to detect and identify protein-protein interactions. We use *C. elegans* as a model organism, and identify interacting partners of our bait protein, the cargo recruiting mu2 adaptin of clathrin AP 2 complex, using proteins extracted from normal or heat stressed worms. Through mass spectrometry analysis, we identified four interacting partners of our bait that only appear under the heat shock condition. These four proteins are known to play a significant role in the heat shock response. The identification of novel interacting partners of clathrin AP complexes provides valuable information in understanding the pathways that govern the heat shock response.

A05
Effects of Modifications to Hsp27 on Viability of Smooth Muscle Cells Under Oxidative Stress

Presenter(s)
Kyle Mou, Illinois Mathematics and Science Academy

Advisor(s)
Jody Martin, Loyola University
Margaret McShane, Loyola University

Heat shock proteins serve to protect cells under stress by facilitating the proper folding of other proteins. The small heat shock protein 27 (Hsp27) protects the cytoskeleton by preventing filamentous actin from being cleaved to globular actin. We investigated the effects of various modifications to both the Hsp27 protein and its level of expression on cell death in A7r5 smooth muscle cells exposed to hydrogen peroxide. The cells were treated with phosphorylation-inhibiting drugs and recombinant adenoviruses expressing Hsp27 in its non-phosphorylatable form. Cell viability was determined by colorimetric assays. We found that overexpression of Hsp27 increased cell viability significantly, while overexpression of the non-phosphorylatable form slightly increased cell viability. Our data for the use of phosphorylation inhibitors was inconclusive. This implies that expression of Hsp27 is protective for our model of oxidative stress of smooth muscle cells. These results may be useful for treatment of vascular disease caused by noxious stresses.

B01
Incorporating Apoptosis in a Cell Proliferation Simulation Program

Presenter(s)
Eaton Guo, Illinois Mathematics and Science Academy

Advisor(s)
Jie Liang, University of Illinois at Chicago
Hammad Naveed, University of Illinois at Chicago

In my investigation, I have been using Visual Studio to modify a program developed by my SIR advisors that models the proliferation of epithelial cells. The program does not currently account for the variable of cell death in its simulations, and my goal is to incorporate it. My methods include researching scientific articles on apoptosis, and strengthening my background in C through books and online resources. In order to understand the program better, I have been reviewing it part by part with my advisor. So far through research and the help of my advisor, I have found a reliable figure for the rate of cell death which I will later use when adding apoptosis to the program. I have also read through the program's essential methods and structure, so that when I begin modifying it I will know what kinds of functions and variables to use. By running the program using four different built-in methods of cell division, I have reached the same conclusion that the largest-angle division method is the most accurate in comparison to experimental data. By my current progress, I conclude that I have learned a lot and should be ready to modify the program soon.

B02
Design and Characterization of Three Dimensional Bioplotted Natural Biopolymer Constructs for Tissue Engineering Applications

Presenter(s)
Nilesh Kavthekar, Illinois Mathematics and Science Academy

Advisor(s)
Karen Chien, Northwestern University
Ramille Shah, Northwestern University

The enormous global demand for tissue and organ transplants has increased interest in technologies that can regenerate functional tissues and organs outside the body. This investigation explored one such technology: scaffolding made with natural biopolymers including soy protein isolate (SPI) and collagen. In this investigation, optimal parameters to produce porous scaffolds with three-dimensional bioplotting technology, a type of three-dimensional printing, were established. These parameters were used to fabricate one-layer scaffold constructs of the two material types and in square and triangle spatial pore configurations. Surface morphology and construct dimensions were characterized using scanning electron microscopy. The proliferation of human mesenchymal stem cells (hMSCs) seeded onto the constructs was studied qualitatively (using confocal microscopy) and quantitatively (using PicoGreen DNA quantification assay) over fourteen days. Imaging showed that hMSCs were establishing confluent layers on the pore surfaces. Both SPI and collagen scaffolds maintained cell viability and induced growth between seven and fourteen days. On collagen scaffolds, cell growth caused scaffold constriction after seven days. Although trends have been observed concerning how the pore shape and material type influence cell proliferation, further experimentation is necessary. This investigation has demonstrated the feasibility of using SPI and collagen three-dimensional bioplotted constructs for tissue engineering purposes.

B03
Role of the Prefrontal Cortex in Trace Eye-Blink Conditioning

Presenter(s)
Akram Khaja, Illinois Mathematics and Science Academy

Advisor(s)
Craig Weiss, Northwestern University

The way the brain creates, stores, and retrieves memory is not well understood. Some parts of the brain, namely the prefrontal cortex and the hippocampus, have known functions in memory consolidation, but the circuitry and importance of each part is still unclear. To help answer the question, neural activity is recorded from the locations while a rabbit learns a memory task called trace eye-blink conditioning. Whisker vibrations and air puffs are paired and eventually, the rabbit starts to associate them and blink in response to the whisker vibrations prior to the air puff. Any trends that are found in the firing rate of neurons in the different regions are analyzed and taken into consideration along with results of other studies. In the end, it was found that the hippocampal neurons had elevated firing rates during the start of training while the prefrontal cortex neurons had low firing rates. After the rabbit learned the task, the firing rates were switched. This implies that memory is initially coded in the hippocampal region but is moved to the prefrontal cortex for permanent storage. Knowing the importance of each structure for memory can help move towards solving memory problems and diseases in the future.

B04
Using the Laser Diode to Determine the Stapedius Reflex

Presenter(s)
Krishna Kudaravalli, Illinois Mathematics and Science Academy
Ajay Pius, Illinois Mathematics and Science Academy

Advisor(s)
Claus-Peter Richter, Northwestern University

The stapedius reflex, an involuntary muscle contraction of the tensor tympani, occurs as a response to high intensity sound. By finding the intensity at which this reflex occurs, one can determine the upper threshold for the comfortable loudness range for ideal hearing. This can be useful in calibrating hearing devices for individuals. In the past, people have measured this reflex through invasive procedures that use either electrical or acoustic measuring device, but we want to measure this reflex with a non-invasive procedure using laser interferometry. This study included measuring the reflex in anesthetized guinea pigs using both electric and acoustic devices stimulation and comparing it with results of the laser measurements. It also involved constructing a laser measurement device, consisting of a laser, a laser diode, and an amplifier. The results show and prove the apparatus in principle. The device is able to accurately detect the vibrations of some surfaces. By placing our apparatus in the ear and shining the laser on the tensor tympani, in principle, we can measure the stapedius reflex. Using the laser diode is possible, but the device has still to be tested on the guinea pig ear prior to testing on humans.

B05
Micelle Formulations of Dendron-Based Block Copolymers with Various Surface Groups

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

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

Dendron-based block copolymers have attracted much scientific interest due to their ability to merge the advantages of dendrimers with those of linear-block copolymers. These amphiphilic polymers have the capacity to form a vast array of self-assembled structures including micelles, vesicles, and cylindrical structures depending on their structural components. Here were present the self-assembled structures formed from three types of linear dendron-based copolymers with varied surface charges (positive/negative/neutral). Using dynamic light scattering, we show that all micelle preparations formed self-assembled structures less than 100 nm in diameter. Surface charges were quantitatively measured as zeta potential. Positively charged micelles were found to have the largest hydrodynamic radius and negatively charged micelles had the smallest measured radius. Micelle formulations that possess a neutral or negative charge are most promising for uses in further biological studies due to their biocompatibilities. Surface functionalization of dendron-based micelles offers numerous future opportunities to tailor the properties of these nanocarrier platforms for targeted drug delivery.

B06
Modeling Spatial Population Dynamics of Stem Cells in Tissue Growth

Presenter(s)
Claire Liang, Illinois Mathematics and Science Academy

Advisor(s)
Youfang Cao, University of Illinois at Chicago
Qing Nie, University of California at Irvine

Understanding cell populations allows insight into control mechanisms of developing mammalian tissues. Negative feedback loops regulate the cell type populations by maintaining equilibrium on the dynamics of populations for tissue proliferation control involving stem cells. Previously, spatial information was neglected, and the feedback controls were unrealistically population based. Our Matlab and C model expresses the shape, growth, and division of each cell using realistic geometry in which the plane is controlled by shape and tension forces. Inhibited growth rate, proliferation, and differentiation probabilities of individual cells are modeled through feedback loops controlled by secretions of neighboring cells within a proper diffusion radius. The division type is selected by Monte Carlo sampling. Our model of temporal-spatial population dynamics demonstrates how feedback loops control the growth of tissues and characterizes cell population dynamics and temporal-spatial relationships of cells within tissue. Stochastic events of symmetric and asymmetric cell divisions of differentiating cells are in our growth model as well. Our model shows that with proper strengths of inhibitions to growth and division types of differentiating cells, the tissue can achieve homeostatic size control. The model can be applied to issues on tissue development and pattern formation in stem cell and cancer research.

B07
Microbial Dynamics in Methane Oxidation for Biochar-Amended Landfill Covers

Presenter(s)
Nishith Reddy, Illinois Mathematics and Science Academy

Advisor(s)
Jean Bogner, University of Illinois at Chicago

Anaerobic degradation in soils accounts for large-scale emissions of landfill gases such as methane. The association of methane with the greenhouse effect has caused global concern for climate change. Soil methanotrophs undergo two major processes for methane degradation, the ribulose monophosphate pathway and the serine pathway, which are implicated in the oxidation and mitigation of methane emissions. However, limited research exists on the specific characteristics of the microbial activity. This study used simulated column experiments with varying methanotroph content to analyze the effect of bacterial growth on methane oxidation. Biochar was used as a mechanism for fostering the additional microbe proliferation. DNA and RNA analysis in this research found that methanotrophic bacteria show non-bias molecular activity in methane mitigation and are consistently more active near the soil surface. This biochar amended soil cover can be used as a methane-mitigating cover in existing landfills.

B08
Effect of Cleaning Methods on Hydrophilicity of Different Thicknesses of TiO_2 Layers

Presenter(s)
Nathan Suek, Illinois Mathematics and Science Academy

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

Failure of implants because of poor integration results in wasted money, time, and a poorer quality of life for patients. Improving the hydrophilicity of the implant can improve integration of the implant with bone to prevent failure (osseointegration). This study examines the effects of different cleaning methods on the contact angle as a measure of hydrophilicity. We compared Ti-II (commercially pure titanium) or Ti-V (alloy) with a TiO_2 layer deposited by atomic layer deposition (ALD). The contact angles were compared after the following conditions: 1) after wash with deionized water and dried by N_2 or air, 2) after sonication with methanol and dried by N_2 or air. It was found that there is no significant difference between N_2 and air drying. Contact angle measurements after ALD for Ti-V with 2 nm coating are also not significantly lower when compared to 2 nm coated TiO_2 coated Ti-II. Contact angle measurements after ALD for Ti-V with 10 nm coating are significantly lower when compared to Ti-II and Ti-V with 2 nm coating. After finding an optimal method for improving hydrophilicity of the substrate, we hope to examine infection control methods such as silver nanoparticles, covalently bonded antibiotics, and ZnO coatings.

B09
Visualization of Functional Group Selection in Creating Hypothetical Metal-Organic Frameworks

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

Advisor(s)
Randall Snurr, Northwestern University
Chris Wilmer, Northwestern University

Carbon dioxide storage has been a common method in reducing the amount of greenhouse gasses in the atmosphere. Metal organic frameworks (MOFs) have shown promise in storing and retaining carbon dioxide gas. The permutations of the functional groups that make up these MOFs result in thousands of possible frameworks. In order to find the most effective framework to store carbon dioxide, the Snurr research group is writing a computer program that generates hypothetical frameworks and subsequently tests them for their carbon dioxide retention rates. Contributions from this SIR investigation have been computer programs that will function as pieces of the research group's final code. These programs include a visual three-dimensional functional group selection program that allows a user to select the desired groups for molecular permutation, as well as the generation of dummy variable files to join functional groups together. These programs will help the Snurr group finish their MOF retention efficiency program by making the interface more efficient, as entering commands will take significantly less time.

B10
Frequency Detection in Deaf Cats

Presenter(s)
Nathaniel White, Illinois Mathematics and Science Academy
Brent Wu, Illinois Mathematics and Science Academy

Advisor(s)
Agnella Matic, Northwestern University
Claus-Peter Richter, Northwestern University

In order to distinguish between different sounds, both cats and humans must differentiate their frequencies. This experiment tests for the frequency equivalent of cochlear implants in the ears of deaf cats in order to determine if the implants are functional. Electrodes are placed on the cochlea to stimulate certain frequency regions so that the cat should hear tones of these frequencies. In order to test the implant, the cat is placed in a feeder system in which various tones are played through a MATLAB program, but only one tone is the correct one. If the cat hears this correct sound and presses on a lever in the feeder, a food reward is given to it; otherwise, no reward is given if the lever is pressed for an incorrect tone. A running MATLAB code that plays different tones and responds to lever presses has been applied to the feeder system. Experimental data will be provided after test trials. The response of the cat to the correct tone and the delay time for the response will be analyzed. If the cats are able to distinguish the correct tone for the majority of the experiment, then the cochlear implants should be functional.

C01
Analysis of Colorectal Cancer Risk Factors in E-Cadherin in Diverse Patient Populations

Presenter(s)
Soham Ali, Illinois Mathematics and Science Academy

Advisor(s)
Nathan Ellis, University of Illinois at Chicago
Archana Krish, University of Illinois at Chicago

The overall goal of this project is to identify and characterize genetic risk factors that confer susceptibility to colorectal cancer (CRC). Of all the American ethnic groups, African Americans have the highest risk of CRC. In genome-wide association students of Caucasians, genetic associations between two single nucleotide polymorphisms (SNPs), rs9929218 and rs1862748, in a genomic region that contains CDH1were identified in CRC (Houlston et al., 2007). These two SNPs were not associated with CRC in a study of two African American CRC groups (Kupfer et al., 2010). To find out the SNP's related to Americans of African descent, I have analyzed the CDH1 region of genomes of sixty-four samples of that ethnic group from Chicago, and found about 851 different single nucleotide polymorphisms in the CDH1 region, while there are around 689 distinct SNPs in the 246 African cases found in three populations on 1000 Genomes online database. Using fixation index (Fst) comparisons, the variance between SNPs of the three 1000 Genome populations and the sample from Chicago were analyzed. The resulting value will indicate the strength of the similarities between the four data sets. Then, using linkage disequilibrium (LD) analysis, the sets will be compared to identify the shared SNPs. Significant variation in Fst and LD when comparing Chicago African Americans with other populations of African descent might indicate important differences in the structure between these populations, which could influence the SNPs related with disease.

C02
The Effects of Plyometric Strength Training on Running Economy

Presenter(s)
Lydia Auch, Illinois Mathematics and Science Academy
Christine Darabaris, Illinois Mathematics and Science Academy

Advisor(s)
Steven Sadowsky, Northwestern University

Running economy (RE) is the efficiency with which athletes use the oxygen they take in when running at a given speed. This topic is of increasing value to athletes because of its strong association with distance running performance. Based on random assignment to control and intervention groups, subjects performed two sub-maximal exercise tests six weeks apart using the first three stages of the Bruce sequence. During the intervening period, members of the control group maintained their normal training schedule (at least twenty miles running per week), and the intervention group completed a plyometric training regime in addition to the normal training schedule. All subjects are currently completing their training programs. After retesting, data will be analyzed to calculate an initial RE value and an ending RE value. Subsequently, two tailed t-tests will be performed to determine if statistically significant differences exist between the groups. The investigators anticipate obtaining a better understanding of the factors affecting RE and how those might be employed to improve athletes' running performances.

C03
Regulation and Role of Regulator of G-protein Signaling-1 in Celiac Disease Pathogenesis

Presenter(s)
Yiyun Cao, Illinois Mathematics and Science Academy

Advisor(s)
Cezary Ciszewski, University of Chicago
Bana Jabri, University of Chicago

Celiac disease (CD) is an autoimmune disorder characterized by oversensitivity to gluten. A recent genome-wide association study has linked regulator of G-protein signaling-1 (*RGS1*) to CD, and single nucleotide polymorphisms (SNPs) which collectively represent either a celiac susceptibility or protective haplotype have been identified. This investigation focused on how these SNPs affect RGS1 expression at the promoter, transcriptional, and translational levels in response to interferon- α (IFN-α), interferon-β, or interleukin-15, which are highly expressed in CD. The functional significance of RGS1 was also studied in lymphocyte-mediated cytotoxicity assays. At the promoter level IFN-β significantly upregulated expression in the protective SNP, but not in the susceptibility SNP. IFN-β also increased transcriptional and translational levels of RGS1. In cytotoxicity assays, IFN-β increased cytotoxicity, likely through upregulation of RGS1. These results suggest a new framework for the role of RGS1 in CD pathogenesis. Although it increases cytotoxicity, higher levels of expression in the protective SNP imply that RGS1 has beneficial effects, potentially through prevention of viral infections which can trigger CD or by reduction of autoantibody production.

C04
Bacterial Species Identification Using Polymerase Chain Reaction

Presenter(s)
Francis Cocjin, Illinois Mathematics and Science Academy
Egle Malinauskaite, Illinois Mathematics and Science Academy

Advisor(s)
Donald Dosch, Illinois Mathematics and Science Academy

Bacterial identification on a genomic level has been shown to be more accurate than common physiological methods. This investigation focused on developing a protocol that can be used to identify bacteria based on their DNA sequence. Small ribosomal RNA (rRNA) genes were studied for their frequency and sequence heterogeneity between species. A DNA extraction protocol was optimized with the use of lysozyme to account for cell wall differences. A polymerase chain reaction (PCR) protocol was optimized with an annealing temperature of 62^{o}C to account for the unique sequence of the primers used. The application of restriction endonucleases to the PCR products showed differences between Gram positive and Gram negative bacterial strains, however, the technique was limited by its inability to accurately identify all species. These results can be used to overcome technique limitations and test the bacteria in the future through DNA sequencing to identify them more effectively.

C05
Hypoxia and Starvation Promote Autophagy as a Survival Mechanism

Presenter(s)
Shelby Daniel-Wayman, Illinois Mathematics and Science Academy

Advisor(s)
Laura Dada, Northwestern University
Markus Queisser, Northwestern University

Cells undergoing periods of nutrient and/or oxygen deprivation (hypoxia) activate autophagy in order to break down unnecessary or damaged proteins and organelles and reuse their parts. AMP kinase (AMPK) recognizes fluctuations in the ATP levels and is activated by phosphorylation during periods of low energy. When phosphorylated, it causes the formation of autophagosomes around aggregates of misfolded proteins. The p62 protein creates these aggregates by attaching to proteins marked for degradation and then attaching to other p62 molecules. Bcl-2 and nineteen-kilodalton interacting protein-3 (BNIP3) also acts downstream of AMPK to upregulate autophagy. In this study, we aimed to determine the molecular mechanism involved in hypoxia-induced autophagy in lung epithelial cells. We exposed lung epithelial (A549) cells to normoxia (21%O_2) and hypoxia (1.5% O_2) in the absence of nutrients for up to 24 hours and assessed the expression of AMPK, BNIP3, and p62 by Western blot. AMPK exhibited a biphasic activation, while BNIP3 steadily increased and p62 significantly decreased from 0 to 24 hours. Cells exposed to hypoxia in the absence of nutrients showed increased formation of autophagosomes as assessed by p62 immunoflourescence. These data suggest that in lung epithelial cells hypoxia causes autophagy mediated by activation of AMPK leading to increased BNIP3 and the formation of p62 containing autosomes.

C06
Characterizing Tolerance in Pediatric Food Allergy

Presenter(s)
Sonya Dave, Illinois Mathematics and Science Academy
Andrew Ta, Illinois Mathematics and Science Academy
Aaditya Tolappa, Illinois Mathematics and Science Academy

Advisor(s)
Ashley Dyer, Northwestern University
Ruchi Gupta, Northwestern University

Previous studies have estimated rates of tolerance to various food allergens, but they have focused on single allergens and have analyzed relatively small sample populations; few have investigated potential associations between demographic factors and tolerance development. This study aimed to report rates for the development of tolerance to various food allergens, and to identify contributing factors for development of tolerance during childhood. A cross-sectional, population-based survey was distributed for nine months starting in June 2009 to a sample representative of U.S. households with children. Logistic regression models of collected data examined tolerance development in comparison to child and household characteristics, as well as to food allergy severity and symptoms. Preliminary analyses revealed associations between the development of tolerance and individual factors such as race, gender, and symptoms associated with food allergy. Observed rates of tolerance by age ten were 45% for milk, 55% for egg, 19% for peanuts, and 13% for shellfish. Further findings may provide insight into possible predictors for food allergy tolerance. Future studies should implement longitudinal observational measures to gain a more accurate understanding of when and how children develop tolerance, and to directly compare tolerance development of different allergens.

C07

Dimethylfumurate Inhibits Tumor Growth Factor-Beta-Induced Myofibroblast Differentiation in Dermal Fibroblasts via the Nrf2 Pathway

Presenter(s)
Sruthi Doniparthi, Illinois Mathematics and Science Academy

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

Studies suggest that the signal molecule transforming growth factor-β (TGF-β) induces fibroblast activation and myofibroblast differentiation, which can cause fibrosis. Previous studies show that nuclear factor (erythroid-derived 2)-like 2 (Nrf2), a transcription factor which plays an important role in anti-oxidative responses and detoxification, abrogates TGF-β-induced fibroblast activation and myofibroblast differentiation. Dimethylfumurate (DMF) is the active agent in BG-12, a drug which currently treats multiple sclerosis by activating Nrf2. To test whether DMF can suppress TGF-β-induced myofibroblast differentiation, dermal fibroblasts were cultured in the presence and absence of DMF and TGF-β for 48 hours. Immunofluoresence showed that DMF suppressed TGF-β-induced collagen synthesis. Real-time qPCR and Western blots compared myofibroblast marker expression at the mRNA and protein level, respectively. DMF suppresses TGF-β-induced collagen by approximately 48% and reduces α-smooth muscle actin by approximately 52% at the mRNA level. Results also suggest that at the protein level, DMF stimulates Nrf2. Luciferase shows that an increase in Nrf2 transcriptional activity in fibroblasts in the presence of DMF. Therefore, DMF inhibits TGF-β-induced fibroblast activation and myofibroblast differentiation dependent of the Nrf2 pathway. This may lead to a potential treatment for fibrotic diseases, such as idiopathic pulmonary fibrosis and systemic sclerosis.

C08

CDDO Inhibits TGF-Beta-Induced Epithelial-Mesenchymal Transition in A549 Lung Epithelial Cells via the PI3K/AKT Pathway

Presenter(s)
Sruthi Doniparthi, Illinois Mathematics and Science Academy

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

Studies suggest that transforming growth factor-beta (TGF-β) induces epithelial-mesenchymal transition (EMT), a process in which epithelial cells trans-differentiate and proliferate into mesenchymal cells such as fibroblasts and myofibroblasts, factors of pulmonary fibrosis. TGF-β regulates collagen and connective tissue transcription via the Smad-dependent and independent pathways. The compound 2-cyano-3,12-dioxooleana-1,9(11)-dien-28-oic acid (CDDO) has been shown to be an anti-inflammatory and anti-cancerous drug and has potential to also be an anti-fibrosis drug. The effect of CDDO on TGF-β-induced EMT was measured by culturing A549 lung epithelial cells in the presence and absence of CDDO and TGF-β for 48 h. Real-time qPCR and Western blots compared epithelial and mesenchymal marker expression at the mRNA and protein level, respectively. Cell migration and immunofluorescence showed change in cell motility and morphology, respectively. Results suggest that CDDO suppresses TGF-β-induced EMT. Luciferase was used to test Smad activity in cells; however, no significant difference was found in cells cultured in the presence of CDDO. Western blot results showed that CDDO inhibits TGF-β-induced PI3K, a TGF-β-induced Smad-independent pathway. Therefore, CDDO inhibits TGF-β's effects on epithelial and mesenchymal expression, motility, and morphology, independent of Smad, by blocking the PI3K/AKT pathway. This may lead to a potential therapeutic treatment for pulmonary fibrosis.

C09
The Effect of Poly I:C on Transforming Growth Factor-β-Induced Fibrotic Responses

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

Advisor(s)
Feng Fang, Northwestern University
John Varga, Northwestern University

Toll-like receptors (TLRs) serve to mediate the initial immune response to antigenic ligands and endogenous cell signaling. Past studies have shown that abnormal TLR signaling plays an important role in chronic inflammation and autoimmunity. However, not much is known about its contributions to fibrotic development. In pursuit of further understanding of TLRs', specifically TLR3's, role in fibrosis, skin tissue was treated with polyinosinic:polycytidylic acid (poly I:C), a synthetic double-stranded RNA that acts as a TLR3 ligand, on a dose and time-dependent basis. Poly I:C inhibited the expression of type I collagen and alpha smooth muscle actin genes in the human fibroblasts by real time-PCR and Western blot assays, while promoting the synthesis of interferon β molecules. When similar tests were run on transforming growth factor-β (TGF-β) activated fibroblasts, the administration of poly I:C drastically reduced fibrotic signaling. This, coupled with previous microarray analyses, suggests that poly I:C attenuates TGF-β-induced profibrotic signaling. These results provide a hopeful sign that poly I:C may be an effective anti-fibrotic candidate for the patients with abnormal TLR3 expression.

C10
Functional Central Polypurine Tract Provides Downstream Protection of HIV-1 Genome from Editing by APOBEC3G and APOBEC3F

Presenter(s)
Beatrice Go, Illinois Mathematics and Science Academy

Advisor(s)
Eun-Young Kim, Northwestern University

The human apolipoprotein B mRNA-editing, enzyme-catalytic, polypeptide-like 3 (APOBEC3) catalyzes the G to A mutation. When viral infectivity factor (*Vif*) is present, APOBEC3 undergoes proteasomal-mediated degradation. Human immunodeficiency virus type 1 (HIV-1) utilizes the central polypurine tract (cPPT) for reverse transcription. In this study, we measured the level of protection of the cPPT in HIV-1 through its effectiveness in preventing the editing by APOBEC3. We analyzed the wild type ($HIV\text{-}1_{VH12}$) and *vif* deficient mutants ($HIV\text{-}1_{VH17}$) with and without functional cPPT and APOBEC3G/F by using PCR, cloning, and sequencing. The electropherogram of $HIV\text{-}1_{VH12}$ sequencing showed significant similarity to the reference $HIV\text{-}1_{HXB2}$. The $HIV\text{-}1_{VH17}$ transfected with APOBEC3G/F showed G to A hypermutation in the viral DNA. In $HIV\text{-}1_{VH12}$ with functional cPPT, the cDNA replication continued with little to no mutations from APOBEC3 editing. The $HIV\text{-}1_{VH17}$ that carried nonfunctional cPPT under the presence of APOBEC3 showed disruption of the central DNA flap, causing the reduction of cDNA extension and interruption of HIV-1 replication. This study shows how viruses escape from the host defenses. Understanding of the host and virus defense mechanisms creates insight of effective strategies to cure HIV/AIDS.

C11
HOXA10 Regulates Transcription of Fibroblast Growth Factor 2 in Myeloid Cells

Presenter(s)
Ashima Gupta, Illinois Mathematics and Science Academy

Advisor(s)
Elizabeth Eklund, Northwestern University
Chirag Shah, Northwestern University

HOXA10 is a member of a family of transcription factors that are involved in definitive hematopoiesis and implicated in the pathogenesis of acute myeloid leukemia (AML). During normal hematopoiesis, HOXA10 facilitates myeloid cell expansion and impedes differentiation of the same subset. To better understand the molecular mechanisms that control these events, our research mainly focuses to identify and characterize HOXA10 target genes. *FGF2* was identified as one of the target genes for HOXA10, and we validated this by subcloning 2kb fragment from the 5` promoter of *FGF2* in pGL3 basic vector. Using this construct, we performed a series of transfection studies in combination with and without HOXA10 cloned in pcDNAmp. Post transfection, the cells were cultured in the lab and harvested to perform luciferase and β-galactosidase enzyme assay. Our data suggests that HOXA10 transcriptionally activates *FGF2* in myeloid progenitor cells and differentiation phagocytes in the U937 cell line. This activation of *FGF2* may be the cause of improved cell proliferation and increased hypersensitivity to cytokines as observed in a subset of targeted AML patients with leukemogenesis. Therapeutic targeting of *FGF2*-stimulated signaling pathways might be a rational approach to the poor prognosis subset of AML leukemogenesis.

C12
A Correlation Between Anticipatory Behaviors and Feeding Times in Captive Animals

Presenter(s)
Katherine Havighorst, Illinois Mathematics and Science Academy
Brooke Kottkamp, Illinois Mathematics and Science Academy

Advisor(s)
Debra Kutska, Brookfield Zoo
Jason Watters, Brookfield Zoo

Mexican Grey Wolves (*Canis lupus baileyi*) and Polar Bears (*Ursus maritimus*) are both endangered native North American predators. We created a study to assess the behaviors of these animals in comparison to their daily feeding schedules. We observed two bear individuals and a pack of eight wolves, paying specific attention to behaviors such as pacing and waiting by their enclosure door. In over thirteen periods of one hour and sixteen minutes, we observed each species in our study. Then we recorded these behaviors in conjunction with species-specific ethograms. Subsequently we found a direct correlation between animal behaviors and keeper interactions. The same was true between behavior and time of day. The juvenile polar bear was anticipatory of the keeper's schedule, causing him to pace and wait at the door in accordance with the time of day. The wolves became more alert when their keepers were nearby, and howled at the end of the day when the keepers began preparing their food. Awareness of these captivity-induced behaviors will help the keepers improve both the animal's condition and guest experience.

C13
Action of Estrogen on Tumorigenic and Non-Tumorigenic Rat Prostate Epithelial Progenitor Cells

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

Advisor(s)
Dan-Ping (Grace) Hu, University of Illinois at Chicago
Wen-Yang Hu, University of Illinois at Chicago
Gail Prins, University of Illinois at Chicago

Early exposure to estrogen of the prostate gland with resultant disposition to carcinogenesis with aging may permanently affect gene expression. In this experiment, two-dimensional and three-dimensional cultures of normal rat prostate cells (NRP152) and tumorigenic rat prostate cells (NRP154) were treated with concentrations of estradiol (E2) between 1nM and 100 nM. Afterwards, the cells were passaged and the size and number of prostaspheres from the three-dimensional cultures were obtained, or polymerase chain reaction (PCR) was run on extracted RNA. Results have shown that concentrations of 1nM E2 and 10 nM E2 significantly increased the number of prostaspheres grown from NRP154 as well as the number of spheres over a size of 80 μM. However, concentrations over 100 nM E2 had an opposite effect and reduced the number of prostaspheres. Results from PCR support the cell counting results, as the expression of estrogen receptor beta was higher in the NRP154 culture than the NRP152 culture. These results suggested that E2 can increase the stem cell population of NRP154, potentially increasing self-renewal and amplification or initiating self-renewal. The data also shows that E2 plays a role in affecting gene expression in NRP154 than in NRP152.

C14
Biological Properties of Cancer Cells Through Soft Agar Cloning

Presenter(s)
Jennifer Huang, Illinois Mathematics and Science Academy
Melissa Kim, Illinois Mathematics and Science Academy

Advisor(s)
Kim Elseth, University of Illinois at Chicago
James Radosevich, University of Illinois at Chicago
Benjamin Vesper, University of Illinois at Chicago

Cancerous cells growing in high concentrations of nitric oxide are generally more resistant to treatment than cancerous cells growing in low concentrations. Soft agar cloning is one method that can be used to determine the biological properties of cancerous cells. One property that sparks a lot of controversy is the formation of big versus small colonies, where it is often argued that small colonies are not viable. Plates of soft agar were made with a 1.2% agarose solution, and A549 (human lung adenocarcinoma) cell lines were spread onto these and incubated. In addition, crystal violet dye was added to one set of plates and the compound 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) was added to another set to compare the number of viable colonies. The MTT assay showed that the small colonies were indeed viable. From this, we constructed a standard curve of cells plated versus number of colonies counted after a week of incubation. Data between parental cell lines and high nitric oxide cell lines were compared, as well as the data between small and big colonies. The results support previous findings that tumor cells grow more robustly in high levels of nitric oxide.

C15
The Effect of the Modified Base m6A on the Splicing of a Pre-mRNA Transcript

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

Advisor(s)
Joseph Piccirilli, University of Chicago

Although scientists have discovered important information concerning N6-methyladenosine (m6A), the general function of the modified base has not yet been revealed. Based on previous research, we believe, however, that m6A affects where a pre-mRNA transcript splices. Splicing is the process that occurs after transcription during protein synthesis where the noncoding segments of the RNA, introns, are removed and the coding segments, exons, are joined so that each piece of the RNA translates into an amino acid for the protein. We needed to synthesize a strand of RNA with the m6A located at the branch point on one of the introns. The branch point helps determine where the splicing occurs within the RNA. After creating the 3' piece, the 5' piece, and the oligo, we ligated them together, and then planned on splicing the RNA that we had. We were unable to reach this step or determine the overall function of m6A because the 3' piece that we synthesized never ligated correctly to the RNA. Because of this, we were unable to continue with our experiment or determine the effect of m6A on splicing, because most of the information we gathered gave very little reliable information because our template was incorrectly constructed.

C16
Leaf Variation in *Agathis robusta* as an Indicator of Forest Structure for Fossil Plants

Presenter(s)
Seneca Hutson, Illinois Mathematics and Science Academy
Amanda Magyar, Illinois Mathematics and Science Academy

Advisor(s)
Kevin Boyce, University of Chicago

In the determination of prehistoric climates, knowing the global distribution of different vegetation types can be useful for understanding the climates of deep geological history that may be important for understanding future climate change. However, leaves are often the only fossils available to inform those environmental reconstructions. In this study, variables of leaf structure including length, width, vein density, and area that may be informative of plant size and type were examined from a single large tree of the broad-leaved conifer *Agathis robusta* using scanned images and the image processing program ImageJ. When leaves from the bottom of the canopy are compared to those of branch falls (representing discrete micro-environments higher in the canopy), variance is about equal, but the actual values for vein density and leaf size are significantly different. For example, mean lengths of 116 mm were found at the bottom of the canopy and 77.5 mm in branches higher in the canopy. These results compare well to previous measurements in more natural *Agathis* forests and to expectations regarding how leaves should vary due to hydraulic demands across different plant sizes; thus, suggesting variance in leaf characteristics should help distinguish vegetation types from fossils.

C17
Efficiency of Magnetic Bead and Gel Insert Preparation in Vector Cloning

Presenter(s)
Tejas Joshi, Illinois Mathematics and Science Academy

Advisor(s)
David Boone, University of Chicago

Vectors are of enormous importance for scientists due to their major roles in the preparation and duplication of genes and proteins. Hence, it is useful to find the most efficient and accurate method of preparation of these vectors. Samples of a gene that codes for enhanced green fluorescent protein with puromycin resistance have been prepared to compare vectors prepared with gel and magnetic bead insert purification. This vector has been transformed into *E. coli* and those colonies have been imaged to verify the expression of the target fluorescent protein. Magnetic bead purification produces more DNA but is nonspecific. It picks up all DNA in the sample, in addition to the DNA you want to amplify. Gel purification of the insert vector allows more control over the DNA amplified and is more efficient for samples that leave more than one band after electrophoresis. In general, gel bead purification appears to be more cost-effective and time-effective for common laboratory procedures.

C18
Loss of miR-145 in Colon Cancer Upregulates Direct Target ADAM17

Presenter(s)
Kaylee Karumanchi, Illinois Mathematics and Science Academy

Advisor(s)
Bruce Bissonnette, University of Chicago
Reba Mustafi, University of Chicago

MicroRNAs (miRNAs) regulate or inhibit the translation of target messenger RNA. They regulate target genes through base pairing between the seed sequence of the miRNA and a complementary sequence in the target mRNA that is often in the 3' untranslated region (3'UTR) of the transcript. In many cancers, miR-145 is downregulated, so we predicted that targets of miR-145 will be upregulated because of loss of miR-145 inhibition. We found that ADAM17, an enzyme responsible for cleaving proligands for the epidermal growth factor receptor (EGFR) is a predicted target of miR-145. Loss of miR-145 is predicted to lead to increased expression of ADAM17, releasing more EGFR ligands. This increase in EGFR signals is important in cancer development. We hypothesized that ADAM17 is a direct target of miR-145. We examined the effect of miR-145 on expression using a luciferase reporter. A eukaryotic expression vector coding for luciferase containing ADAM17 wild type or mutant 3'UTR was transfected into HCT116 colon cancer cells and miR-145 was also cotransfected. The mutant 3'UTR did not show the predicted miR-145-ADAM17 interaction, however, we observed that miR-145 decreased luciferase expression in cells transfected with wild-type ADAM17 3'UTR. Our studies thus demonstrated that ADAM17 is a direct target of miR-145.

C19
The Effects of Iodine on the Ghost Shrimp *Palaemonetes kadiakensis*

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

Advisor(s)
Vicki Burgholzer

Palaemonetes kadiakensis, known as the ghost shrimp, is a common addition to the household aquarium. Unfortunately, this invertebrate dies easily, and for unknown reasons, the addition of iodine in the tank seems to increase the shrimp's lifespan. In this investigation, the effects of potassium iodide (KI) on ghost shrimp longevity were studied, especially during their molting process. Ghost shrimp were placed in four tanks, two of which were controls (one with fish, and one without), and two of which had concentrations of 0.5 ppm and 0.05 ppm of KI. Two groups of shrimp were tested. The first group, tested for about four to eight weeks, had eight shrimp in each tank when none of the tanks had KI. However, the overabundance of macroalgae killed the shrimp in the last three weeks. The macroalgae problem disappeared after several water changes. The second group of shrimp, with three shrimp in each tank and the appropriate concentrations of KI added, has been observed for three weeks and all the shrimp from this group are still alive. The results so far show that while the fish and the iodine may not affect the shrimp, macroalgae may.

C20
The Effects of Cholesterol Level Manipulations in Model Lipid Bilayers

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

Advisor(s)
Adam Hammond, University of Chicago

Various studies have found that the presence of cholesterol in the cell membrane is essential for the phosphorylation of the FcεRI receptor, the trigger for the signaling cascade of the allergic reaction. We hypothesize that cholesterol's necessity results from its ability to drastically alter the lipid phases of the bilayer, and therefore affect the membrane's physical properties. To test this hypothesis, we studied the effects of altering the concentrations of the three lipids in our model membranes: sphingomyelin, dioleoylphosphatiolylcholine, and cholesterol. Each sample also contained small amounts of DiI and DiO, two fluorescent dyes whose natural affinity to different lipid phases illustrates the membrane phase composition. These samples were then analyzed using a fluorometer and OceanOptic's SpectraSuite. Utilizing graphs of light intensity versus wavelength, we calculated the ratio between the fluorescence peak and the amount of fluorescence resonance energy transfer (FRET) for each sample, giving us a measurement of the lipid phases present in that mixture. The samples we created, in general, showed our hypothesized trend: as cholesterol levels increased, the ratio between the fluorescence peaks and the FRET peaks also increased. This signifies that cholesterol levels do play a crucial role in the phase behavior of membranes.

C21
The Effect of the Enteric Biome on Lysosomal Hydrolase Activity

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

Advisor(s)
Glyn Dawson, University of Chicago

Lysosomes digest complex molecules and are present in all animal cells. Based on previous work, feeding 20% ethanol to mice changed the lysosomal activity. Therefore, we questioned whether there were environmental factors involved, for example, bacteria in our gut that modified the activity of these enzymes. We used protein assays on B-hexosaminidase (B-hex) and acid sphingomyleniase (ASMase) and found that there is decreased activity in the liver and brain in mice with an ethanol diet. We also observed that liver from the germ-free mice had even less hydrolase activity. To find out why, we used reverse transcriptase-PCR (RT-PCR) and Western blotting to measure amount of B-Hex and ASMase. The RT-PCR showed that the gene for ASMase was expressed normally in the brain and we will show the relationship between germ-free in liver and in the Western blot. We will report the results of the protein activity in germ-free mice. We will report how the enteric biome affects gene expression of human lysosomal hydrolases.

C22
Investigation of the Expression Pattern of Thioredoxin Domain Containing 9 in Developing Zebrafish

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

Advisor(s)
Eric Schroeter, Loyola University

Thioredoxin domain containing 9 (TXNDC9) is a protein that is expressed in zebrafish 24 hours post fertilization. It is hypothesized that this protein may act in several locations in the zebrafish embryo, including in the nervous system and in the retina. In order to determine the location of the protein, we used zebrafish with the roy/roy mutation. This mutation eliminates pigments from the embryo so that we are able to observe the fluorescence inside. The embryos are stained using immunohistochemistry, and are viewed under a confocal microscope. The results show that the TXNDC9 protein is localized in the central nervous system, retina, and skin. In addition, it is associated with microtubules within the cell. The fact that the TXNDC9 protein is a microtubule-associated protein and is expressed in the skin and nervous tissue suggest that it may play a role in differentiating ectodermal tissue during the growth of the embryo. Knockout gene tests must be conducted to verify this conclusion. Further tests must be run to verify the results.

C23
The Role of *SGK1* in Cell Proliferation and Apoptosis in Endometriotic Cells

Presenter(s)
Shannon Kurian, Illinois Mathematics and Science Academy
Monica Patel, Illinois Mathematics and Science Academy

Advisor(s)
Serdar Bulun, Northwestern University
Diana Monsivais, Northwestern University

Endometriosis, an inflammatory disease, occurs when endometrial-like tissue attaches outside the uterine cavity. In endometriosis, increased estrogen levels act via estrogen receptor β (ERβ) to regulate the transcription of the serum and glucocorticoid regulated kinase-1 (*SGK1*) gene. Using Western blot experiments, we determined the effect of *SGK1* on cell proliferation and apoptosis, the regulation of *SGK1* by β-estradiol (E_2), and the relationship between ERβ silencing and *SGK1* expression. We probed for the apoptosis marker, poly ADP ribose polymerase (PARP), and cell proliferation marker, proliferating cell nuclear antigen (PCNA). The increase of PCNA and decrease of PARP during gene expression indicate that *SGK1* affects endometriotic cell proliferation. We also treated endometriotic cells with E_2 and found that the protein and mRNA levels of *SGK1* increased, showing that the expression of this gene depends on estrogen. Finally, to prove the effect of ERβ on *SGK1* expression, we silenced ERβ and found that target gene expression decreased. This shows that ERβ affects *SGK1* expression. Our results further characterize altered gene expression in endometriosis, specifically the effects of estrogen on *SGK1* expression.

C24
An Examination of Nutritional Stress in a Nineteenth Century Skeletal Population From Peoria, Illinois

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

Advisor(s)
Anne Grauer, Loyola University

Human skeletal analysis may provide insight into health and disease of past populations. One health issue is the lack of adequate nourishment, which can interrupt the natural growth processes of the body. For this study, data on eighty-five skeletons from a nineteenth century cemetery in Peoria, Illinois were collected to reconstruct stature and the presence of growth disruption on teeth, known as enamel hypoplasia (EH). It was postulated that shorter stature would be associated with the presence of enamel hypoplasia. Stature was determined using Trotter and Gleser's (1952) calculations. The presence of EH was detected macroscopically and noted if linear striations or pits were present on the tooth cusp. The results indicate that thirty-seven of sixty-six individuals with recovered teeth display enamel hypoplasia in this population. Within the population, the mean stature of females without EH was 154.05 centimeters, while females with EH had a mean height of 152.89 centimeters. The mean stature of males without EH was 177.15 centimeters. Males with EH had a mean height of 167.29 centimeters. Statistical evaluation indicated that the difference in the means was not significant. Multiple interpretations of these findings are offered and the data are compared to similar Illinois populations.

C25
Characterizing the Ideal Antibody Isotype Distribution Against Influenza

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

Advisor(s)
Patrick Wilson, University of Chicago

Regarding vaccines, different antibodies will protect different areas of the body. Research can apply such knowledge by giving vaccines through diverse routes to stimulate production of multiple isotopes of antibodies. In this experiment, the neutralization ability of antibodies expressed as IgA molecules were tested to determine if multiple classes of antibodies would be more effective than just one. To test this hypothesis, the genes that previously expressed IgG were changed to express IgA instead and tested for both binding to influenza hemagglutinin and neutralization capacity. To change the V region of the IgA vector, a restriction site was introduced on the IgA side. After designing the vector, the PCR product of a flu antibody gene was cloned and inserted into IgA as well. Also, the IgA vector has been assayed to show that it can express IgA antibodies. Then the PCR product insert and vector were ligated and transformed. To finish the experiment, the effectiveness of the IgA vector to IgG and IgM vectors needs to be compared.

C26
The Effects of HSP70 Antibodies in an Anti-Tumor Response

Presenter(s)
Sirisha Manam, Illinois Mathematics and Science Academy

Advisor(s)
Caroline Le Poole, Loyola University
Jeffrey Mosenson, Loyola University

Inducible heat shock protein 70 (HSP70i) is a chaperone that folds proteins within a cell, is used as an adjuvant for anti-melanoma vaccines, and supports the induction of vitiligo. Previous experiments show that vaccinating mice with mutant HSP70i ($HSP70_{iQ435A}$) DNA prevents vitiligo and produces antibodies towards HSP70i. Melanoma overexpresses surface HSP70i, which may act as a target. We hypothesized that mice vaccinated with mutant $HSP70_{iQ435A}$ and wild type HSP70i would produce antibodies to the region of HSP70i found on melanoma cells. To identify this region, I ran Western blots using sera from mice vaccinated with wild type, mutant $HSP70_{iQ435A}$, or empty vector DNA to stain full length, $HSP70i_{Q435A}$ wild type HSP70i, or HSP70i protein fragments. Before using mouse sera, I used commercial antibodies SPA-810 and SPA-811 to verify that COS7 cells transfected with DNA encoding $HSP70i_{1-377}$, $HSP70i_{320-641}$, and $HSP70i_{261-551}$ expressed the desired segments. Results indicate that mice vaccinated with $HSP70i_{Q435A}$ and wild type HSP70i produce antibodies towards the extracellular C-terminus of HSP70i downstream of the dendritic cell-activating region. Next, we will determine whether antibodies from these mice bind melanoma via flow cytometry, and whether they induce cytotoxicity *in vitro*. Results of this experiment could aid the development of melanoma vaccines.

C27
Heat Shock Protein 70 Regulates Interleukin 10 Producing Regulatory T Cells

Presenter(s)
Anuj Marathe, Illinois Mathematics and Science Academy

Advisor(s)
Eugene Chang, University of Chicago
Yunwei Wang, University of Chicago

Heat shock protein 70 (Hsp70) is known for its regulation of the anti-inflammatory cytokine interleukin 10 (IL-10). Interestingly, regulatory T-cells (T-reg) that produce IL-10 have been shown to assist in protecting the colonic epithelium against inflammatory damage. This study aimed to examine the effect that Hsp70 would have on IL-10 producing T-reg cell populations. Five wildtype and five Hsp70 knockout (KO) mice were used and each was induced with severe bowel inflammation using dextran sodium sulfate (DSS). After five days of treatment, tissue samples from the colon and mesenteric lymph nodes were collected for histology tissue staining, cytokine analysis, and flow cytometry was performed for T-reg cell detection. It was found that Hsp70 KO mice were more susceptible to inflammatory damage and that they exhibited a pro-inflammatory colonic environment from elevated levels of IL-6 and decreased levels of IL-10. Flow cytometry revealed that the number of IL-10 producing T-reg cells decreased significantly. This data showed that Hsp70 most likely plays a contributory role in the regulation of IL-10 producing T-reg cells. These findings may indicate a new treatment option for inflammatory bowel disease that involves the upregulation of Hsp70 to reestablish homeostatic conditions.

C28
The Role of RBP2 in MCF-7 Cancer Cell Drug Resistance

Presenter(s)
Aalap Mehta, Illinois Mathematics and Science Academy

Advisor(s)
Elizaveta Benevolenskaya, University of Illinois at Chicago

A major problem in cancer chemotherapy is drug resistance, which is enabled by multidrug resistance (MDR) genes and DNA damage response genes. The expression of MDR and DNA damage response genes can be altered through epigenetic mechanisms by the knockdown of the histone demethylase retinoblastoma binding protein 2 (RBP2). In order to investigate the role of RBP2 in the regulation of these genes, mRNA was extracted from MCF-7 cells both treated and untreated with cisplatin and with and without RBP2 knockdown. Through reverse transcription of mRNA, cDNA was formed and mixed with SYBR Green and cDNA primers for use in reverse transcription quantitative polymerase chain reaction (RT-qPCR) assays. The results of these assays comparatively showed the gene expression of primer groups with fully functional RBP2 and with RBP2 knockdown. After RT-qPCR assays had been performed, it was found that MDR genes tended to be downregulated in cells with RBP2 knockdown while DNA damage response genes tended to be upregulated in cells with RBP2 knockdown. Specific highly differentially expressed genes were also identified.

C29
Transcriptional Regulation by Retinoblastoma Binding Protein 2

Presenter(s)
Aalap Mehta, Illinois Mathematics and Science Academy

Advisor(s)
Elizaveta Benevolenskaya, University of Illinois at Chicago

Retinoblastoma binding protein 2 (RBP2) is a histone demethylase protein which can remove methyl groups off lysine 4 of histone H3. Through epigenetic mechanisms, or those which deal with the change in the structure of the chromatin, the protein can alter the expression of various genes. During the investigation, transcriptional coregulation by RBP2 and the DREAM protein complex, which is assembled by E2F4, was studied. Data was obtained from reverse transcription quantitative polymerase chain reaction (RT-qPCR) assays which showed the gene expression levels of NUSAP1 and OIP5, which are nearby each other on the genome. The types of cells used in the assays were those with no knockdown, those having E2F4 knockdown, those having RBP2 knockdown, and those having both E2F4 and RBP2 knockdown. The results showed that when E2F4 and RBP2 were individually knocked down, NUSAP1 and OIP5 were overexpressed. Furthermore, when both E2F4 and RBP2 were knocked down, there was even greater overexpression of NUSAP1 and OIP5. The data suggested the proteins have different mechanisms for regulating either NUSAP1 or OIP5. The knowledge gained from this investigation could be useful in determining how to manipulate the presence of RBP2 in order to treat cancer.

C30
Frequency of Periosteal Reactions in a Nineteenth Century Skeletal Population From Peoria, Illinois

Presenter(s)
Vamsikrishna Naidu, Illinois Mathematics and Science Academy

Advisor(s)
Anne Grauer, Loyola University

Periosteal reaction is the formation of new bone in the periosteum caused by infection or inflammation. Excavation of eighty-five bodies from a mid-eighteenth century cemetery in Peoria, Illinois provided an opportunity to study their remains. The goal of this investigation was to determine the frequency of periosteal reactions within the Peoria population. Location and frequency of the reactions were tallied and recorded. Results showed that twenty-six of eighty-five bodies had reactions present. The reactions were limited to the long bones of the arm, leg, ribs, and the upper portion of the skull, as well as the jaw, with the tibia being the most commonly affected anatomical element. Frequency of the reactions was similar. However, frequency in the tibia was much higher. When compared to other populations, the rate of periosteal reactions in the Peoria cemetery was high. Explanations for these differences in data are explored.

C31
The Glycobiology of Prostate Cancer

Presenter(s)
Areen Pitaktong, Illinois Mathematics and Science Academy

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

The surfaces of cells are covered with chains of carbohydrates known as glycoconjugates, which dictate cell:cell interactions such as communication and adhesion. Aberrant glycoconjugate expression is a hallmark of virtually all tumor cells. Previous studies have shown that altering glycoconjugate expression in cancer cells by modulating the expression of the glycogenes that control their synthesis and degradation significantly affects malignancy. The hypothesis that a similar relationship exists between glycogene expression and the metastatic potential of prostate cancer cells was tested. In this study, analysis of differential glycogene expression in prostate cancer cell lines of varying metastatic potential (BPH1, RWPE-1, PC3-S, PC-3NI, PC-3M, PC-3MPro4, PC-3MLN4, DU145, and LNCaP) was undertaken. Quantitative reverse transcriptase polymerase chain reaction (qRT-PCR) analyses of prostate-specific markers including prostate-specific antigen, as well as a panel of glycogenes implicated in highly invasive tumors will determine the viability of this hypothesis. Characterizing the glycogene fingerprints of these cell lines will allow prioritization for future microarray-based analyses. Genes demonstrating differential expression patterns in these model cell lines may serve as targets for future *in vitro* and *in vivo* studies.

C32
The Effect of Vector Backbones on PCR Cloning of Green Fluorescent Protein

Presenter(s)
Nishith Reddy, Illinois Mathematics and Science Academy

Advisor(s)
David Boone, University of Chicago

High throughput cloning by circular polymerase extension depends on numerous factors, which can each affect the final yield and efficiency of the process. This study attempts to determine the effect that alternative preparations of a lentiviral vector backbone can have on the expression of green fluorescent protein, Cerulean, in *E. coli*. The Cerulean insert was cloned into a pSMPUW IRES Blasticidin backbone by PCR, gel isolation, and ligation. The effect of the treatment of the Maxi-prepped vector sample with Dpn1 was observed. Preliminary results indicate that the vectors have the potential to tranfect cells and cause the expression of green fluorescent protein. By optimizing the vector backbone preparation, this study provides a valuable technique for studies in genomics, proteomics, and synthetic biology.

C33
How Does the Silencing Mediator of Retinoid and Thyroid Hormone Receptors Affect Glucocorticoid Receptor Action?

Presenter(s)
Sabrina Roberts, Illinois Mathematics and Science Academy

Advisor(s)
Ronald Cohen, University of Chicago

The silencing mediator of retinoid and thyroid hormone receptors (SMRT) represses the transcriptional activity of a variety of nuclear receptors, but its role in regulating glucocorticoid receptor (GR) action is unknown. The GR is a nuclear receptor vital for the regulation of metabolism and inflammation. Mouse embryonic fibroblasts, with and without SMRT, were transfected with GR and glucocorticoid response element (GRE) plasmids, and treated with zero to 100 nM of dexamethasone, a GR agonist. Luciferase activity was evaluated to assess alterations in GR transcriptional activity between cells with and without SMRT. We found no significant increase in luciferase activity in the absence of SMRT, suggesting that SMRT may not regulate GR action. However, there were some technical issues with the experiments, and the studies are ongoing. This research, if continued, could potentially contribute to our understanding of glucocorticoid function, type 2 diabetes, and Cushing's syndrome.

C34
The Role of Protein Vpx in HIV Inhibitor SAMHD1 Degradation

Presenter(s)
Sarah Salameh, Illinois Mathematics and Science Academy
Urmi Sheth, Illinois Mathematics and Science Academy

Advisor(s)
Thomas Hope, Northwestern University

The nuclear protein SAMHD1 inhibits human immunodeficiency virus (HIV) replication by decreasing the number of free nucleotides in the cytoplasm. In eliminating many nucleotides, it prevents the reverse transcription of viral RNA. It is most effective in myeloid cells. Vpx causes the proteasomal degradation of SAMHD1, while the similar Vpr protein does not. HeLa cells expressing GFP-tagged SAM were treated with Vpx. Images were taken using a fluorescent microscope to determine at which point during infection Vpx degraded SAMHD1. Images taken using an environmentally controlled, high resolution, fluorescent microscope were compiled into a movie. The degradation of GFP-tagged SAMHD1 was expected to be seen through a general decrease in fluorescence, but was not observed. Therefore, fixed cell imaging was used instead. This study will further the understanding of the HIV life cycle and how Vpx degrades nuclear protein SAMHD1.

C35
The Role of the Receptor Nectin-1 in Viral Spread of Herpes Simplex Virus-1

Presenter(s)
Navika Shukla, Illinois Mathematics and Science Academy

Advisor(s)
Tibor Valyi-Nagy, University of Illinois at Chicago

Herpes simplex virus (HSV) is highly prevalent, affecting nearly 30-90% of the adult population. During corneal infection and viral spread, HSV-1 is known to use three classes of gD receptors for cell entry in human tissue; however the role of these receptors is not well understood. This study aimed to determine whether nectin-1, a major HSV-1 receptor, is sufficient for viral entry by using a mutant HSV-1 virus (RID-1) and comparing its ability for cell-to-cell spread to the wild-type HSV-1's ability for cell to cell spread. Through the use of immunohistochemical analysis and real-time PCR, it has been determined that although there is an initial delay in spread, RID-1 is able to infect cells with an efficacy similar to that of the wild-type HSV-1. The results have established that nectin-1 is sufficient for viral entry, spread, and establishment of latency.

C36
The Selection of Resistance in *E. coli*

Presenter(s)
Steven Suh, Illinois Mathematics and Science Academy

Advisor(s)
Donald Dosch, Illinois Mathematics and Science Academy

Antibiotics, while being the miracle drug of the twentieth century, have been causing resistance in bacteria to unprecedented levels. The resistance of antibiotics was measured in *E. coli* by performing consecutive Kirby disc diffusion assays, isolating the resistant colonies, and re-culturing them. After measuring the sizes of the zones of inhibitions, we used statistical analysis to evaluate the changes. Challenging a population of *E. coli* selected for stronger resistance to antibiotics. However we found that increased resistance for one antibiotic did not mean an increased resistance in other antibiotics. This leads us to conclude that antibiotic resistance is conferred by different mechanisms. The zones of inhibition in the Kirby disc diffusions indicate that the selection for antibiotic resistance is quite fast and that it should be more carefully regulated in medicine.

C37
Increased Heterogeneity of Calcium Cycling in Ventricular Myocytes from Failing Hearts

Presenter(s)
Shannon Tai, Illinois Mathematics and Science Academy

Advisor(s)
Andrew Wasserstrom, Northwestern University

Intracellular calcium cycling is crucial in heart muscle contraction and relaxation cycles and ensures that blood is circulated throughout the body consistently. In heart failure, a number of defects had been found in calcium cycling in hearts, especially under elevated pacing rates. The goal of this investigation was to measure the defects in intracellular calcium cycling within failing left ventricular myocytes. The hearts were placed on the Langendorff apparatus in order to keep the heart alive. Electrical stimulation was used to produce heart muscle contractions at basal pacing (700ms) and rapid pacing (300-400 ms). Calcium transients were recorded in single cells within Wistar-Kyoto (WKY) controland spontaneously hypertensive rat (SHR) hearts, an animal model of congestive heart failure, using confocal microscopy and analyzed using LSM 5 Image Examiner. Compared to calcium transients in WKY, those of SHR showed decreased transient magnitudes, prolonged transient duration at 50% and 80% of recovery, and longer time-to-peaks. There was also greater heterogeneity in calcium transient characteristics within individual SHR myocytes on average. Our results showed that failing myocytes showed many defects and greater intracellular variability in calcium cycling.

C38
An Analysis of the Effects of Azelaic Acid on Principal Gene Expression and Root Growth in *Arabidopsis thaliana*

Presenter(s)
Arjun Tambe, Illinois Mathematics and Science Academy

Advisor(s)
Nicolas Cecchini, University of Chicago
Jean Greenberg, University of Chicago

After an initial pathogen infection, plants often develop a long-lasting and broad-spectrum resistance to new infections at distal sites, systemic acquired resistance (SAR). Azelaic acid (AZA), a lipidic signal, has been shown to be implicated on the induction of a primed state during SAR in *Arabidopsis*, such that a secondary infection induces a stronger defense response. Moreover, exogenous AZA treatment induces key SAR components such as the *AZI1* and *DIR1* genes, which are essential to SAR induction. To better understand AZA-priming signaling components, I analyzed the effects of exogenous AZA on different *Arabidopsis* mutant plants affecting SAR induction. Because AZA also inhibits root growth, I compared the root lengths of mutant and wild type plants in growing media supplemented with and without AZA. This method allowed a thorough analysis of SAR mutants. Plants with mutations in the *AZI1* and *SFD1* genes showed less susceptibility to AZA than wild types, indicating that these genes are important in AZA signaling. Furthermore, the AZA-responsive genes *AZI1* and *DIR1* showed differential expression in the *sfd1* mutant. Notably, *AZI1* and *SFD1* are proteins related to lipid movement and synthesis, respectively, thus supporting AZA as a key lipidic SAR signal. Understanding SAR components will provide the possibility of improving plants' chances of surviving pathogenic infections.

C39
Modulation of the Akt/Protein Kinase B Pathway in Human Neutrophils Through the Inhibition of Phosphatase and Tensin Homolog and PH Domain Leucine-Rich Repeat Protein Phosphatase

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

Advisor(s)
Xiangdong Zhu, University of Chicago

The Akt/protein kinase B signaling pathway is vital to cell survival. Our investigation aimed to test novel methods of enhancing Akt phosphorylation in human neutrophils *in vitro* through modulation of the pathway with phosphatase and tensin homolog (PTEN) and PH domain leucine-rich repeat protein phosphatase and to explore the functional consequences thereof. Akt phosphorylation was assessed qualitatively using Western immunoblotting. Neutrophil adhesion and migration were measured using modified adhesion assays and modified Boyden chamber assays respectively. Due to the relatively short duration of this investigation, no conclusive results have been found. In human neutrophils, VO-OH does not have a significant effect on Akt phosphorylation, but NSC-117079 shows a trend of increasing Akt phosphorylation with increasing dosages. Further testing is needed to confirm these results. These drugs still need to be tested thoroughly *in vitro* before any pharmaceutical *in vivo* testing and clinical trials may be performed.

C40
Comparison of Drosophila *cmi* and Human MLL/ALR Type 3 PHD Fingers

Presenter(s)
Riva Trivedi, Illinois Mathematics and Science Academy

Advisor(s)
Andrew Dingwall, Loyola University
Claudia Zraly, Loyola University

The MLL/ALR family consists of large multi-domain proteins found in large co-activator complexes involved in nuclear receptor dependent gene transcription. Loss of the human MLL/ALR genes has been implicated in developmental disorders and cancers. The Drosophila MLL/ALR homolog is a single representative split into two genes during evolution, known as *cmi* and *trr*, with each encoding for conserved portions essential for transcription regulation. To further define the functional relationship between *cmi* and *trr*, we used *in vivo* knock-down experiments using conditional shRNAi transgenes. We found depletion in *cmi* and *trr* gene levels greatly affected development of Drosophila, and resulted in lowered global histone lysine methylation. Different loss of function phenotypes were also noted, such as defects in wing vein development. To determine whether the fly and human MLL/ALR share similar histone binding properties, we cloned the human ALR/MLL2 PHD3 finger by polymerase chain reaction, performed protein expression analysis and determined histone binding preference using histone arrays. We are currently in the process of more precisely determining the histone binding preference of the ALR/MLL2 PHD3 finger.

C41
Population Structure of Avian Chewing Lice *Brueelia laticeps* on Two Toucan Genera *Andigena* and *Aulacorhynchus*

Presenter(s)
Malia Wenny, Illinois Mathematics and Science Academy

Advisor(s)
Shannon Hackett, Field Museum
Heather Skeen, Field Museum
Jason Weckstein, Field Museum

Chewing lice (Phthiraptera) in the genus *Brueelia* are relatively host-specific, rendering them useful for studies of cospeciation. We studied the biogeography and phylogeny of the louse species *Brueelia laticeps*, which parasitizes two different South American toucan genera, *Andigena* and *Aulacorhynchus*. We extracted, amplified, and sequenced nuclear elongation factor 1- α and mitochondrial cytochrome oxidase I DNA from seventeen louse specimens and included two louse sequences from a previously published paper. We reconstructed a phylogeny for *Brueelia laticeps* using Maximum Parsimony, Maximum Likelihood, and Bayesian Inference methods. The phylogenetic tree, generally well supported by bootstrapping, showed three major monophyletic groups within the single species *Brueelia laticeps*. These three groups corresponded to geographic regions; however, the groups did not correspond to avian host species or genera within each geographic range. Our genetic data suggest that the evolutionary history of *Brueelia laticeps* is primarily structured by biogeography rather than host species.

C42
Phase Behavior in Cell-Free Membrane Vesicles

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

Advisor(s)
Adam Hammond, University of Chicago

The cell membrane is known to be composed of a mix of lipids that behave differently from one another alone. When mixed in artificial membranes, these lipids are known to either mix together or separate into two separate phases that define their behavior. By purifying cell membranes off of mammalian cells, our investigation used phase-specific dyes to investigate the composition of these cells. Cells were incubated in a buffer containing formaldehyde until the cells blebbed off sections of membranes. This buffer was then dyed using fluorescent dies DiI and DiO and observed through microscopy. Strong phase separation was found in the membranes. However, when formaldehyde was diluted out of the buffer containing the membranes, phase separation was weakened. This behavior may be a result of cross-linking membrane bound proteins after being exposed to formaldehyde. This is consistent with previous studies that found that cross-linking causes a stronger preference for phase-separation. Future investigations will need to find a way to purify cells without the addition of formaldehyde.

C43
Triggered Intracellular Ca^{2+} Release in Failing Canine Atrial Myocytes

Presenter(s)
Shannon Tai, Illinois Mathematics and Science Academy
Shohei Yamakawa, Illinois Mathematics and Science Academy
Satya Yerrabolu, Illinois Mathematics and Science Academy

Advisor(s)
Andrew Wasserstrom, Northwestern University

Intracellular Ca^{2+} is necessary for cardiac systolic and diastolic function. Experiments were performed in canine left atrial myocytes to compare intracellular Ca^{2+} cycling between healthy and failing hearts. To induce heart failure, pacemakers were surgically implanted in the right ventricle of a dog and rapidly paced for four to six weeks. Myocytes were isolated from whole hearts and were loaded with a calcium-sensitive fluorescent dye, Fluo-4 AM. Calcium cycling was measured at different electrical stimulation rates using a laser scanning confocal microscope. Irregular, propagated Ca^{2+} release events known as Ca^{2+} waves, were triggered during rapid pacing. Our results suggest that the frequency of triggered Ca^{2+} releases by the sarcoplasmic reticulum is significantly higher in heart failure cells. The frequency of these waves also increased with an increase in stimulation rate and diastolic Ca^{2+} level. Results also indicate that wave velocity was slower in heart failure cells. These results show a difference between the frequency of triggered events in normal and failing canine left atrial myocytes. Higher frequency of these events, which is indicative of heart failure, is correlated with higher diastolic Ca^{2} levels and higher electrical stimulation rate. Higher diastolic Ca^{2+} and higher heart rate may be characteristics of heart failure.

C44
Comparison of the Sutural Morphologies of the Lungfish Taxa Neoceratodus and its Close Relatives

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

Advisor(s)
Jutin Lemberg, University of Chicago
Neil Shubin, University of Chicago

Small differences between closely related taxa are important in identifying how the species may have branched, and what evolutionary advantage their unique morphologies gave them. Measurements of the sutures in *Neoceratodus* allow for comparison between its sutural morphologies to those of its close relatives such as *Protopterus* and *Lepidosiren*, which may aid in discerning their plesiomorphic characteristics versus their derived characteristics, as they relate to skull function. The identification and measurements of the sutures of the *Neoceratodus* used in this experiment were carried out on AMIRA, an interface that allows the user to work with computer tomography scans. On *Neoceratodus*, sutures have been identified separating the parasphenoid, the dermal ethmoid, the frontoparietal, and the left and right supraorbitals and squamosals. One example of a comparison between the taxa is the lack of hard tissue connecting the dermal ethmoid and frontoparietal in *Lepidosiren*, while the dermal ethmoid of *Neoceratodus* is connected to the frontoparietal. Such differences may be indicative of a lack of bite force on the dermal ethmoid of *Lepidosiren*, while the dermal ethmoid of *Neoceratodus* is subject to more stress during feeding.

C45
The Role of the Silencing Mediator of Retinoid and Thyroid Hormone Receptor in Regulating 1,25-Dihydroxyvitamin D Receptor Activity

Presenter(s)
Kelly Yom, Illinois Mathematics and Science Academy

Advisor(s)
Ronald Cohen, University of Chicago
Margo Emont, University of Chicago
Michael Landeche, University of Chicago

The silencing mediator of retinoid and thyroid hormone receptor (SMRT) is a protein that acts as a nuclear corepressor for the transcription of certain genes. Based on previous research from other labs, we have reason to believe that SMRT interacts with the vitamin D receptor. In order to test this, kidney tissue was taken from both wild type laboratory mice and a heterozygous SMRT knockout mouse model. RNA was then extracted from these samples and analyzed with qPCR to determine the effects downstream of the VDR, using the reporter CTP24a1. Our data shows that genes that are regulated by vitamin D and the vitamin D receptor are upregulated in heterozygous animals as compared to wild type animals in the absence of vitamin D. This means that when SMRT levels are reduced, the vitamin D receptor is less able to downregulate the expression of downstream genes, suggesting that SMRT does serve as a corepressor for the VDR. Currently, experiments that show us that SMRT interacts directly with the VDR are being performed.

C46
CD1-d Expression in Breast Cancer Progression

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

Advisor(s)
Ming Zhang, Northwestern University

Invariant natural killer T-cells (iNKT) mediate immune-based tumor surveillance and numerous studies have linked aberrant concentrations of these cells to tumor growth, proliferation, and invasion. Recently, a class of iNKT cells restricted to the membrane-bound, antigen presenting glycoprotein CD1-d was shown in mouse models to have been downregulated in metastatic breast cancer. In a study of eighteen formalin fixed, paraffin embedded (FFPE) human tissue sections grouped as normal breast, ductal carcinoma in situ (DCIS), and invasive, we performed quantitative immunohistochemistry to assess CD1-d expression on four representative regions from each tissue section. Using a MATLAB algorithm created to differentiate stain intensity using red/green/blue pixel analysis, we show that there is a significant three-fold decrease in CD1-d stain intensity between normal and DCIS tissue regions and a significant two-fold decrease in expression from DCIS to invasive regions. Building off of our preliminary findings, we have begun batch staining and analysis of over one-hundred other FFPE tissue sections and an inquiry into possible microRNA based down-regulation of CD1-d. Thus far, our study is the first to characterize and quantify significant CD1-d down-regulation in human tissue, and suggests that evasion of iNKT antigen presentation is a critical step in breast cancer tumorigenesis.

D01
A Nonlinear Portfolio Building Model in Futures Trading Strategy

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

Advisor(s)
Doug Adams, Aardvark Trading L.L.C.

Electronic market data and execution have made algorithmic trading possible, where traders develop automated systems that constantly track data and place trades. While multiple models may compose a qualitative system, or black box, the portfolio construction model synthesizes information from the other models to determine which trades to take and their quantities. The goal of my investigation was to learn about futures trading and see how differential equations could be applied to a portfolio construction model. I began by reading textbooks on finance, futures, and quantitative trading. I used a Mathematica tutorial to learn differential equations. With my advisor, I then applied this to a modeling project using historical price data and Microsoft Excel. Differential equations might be used in a portfolio construction model because their behavior is theoretically similar to that of futures prices. Specifically, the second-order forced oscillator y"[t] + by'[t] + cy[t] = f[t] is of interest. It can model springs and electricity, so it might also be applied to futures, in the context of a trade known as fading. If viable in the end, this model could actually be implemented commercially.

E01
Characterization of Electron Beam-Induced Deposited Nanoparticles in Liquid Medium

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

Advisor(s)
Ralu Divan, Argonne National Laboratory
Leonidas Ocola, Argonne National Laboratory

With increasing global demand for energy, there is a need for more effective and efficient solar cell technology. Given the unique optical properties of silver, studying the properties of silver nanoparticles could provide key insight into their application in solar cells. Silver nanoparticles were deposited from a solution of silver nitrate by utilizing a scanning electron microscope. A focused electron beam was shot into a liquid cell containing a silver nitrate solution. Various doses, pitches, and acceleration voltages were tested. After exposure, samples were rinsed, dried, and then analyzed with near-infrared microscopy and ultraviolet microscopy to determine the peak intensity and location of the plasmonic activity. It was found that deposition became more intense as the acceleration voltage was decreased from 20 kV to 5kV. Higher acceleration voltages caused electrons to move through the medium too quickly before reacting, resulting in less deposition. Increasing the dose also increased the amount of deposition and, therefore, the amount of plasmonic activity. This experiment also confirmed previous experiments that showed the silver plasmon peaks appearing at wavelengths of 350~400 nm (in the ultraviolet range). The results of this study could be used for solar cell applications, as well as chemical sensing.

E02
Determining the Global Minimum Binding Energy of the Interaction Between Different Gas Molecules and Functional Groups in Metal-Organic Framework Using Quantum Chemistry Calculations

Presenter(s)
Sanggyu (Raymond) Chong, Illinois Mathematics and Science Academy
Michelle Suh, Illinois Mathematics and Science Academy

Advisor(s)
Ki Chul Kim, Northwestern University
Randall Snurr, Northwestern University

Capturing harmful gases - mostly greenhouse gas like NOx, SOx, and NH_3 - in the air is an important task in today's world. Metal organic framework (MOF) is one of the attractive candidates that can selectively adsorb these unwanted gas molecules. This study strives to expand on a previous study on calculating the lowest binding energy between a functional group, a possible linker in MOFs, and a gas molecule. The previous study's values were considered inaccurate because the result corresponds to the local minimum based on only one possible initial position for each pair of functional group and gas molecule. However, there is a possibility that the global minimum can be obtained from other possible initial positions. Our study focused on finding the global minimum (lowest of the lowest) binding energy through experimenting with multiple initial positions. The binding energy is obtained from MP2 optimization method using the Gaussian software. Materials Studio was used to view the molecules three-dimensionally. Our result shows that there are numerous local minimums for the calculated binding energies. Depending on the initial position of a gas molecule, the optimized position of the molecule is varied, and the values can differ by a single unit to 200 kJ/mol.

E03
Comparing the Antioxidant Contents of Blueberries, Grapes, and Açaí Berries

Presenter(s)
Yan-Yang Feng, Illinois Mathematics and Science Academy
Mingyang (Jennifer) Li, Illinois Mathematics and Science Academy

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

Antioxidants are important biological molecules, responsible for suppressing chain reactions caused by dangerous reactive species in the body. Thus, much research is being done to discover abundant sources of antioxidants for human consumption. This study uses the Folin-Ciocalteau assay for total phenolic content and the ferric-reducing ability of plasma assay to compare the antioxidant contents of blueberries, grapes, and açaí berries. Phenol-rich extracts were prepared according to a published study. While no statistical analysis has been done, data from preliminary runs of both assays have shown blueberries to have the highest antioxidant content of the three fruits (averaged absorbance values were higher by 0.5). Calibrations of the concentrations of the sample dilutions still need to be made to reduce noise. Media sources have created hype over the high antioxidant content of exotic fruits like açaí berries, but preliminary results show that açaí may not be any more antioxidant rich than blueberries.

E04
An Investigation into Solid Catalysts for Biodiesel Conversion Using Fresh Soy Oil

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

Advisor(s)
Justin Notestein, Northwestern University

As fossil fuels rapidly deplete, the use of alternative fuels, such as biodiesel, is vital. Biodiesel is synthesized from vegetable oils and methanol with the help of catalysts. This experiment sought to understand the effect of time, temperature, and percent concentration of a solid catalyst on the conversion of unused soybean oil into biodiesel. Calcium oxide was found to be the top catalyst when tested in a 1:6 molar ratio of soy oil to methanol, as compared to magnesium oxide and zinc oxide. The three variables of biodiesel synthesis tested were catalyst loading (6%, 9%, and 12% by weight), reaction temperature (60-100ºC), and reaction time (up to three hours). The refractive index was taken of each sample, and percent conversion was found in comparison to a sample of biodiesel synthesized by a typical protocol. It was found that conversions approached 100% as the time of the reaction increased. The effects of temperature and percent loading of catalyst continue to be investigated. In general, catalysts were crucial for the reaction to occur because they sped up the reaction; by using an optimized catalyst and reaction variables, the conversion of fresh soy oil and methanol to biodiesel can be maximized.

E05
Standardization of Chinese Medicinal Herbs by Thin-Layer and High-Performance Liquid Chromatography

Presenter(s)
Joshua Lam, Illinois Mathematics and Science Academy

Advisor(s)
Chun-Tao Che, University of Illinois at Chicago

Medicinal plants are becoming widely accepted as a source of dietary supplements for health maintenance or as remedies for treatment of ailments. For this reason, it is important that the source materials be correctly identified as a means to ensure the quality of the end products. The objective of this study is to establish chemical characterization of medicinal plants through the analysis of their extracts. Specifically, both thin layer (TLC) and high performance liquid chromatographic (HPLC) methods were explored in order to construct a standardized procedure for identification and standardization purposes. Two plants, *Radix asteris* (root) and *Coptis chinensis* (rhizome), were investigated. In the process of determining the proper conditions for chromatographic separation, various mobile phases containing organic solvent mixtures were tested. It was noted that different solvents would have different effects and their polarity would influence the chromatographic behaviors. The resulting TLC and HPLC chromatograms displayed characteristic chemical profiles for each plant extract, allowing comparison with known chemical compounds. As a result of these examinations, procedures to produce fingerprint chromatograms for each plant species were established. This research will lead to a better understanding of the chemical composition of medicinal plants as well as proper identification of these medicinal materials.

E06
Thin Layer and High Performance Liquid Chromatography of Chinese Medicinal Herbs

Presenter(s)
Grace Li, Illinois Mathematics and Science Academy
Lily Lou, Illinois Mathematics and Science Academy

Advisor(s)
Chun-Tao Che, University of Illinois at Chicago
Ming Zhao, University of Illinois at Chicago

Chromatography is an important technique for isolating compounds from medicinal plants and standardizing herbal preparations. This investigation focused on the Chinese medicinal herbs Flos Farfarae, Radix Curcumae and Rhizoma Coptidis, with an objective to establish thin layer chromatographic (TLC) and high performance liquid chromatographic (HPLC) profiles for identification and standardization purposes. In this study, different combinations of organic solvents were used for the extraction and separation of chemical ingredients in the plant extracts. TLC and HPLC were performed with both the leaves and flowers of Flos Farfarae in order to obtain characteristic profiles of their chemical components. For Rhizoma Coptidis, special conditions (addition of ammonium solution) of the TLC chamber were required to achieve good separations. For Radix Curcumae, a quantitative HPLC analysis was performed by constructing a calibration curve of the reference compound, curcumin. Different samples of Radix Curcumae were then tested to estimate their curcumin contents. In summary, a general knowledge of the process of different chromatographic techniques and satisfactory analytical procedures of the aforementioned medicinal plants have been established. This research can be further used to identify and determine the concentration of known compounds present in the herbs.

E07
Search for an Anti-Bird Flu Agent From Southeastern Asian Plants

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

Advisor(s)
Hongjie Zhang, University of Illinois at Chicago

Avian influenza has become an increasing health risk over the past decade. It is impossible to predict mutations of the virus strain, and therefore vaccines against the virus cannot be produced until after an outbreak occurs. Therefore, antiviral agents must be prepared to combat bird flu outbreaks. Tropical plant species (1606) were sampled from parts of Laos and Vietnam for research. Each sample was tested for activity against bird flu, and then active samples were subjected to a bioassay guided fractionation, where column chromatography was used to divide each sample into fractions. Each fraction was then tested for activity against bird flu, and active fractions were once again partitioned using silica gel chromatography, and then put through another bioassay. High performance liquid chromatography was then used to determine the individual compounds that could inhibit bird flu. It was determined that one species, *Quercus macrocalyx* H. et C., was highly effective against bird flu. Of the twenty-five fractions obtained from the column chromatography, one of the fractions showed 90% inhibition of viral replication at 10 µg/mL against bird flu, without cytotoxicity. Further separation and research on this species is necessary to determine the cause of its effectiveness against the bird flu virus.

E08
An Investigation into Solid Catalysts for Biodiesel Synthesis from Used Fryer Oil

Presenter(s)
Ashley Radee, Illinois Mathematics and Science Academy

Advisor(s)
Justin Notestein, Northwestern University

Biodiesel has become prevalent with the recent need for alternative fuels. Though traditionally made with a caustic basic solution catalyst, solid catalysts are being researched as a more cost-effective and safer method. In this work, solid catalysts were tested by combining soy oil and methanol in a 6:1 molar ratio, adding 6-12 weight % catalysts, heating to 60-90ºC and mixing the reactants for up to three hours. The biodiesel/oil phase was collected by centrifugation and pipetting, and put in a rotary evaporator to remove residual methanol. The refractive index was determined and compared to a calibration curve to measure the conversion to biodiesel. The effects of the aforementioned variables on conversion of used and new oil were determined. Acid catalysts performed poorly with new oil; however, they performed better with used oil. The different catalyst effectiveness is hypothesized to be caused by free fatty acids in used oil. In contrast with longer times required for fresh oil, most of the reaction seems to occur within 30 minutes, but conversion is low. Relative conversions continue to be investigated as a function of catalyst loading and temperature. A better understanding of used oils could lead to an economical alternative to traditional petroleum.

E09
Spectroscopic Analysis of Chemical Intermediates of Lithium-Air Batteries

Presenter(s)
Richard Shen, Illinois Mathematics and Science Academy

Advisor(s)
Hsien-Hau Wang, Argonne National Laboratory

The lithium air battery may be the next generation of the lithium ion battery technology due to its high energy capacity. However, a major issue with the lithium-air battery is its lifespan, and one obstacle to solving this problem is that during the battery's operation, lithium peroxide precipitates and clogs the electrode pores, making it important to study lithium peroxide's different means of synthesis and their associated chemical activities. This compound was analyzed using Raman and electron paramagnetic resonance (EPR) spectroscopies to better understand its electronic structure. Raman scans of a 60 minute reaction between lithium peroxide and carbon dioxide in air to form lithium carbonate were taken to gauge its activity. Furthermore, an EPR scan of lithium peroxide had different results than predicted by its chemical structure. Although lithium peroxide should have no free electrons, and thus a negligible EPR signal, this was not the case. Finally, purchased and synthesized lithium peroxide's chemical activities were compared and shown to be different. These results will hopefully help in improving the cycle life of lithium-air batteries by allowing scientists to better understand the electronic properties of the compounds used in its function.

E10
Crystallization of Electronic and Magnetic Molecule-Based Materials

Presenter(s)
Yuanhao Wang, Illinois Mathematics and Science Academy

Advisor(s)
John Schlueter, Argonne National Laboratory

Molecule-based magnets are magnets which have structural building blocks composed of organic molecules, coordination compounds, or a combination. These magnets are highly-tunable, frequently transparent, moderately soluble in organic solvent, and easily prepared under mild conditions. By using paramagnetic transition metal cations and various organic bridging ligands, one-dimensional, two-dimensional, and three-dimensional magnets and various chain motifs have been discovered. The purpose of this investigation was to discover whether or not the different phases of the magnets can be developed by altering the environment in which they are produced. Magnets were both hydrothermally produced using ovens and also produced at room temperatures. The hydrothermally developed crystals resulting from the combination of CuF_2, pyrazine, FeF_3, NH_4HF_2 is one of these new structures that has the formula $CuFeF_6$ $pyz_2H_2O_4$. These crystals have been sent to Los Alamos National Laboratory to study magnetic properties up to 100 Tesla. We've attempted to modify this structure by replacing the pyrazine ligand with dioxine and have grown nice crystals that are currently being analyzed by single crystal X-ray diffraction and SQUID magnetometry.

F01
Extracting Key Words from News Articles to Find Appropriate Sites

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

Advisor(s)
Larry Birnbaum, Northwestern University
Patrick McNally, Northwestern University
Shawn O'Banion, Northwestern University

Website organization is a key issue for major news sites. The Intelligent Information Laboratory utilizes web data mining to extract parts of articles to find similar websites for more information. This project's main goal is to develop a program that finds related links to websites by using the Python 2.5 programming language that calls for a news article on a website. It then parses the Hypertext Markup Language to retrieve the main body of text via BeautifulSoup and number the frequency of words via National Language Toolkit. It will then send the top five words into a Bing Search Applied Personal Interface (API) to generate relative search links. Currently, the program analyzed a New York Times article about Biden's visit to Japan, and has generated a histogram showing the frequency of words in the article. The top five words are “Biden” occurring nineteen times; “Japan” occurring thirteen times; “minister” occurring eight times” and “Japanese” and “American” occurring seven times each. The program is being modified to send these five words through the Bing Search API. Eventually, it should also be able to process any website and send it through multiple search APIs for sites such as YouTube.

F02
TitanOS: The Student Operating System

Presenter(s)
Mosab Elagha, Illinois Mathematics and Science Academy
Ivan Zlatanov, Illinois Mathematics and Science Academy

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

TitanOS creates a Linux-based operating system customized and optimized for student use. The construction of this operating system entails finding, downloading, and compiling packages and files needed for this operating system to function. Thus far, the group has found many of these packages and is gathering them for compilation on an external server. Packages designed to enhance the student experience and preference were included and placed neatly into an ISO using Ubiquity. The team is currently working on this process. The next step is to send the system out to alpha and beta testers in an attempt to find bugs. We hope that this system can become the preferred candidate for not just IMSA students, but students around the world.

F03
Modeling the Motions of High Altitude Balloons

Presenter(s)
Joshua Fornek, Illinois Mathematics and Science Academy

Advisor(s)
Mark Subbarao, Adler Planetarium

High altitude balloons (HAB) are a cost effective way to launch experiments into near-space at a much lower cost per pound than rockets or satellites. A drawback of HAB is the uncontrolled motions of the payload suspended from the balloon. The first step in eliminating these motions is making a model of them and using that to determine how design modifications made to the payload of the balloon can improve the stability of the payload. This study modeled the motions of high altitude balloons using video analysis techniques. This involves three steps: retrieving the raw data, analyzing the data, and visualizing the data. To retrieve the raw data, an upward facing video camera is mounted onto the top of the payload during the flight. To analyze the data, a program was written to go through each individual frame of the video and calculate the expansion and rotation motions of the balloon. These data are then used to create a visualization of the system's motion that can be used to compare differing design solutions. This is of critical importance to high altitude balloon experiments in order to obtain the least biased data possible. This is especially important for imaging, as stabilization allows for a wider range of experiments.

F04
Autonomous Flight of an Android Piloted Plane

Presenter(s)
Jason Lin, Illinois Mathematics and Science Academy

Advisor(s)
Namrata Pandya, Illinois Mathematics and Science Academy

Autonomous flight of a smartphone-piloted plane unmanned aerial vehicles (UAV) are becoming more and more common for military as well as civilian surveillance, however they are too expensive. The average smartphone theoretically has sufficient instrumentation and processing capability to process flight data and control flight surfaces. An autonomous flight program was designed using C in conjunction with the Microsoft Flight Simulator X on a computer to design the flight algorithm. The program was then ported over to an Android phone for testing with the flight simulator. The program was optimized for flight of a Cessna 172 Skyhawk and has been able to successfully guide a plane through take off, ascent, turning, cruising, and descent in the flight simulator between any two airports in the flight simulator. The Android Java program is still being written. The Android phone sensors are yet to be tested for sufficient accuracy to fly a plane, but the processor has proven to be sufficient for flight calculations. These findings mean an Android powered UAV is still plausible, which would greatly increase the availability of UAV for non-military personnel such as farmers, surveyors, and police.

F05
An Exploration into Artificial Intelligence: The Mind as a Complex, Adaptive System

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

Advisor(s)
Mike Ososky, Applied Computer Tech.

Artificial intelligence (AI) has been on the forefront of research since the creation of the first computer. AI has since raised important questions about the nature of intelligence and the hard problem of cognition: How can abstract thought arise from the brain? Through review of literature from experts in cognitive science, evolutionary theory, and complex systems we have explored the nature of the mind and how it can be replicated within a machine. We have modeled the mind as a complex adaptive system that arises out of the connection of neurons. Furthermore, the mind exists as part of other similar systems that exist in the universe, such as culture and economics. By observing the nature of these systems and the emergent phenomena that arise out of them, a theoretical framework has been suggested that would lead to the emergence of a complex adaptive system that, within the right constraints, would become sufficiently powerful to meet or surpass human intelligence. Future investigations will go into optimizing these constraints to allow for a meaningful system to arise.

F06
Graphics Processing Unit-Accelerated Proton Collision Modeling in C++ and CUDA

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

Advisor(s)
Walter Giele, Fermi National Accelerator Laboratory
Gerben Stavenga, Fermi National Accelerator Laboratory

When protons collide, jet events, or sprays of particles resulting from a series of specific interactions, may occur in varying number and type. However, as the number of jets increases the possible interactions to acquire a specific jet event scales as a factorial (though the probability approaches infinitesimal values as well). Simulation of this phenomenon is extremely computing-intensive, requiring grids of central processing units (CPU) to evaluate. This investigation compares the processing speeds of the CPU and the graphics processing unit (GPU) through a custom program that evaluates the relative probability of a certain number of jets emerging from the collision. The first draft was written for the CPU of an ordinary computer in C, and is being transferred to a GPU in CUDA to more rapidly process multiple events. We have completed and translated a program that accurately evaluates probabilities for gluon-only interactions onto the GPU and have also accurately evaluated speed ratios between the CPU and GPU; the GPU runs more than two-hundred times faster. This comparison reveals the cost-effective nature of a GPU-based system as opposed to a multi-CPU grid. Currently, we are in the process of integrating quarks to account for the probability of remaining possible interactions.

G01
Analysis of Market-Based Water Conservation Methods in the United States

Presenter(s)
Yusuf Aktan, Illinois Mathematics and Science Academy

Advisor(s)
Sabina Shaikh, University of Chicago

Water is a vital resource for America's agriculture, energy, and industrial sectors, as well as a major expense for municipalities and governments to maintain. Although several minor water market and banking systems exist in the United States, a large-scale interstate water market has the potential to secure and sustain drying water resources vital for agriculture. Nutrient pollution in water sources endangers the environment, as well as restricts America's clean water supplies. Through a review of federal and state law, government reports, and economics literature, this study provides an analysis of water and nutrient market systems, how they can be combined, and how they can be used to generate economic activity and sustain America's clean water supplies. Results suggest interstate nutrient markets would preserve access to clean water, save municipalities and corporations hundreds of millions of dollars in meeting government-mandated nutrient reduction timetables, as well as generate revenue for farmers and municipalities that attain nutrient reductions beyond those mandates. An interstate federal agency is needed to manage water resources that cross state boundaries, along with expanded advertisement of these agencies to potential market users, and less complicated regulation to create large-scale water market systems in the United States.

G02
Modeling and Forecasting the Price of Gold Futures: Comparing the Black-Scholes Equation Against a Multi-Factor Linear Regression Model, Time-Series Analysis, and More Complex Stochastic Models

Presenter(s)
Henry Deng, Illinois Mathematics and Science Academy

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

Recently, the price of gold futures has experienced drastic price fluctuations due to concerns such as lack of consumer confidence. This stimulus has caused investors to develop new models in their attempt to forecast the value of gold futures. Traditionally, the Black-Scholes options pricing model has served as an effective short-term forecasting tool. However, in times of greatly varying volatility, more complex stochastic models accounting for the change in volatility over time are needed. In this study, the initial testing compared the Black-Scholes model against multi-factor linear regression models and compared their ability to forecast the price of gold futures. The more simplistic linearly regressive models served as a base to which the more sophisticated Black-Scholes models could be compared. Testing revealed that Black-Scholes models proved much more effective than the linearly regressive models, but failed during times of greatly varying volatility. Afterwards, a time-series analysis was applied on the price of gold, and more complex stochastic models were developed and tested using a Monte Carlo simulation. In addition, using a distribution fitting program, a new method of modifying Black-Scholes was developed. Testing results revealed that more complex stochastic models could be more effective at accurately predicting the price of future options. Finally, connections to economic principles such as the Efficient Market Hypothesis were developed.

G03
Combating Corruption and Spreading Financial Services via Technology in Himalayan Economies

Presenter(s)
Saarthak Gupta, Illinois Mathematics and Science Academy

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

The abundance of corruption in the developing world, particularly in rural areas, is a great hindrance to the spread of finance and to development. A recently developed technology, titled the Unique Identification Number, uses software and hardware mounted on cell phones to spread financial services and combat fraud by allowing for an easy and universal identification method. I devised a method to test the boundaries of this technology and its possible effects. By determining the density of cell phone users and government employees, it was found that the software could be successfully implemented. By measuring the software's availability, versatility, and security, it was determined that the software could be used to defend against citizen fraud, but was generally useless against the government variety. If we use the system correctly, by realizing its boundaries and by implementing the necessary checks and balances, it could have a significant effect in regards to spreading financial services and combating corruption.

G04
The Great Recession: A Clarification

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

Advisor(s)
Lee Eysturlid, Illinois Mathematics and Science Academy

In light of the disastrous financial events of 2007 as well as the following economic downturn, it is now more important than ever to gain a deeper understanding of our nation's fiscal system and, in particular, of aspects of that system that contributed to the fallout. This study examines the Great Recession of the late 2000s through works representing a variety of opinions, including PBS Frontline's documentary *Inside the Meltdown*, Joseph E. Stiglitz's book *Freefall*, and Charles Ferguson's controversial Academy Award winning film *Inside Job*. Through analysis of these sources and more, it is possible for key factors that catalyzed the catastrophe to be identified and for those factors to be categorized in three distinct classes: failed practices, characteristics of the flawed market, and the inept or corrupt actions of financial leaders. Furthermore, these deductions allow for all of the elements involved to be displayed visually. The final product provides a concise but meaningful illustration of what is considered to be the worst financial crisis since the Great Depression.

G05
Determining the Value of a Baseball Player

Presenter(s)
Samuel Kaufman, Illinois Mathematics and Science Academy
Matthew Tennenhouse, Illinois Mathematics and Science Academy

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

Baseball is a game of numbers, and there are many factors that impact how much a player contributes to his team's success. We analyzed statistics such as hits, walks, and innings played to determine how many runs each player added to their team’s total runs scored, and then used that value to determine how they performed relative to other players. Using various statistical databases such as Lahman's Baseball Database and FanGraphs' publicly available resources, we compiled data and manipulated it to form an overall formula to determine the value of a player. To analyze the data, we researched formulas to determine an individual player's hitting, fielding, and pitching production during games. Although we are still in the data compilation stages, we have developed a formula that evaluates a player's performance into a win equivalent. Therefore, our formula will express the value of a player to his team in increments of wins. Using our statistic, baseball teams would be able to compare the impact of various players to the team in evaluating talent as well as in determining salary.

H01

A Case Study Comparing Parent Involvement Indicators and Factors Between Two Elementary Schools of Different Socioeconomic Levels.

Presenter(s)
Karina Banda, Illinois Mathematics and Science Academy
Joscelyn Garcia, Illinois Mathematics and Science Academy
Mariela Rodriguez, Illinois Mathematics and Science Academy

Advisor(s)
Jose Palos, Illinois Mathematics and Science Academy
Aracelys Rios, Illinois Mathematics and Science Academy

The socioeconomic status of a family is known to correlate with the level of parent involvement. Two surveys were designed to test the prediction that two characteristically different elementary schools, by socioeconomic status, ethnicity, language composition, and so forth, will show distinctly different profiles of parent involvement. Teachers and students were surveyed in order to describe school context and the local nature of parent involvement. The surveys consist of questions that represent contextual factors known to influence parent involvement. Each question is expected to indicate parent involvement based on a conceptual definition of parent involvement that was developed through research. Results were assessed in order to show whether there is a significant difference between the parent involvement factors in each school. These data are expected to be useful for investigating how contextual factors and enablers of parent involvement such as programs, expectation, and opportunities differ in structure between two very distinct educational settings. Parent involvement models built from the surveys could potentially help schools improve their parent involvement policies and programs around the variables that are shown to be most influential.

H02

The Self-Perceptions of Academic Achievement Amongst Racially Diverse Gifted Students

Presenter(s)
Morgan Ashley Craft, Illinois Mathematics and Science Academy
Ashley Washington, Illinois Mathematics and Science Academy

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

Self-perceptions develop from one's beliefs about moral structure, academic abilities, and attitude. This study investigated the differences in self-perception amongst the African American, Caucasian, Asian/Indian and Hispanic students at the Illinois Mathematics and Science Academy (IMSA). The instrument used to measure self-perception was a thirty-nine multiple choice survey designed based on the Cooperative Institution Research Program. The survey questions provided a description of students' academic engagements, extracurricular activities, and future aspirations. The analysis contrasted these three constructs by race. With the information gathered from this investigation, different teaching methods can be designed for students based on their racial background to help guide them in their academic career at IMSA and beyond.

H03
Preparedness of Ninth and Tenth Grade Mathematics Teachers for Implementing Common Core State Standards

Presenter(s)
Margaret Daly, Illinois Mathematics and Science Academy
Sandy Perez, Illinois Mathematics and Science Academy

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

Introduced in the summer of 2011, Common Core State Standards in mathematics replaced most of those that states had created in response to the No Child Left Behind Act of 2001. This is followed by the creation of new curriculum and standardized assessments. With new standards, curriculum, and assessments, teachers will need to change their way of teaching. Questions were developed on ideas about change in education as progressing from awareness through preparation to full implementation. In collaboration with the Illinois Regional Offices of Education, teachers throughout the state were invited to take a web-based survey. From the amount of time they have had to familiarize themselves with these standards, extant literature predicts they should not be far in the change process. Tools such as guiding materials and professional development aid in this process. Teachers are most likely to be in the beginning of the developmental stage where they have already been exposed to the information and outside factors are now influencing their preparatory actions toward implementing the standards. More professional development and resources are needed before full implementation can occur. The results can help guide and inform ongoing work to successfully aim educational reforms.

H04
Improving American Mathematics and Science Education for Global Success Using the Programme for International Student Assessment Results, Surveys, and Interviews

Presenter(s)
Lucija Filipac, Illinois Mathematics and Science Academy
Sonam Vyas, Illinois Mathematics and Science Academy

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

With the introduction of the Programme for International Student Assessment (PISA) exam in 2000, OECD countries suddenly had access to a quantifiable measure of their 15-year-old students' achievement in mathematics, science, and reading. Drawing on the results from the 2000, 2003, 2006, and 2009 PISA exams, as well as a variety of global and national studies, we have designed surveys and conducted interviews examining the cultural, economic, and educational factors behind sustained success or significant improvement on the exams. Contrary to ten common myths prevalent in American education, both PISA findings and our survey research results produced ample evidence that highly successful and improving school systems pursue policies and practices that contradict these myths. For example, increased professional development is worthwhile when it is aimed toward achieving a specific goal, increased autonomy must be accompanied with accountability, a large amount of funding is not necessary and smaller class sizes are not as beneficial as previously thought. These cumulative results will not only debunk myths, but have led us to propose more effective educational practices and policies for improving American education.

I01
Methods for Reduction of Power Consumption in Display Electronics

Presenter(s)
Jorge Acosta, Illinois Mathematics and Science Academy
Ayun Brown, Illinois Mathematics and Science Academy

Advisor(s)
Lucas Sturnfield, Lixi, Inc./Palladium Energy

Immense amounts of energy are lost while electrical devices remain fully powered when not in immediate use. We investigated sensor-assisted methods for reducing the consumption of such phantom-loads. We created a large-scale display device and experimented with a variety of environmentally-aware power reduction techniques utilizing motion sensors, ambient light sensors, and time-of-day. We have developed an embedded software algorithm that demonstrates significant power reduction in time display applications. We implemented a video control host with a PIC18F45k80, four LED controllers each with a PIC24HJ64GP506A, connected by a CAN2.0b communication bus. Our research in the use of environmental sensors for display device power reduction is extendable to any electronic system that remains fully powered indefinitely.

I02
Development of a Field Programmable Gate Array Block for Real Time Pulse Analysis with Applications in High Energy Physics

Presenter(s)
Paul Bogdan, Illinois Mathematics and Science Academy

Advisor(s)
Mircea Bogdan, University of Chicago
Henry Frisch, University of Chicago

The Large-Area Picosecond Photo-Detector Project (LAPPD) at The University of Chicago will measure the arrival of relativistic particles with picosecond time resolution. One major component in this experiment is the Data Acquisition System (DAQ). The front-end of the DAQ has a set of application-specific integrated circuits which digitize the incoming electrical pulses, generating constant streams of 12-bit values. Because of the high acquisition rates, this amount of data needs to be reduced to manageable levels. Using the Altera Quartus 9.1 Design Environment, we developed a field-programmable gate array (FPGA) block that effectively processes these pulses. This FPGA block receives a continuous stream of 12-bit words, representing the digitized pulses. The block outputs: the times when several threshold are crossed, the average height for the baseline, the amplitude of the peak and the integral of each pulse, as well as the slope of the pulse's rising edge. By doing these calculations in real time and with minimal delay, the amount of data transferred downstream, for further processing, is greatly reduced, thus increasing the maximum acquisition rate of the DAQ system.

I03
The Physical, Structural, and Chemical Properties of Ni_2ZrIn

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

Advisor(s)
Philip Nash, Illinois Institute of Technology

This investigation is concerned with determining the various properties of the Heusler alloy Ni_2ZrIn. These ternary metallic compounds have exhibited thermal shape memory and ferromagnetism, both of which have practical applications to society. To provide a workable source of material for these experiments, measured portions of the individual metals were fused with an arc melting machine. An arc melted sample was then annealed in a furnace. Mechanically pressed pellets made from elemental powders were used to measure heat of formation and heat of reaction. An X-ray diffractometer, or XRD, tested filed powder of the alloy to find its crystal structure. Density of the compound was taken using an Archimedes balance, and the lattice parameters of a cubic unit were calculated two times, first using the XRD data and again using the density measurement. These values were found to correspond, with values of 6.012 and 6.304 Angstroms respectively. The alloy's hardness was measured using an indenter-based on the Vickers scale. A dilatometer measured thermal expansion of a sample. An electronic scanning microscope was used to get a close look at the alloy and determine whether a secondary phase was present. This investigation confirmed that the compound forms a Heusler phase.

I04
Finding Hydrophobic Chemical Structure That Enables the Adsorption of Ammonia

Presenter(s)
Sanggyu (Raymond) Chong, Illinois Mathematics and Science Academy

Advisor(s)
Ki Chul Kim, Northwestern University
Randall Snurr, Northwestern University

Due to the heavy emphasis on industry and contemporary demands of the society, the Earth's atmosphere currently suffers from the abundance of unneeded gases that can be truly detrimental to our health. Among a variety of materials, chemically structured frameworks such as metal oxides, metal sulfides, and metal-organic frameworks (MOFs) have the potential to be used for the removal of the unwanted gas molecules in the atmosphere. This study reports our examination on the adsorption of ammonia, undesired gas, water, and harmless gas on metal oxides, metal sulfides, and functional groups that can act as the organic linkers in MOFs. We specifically studied binding energies of the molecules on the mentioned target groups through Møller-Plesset 2 calculations based on Gaussian 09 software and density functional theory calculations based on Vienna Ab-initio Simulation Package. We are currently in the process of studying the potential of some more metal sulfides, namely molybdenum sulfide, ruthenium sulfide, and tungsten sulfide for ammonia capture. Conclusively, few strong candidates have been found from analyzing our quantum mechanical calculations, and further examination of these candidates is necessary so that the materials can be utilized for the removal of the harmful gases in the atmosphere.

I05
Optimizing the Conjugation and Separation of Linear Chains of Polyphosphates

Presenter(s)
Aditya Karan, Illinois Mathematics and Science Academy

Advisor(s)
Ying Liu, University of Illinois at Chicago

The mechanisms and kinetics of blood coagulation induced by linear chains of polyphosphates (polyP) have been studied by Dr. James Morrissey, at University of Illinois at Urbana-Champaign. For *in vivo* applications, an appropriate delivery system is necessary to release or expose polyP at appropriate sites inside the body. Conjugation of PolyP onto dendrimers, polysterene, and gold nanoparticles were optimized using 1-(3-dimethylaminopropyl-3-ethylcarbodiimide hydrochloride as the ligand and separated using different methods such as chromatography and centrifugation. Results have shown that dendrimers and polysterene may have degrees of degradation. Therefore, gold was chosen to form the nanoparticles. Results have shown that dendrimers and polysterene are ineffective carriers of polyp. Reaction conditions of the conjugation of polyP to 5 nm, 10 nm, and 15 nm gold nanoparticles were optimized based on pH, temperature, and length of the reaction. The reaction was optimized at standard room temperature, at a pH of 7 for 72 hours. However, preventing aggregations is the main obstacle to effective use of gold nanoparticles. Centrifuging is the most effective method of separation, however aggregation continues to inhibit the process. Current efforts are directed towards maximizing the separation of gold nanoparticles while minimizing the g-force that the nanoparticles experience. The results will then be applied *in vivo* studies to study the response of blood coagulation in internal bleeding.

I06
Determining the Feasibility of Using Polymer Electrode Membrane Fuel Cells as a Household Power Source

Presenter(s)
Keith Kimberling, Illinois Mathematics and Science Academy

Advisor(s)
Brooke Schmidt, Illinois Mathematics and Science Academy
Promod Vohra, Northern Illinois University

Fuel cells are one of today's most promising green technologies. Their remarkable efficiency and minimal environmental impact makes them an excellent prospect for clean energy in the future. Polymer electrode membrane (PEM) fuel cells were selected for research because of their small size and low operating temperature makes them ideal for small domestic applications such as serving as a source of energy for households and private vehicles. Experiments on PEM fuel cells were designed to provide evidence to help engineers determine the feasibility and practicality of using PEM fuel cells for households. The first experiment dealt with determining the efficiency of the process used to create hydrogen used in fuel cells since this has a big impact on cost. In this experiment, my measured efficiency rate was only around 25 percent, much lower than my expected range of 70 to 85 percent. When I measured the efficiency of the PEM fuel cell itself, I found it to be around 30 percent, which is lower than the 40 to 50 percent rate I expected to find, but is still relatively efficient. Overall, I concluded that PEM fuel cells are, as of now, too expensive for widespread domestic use.

I07
Designing a Water Filter for Developing Nations

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

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

There is a shortage of drinkable water in the world, and those most affected live in developing nations. More than 3.5 million people die every year from water-related diseases. By means of a porous ceramic filter impregnated with nano-particulate silver, we aimed to create a low cost but effective water filter. Specifically, we are finding the optimal balance between flow rate and killing efficiency by manipulation of the type and amount of embedded organic material when pressing our filters. Filters were effective, but fall short of simultaneously satisfying the goals of 99.9% killing and >40 L/day flow. The best iteration we created was able to operate at 1.2 L/hr at 0.5 m of pressure, and killing at least 99.99% of bacteria. Trying a variety of organic materials, sawdust remains one of the best choices at 60-70% of the clay mixture; however rice flour is worthy of further exploration. We found that the absorbency of the organic material in general determines the shrinkage and by extension cracking of the clay upon drying. We also observed that previous cone-shaped prototypes were highly variable under testing and thus favor a more reproducible disk shape. We hope to soon meet our goals.

I08
Designing a Mixed-Use Facility in a Semi-Urban Environment

Presenter(s)
Byron Mui, Illinois Mathematics and Science Academy
Justin Sass, Illinois Mathematics and Science Academy

Advisor(s)
Steven Vasilion, Vasilion Architects

This investigation was to redevelop a 0.9 acre site located in the Art District of downtown Batavia. The owner was interested in developing the site into a practical, efficient and mixed-use urban development. Collaborating with four other students from Geneva and Batavia High Schools, we researched the regulations for the site and learned the zoning code to ensure a complete understanding of the site restrictions and parameters. In addition, the group finalized the layout of the site and individual units in AutoCAD and created a three-dimensional rendering with photorealistic images of the site to help to visualize the spatial distribution. The resulting design includes a layout of retail and office spaces, parking spaces, and residential units in the property, along with a master suite for the owner. Revisions to the designs were made based on the owner's and city official's specifications. The group will present the final design to the city and the owner, and if any ideas are well-liked, it may be implemented into an actual design being built in the future.

I09
Properties of the Heusler Alloy Ni_2GaZr

Presenter(s)
Zoe Phillips, Illinois Mathematics and Science Academy

Advisor(s)
Philip Nash, Illinois Institute of Technology

Heusler alloys form a cubic crystal structure that gives them properties they would otherwise lack. Half-metallic Heusler alloys can be used in spintronic computers which are more energy efficient than current computers. All Heusler alloys have the same chemical formula: X_2YZ where X and Y are transition metals and Z is an element from groups III-V. This project focuses on the properties of Ni_2GaZr in its arc-melted and annealed forms. The heat content and enthalpy of formation were measured using the results of calorimeter tests. The crystal structure and lattice parameters were determined using an X-ray diffractometer. The crystal structure was face centered cubic with a lattice parameter of 6.07 Å. The density was measured using an Archimedes balance and compared to the density calculated from the lattice parameter. The hardness of the annealed and arc-melted samples was determined using the Vickers scale. Dilatometry testing was performed to determine the thermal expansion coefficient of Ni_2GaZr. Ni_2GaZr is not magnetic at room temperature. The annealed and arc-melted samples were viewed with an optical microscope and a scanning electron microscope. Ni_2GaZr has a Heusler phase and a small amount of Ni_3Ga. The data will be compared to other Ni_2YZ Heusler alloys.

I10
Improving the Design of a Dual Intermeshing Rotor Helicopter

Presenter(s)
Amir Safavi, Illinois Mathematics and Science Academy

Advisor(s)
Francisco Ruiz, Illinois Institute of Technology

People have always been fascinated by flight, and while the airplane allows people to fly, the helicopter gives them flexibility in the air that the airplane cannot provide. However, helicopters are difficult to fly and that is why the design of the dual intermeshing rotors was created. It makes it easier for the average person to fly the helicopter. The work at Illinois Institute of Technology guided by professor Francisco Ruiz focused on perfecting a design of this helicopter by working on a model helicopter. During the work, the helicopter was redesigned for different gears. The parts for the helicopter were designed on Solid Works and later machined at the local machine shop. Some of the aspects studied included special high-oxygen fuels, helicopter maintenance, aerodynamics, and helicopter flight. While the helicopter's rotors did turn, it did not fly because the gears disengaged at high RPMs. The design was improved upon by adding pieces to hold the gears in place.

I11
A Transimpedance Amplifier Under Cryogenic Temperatures

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

Advisor(s)
Rene Padilla, Fermi National Accelerator Laboratory

In a superconducting radio frequency particle accelerator, such as that being developed at Fermilab, it is often important to measure the amount of ionizing radiation emitted by particles due to Bremsstrahlung and other effects in order to protect the accelerator from damage. Excessive exposure of machine components to this type of radiation can result in a variety of failures. Cryogenic loss monitors strategically located inside the machine cryostat help in the diagnosis. We designed and tested a key component, a transimpedance amplifier, operational at cryogenic temperature as part of the loss monitor diagnostic. Our study focuses on optimizing critical characteristics of this single supply circuit at liquid nitrogen temperature such as frequency response, signal-to-noise ratio and bandwidth. We have optimized a transimpedance amplifier at liquid nitrogen temperatures with a 6.6 pF capacitor, 10 MΩ resistor, and 2500 Hz bandwidth.

I12
Changing Cell Fate: A New Method to Treat Colon Cancer Without the Side Effects of Chemotherapy and Radiation Therapy

Presenter(s)
Hyun Jin Song, Illinois Mathematics and Science Academy
Jennifer Zhang, Illinois Mathematics and Science Academy

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

The goal of this research, supported with new cancer cell biology, cellular biomechanics, and high resolution biomedical imaging data, is to find whether different types of cancers can be cured without using drugs, which often cause side effects. With our capabilities to reproduce the extracellular matrix (ECM), we investigated how different kinds of ECM topographies affect cells' fate. One of our goals is to make an ECM topography that could cure cancerous cells. Firstly, we used atomic force microscopy to image cells in a liquid environment, a normal environment for living human cells. Secondly, we employed state of the art electron beam lithography to fabricate ECM topographies that could be used to test how cells grow and differentiate on them. We fabricated one to one topographies of four different cancerous ECM stages, from normal to cancerous ECM. Finally, our colleagues from the UIC College of Medicine tested the interactions and responses between different fabricated ECM topographies and different cells ranging from normal to cancerous. Initial results demonstrated that fabricated ECM topographies in fact influence the cell life. A possible extension to this experiment is to use ECM topographies to influence the ultimate cell types that stem cells would become.

I13
IMSA Students' Motivations to use Electricity Generating Bikes

Presenter(s)
Kyle Stanevich, Illinois Mathematics and Science Academy

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

This investigation focused on building a bike that generates electricity so that IMSA students could use it. A ten question survey was designed to study the motivations of IMSA students to go green and exercise on the bike. Although not every IMSA student was able to utilize the bike, they could still take the survey based on their motivation for exercising and going green in prior experiences. The bike was modified to have pedals with a plywood flywheel attached directly to them, which turns a generator. Then the electricity that is produced is stored in a battery, which is connected to an inverter, so that the battery could charge a phone, iPod, or power anything else plugged into it. Overall, the process of building this bike was challenging. The bike has two uses, a device for exercising and something that generates usable electricity, which is why there are two completely separate motivations being studied in just one object. Finally, there are economic advantages to having a bike like this, and it could find uses outside of just testing, and household projects.

I14
Characterization and Manipulation of Nanorods via an Applied Magnetic Field

Presenter(s)
Summer Wu, Illinois Mathematics and Science Academy

Advisor(s)
Vinayak Dravid, Northwestern University
Shih-Han Lo, Northwestern University

In recent years one-dimensional nanostructures have drawn considerable attention due to their potential applications in electronics and therapeutics. In this study, a remote system capable of controlling the motion of magnetic nanorods was created. Two different systems, electromagnets and magnetic stirrers, were used to create continuously changing magnetic fields, thus applying a constant torque to make nanorods rotate as nanostirbars. The system was tested on three different types of synthesized nanorods: multi-segmented nickel/gold, pure nickel, and pure gold nanorods. Nickel and gold were chosen due to the combination of the magnetic properties of nickel and the biocompatible properties of gold. Variables such as length, shape, and geometries of the nanorods were characterized by a scanning electron microscope and an atomic force microscope, and the composition of the nanorods was analyzed by energy dispersive X-ray spectroscopy elemental analysis. The spinning motion of the nanorods was observed through an optical microscope. It was concluded that while geometric variables did not impact the spinning ability of the nanorods, composition was critical. Additionally, the synthesized fifty-fifty nickel/gold nanorods had sufficient spinning force to perform as nanostirbars. These experiments demonstrate a system capable of non-contact manipulation in solution at the nanoscale.

J01
"The One Sin the Gods Never Forgive Us is That of Being Born Women:" A Study of Women in Popular Modern Fantasy

Presenter(s)
Brianna Collender, Illinois Mathematics and Science Academy
Karolyn Stromdahl, Illinois Mathematics and Science Academy

Advisor(s)
Adam Kotlarczyk, Illinois Mathematics and Science Academy

Popular modern fantasy was read to study the changes that were based on gender of the characters. Specifically focusing on female characters; the different aspects that can change for the characters were authority, voice, and appearance. To discover these changes, five popular modern fantasy series' were studied. The books were written by, J.R.R Tolkien, C.S. Lewis, Le Guin, J.K. Rowling, P.C. Cast and Kristen Cast. As time progressed in Britain and the United States, female characters gained authority, developed more influential voices, and relied less on their physical appearances. In the earlier years women had little authority, almost no voice, and were judged by their appearance. The study shows that as the world progressed women are allowed a greater role in society, with rare exception. Popular modern fantasy novels reflect this historical gender development with their characters growing as society is changing throughout the decades.

K01
Comparing the Effectiveness of Natural and Chemical Laboratory Waste Water Treatment Methods: An International Collaborative Effort

Presenter(s)
Mitchell Bieniek, Illinois Mathematics and Science Academy
Christopher Sartain, Illinois Mathematics and Science Academy
Samuel Walder, Illinois Mathematics and Science Academy

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

Educational, scientific, and industrial institutions are dissuaded from using heavy metals in experiments as the wastewater byproducts are too difficult and expensive to filter. Laboratory wastewater cannot be rinsed down a sink, and introducing heavy metals into the environment has adverse effects. The unavailability of safe, clean water for agriculture and consumption can force people with no alternatives to use water that is contaminated with heavy metals. Working with student researchers at RDFZ High School in China, we evaluated both biological treatment methods and chemical reactions for their effectiveness in removing heavy metals and hydrocarbons including lead, cobalt, chromium, benzene, and toluene from water. In addition, researchers at both sites created artificial wetlands to ascertain the effectiveness of plants in purifying identical samples of laboratory wastewater. Our plants included *Eichornia crassipes* and *Typha domingensis* while RDFZ students used *Convolvulaceae*, *Cactaceae*, and *Eichornia crassipes*. While data on the comparative effectiveness of wetland plants are currently inconclusive, chemical methods are more effective, but costlier, than natural methods in removing pollutants. The most cost-effective filtration also uses a combination of chemical and natural methods. This saves money while encouraging the development of wetlands near laboratory sites, making for significant environmental advantages.

K02
The Plausibility of Creating Green Energy Farms From Blemished Crops

Presenter(s)
Ty Bottorff, Illinois Mathematics and Science Academy
Kenzo Esquivel, Illinois Mathematics and Science Academy
Olivia Legan, Illinois Mathematics and Science Academy

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

So many crops are wasted every year; even up to twenty percent of all watermelons are left in the field due to blemishes, deformities, and bugs. These wasted crops are not sold to consumers merely due to slight blemishes, so there is a true possibility for farms to become self-sustaining in terms of energy simply by using these otherwise thrown out crops. We have investigated the plausibility of converting blemished fruits (lemons, limes, oranges, and apples) into usable fuel through cutting, blending, straining, diluting (so the yeast does not die from a high alcohol concentration), fermentation, and distillation of these crops. We have created an ethanol that is 85% as effective as pure ethanol, calculated by comparing the relative efficiency of our ethanol at heating water as compared to pure ethanol. We are also investigating possible uses of leftover fibrous material from distillation, so all parts of blemished fruit could be used to create a green farm. From these results, it is worthwhile for farms to set up fermentation and distillation labs on site to convert otherwise wasted crops into fuel usable for farm equipment, creating a self-sustaining farm.

K03
Energy Efficiency of Hand Dryers Compared to Paper Towels and Their Effect on Energy Consumption on the IMSA Campus

Presenter(s)
Christina Cheng, Illinois Mathematics and Science Academy
Harsha Jujjavarapu, Illinois Mathematics and Science Academy

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

This study compared the amount of energy consumed by the use of paper towels to the energy expended when using heatless hand dryers. This data allowed us to make IMSA into a more energy-efficient, as well as an increasingly energy conscious, campus. In this retrospective study, two Dyson Airblade hand dryers were installed into the two bathrooms by the TV Pit. Using a Smart Meter, we calculated the amount of energy expended by the hand dryers over a period of two weeks and compared this to the energy required throughout the lifespan of a paper towel. The amount of energy consumed by the heat-less hand dryers was significantly less than the energy consumed by the paper towels as well as hand dryers that used heated air. Since the energy consumed by the Dyson Airblade was significantly less, it is expected that installing these hand dryers will be significantly cost efficient in the long term. These results will be beneficial as they would convince IMSA administration to install more heat-less hand dryers throughout the IMSA campus.

K04
The Optimization of Cellulosic Ethanol Production from Corn Stover, Mixed Prairie Plants, and Switchgrass

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

Advisor(s)
Margaret Workman, DePaul University

Currently in the US, biomass fuel is produced from corn, a food source, and thus not a viable, long-term replacement for fossil fuels. As an alternative, researchers are looking towards cellulosic ethanol. However, questions regarding which non-food biomass to use and how to optimize the energy-intensive process have arisen. This study looked at two variables: biomass type (corn stover, mixed prairie plants and switchgrass) and mechanical pretreatment (grinding and chopping). The biomass was mechanically and thermally pretreated, hydrolyzed with cellulase enzyme, and fermented with brewer's yeast. The amount of cellulosic ethanol produced was then determined. Grinding the biomass produced significantly more ethanol than chopping in all cases. In addition, the pretreatment method had significantly more of an impact on the mixed prairie plants than the other plant types. Corn stover produced significantly more ethanol per plot than the other plant types and switchgrass produced the least. Based on the results, corn stover is the best option for the production of ethanol on a per plot basis. However, these results are based on the first year planting of the crops and may change in subsequent years.

K05
The Potential of Vertical Farming

Presenter(s)
Logan Dodd, Illinois Mathematics and Science Academy
Bryan Hoffman, Illinois Mathematics and Science Academy

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

As human population increases many natural resources, including farmable land, are depleted. One possible solution to the depletion of land is vertical farming. We assessed the feasibility of vertical farming and its potential problems, and created a model using Google SketchUp that could solve these problems. We found that our helical model was not only more efficient than the current vertical model, but as it was based on a single surface, also solved problems brought about by the current layered model. A notable feature of our model is that it is an entirely enclosed design, as flat land farms are susceptible to the elements and pests. Our model is also unique as it is applicable to both rural and urban settings. We grew corn on various angles and found that 50 degrees was the maximum for growth. This information aided us in further developing our model. In evaluating efficiency, our calculations showed that for every rotation in our helical model 301.5 square meters of usable land is created for farming. This means that after two rotations, the design becomes twice as efficient as a conventional farm.

K06
Indices of Sustainability

Presenter(s)
Christian Fitzsimmons, Illinois Mathematics and Science Academy

Advisor(s)
Michael Horn, Northwestern University

Property owners, politicians, and others have lately shown an interest in complete and dependable information about environmentally friendly buildings to inform their decision making. There are a number of different organizations attempting to supply this information in a useful format, but they all have different methods and goals. Different rating systems, standards of "green-ness" and faulty data can also make using this information very unreliable. The purpose of this paper is to analyze indexes produced by two of these organizations (the Greenprint Carbon Index produced by the Greenprint Foundation and the IPD Sustainable Property Index produced by the International Property Database), determine which has the more appropriate or refined approach, and offer several suggestions for improvement and expansion in the future.

K07
Acceleration and Expansion of Diversity in the Illinois Mathematics and Science Academy Prairie

Presenter(s)
Clare Leahy, Illinois Mathematics and Science Academy
Elaina Zintl, Illinois Mathematics and Science Academy

Advisor(s)
Donald Dosch, Illinois Mathematics and Science Academy

The Illinois Mathematics and Science Academy (IMSA) prairie was started in 1996; its first and only burn was in the fall of 2010. We endeavor to foster the prairie and increase plant diversity, as well as expand the prairie. We identified plants currently in the prairie and desired plants to add through field guides and literature review. We also researched germination techniques and are currently germinating plants to find which method works the best. We identified twenty-three plants in the prairie, experimented with three germination techniques, and have determined where to plant our specific desired plants based on water drainage maps, elevation maps, and other research. We planned and established a grid for our current project and for further study of the prairie by future SIR researchers and students. We developed the IMSA Prairie Field Guide, determined that the prairie should be expanded over the southeast hill, and decided, based on our research, these plants should be introduced: blazing star, prairie dock, purple coneflower, and rattlesnake master.

K08
The Efficiency of Green Roofs as a Method of Insulation for Urbanized Buildings

Presenter(s)
Ashwin Mitra, Illinois Mathematics and Science Academy

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

Green roofs are a method of reducing the costs of insulation and internal temperature of a structure through the use of greenery on roofs. I tested the effectiveness of green roofs as a method of insulation for urbanized buildings. Based on the literature regarding green roofs, I built my own experimental green roof models. I measured the internal temperature of the space located underneath the model's roof. I put clay fertilizer potting mix, or planted a Lolium and *Poa pratensis* mix or Weihenstephaner gold in the models to compare the effect of leaf size on the green roof efficiency. The models are placed in a green room with a constant temperature specifically for the growth of plants. I predict the green roof model with the most greenery to be the most effective due to a higher absorption of and defense against sunlight. Results show the models with greenery to posses, on average, a lower temperature of about one degree Celsius over the course of a one-week period. Findings will give scientific evidence of the insulating properties of green roofs and the effect of leaf size on green roof efficiency.

K09
Determining Toxicity of Sediment in the North Shore Channel

Presenter(s)
Hyun Bin Park, Illinois Mathematics and Science Academy

Advisor(s)
Jean-Francois Gaillard, Northwestern University

The toxicity of metals in sediment can be determined by observing the bioavailability of metals. A metal bound to a sulfide is non-toxic; if there exists more moles of sulfide than moles of metal in sample sediment, one can assume that the sediment will be non-toxic. Using the simultaneously extracted metals - acid volatile sulfide method (SEM-AVS method), one can determine the moles of zinc, copper, and lead as well as the moles of sulfide in sediment. In this experiment, sediment from the North Shore Channel was extracted at various locations to be checked for toxicity. We found variable levels of sulfide in sediment as well as metals. The notably low sulfide data points were most likely due to the system's exposure to oxygen during the SEM-AVS method. Based on the results of the moles of sulfide and metal, we will determine the toxicity of the metals.

L01
Understanding Music Structure and Form with the Intent of Composing Music

Presenter(s)
Carol Gu, Illinois Mathematics and Science Academy

Advisor(s)
Peter Dong, Illinois Mathematics and Science Academy

This investigation focuses on composing a piano piece that successfully builds and resolves tension by manipulating the musical work's structure and form. The harmonic, melodic, rhythmic, and form analyses of Classical and Romantic pieces were completed for the purpose of building a solid foundation on how to recreate methods of building tension in a piece. By studying what has in the past achieved a musically aesthetic sound, this gives the composer adequate background on how to write music. Harmonically, this study explored chord progressions that build tension, cadences that resolve tension, and pivot chords or cadences that transition the piece into another key. Melodically, contrasting themes were used to emphasize tension and bring together the musical work as a whole. In addition, focus on counterpoint allows the composer to flesh out a quality melody that matches the harmony. Rhythmically, the speed of changing chord progressions creates motion within a piece, driving it progressively forwards to create tension. Each of these factors is evident in the composition. These components work together to create an aesthetic type of knowledge, presented in the form of an original musical piece.

L02
Original Analysis of Webern's *Variations for Piano,* Op. 27

Presenter(s)
Henry Ward, Illinois Mathematics and Science Academy

Advisor(s)
Michael Keyton, Illinois Mathematics and Science Academy
Mario Pelusi, Illinois Wesleyan University

Non-tonal music has influenced generations of composers since its inception in the early twentieth century. Conventional music analysis techniques are generally ineffective when applied to non-tonal music, and as such, pieces are often analyzed on a case-by-case basis. Certain standards apply when analyzing non-tonal works, however. These standards provided the foundation for this analysis of Anton Webern's *Variations for Piano*, Op. 27. No other analyses of Webern's works were consulted. Webern's Op. 27 is a highly developed non-tonal piece, utilizing many standards of non-tonal music such as symmetry and tone rows. It redefines the meaning of variation for use in non-tonal music in differing ways throughout its three movements. It also retains elements of tonal form that serve to create a complicated piece rich in contrast.

M01
French Colonial North America

Presenter(s)
Luis Gomez, Illinois Mathematics and Science Academy

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

The presence of the French in North America has affected the history and characteristics of the areas in which they once governed. The French developed a hybrid culture in the Americas based on a combination of their native culture and attitudes and the culture of the new world. Unlike the English, the French did not keep hold of their assets in the New World. To the inexpert eye, it may seem that the French were incompetent and unintelligent in their decisions and attitudes in the New World. After reading scholarly literature, the French motives and attitudes appear more logical, realistic, and even extremely intelligent in regard to Quebec. The French had a small navy which was negligible compared to the British and without a large navy overseas territories could be lost easily. This is why the French chose not to send many settlers and as results of their low population in the New World they needed the Indians. The small number of French made the fur trade the economy's center for the Indians harvested the pelts and the French solely collected them. This investigation provided a new perspective of the actions and attitudes of the French that contradicts popular assumptions.

M02
The Effect of the Arab Spring on Egypt's Government, Diplomatic Relations, and its Economy

Presenter(s)
Connor Kasch, Illinois Mathematics and Science Academy

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

Following the overthrow of the monarchy in 1952, Egypt has been a dictatorship. During much of the Cold War, the Soviet Union was Egypt's main benefactor, but following the peace treaty between Israel and Egypt in 1979, the United States has supported the Egyptian government and military with substantial financial aid. As a consequence, Egypt became the cornerstone of U.S. diplomatic policy in the Middle East. However, because of the recent civilian movement, the Arab Spring, the Egyptian people succeeded in overthrowing the old regime and their president, Hosni Mubarak in February of 2011. The military, who assisted them, took the role of the transitional government. The change in rule has presented many questions about the future of the government and its position towards the West and Israel. The Muslim Brotherhood emerged as the dominant party after Egypt's recent democratic elections. A more populist government may negatively affect relations with Israel and its sponsor, the United States, upon which Egypt's economy heavily relies. Primary documents, books, and news articles provided the background knowledge and insight needed to understand the implications of the Arab Spring and allow for the researcher to make predictions on the future of Egypt.

M03
The Rise and Fall of Great Powers

Presenter(s)
Mia Leckie, Illinois Mathematics and Science Academy
Agnel Philip, Illinois Mathematics and Science Academy

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

Our goal in this investigation was to determine what factors and conditions led to the rise and subsequent fall of great world powers. We then took these conditions and applied them to the present day. Our ultimate goal was to figure out what the lifespan of the United States' reign as a world superpower would end up being. Using a list of great powers that included the Chinese Empires, Roman Empire, British Empire, Egyptian Empire, and many others, we compiled information of what contributed to the rise of these powers. From this, we constructed a "rule book" for the rise of great powers. We included location, competition, tolerance, and technological advancements in this rule book as necessary for the formation of great power. While not an indicator that a great power will form, one cannot form without them. We then turned our attention to what made these powers fall. As we examined this in the classical sense, we determined that the greatest driving force behind this is the increase in the cost of war. However, we have concluded that the transition from agrarian society to a capitalist industrial society in the last three centuries has negated previous conceptions of great power.

M04
Post World War II German Identity, From Pride to Problem

Presenter(s)
Caitlin Walczyk, Illinois Mathematics and Science Academy

Advisor(s)
Christian Nokkentved, Illinois Mathematics and Science Academy

The purpose of this study was to evaluate the effects that World War II had on German national identity, and how most Germans currently view their country. In order to do this, a literature search was done, first focusing on the period leading up to 1945 to establish the national identity prior to World War II. The focus then shifted to events after World War II leading up to Germany today. The 2006 World Soccer Cup matches increased the level of national pride of many German citizens and their identification with their nation. It was concluded that after World War II, the pride that most Germans had in their country decreased substantially, and for a significant period of time, Germans lost almost every aspect of national identity. Through time, arguments were made in an attempt to create a new sense of identity; however, even after unification, Germans continued to struggle with this issue, leading them to identify themselves as European rather than German.

N01
An Analysis of the Death Penalty Worldwide

Presenter(s)
Jennifer Bailey, Illinois Mathematics and Science Academy
Katia Colin, Illinois Mathematics and Science Academy

Advisor(s)
Sandra Babcock, Northwestern University
Delphine Lourtau, Northwestern University

Since the mid-twentieth century, the number of countries retaining the death penalty has steadily decreased. As of 2012, there are forty-four retentionist countries that institute the death penalty for a variety of crimes, including but not limited to murder, rape, drug possession, and apostasy. In our investigation, we worked with an online database, Death Penalty Worldwide, to analyze death penalty trends throughout the world and over time. The relationships we found were compiled into graphics that would allow those unfamiliar with the death penalty to become acquainted with the topic. Our figures addressed issues such as the death penalty status of countries over time and geographically, countries with a mandatory death penalty, and executions worldwide in 2010. Notable facts that can be observed from the data include China's extremely high rate of executions, the Middle East's reluctance to abolish the death penalty, and the United States' singularity as a retentionist country in North America. Our research will be used in a fact sheet on the Death Penalty Worldwide website, which will educate readers about the history and future of the death penalty.

N02
Criminal Minds?: A Psychological and Legal Analysis of the Insanity Plea's Credibility

Presenter(s)
Mindy Jian, Illinois Mathematics and Science Academy
Heidi Warning, Illinois Mathematics and Science Academy

Advisor(s)
Colin Miller, John Marshall Law School

The media often distorts the legal procedures faced by mentally ill criminals. In reality, these procedures are much more complicated than their Hollywood counterparts. The aim of this investigation was to clarify these misconceptions and further examine the validity of the insanity plea. Inquiry days were spent at John Marshall Law School reviewing case files, reading books detailing the diagnosis and classification of mental illnesses, and attending criminal law classes. We discovered that pleading not guilty by reason of insanity presents some controversy. From a legal standpoint, a guilty party may use this plea as a loophole to receive lesser punishment than deserved. Alternatively, from a psychological perspective, mental illnesses are perfectly capable of crippling people's mental state to the point where they are no longer responsible for their actions, calling for treatment rather than punishment. However, psychologists can only qualitatively assess mental illness. This means that legal procedures regarding such cases must allow for subjectivity, and there is no completely objective method of defining various levels of mental degradation. The study mentioned examines the efficacy of our judicial system in dealing with such delicate issues, as the wrong standards could lead to false incarceration of innocent citizens.

O01
Educating the World with Game Theory

Presenter(s)
Austin Gonzalez, Illinois Mathematics and Science Academy
Erik Luo, Illinois Mathematics and Science Academy

Advisor(s)
Namrata Pandya, Illinois Mathematics and Science Academy

Game theory is a mathematical field that was first discussed in a letter pertaining to a game of cards in 1714 and has since grown into a complex system of theorems and conclusions. This field can be used to settle disputes as simple as the prisoner's dilemma to situations as complex and delicate as the Cuban missile crisis. We researched and reviewed scholarly literature to understand the fundamental game theoretical concepts before creating a website to help teach others. The driving focus of our investigation has evolved from linking game theory with computer science into an educational endeavor. Using Hypertext Markup Language, JavaScript, and other web technologies, we have designed a functioning website which demonstrates mathematical and computer science concepts. Over myriad iterations, our work led to an editable payoff table of arbitrary size, real-life scenarios that apply to game theory, and implicitly-defined browser-based functions for finding mixed strategies and Nash equilibria. Our work will be made publicly available on the IMSA web server for anyone to utilize our site and learn game theoretical concepts. The website's goal is to demonstrate how game theory can be an effective, holistic approach to solving any problem.

O02
2- ε Devils Trap an Angel of Power 2

Presenter(s)
David Wang, Illinois Mathematics and Science Academy

Advisor(s)
Mark Fischler, Fermi National Accelerator Laboratory

The Angel Problem is a number theoretical game first proposed by John Conway in 1982 and is played on an infinite chess board. In the game, an angel of power n moves n consecutive squares in distance per turn while p devils attempt to trap it on a finite area of the board by permanently blocking p squares per turn. With 2-ε devils, we formulate a series of blocked square formations called glides, slides, spikes, and drifts that force an angel that specifically moves like a knight to travel around the perimeter of a finite square board, trapping it within. The glides and slides force the angel to travel in one direction indefinitely while the spikes cause it to turn ninety degrees in its trajectory. We find that two devils is sufficient to trap a knight-angel and calculate a range of board sizes for which this strategy is possible. Also, by defining the game for non-integer number of devils, we investigate the possibility of trapping the knight-angel with 2-ε devils, where ε is between zero and one.

P01

Effect of Chemically-Induced Hypoxia on the Metastasis of High Nitric Oxide Adapted and Parent Cancer Cell Microenvironments

Presenter(s)
Courtney Amegashie, Illinois Mathematics and Science Academy

Advisor(s)
Kim Elseth, University of Illinois at Chicago
James Radosevich, University of Illinois at Chicago
Benjamin Vesper, University of Illinois at Chicago

Nitric oxide (NO) is a short-lived free radical known for its activity in oncogenesis and tumor growth. As tumor volume increases, it grows faster than its supporting vasculature, resulting in hypoxic conditions in the solid tumor mass. To encourage oxygen homeostasis in this microenvironment, the tumor utilizes hypoxia-inducible factor 1- α (HIF-1α), a molecular regulator known for promoting an invasively aggressive phenotype in the tumor. Given the role of HIF-1α in tumor aggressiveness, this study sought to analyze the effects of varying concentrations of the hypoxia mimetic, cobalt chloride, on the migration velocities of several high nitric oxide (HNO) adapted cell lines. Using a standard *in vitro* scratch assay with cobalt chloride-enriched media, cell migration velocities were measured in units of pixels per hour. Results suggest that HNO cells have metastatic rates that are greater than or equal to those of the analogous, unadapted parent cell line, depending on the concentration of cobalt chloride. These findings support the hypothesis that HNO cells are more metastatic than the parent cell line in hypoxic environments. Future work will focus on validating the aggressive behavior of the HNO cell lines towards a chemotactic source in an *in vitro* model.

P02

The Effect of Insulin-Like Growth Factor 1 Chemotaxis on the Metastasis of Cancer Cell Microenvironments

Presenter(s)
Courtney Amegashie, Illinois Mathematics and Science Academy

Advisor(s)
Kim Elseth, University of Illinois at Chicago
James Radosevich, University of Illinois at Chicago
Benjamin Vesper, University of Illinois at Chicago

Nitric oxide is a free radical known for its role in cancerous tumor growth and metastasis. After several experiments in an *in vitro* scratch assay, nitric oxide has been observed to be a causative factor of metastatic aggressiveness in cancerous cells. With a primary function of promoting tissue growth, insulin-like growth factor-1 (IGF-1) is a hormone similar to pancreas-produced insulin, but much more potent. In the *in vitro* environment, IGF-1 promotes cellular movement towards the area of highest IGF concentration. Given the role of IGF-1 in the chemotaxis of cancer cells, this study sought to analyze the metastatic effects of this chemical on high nitric oxide (HNO) adapted cell lines. Utilizing an *in vitro* comparative agarose dot assay with control (no IGF-1) and IGF-1 enriched dots, the metastatic aggressiveness of cells towards the chemotactic source was measured. Results confirmed the positive roles of IGF-1 and high levels of nitric oxide on the metastatic aggressiveness of cancerous cells. These findings support the hypothesis that motility towards a chemotactic source is greater in HNO adapted cancer cell lines than in their corresponding non-adapted (parent) cell lines. Future work will focus on confirming these findings in other *in vitro* models.

P03
The Effect of Ccl22 on Regulatory T Cells and Skin Depigmentation in Mice

Presenter(s)
Wendy Bindeman, Illinois Mathematics and Science Academy

Advisor(s)
Jonathan Eby, Loyola University
Hee-Kap Kang, Loyola University
Caroline Le Poole, Loyola University

Vitiligo is a skin depigmentation disorder that occurs when autoimmune T cells destroy melanocytes. Previous research has demonstrated that regulatory T cells (Tregs), which modulate T cell responses, are present in reduced numbers in vitiligo skin. This study investigates the role of chemokine (C-C motif) ligand 22 (Ccl22) in the migration of Tregs to the skin and its effect on depigmentation. C57BL/6 wild-type mice were DNA vaccinated with optimized *Trp1* to induce depigmentation and with either *Ccl22* or empty vector (EV). A spontaneously depigmenting mouse model, h3TA2, was vaccinated with either *Ccl22* or EV. Depigmentation was measured by imaging, and the expression of Ccl22 and various cell markers was analyzed by immunohistochemistry. C57BL/6 mice showed no significant difference in depigmentation (n=10). Male h3TA2 mice showed significant differences in depigmentation (n=12). Immunohistochemistry using h3TA2 tissue showed increased Ccl22, interleukin 2 receptor, alpha chain (CD25), and chemokine receptor 4 (Ccr4) and decreased Vb12 in Ccl22-vaccinated mice (n=4) compared to EV-vaccinated mice (n=4). The data suggest that Ccr4 cells, including Tregs, migrated to the region, while the number of Vb12-expressing effector T cells decreased. This study suggests that Ccl22 treatment may be an effective therapy for human vitiligo.

P04
Qualitative Assessment of Modern Dental Products

Presenter(s)
Seth Butcher, Illinois Mathematics and Science Academy

Advisor(s)
Dean Lodding, Smiles for Life Dental

Modern dental product companies are constantly competing for your attention. Such companies have become adept at selling their product as superior or exceptional, but give little supporting evidence. This investigation examined several modern products, centered on consumer use for applicability, to gain some insight on which, if any, products are actually superior to one another. The focus of this SIR was primarily at the chemical and mechanical interactions of products such as xylitol, numerous pain killers, and personal care products including toothpaste and mouthwash. Substantial insight on personal oral care can be used to adjust your own dental products in order to improve dental health. While this investigation did not produce a complete list of ideal oral healthcare products, the attributes that would compose such items are discussed in detail. Topics to be discussed include eliminating as much pain as chemically possible from your dental experiences, using xylitol to prevent cavities, and which products actually provide the services they advertise. Ideally, one would be able to choose the best products for their own dental and dietary plan, enhancing their oral health through minimal, but effective changes.

P05
An Assessment of the Benefits of a Spinal Surgery Simulator on the Learning and Growth of Neurosurgical Residents

Presenter(s)
Alice Chang, Illinois Mathematics and Science Academy
Jiachen Wang, Illinois Mathematics and Science Academy

Advisor(s)
Aruna Ganju, Northwestern University

In many disciplines, the use of simulators has been shown to decrease the learning curve, increase time efficiency, and provide a safe environment for students to learn a task. Although various medical fields utilize simulators, in the field of neurological surgery, simulation is in its infancy. The value and benefit of simulation has not yet been universally accepted, yet prior work suggests that simulation can increase surgeons' skills and patient safety. A needs assessment was completed regarding the utility of a neurosurgical simulator. In addition, a video-based tutorial of a cervical laminectomy was produced for translation to a virtual simulator. A ten question survey regarding the use of surgical simulators was distributed to the physicians in the Department of Neurological Surgery at Northwestern University. A 42 percent response rate was achieved. The majority of the participants agreed that the experience gained from a surgical simulator would be applicable to neurosurgery. This suggests that neurosurgical simulators would be beneficial in increasing surgeons' skills to provide patient safety. Further work needs to be done to develop virtual simulators for neurosurgical use.

P06
Reducing Radiation from Diagnosing Patients with Suspected Ischemic Stroke

Presenter(s)
Ajay Chatrath, Illinois Mathematics and Science Academy

Advisor(s)
Arun Jagannathan, Riverside Medical Center

Although computer tomography (CT) scans are useful for diagnosing illnesses, there is increasing concern of overuse throughout the United States, resulting in unnecessary radiation exposure to patients. CT scans performed for suspected ischemic stroke in the emergency room are especially overused, since most of these scans are ordered in sets of three or five. Data from eighty-one patients who received magnetic resonance imaging (MRI) or a set of CT scans for suspected ischemic stroke was filtered in Excel based on age, scan used, and scan results. There was no statistical difference between the CT cerebral vascular accident (CVA) protocol, consisting of three CT scans, and the CT CVA advanced protocol, consisting of five CT scans. Although CT scan results can be obtained almost immediately, MRI results take one hour to obtain. However, MRI results were far more effective at diagnosing ischemic stroke than CT scans. The results suggest that the CT CVA protocol can replace the CT CVA advanced protocol for patients with serious symptoms, whereas the MRI could replace the CT CVA protocol for diagnosing patients with minimal symptoms.

P07
Associations Between HIV Susceptibility and Mutations in the Vif-Associated APOBEC3G Proteasomal Complex

Presenter(s)
Kevin Chong, Illinois Mathematics and Science Academy
Jackson Michuda, Illinois Mathematics and Science Academy

Advisor(s)
Sudhir Penugonda, Northwestern University

A differential advantage in responding to HIV/AIDS is associated with differences in the genetic determinants of immunity to HIV infection. HIV presents multiple functional accessory proteins, which interact with host machinery to improve pathogenicity. Viral infectivity factor (Vif) is well described as protecting HIV virions from human APOBEC3G (hA3G) hypermutation via a host-derived, multiprotein proteasomal complex. Our experiment is a genetic interrogation of the Vif-associated hA3G degradation complex to examine the effects of host genetic polymorphisms in HIV replication and susceptibility to infection. We have conducted a population-based study of high-risk men enrolled in a well-described longitudinal cohort. We have used a combination of bioinformatics and genomics approaches to identify genetic polymorphisms in genes encoding proteins involved in Vif-associated hA3G degradation. We have exploited high-throughput, microarray-based genotyping for rapid analysis of genetic variants, and examine associations with infection and disease progression phenotypes.

P08
A Literature-Based Study on Adolescent Idiopathic Scoliosis

Presenter(s)
Breanna Dachsteiner, Illinois Mathematics and Science Academy

Advisor(s)
Sowmya Anjur, Illinois Mathematics and Science Academy

Although research on the disease adolescent idiopathic scoliosis has exploded in the past ten years, very few people know of the disease and its implications. This disorder primarily affects the body by creating an irregular curvature of the spine. In this study, an investigation was done focusing on the disease itself, incorporating the diagnosis, treatment, and possible causation of the irregular spinal curvature, by analyzing scholarly research articles and informative databases. Through my research, I learned that the Risser Grade and Adam's Bend Forward test are primarily used to diagnose the patient. Also, I researched the treatments for adolescent idiopathic scoliosis, including bracing and spinal fusion which are the most effective treatments for different degree of curvatures. Furthermore, although the causation of the disorder hasn't been found, my research also included possible originations that have been discussed in the medical world. In conclusion, adolescent idiopathic scoliosis has gained more attention in the scientific world, but there is still much to learn about this debilitating disease.

P09

Investigating Beta-Catenin and Calretinin as Possible Markers for Recurrence or Transformation of Glioneuronal Tumors in Pediatric Patients

Presenter(s)
Sonya Dave, Illinois Mathematics and Science Academy

Advisor(s)
Veena Rajaram, Children's Memorial Hospital

Recent studies have suggested beta-catenin and calretinin as possible markers of transformation or recurrence of tumors in pediatric patients. In one study, mutations in beta-catenin a cytoplasmic protein, leading to its accumulation in the nuclei and cytoplasm, were linked to increased likelihood of malignant tumor tissue transformation. Another study found calretinin, a calcium-binding protein, in rapidly proliferating carcinoma cells. An additional investigation suggested calretinin mRNA as a marker in differentiated cells. These suggest that its presence may be a marker of neoplastic transformation. However, previous research has not been conducted to link the presence of either protein to recurrence or transformation of glioneuronal tumors (GNTs) to malignant form. Our study compared beta-catenin and calretinin expression on thirty-four pediatric samples of various GNTs, including gangliogliomas, dysembryoplastic neuroepithelial tumors, and desmoplastic infantile gangliogliomas. Mann-Whitney analyses found no statistically significant difference between the expression patterns of these markers in tumors with or without transformation or recurrences ($p>.05$, 95% degree of certainty required). These results bring focus to and provide a better understanding of potential markers and characteristics of GNTs. In addition, these findings may pave the way for future studies investigating GNTs.

P10

Institutional Review Board Unanticipated Problems Involving Risks to Subjects or Others Reports Lack Sufficient Information to Determine Causality

Presenter(s)
Annie Guo, Illinois Mathematics and Science Academy

Advisor(s)
Steven Belknap, Northwestern University
Debra Gibson Tice, Northwestern University
Dennis West, Northwestern University

Unanticipated problems involving risks to subjects or others (UPIRSOs) are federally mandated to be reported to the Institutional Review Board (IRB). However, an investigator's determination of causality is not typically confirmed using a validated causality assessment method. The objective of this study is to determine whether UPIRSO reports include adequate information for causality assessment using the Naranjo algorithm, a validated causality assessor. The items of the ten question Naranjo algorithm estimate the chance of the event being an adverse drug event within four different categories: highly probable (score >8), probable (score of 5-8), possible (score of 1-4), and doubtful (score <1). We assessed 125 de-identified reports for causality based on the Naranjo algorithm, and the principal investigator's (PI) and sponsor's assessment of causality. Our results showed that UPIRSO reports answered a median of 2/10 Naranjo questions. Of the UPIRSO reports, 83/125 (66.4%) did not provide a PI's assessment and 40/125 (32%) did not provide a sponsor's assessment. The mean calculated Naranjo score was 2.8 (range of 1-7). Our results show that causality determination by the IRB, PI, and sponsor all lack sufficient detail to assess causality a majority of the time. Knowing the adequacy of information reported to the IRB could shorten delays in safety information with drugs and advance the protection of human subjects by providing accurate determinations of drug causality.

P11

Comparison in the Need for Resuscitation in Spontaneous Vaginal Births Versus Cesarean Sections

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

Advisor(s)
Richard Kampanatkosol, Loyola University
Jonathan Muraskas, Loyola University

Currently, the incidence of resuscitation is expected to be higher in routine Cesarean deliveries versus routine vaginal deliveries. This study reviews the incidence of resuscitation required for infants born at greater than 37 weeks gestation, delivered by spontaneous vaginal delivery versus routine Cesarean section, to determine the necessity of a high-risk delivery team at routine Cesarean sections. There will be a retrospective chart review of all infants born at greater than 37 weeks gestation at Loyola University Medical Center from 2008-2011. APGAR scores and the number of resuscitations were analyzed for each mode of delivery. There are 2,503 recorded infants that were born between 2008 and 2011. Of these, 892 were born via Cesarean section and 1,638 were born via vaginal birth. The incidences of resuscitation still need to be determined. In review of this data, we hope to find that the incidence of resuscitation in term Cesarean sections is no greater than vaginal births. As a result, they would make attendance of routine Cesarean sections by a high risk team unnecessary, making a significant difference towards the cost of health care.

P12

Exploring the Relationship Between Metabolic Acid-Base Status and the Number of Apnea, Bradycardia, and Desaturation Alarms in Infants 27-32 Weeks Gestation in the First Two Weeks of Life

Presenter(s)
Rae Hohle, Illinois Mathematics and Science Academy
Aditi Warhekar, Illinois Mathematics and Science Academy

Advisor(s)
Patricia Hummel, Loyola University

Apnea of prematurity and metabolic acidosis are common in preterm neonates. Metabolic acidosis is commonly corrected, but it is unknown to what degree it should be and whether doing so would affect the severity of apnea, bradycardia, and desaturation alarms. In order to determine whether a relationship between metabolic acid-base status and apnea of prematurity in infants 27-32 weeks gestation in the first two weeks of age for infants born in 2010 existed, charts of thirty-eight babies born at Loyola University Medical Center were reviewed for pH, PCO_2, bicarbonate, base excess/base deficit, and sodium bicarbonate levels, as well as bradycardia, apnea, and desaturation alarms, each for the first fourteen days of life. Using this data, a correlation was run, with the intent of finding a possible connection between these factors. Significantly positive correlations were found between bicarbonate levels and desaturation alarms and total number of alarms. A significantly negative correlation was found between pH and bradycardia alarms. These correlations support the hypothesis that there is a relationship between acid-base status and the number of monitor alarms. However, before reaching a conclusion, more in-depth and detailed studies should be conducted.

P13

The Stimulatory Effect of Atractylodiol on the Spontaneous Contractility of Rat Distal Colon

Presenter(s)
Eun Ji Jeong, Illinois Mathematics and Science Academy

Advisor(s)
KyuYong Jung, Wonkwang University

The effect of atractylodiol (ATD), a main component in *Atractylodes japonica,* is traditionally used for improving the declined gastrointestinal motility on the spontaneous contractility of rat distal colon, and was examined using an isometric transducer. In a cumulative dose-response of ATD in the rat distal colon, both the amplitude and tension of longitudinal smooth muscle of the distal colon had significantly increased whereas only the amplitude of the circular smooth muscle increased significantly. Under constant molarity of ATD (10^{-6}M), the longitudinal muscle contractility gradually increased for 90 minutes. Even with L-N^G-nitroarginine methyl ester, a nitric oxide (NO) synthase inhibitor, the amplitude of ATD-induced longitudinal muscle contractility increased significantly ($p<0.05$). However, S-nitroso-N-acetyl-D,L-penicillamine, a NO donor, decreased both the amplitude and tension of ATD-induced longitudinal muscle contractility significantly ($p<0.01$). Similarly, adenosine 5'-[beta-thio] diphosphate, a selective P2Y receptor agonist, significantly attenuated both the amplitude and tension. These data suggest that ATD plays an important role in contractility of rat distal colon. Further studies should test whether ATD affects the contractility of intestine greater than diacetyl-atractylodiol.

P14
Defining the Sleep and Cardio-Metabolic Phenotypes of Individuals with Age-Related Insomnia

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

Advisor(s)
Hrayr Attarian, Northwestern University
Roneil Malkani, Northwestern University
Kathryn Reid, Northwestern University

Chronic sleep disturbance is reported by nearly 50% of the elderly population, and insomnia is more prevalent and severe in older adults as compared to other age groups. Although all types of insomnia increase with age, sleep maintenance insomnia and early morning awakening are particularly common. The overall aim is to define the sleep and cardio-metabolic phenotypes of individuals with the most common types of age-related insomnia (such as sleep maintenance insomnia, sleep-initiation insomnia, and early morning awakening insomnia). Objective and self-reported measures of sleep and metabolic function were assessed in older adults with insomnia and compared to age, gender, race, and body-mass index matched controls without insomnia. These measures were quantified using data such as blood pressure, glucose and insulin levels, dyslipidemia, inflammation markers, and time and quality spent sleeping during certain key stages of sleep. Patients with insomnia and controls without insomnia were brought in from the Chicago Heart Association. Initial data has shown a lower quality of sleep and higher cardio-metabolic phenotypes based on increased blood pressure, insulin levels, dyslipidemia, and inflammation markers and a lower time and quality of sleep, based on sleep fragmentation, total sleep time, and rapid eye movement sleep time. However, more patients must be tested to confirm result accuracy.

P15
Thymoquinone Inhibits Cigarette Smoke Extract Induced Invasiveness of Cultured Cervical Cancer Cells

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

Advisor(s)
Kenneth Alexander, University of Chicago

Previous experiments in the Alexander Lab showed that cigarette smoke extract (CSE) upregulates the protein complex NF-κB. NF-κB stabilizes the E6 oncogene, which in turn drives the degradation of the p53 tumor suppressor. We hypothesized that CSE-mediated activation of NF-κB will lead to increased invasiveness of cancer cells in a standard invasion assay, and that the increase in invasiveness is mediated at least in part through the effects of E6-mediated reductions in expression of the p53 tumor suppressor. We also hypothesized that pharmacologic modulation of NF-κB activity can be used to decrease cell invasiveness through interference with the activation of NF-κB. SiHa cells were treated with different doses of CSE and their invasiveness in the BioCoat™ Matrigel™ invasion chamber was assessed. To modulate NF-κB, thymoquinone, a known inhibitor of NF-κB activation, was added to the cultured cancer cells in the presence and absence of CSE. The results showed that the CSE levels of 0.5% and 0.3% increased invasiveness of cancer cells and that this effect was inhibited by thymoquinone. We also found that p53 expression was essential for the thymoquinone-mediated reduction in cell invasion. These results supported our hypothesis that CSE-induced cancer cell invasiveness is mediated by NF-κB and by an increase in p53 expression. Our data also suggests that inhibition of NF-κB activation could be used therapeutically to prevent cigarette smoke related cancer.

P16
Effect of Laser Photocoagulation Therapy on the General Morphology of Mouse Retina

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

Advisor(s)
Xiaorong Liu, Northwestern University

To test possible treatments for glaucoma, a consistent animal model is needed that simulates the damage due to increased intraocular pressure caused by glaucoma. Translimbal laser treatment has been used to damage the trabecular network of mice to simulate the blockage of aqueous humor, but the side effects and unintentional damage to the retina due to the procedure have not been extensively studied. Healthy wild type mice were euthanized using Euthasol, and then perfused with phosphate buffered saline and 4% paraformaldehyde solution. Whole eyes were enucleated, sectioned, and stained using standard immunostaining protocol with Pou4f1 and Pou4f2 antibodies. The slides were then imaged using an inverted light microscope. Preliminary trials of the protocol have confirmed the expected result of the procedure, specific staining of the retinal ganglion cells corresponding to the two antibodies. Ultimately, this protocol will be conducted with von Willebrand's and fibroblast growth factor antibodies on both laser treated and control mice to stain for inflammation and damage to the neural tissue.

P17
Characterizing Recent Patent Activity Related to Diagnostic Genetic Testing

Presenter(s)
Daniel Matthews, Illinois Mathematics and Science Academy
Douglas Zhu, Illinois Mathematics and Science Academy

Advisor(s)
Brandon Pierce, University of Chicago

Single Nucleotide polymorphisms (SNPs) are variants in DNA occurring when a single nucleotide differs from the usual DNA sequence. We have catalogued patents that protect the right to test the SNP that causes an increased risk for developing the disease. In our investigation, we sought to catalog patents that protect the right to test for genetic variants that have been discovered using genome-wide association studies (GWAS). In addition to this, we also categorized patents based on factors such as ownership (public versus private, U.S. versus international), type of disease the patent is focused on, and track the trend of issued patents over time (number per year). We have discovered that the most common diseases are age-related macular degeneration and myocardial infarction. Also, we found out that there are more privately owned patents than publicly owned, and that the number of patents issued has increased every year since 2008. Since gene patenting is very controversial, policy-makers need to be aware of the patent activity related to genetic testing. Our research will lay the foundation for future investigations for patents on genetic testing.

P18
Controlling the Release and Targeting Kinetics to Cancer Cells of a Folic Acid-Targeted Delivery System

Presenter(s)
Tahir Mohideen, Illinois Mathematics and Science Academy

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

Current chemotherapeutic drugs kill specified regions of human cells in order to destroy cancerous cells. As a result, they can unintentionally destroy healthy cells as well. Previously, it has been shown that several types of cancers overexpress the folic acid (FA) receptor (FR). For this reason, FA has been employed as a tumor targeting agent in anticancer drug delivery systems. In order to improve the targeting efficiency and release rate of drug carriers, FA was attached to polyamidoamine dendrimers, which were then encapsulated into polyethyleneglycol–poly-L-lactic acid copolymers to produce hybrid nanoparticles (NPs). FA-targeted NPs were tested for their targeting efficiency in FA receptor (FR)-overexpressing KB cells using a fluorescence microscope. It is expected that the encapsulated dendrimer-FA conjugates will show a slower rate of receptor targeting compared to the unencapsulated conjugates, by controlling the release of the dendrimers. This will serve as a starting point for incorporating a chemotherapeutic drug such as methotrexate into the system. Drug-containing NPs will be further tested in terms of toxicity to cancer cells and targeting efficiency in vitro and in animals.

P19

Priming of Alveolar Macrophages by Lipopolysaccharides Augments Inflammatory Response When Stimulated by Anthrax Lethal Toxin

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

Advisor(s)
Irena Levitan, University of Illinois at Chicago
Johnson Thomas, University of Illinois at Chicago

Macrophages upon stimulation by anthrax lethal toxin (LeTx), a major virulent factor of *B. anthracis*, secrete a pro-inflammatory cytokine, interleukin-1β (IL-1β). LeTx and lipopolysacchride (LPS) induce activation of Kir and Kv, the two K channels expressed in mouse macrophages and blocking these channels inhibits IL-1β release. Priming macrophages overnight with a low dose of LPS exhibits a two-fold increase in IL-1β release upon 1 hour LeTx challenge compared to unprimed macrophages. We observed a corresponding increase in Kir/Kv activation in primed macrophages. We propose that in primed macrophages LPS-mediated reactive oxygen species (ROS) generation plays a role in K channel activation. Channel activation was recorded by whole cell patch-clamp and IL-1β release was measured by enzyme-linked immunosorbent assay. To measure ROS-induced K channel activation, cells were exposed to H_2O_2 (a ROS molecule) with or without ROS scavenger manganese(III) tetrakis(1-methyl-4-pyridyl)porphyrin (MnTmPyp). H_2O_2 alone stimulates K channels. Repression of ROS by MnTmPyp inhibits K channel activation, implying ROS's function in K channel stimulation. MnTmPyp used in combination with LPS (a ROS generator) prevented K channel activation as compared to LPS alone. LeTx or LPS alone is sufficient to activate K channels and IL-1β release. We conclude that LPS-generated ROS may be a priming method of K channel function and IL-1β release.

P20
Tumor-Associated Mastocytosis in Human Ulcerative Colitis Leading to Colon Cancer

Presenter(s)
Saieesh Rao, Illinois Mathematics and Science Academy

Advisor(s)
Mohammad Khan, Northwestern University
Khashayarsha Khazaie, Northwestern University

Mast cells play many roles that would theoretically benefit tumor growth; they release vasodilators (histamine) and blood anticoagulants (heparin), as well as angiogenic factors and proteases, which would increase nutrient flow to an emergent tumor. In the case of gastrointestinal cancers, elevated mast cell populations in the tissue have been associated with cancer growth and development. The stratification of healthy epithelium is disrupted in dysplastic tissue, which poses the question of whether mast cells contribute to tissue remodeling. In this study, we examined the number of mast cells in the colonic mucosa and submucosa at multiple stages of cancer development, ranging from healthy tissue to malignant neoplasia, by utilizing an alkaline phosphatase stain for a mast cell specific tryptase. We also examined inflammation by performing a chloroacetate esterase protocol to detect tumor-infiltrating mast cells as well as granulocytes. Initial analysis showed increased inflammation in dysplastic and neoplastic tissue and a steady increase in mast cell counts that paralleled cancer progression. However, reclassification of tissue samples has resulted in smaller sample sizes and a loss of statistical significance. Further trials are required and ongoing to ensure the statistical significance of these results.

P21
Comparing Invasive and Non-Invasive Blood Pressure Recordings in Premature Patients Less than Thirty Seven Weeks Gestational Age with Diagnosis of Patent Ductus Arteriosus

Presenter(s)
Brooke Ray, Illinois Mathematics and Science Academy

Advisor(s)
Cristina Vega, Loyola University

The current belief in neonatology is that infants who have a patent ductus arteriosus (PDA) will present clinically with the classic signs of widened pulse pressure >25 mm Hg, a continuous machinery-like systolic murmur, bounding pulses, and a prominent precordial pulse. We collected data on all premature infants born <37 weeks gestational age at Loyola University Medical Center's Neonatal Intensive Care Unit between the years 2008 and 2010, to analyze widened pulse pressure. A total of 299 infants were analyzed; 164 had a PDA and 135 did not have a PDA confirmed by an echocardiogram in the first seven days of life. All the infants had their systolic and diastolic blood pressures and pulse pressures recorded for the first seven days of life through both invasive and non-invasive methods of blood pressure collection. At this time, all of the data has been collected; however, a statistical analysis has not yet been finished, leaving the result of this project unclear. The demographics also have been recorded, but an analysis of the various components still needs to be completed. The data analysis will reveal whether or not widened pulse pressures are a sign of PDA in premature babies.

P22
Role of Foxc1 and Foxc2 in Differentiation of Embryonic Stem Cells to Vascular Endothelial Cells

Presenter(s)
Mahendra Reddy, Illinois Mathematics and Science Academy

Advisor(s)
Anees Fatima, Northwestern University
Tsutomu Kume, Northwestern University

Previous studies have suggested that Foxc1 and Foxc2 transcription factors play a role in cardiovascular development. However it is not clear if these transcription factors play any role in specification and differentiation of vascular endothelial cells. Mouse embryonic stem cells (mES) were used to establish an *in vitro* model of vascular endothelial differentiation on collagen IV. Flk-1 positive cells mES cells, which we studied for the Foxc1 and Foxc2, were sorted by fluorescence-activated cell sorting. Foxc1 and Foxc2 were either over expressed or knockdown using siRNA oligonucleotides in Flk-1 sorted cells. Vascular endothelial differentiation related gene expression was quantified by qPCR. In the over expressed and knockdown samples the expression of both arterial and venous differentiation related markers were compared. The Foxc1 knockdown showed a suppression of both EfnB2 (arterial) and EphB4 (venous) markers, and over expression of Foxc1 showed an increased expression of EfnB2 and EphB4. However the knockdown of Foxc2 suppressed EfnB2. The over expression of Foxc2 increased expression of both EfnB2 and EphB4. Preliminary results of over expression and knockdown of the Foxc1 and Foxc2 transcription factors in Flk-1 mES cells indicate that these transcription factors might play a role in specification of vascular endothelial cells. However further investigations are necessary to confirm these results.

P23
Characterization of Liver-Detargeted Oncolytic Adenoviruses

Presenter(s)
Ross Skelly, Illinois Mathematics and Science Academy

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

The transforming growth factor beta (TGFβ) cellular pathway controls normal cell growth and proliferation in healthy cells. In late-stage cancers, it promotes tumor progression and metastasis of the cancerous cells to bones. While the *dl*01/07 mutant adenovirus used in previous experiments has inhibited tumor progression by targeting the TGFβ pathway, body scans of mice indicate the virus also accumulates in the liver, causing toxicity. We replaced hexon 5 in the viral DNA with hexon 48. Therefore, the adenoviruses should not bind to factor X, a clotting agent in the blood which acts as a bridge for the adenoviruses to accumulate in the liver. After these adenoviruses were created, Western blots, sulforhodamine B (SRB) assays, and mouse experiments were performed to examine the effect of the new adenoviruses on cancer cell lines and mouse livers. Western blots and SRB assays indicated that the ability of the modified adenoviruses to inhibit tumor progression and bone metastasis were not significantly different from the non-modified adenoviruses. Additionally, mouse experiments indicated that modified adenoviruses did not accumulate to toxic levels in the livers of cancerous mice. Alanine aminotransferase levels in the bloodstreams of mice confirmed that modified adenoviruses were not toxic to mouse livers.

P24
The Effect of Cardiac Reoperation on Ventricular Function

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

Advisor(s)
Jia Raman, Rush University Medical Center

In recent times, heart failure has increased its presence in our medical lives. While the instance of cardiac surgery increases in this country to respond to this epidemic, the likelihood that a patient will undergo multiple thoracic operations in his lifetime increases as well. The rising amount of reoperative surgeries, especially coronary artery bypass grafting, and valve replacement surgery, has contributed to this. It is hoped that this study helps link the risk of reoperation with postoperative physical effects as well. A body of four-hundred cardiac patients, who received operations at Rush Medical Center during a ten year period were chosen. Using the eResearch program of the Velos Company, they were separated by their history of previous interventions, and the nature of these interventions. This was then compared to the ejection fractions, which were used as a uniform measure of ventricular function. Reoperative valve replacement has not been shown to decrease function. Understanding the potential effects of cardiac reoperation on overall ventricular function would help guide patients and surgeons towards beneficial decisions in both the immediate and long term future.

P25
HIV: The Trojan Horse

Presenter(s)
Adekore Taiwo, Illinois Mathematics and Science Academy

Advisor(s)
Minh Dinh, Northwestern University

HIV is a life threatening virus of endemic proportions that destroys cells bearing the CD4 receptor. Understanding how HIV enters the cell would allow scientists to derive an effective means to eradicate the resulting syndrome, AIDS. This investigation studies the effectiveness through which different strains of HIV enter the epithelia of abdominal and facial skin. Tissue samples extracted from humans were sliced and put on a slide. The tissue was then stained using florescent antibodies which attached to CD4 T-cells, Langerhans cells, filaggrin protein, and tight junction complexes. Using an imaging microscope, pictures were taken of isolated areas of epithelia. The cell structures and total HIV virions were counted. This was followed by measuring the distances between the cell structures and epithelial surfaces. Results show there is a significant difference ($p=.002456$) between the distances that DeltaENV virus and CCR5-tropic virus penetrate the epithelia layer, but no significant difference in the depth of penetration into facial and abdominal tissue ($p=.14$), or in the number of DeltaENV and R5-tropic virions in facial or abdominal tissues ($p=.07$). These results suggest different forms of HIV are more adept at going through tight junctions and infecting CD4 T cells.

P26
Modulation of Stem Cell Marker (DCAMKL1) Expression During Colon Cancer Chemoprevention

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

Advisor(s)
Mart DeLa Cruz, North Shore University Health System Research Institute
Ramesh Wali, North Shore University Health System Research Institute

Mortality rate from colorectal cancers (CRC) remains high despite advances in screening and chemoprevention. Stem cells are now recognized as the precursors to a majority of CRCs and the stem cell protein doublecortin and calcium/calmodulin dependent protein kinase-like1 (DCAMKL1) has emerged as a biomarker for CRC initiation and progression. Whether DCAMKL1 is appropriate for evaluating CRC chemoprevention is not known. Our studies were undertaken to investigate modulation of DCAMKL1 expression by chemopreventative agents such as polyethylene glycol (PEG) and sulindac. We utilized polyposis in rat (PIRC) colon as a model for familial CRC in which rats were fed AIN-76A high fat diet to accelerate tumor progression. Control and PIRC rat diets were supplemented with either sulindac (320 ppm) or with PEG-6000 (10%) for twelve weeks. DCAMKL1 expression was examined in rat colons by immunohistochemistry or Western blotting. Results demonstrated an increase in DCAMKL1 immunostaining in colonic crypts of PIRC rats compared to control and a reduction in staining by both PEG and sulindac. Similarly, in cell culture, colon cancer cell line HCT-116 showed a reduced expression of DCAMKL1 with both sulindac and PEG. These novel findings present DCAMKL1 as suitable biomarker for assessing the efficacy of chemopreventative agents for CRC.

P27
More Factors Influencing Successful Weaning from Caffeine and Outcomes of Infants Who Failed Weaning From Caffeine

Presenter(s)
Rheanna Vimawala, Illinois Mathematics and Science Academy

Advisor(s)
Patricia Hummel, Loyola University
Christine Sajous, Loyola University

Apnea of prematurity is a major concern for neonates born before 34 weeks of gestation. The magnitude of this problem led to the development and usage of caffeine on premature babies. Usually physicians try to wean babies from caffeine at around 34 weeks of gestation, however the infants do not always wean successfully. Last year another IMSA student examined the same population and analyzed whether gender, birth weight, and race influenced weaning from caffeine. Furthering this study this year we looked at the effect of intraventricular hemorrhage (IVH), patent ductus arteriosus (PDA), and necrotizing enterocolitis (NEC) on weaning from caffeine and if failing to wean is a predictor of long term problems. To conduct this investigation, data of infants born between August 15, 2006 and August 15, 2010 from the Loyola Neonatal Intensive Care Unit database was compiled. Additionally, babies who failed to wean were matched by birth weight and gender to babies that successfully weaned from caffeine and outpatient clinic data was collected at eight to thirteen months adjusted age for each of the individually matched babies. There was no significant correlation found between neonates who had IVH, PDA or NEC and failed weaning from caffeine and the ones who weaned. The second part of this study which looks at whether failing to wean from caffeine is a predictor of long-term disability is ongoing. This information can help neonatologists predict the significance of failing to wean from caffeine at 34-35 weeks.

P28
Effects of Fatty Acids on Pancreatic Cancer Cells

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

Advisor(s)
Paul Grippo, Northwestern University

Omega-3 and omega-6 are polyunsaturated fatty acids (PUFAs) that have positive effects on the body in comparison to saturated fats. Omega-3 fatty acids (ω-3 fa) have been used to maintain heart health, but recently, it is becoming a use for pancreas cancer prevention. One method that is used to study this is the use of cell culture, which helps determine whether or not the effects of fatty acids on pancreas cells are caused by secreted factors. When metabolized, PUFAS can be turned into prostaglandins, a type of eicosanoid, which can be secreted out of a cell. An oncogene called Kras, which is a model of early cancer, has been engineered into two human pancreas cell lines. Human pancreatic nestin expressing (HPNE) cells, human pancreatic ductal epithelial (HPDE) cells, HPNE-Kras, and HPDE-Kras have been treated with PUFAs. After their initial responses to the PUFAS, the media was swapped with fresh media. A Western blot was then run on the proteins from the fresh media to find the level of pAkt, a factor that favors cell growth. pAkt levels were found to be decreased from ω-3 fa treated media, which proves that ω-3 fa indicts a secreted factor in the cells.

Q01
Measuring Cerebrovascular Reactivity in Patients With and Without Brain Disorders

Presenter(s)
Megan Bacani, Illinois Mathematics and Science Academy
Dhruv Patel, Illinois Mathematics and Science Academy

Advisor(s)
Jennie Chen, Northwestern University
Todd Parrish, Northwestern University
Xue Wang, Northwestern University

The brain consists of a network of neurons, which requires a cerebrovascular system that provides necessary nutrients to function properly. Changes in this cerebrovascular response can be measured by taking images of the brain with blood oxygenated level-dependent functional MRI (BOLD fMRI). In this study, patients with and without brain disorders were given cued breathing instructions including fifteen-second breath holds, while being scanned in an MRI machine. Breath holding causes an increase in the amount of carbon dioxide in the blood, causing a strong temporary BOLD signal increase. Scans were sorted through MATLAB and analyzed in BrainVoyager by measuring signal changes. Thirteen patients with arteriovenous malformation, epilepsy, tumors, stroke, or without diseases were tested and cerebrovascular maps were created. Results show that changes in BOLD signals and cerebrovascular reactivity are dependent on the disease that the patient has. This investigation can potentially determine the effect of various brain disorders and their effects on cerebrovascular reactivity. This method can be used to verify if treatments are affecting the vascular system. Furthermore, they can be used to verify that patients are capable of generating a blood flow response that can be detected by functional MRI.

Q02
Correlation of Hippocampal Asymmetric Index and Nonverbal Memory Performance for Primary Progressive Aphasia Patients

Presenter(s)
Ashley Chong, Illinois Mathematics and Science Academy

Advisor(s)
Emily Rogalski, Northwestern University
Lei Wang, Northwestern University

Primary progressive aphasia (PPA) patients experience a decline in language functions and atrophy in the language network and left hippocampus which is important for memory. However, it is unclear if atrophy in the hippocampus of PPA patients is related to memory performance. For that reason, we calculated hippocampal asymmetric index (AI) [(RH-LH)/(RH+LH)] to see if it correlated with performance on the immediate or delayed nonverbal memory subtests of the Weschler Memory Scale III. To compare the magnetic resonance images (MRI) accurately, the left and right hippocampi were manually edited because the MRI brain imaging software Freesurfer overestimates hippocampal volume. Inter-rater reliability was established: controls (overlap mean=LH: 88.42%; RH: 88.87%) and patients (overlap mean=LH: 87.34%; RH: 92.31%). Then, a Pearson Correlation was run between the memory test performance (immediate and delay) and AI for four groups (control, PPA, PPA-L, and PPA-G) using the statistical analysis program SPSS. In terms of AI and memory scores, there was no significant correlation within any of the groups ($p \leq 0.001$, for both). Immediate and delay scores correlated in the control and patient groups. Therefore the data suggests that no conclusions can be made between the asymmetry of hippocampus and nonverbal memory performance.

Q03
Laboratory Techniques for Studying Amyotrophic Lateral Sclerosis

Presenter(s)
Zi-Ning Choo, Illinois Mathematics and Science Academy
Ted Li, Illinois Mathematics and Science Academy

Advisor(s)
Pembe Hande Ozdinler, Northwestern University

This investigation involved understanding laboratory techniques with the aim of applying these experimental procedures to studying the role of alternative splicing in amyotrophic lateral sclerosis (ALS). Laboratory techniques included tissue sectioning, immunohistochemistry, DNA isolation, polymerase chain reaction (PCR), and gel electrophoresis. The purpose of sectioning tissue is to prepare samples for immunohistochemistry, during which proteins are labeled with antibodies so that they can be visualized through light microscopy. DNA isolation, PCR, and gel electrophoresis are involved in genotyping the mice used in these experiments. This lab used the transgenic SOD1 G93A mouse to model the motor neuron degeneration that characterizes ALS. DNA was isolated from tail samples of the mice. The DNA was then amplified through PCR and pieces of different lengths were separated through electrophoresis. The location of the DNA on the gel revealed whether the mutated human SOD1 gene was present. We learned through this investigation that understanding methodology is a crucial component of research because it allows for the collection of relevant data and the replication of experimental procedures by other researchers.

Q04
Aberrant Alternative Splicing in Amyotrophic Lateral Sclerosis

Presenter(s)
Zi-Ning Choo, Illinois Mathematics and Science Academy
Ted Li, Illinois Mathematics and Science Academy
Areen Pitaktong, Illinois Mathematics and Science Academy

Advisor(s)
Pembe Hande Ozdinler, Northwestern University

Amyotrophic lateral sclerosis (ALS) is characterized by the death of motor neurons and the loss of voluntary movement. RNA editing and alternative splicing defects have been implicated as potential mechanisms for motor neuron vulnerability. Alternative splicing refers to the retention of different combinations of exons during RNA splicing, resulting in the generation of different splice variants. The relationship between aberrant alternative splicing and ALS was studied through exon array analyses. These analyses measure the expression levels of exons in the mRNA transcript and were collected from corticospinal motor neurons (CSMN), which degenerate in ALS, and colossal projection neurons (CPN), which do not. Several genes with different alternative splicing patterns between CSMN and CPN were found. The alternative splicing of these genes will now be verified via reverse transcription-polymerase chain reaction and immnunohistochemistry. The discovery of alternatively spliced genes is significant because it can contribute to the development of an early detection marker for ALS and serve as a target for gene therapy.

Q05
Investigation of Language Networks Using fMRI with Auditory and Visual Stimuli

Presenter(s)
Mary Do, Illinois Mathematics and Science Academy

Advisor(s)
Todd Parrish, Northwestern University
Xue Wang, Northwestern University

As one of the most important human functions, language is the object of much research and experimentation which frequently utilizes a method called functional magnetic resonance imaging (fMRI). Functional MRI indicates areas of activation in the brain and therefore assists in showing how the brain is responsible for language. In this investigation, fMRI was used to show how the language networks in the brain are affected by visual and auditory stimuli during a synonyms task. In the auditory synonyms task, the subjects listened to pairs of words or pairs of tones and decided whether the words were synonyms or whether the tones were the same. In the visual synonyms task, the subjects saw pairs of words or pairs of letter strings on a projector and decided whether the words were synonyms or whether the letter strings were the same. The fMRI results of this study indicated that the auditory task activated more areas of the language networks in the brain than the visual task did. They suggested that it would be more efficient to use the auditory task than the visual task in presurgical mapping of the language networks in the brain.

Q06
Water Diffusion as an Effective Biomarker to Evaluate Efficacy of Brain Treatment Performance

Presenter(s)
Mary Do, Illinois Mathematics and Science Academy
Joan Shang, Illinois Mathematics and Science Academy

Advisor(s)
Jennie Chen, Northwestern University
Todd Parrish, Northwestern University
Xue Wang, Northwestern University

At any given time, over five million patients are diagnosed with brain diseases nationwide, and the treatments they undergo are often ineffective with harmful side effects. The orthodox method for evaluating a treatment's efficacy usually requires several months, so we propose using diffusion MRI (dMRI) to reduce the evaluation time. Using MATLAB software, we calculated patients' apparent diffusion coefficient (ADC) values, an indicator of brain damage, over the course of their treatment. We referenced their clinical data to assess the predictive ability of changes in ADC values. The graphs of changing ADC values corresponded well with the patient's clinical history and treatment. Increasing ADC values, which indicate damage inflicted on the brain, matched clinical records that suggested disease progression. Decreasing values, which indicate brain recovery, matched with records showing effective treatments. This correlation suggested that water diffusion has a reliable quantitative predictive ability. Therefore, diffusion MRI is recommended in determining the efficacy of different treatments against brain diseases. It would reduce the evaluation time, allowing a treatment plan to be changed in a timely manner. However, additional data is necessary to validate this conclusion.

Q07
Using Hippocampal Structure to Differentiate Between Mild Cognitive Impairment Types

Presenter(s)
Dominic Gentile, Illinois Mathematics and Science Academy
Previn Kumar, Illinois Mathematics and Science Academy

Advisor(s)
Kate Alpert, Northwestern University
Adam Christensen, Northwestern University
Lei Wang, Northwestern University

About 15%-20% of amnestic mild cognitive impairment (MCI) patients have shown to eventually progress to Alzheimer's disease (AD). Studies have indicated that there is a difference in hippocampal structure between AD patients and cognitively normal healthy elderly individuals. We used a Matlab program to analyze brain scans from the Alzheimer's Disease Neuroimaging Initiative by using principal components analysis to compute shape scores of the hippocampal CA1 and subiculum subfields. After the brain scans had been analyzed, multivariable ANOVA (MANOVA) was used to compare the volumes of the hippocampus and its subfield shape scores between control patients, MCI patients, and AD patients. The MANOVA tests found a significant difference between the volumes of the control and MCI hippocampus, the MCI and the AD hippocampus, and the control and the AD hippocampus. A significant difference in the structure of the entire hippocampus among the three groups was also found. Within the CA1 and subiculum subfields, a significant difference was found in the structure between all three groups. These data show that the structure of the CA1, subiculum, and entire hippocampus in AD patients and MCI patients are significantly different and furthermore, more significantly different than the overall volumes.

Q08
The Effects of Methamphetamine and Dopamine Receptor Antagonists on the Neurovasculature

Presenter(s)
Brinda Gupta, Illinois Mathematics and Science Academy

Advisor(s)
Paul Carvey, Rush University Medical Center
Bill Hendey, Rush University Medical Center

The exact mechanism(s) of methamphetamine (meth)-induced neurotoxicity is unknown. Neurovascular changes have been identified to induce toxicity with meth use, and clinical studies report reductions in regional cerebral blood flow (rCBF) in the striatum of detoxified meth abusers. Meth increases dopamine (DA), a known vasoregulator. Dopamine activity at the D2 receptor produces vasoconstriction and D1 receptor activation produces vasodilation. We hypothesized that D2 receptor antagonist pretreatment (L741,626) would attenuate meth-induced hypoperfusion while pretreatment with a D1 receptor antagonist (SCH23390) would have no effect. Rats were treated with one of two doses of SCH22390 or L741,626 30 minutes prior to meth (2.5 mg/kg intraperitoneal) and perfused with FITC-LA or microfil-MV, vascular markers. L741,626 pretreatment produced normal FITC-LA perfusion, attenuating meth-induced striatal hypoperfusion. Micro-computed tomography (μCT) analysis revealed that L741,626 pretreatment increased the vascular volume ratio, vascular number, and vessel thickness in the striatum compared to meth treatment alone. SCH23390 did not produce normal striatal FITC-LA perfusion and appeared to increase μCT measurements of vascular volume ratio and vascular number at the higher dose (0.5 mg/kg). Selective and persistent reductions in the rCBF in the striatum, potentially mediated by DA receptors, may contribute to the selectivity of the neurotoxic effects of meth in this brain region.

Q09
Moderate Ethanol Preconditioning Induction of Heat Shock Protein 70 in Non-Primary Neuronal Cell Lines and its Correlation to Neuroprotection

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

Advisor(s)
Michael Collins, Loyola University
Donald Dosch, Illinois Mathematics and Science Academy

There is no question that chronic alcohol (ethanol) abuse causes neuronal dysfunction and brain damage; however, low or moderate ethanol concentrations (10-30 mM) have been demonstrated to exert protective effects in *in vivo* models. Recently, various studies have indicated that light/moderate alcohol consumers have lower risks of age-dependent cognitive decline and/or dementia, including Alzheimer's disease (AD), in comparison to abstainers. This experiment posits that the aforementioned reduced risk of cognitive decline is a result of the ethanol preconditioning phenomena observed in brain glia and neurons. To mimic this effect, the neuronal cell line PC-12 was subjected to moderate ethanol preconditioning (MEP) of 10-30 mM ethanol, which was shown to prevent simulated neurodegeneration due to β-amyloid, an important protein implicated in AD. In addition, upon applying MEP, it was found that onset of neuroprotection correlates temporally with elevations in effector heat shock protein 70 (HSP70). This, and other previous research, suggests that HSP70 plays a role in neuroprotection and could be a possible mechanism for the therapeutic effect that MEP could potentially provide for AD patients.

Q10

Vasogenic Edema as a Mechanism of Transgenic Human Antigen R-Mediated Increase in Ischemic Lesion Size in a Mouse Stroke Model

Presenter(s)
Kevin Hong, Illinois Mathematics and Science Academy

Advisor(s)
Agnieszka Ardelt, University of Chicago
Randall Carpenter, University of Chicago

The regulatory protein human antigen R (HuR) has been shown to stabilize mRNA in the brain during an injury. It was previously hypothesized that over expressing HuR in astrocytes would decrease lesion size by promoting proteins for neurorepair. However, transgenic expression of HuR in astrocytes has been shown to increase ischemic lesion sizes. This investigation looked at the possibility that HuR increases the concentration of the proteins matrix metalloprotease-9 (MMP-9) and vascular endothelial growth factor (VEGF). MMP-9 degrades the extracellular matrix, and VEGF causes vascular permeability. These effects would weaken blood brain barriers prior to angiogenesis, causing increased vasogenic edema in the brain, which would be responsible for the larger lesion sizes. Wild type (WT) and transgenic (Tg) male and female mice were given strokes and euthanized 24 hours or 72 hours later. The presence of tight junctions, indicating mature blood brain barriers, was investigated by staining for the protein zona occulden-1; no quantitative difference were observed between WT and Tg animals. Tissue sections were immunofluorescently stained for VEGF and MMP-9, but results were inconclusive due to high background. Brains were also analyzed with Western Blots to quantify the protein levels. Finally, Evans blue was used to directly quantify vasogenic edema.

Q11

Identifying Interesting Genes that Show Differences in Healthy and Diseased Amyotrophic Lateral Sclerosis Transgenic Mice at Different Stages of Disease Progression

Presenter(s)
Lakshmi Katta, Illinois Mathematics and Science Academy
Maura Slattery, Illinois Mathematics and Science Academy

Advisor(s)
Pembe Hande Ozdinler, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease that impairs communication between the brain and a person's voluntary movements. Alternative splicing is thought to have a significant role in the neuronal death in ALS patients. To investigate that role further, we researched the different types of gene expression that may be related to the disease. We sorted through microarray data of thousands of different genes found in the corticospinal motor neurons (CSMN) and colossal projection neurons (CPN), searching for ones with an expression that indicated a link to ALS in wild type, SOD1, and UCHL-1 transgenic mice. The genes were classified based on expression pattern of their exons. In the future, knockout mice will be used to see if the identified genes are the mechanisms behind the neuronal degradation. We hope to find the relation with gene expression and disease progression.

Q12
Clustering Depressive Symptoms in Aging: Group Differences and White Matter Correlates

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

Advisor(s)
Mailynn Grajewski, University of Illinois at Chicago
Laura Korthauer, University of Illinois at Chicago
Melissa Lamar, University of Illinois at Chicago

Symptoms of depression are different in older adults than in younger adults. Adults affected by late life depression (LLD) have a higher amount of white matter lesions than their younger counterparts. The purpose of this study is to find relations between clusters of LLD symptoms and white matter hyperintensity (WMH) volumes. There were sixty-three healthy controls and thrity-two LLDs diagnosed by the Structured Clinical Interview for DSM Disorders (SCID) and Hamilton Rating Scale for Depression (HAM-D) by trained psychiatrists. We clustered the Center of Epidemiologic Studies Depression Scale (CES-D) scores according to three groups: physical/cognitive symptom, affective symptoms, and psychosocial symptoms. The between group analyses, as expected, showed that the LLD group had more depressive symptoms than the healthy controls regardless of category. The within group analyses showed that within the LLD group, physical/cognitive and affective symptoms were more prominent than psychosocial symptoms. For the healthy controls, the physical/cognitive symptoms were more prominent than both the affective and psychosocial symptoms albeit at nondepressed levels. Despite different patterns of symptoms, there was no association to WMH in either the healthy control or LLD groups. The results could be used to diagnose/treat adults with LLD based on the symptom profiles that they show.

Q13
Mouse Model for the Study of Axonal Degeneration in Huntington's Disease

Presenter(s)
Sooyeon Kim, University of Illinois at Chicago
Sidra Salman, Illinois Mathematics and Science Academy

Advisor(s)
Rodolfo Gatto, University of Illinois at Chicago
Gerardo Morfini, University of Illinois at Chicago

Huntington's disease (HD) is a neurodegenerative disease caused by abnormal elongation of a polymorphic polyglutamine (polyQ) tract in the Huntingtin protein (Htt). The motor and cognitive effects associated with HD involve deficits in corticostriatal connectivity. However, molecular mechanisms causing synaptic and axonal dysfunction remain unknown. A large body of experimental precedents led us to hypothesize that axonal degeneration in HD results from the abnormal activation of the cJun amino-terminal kinase (JNK) pathways. To further investigate this claim, we set out to establish an animal model of HD that facilitates the visualization of axons and the quantifications of axonal degeneration. To this end, a well-characterized HD mouse model (R6/2 mice) expressing mutant Htt (PolyQ-Htt) was bred with transgenic mice expressing yellow fluorescent protein (Thy1-YFP mice). Littermates from this cross were genotyped and the coronal brain sections were analyzed at 30 days, 60 days, and 90 days, using fluorescent microscopy. Images of the corpus callosum were obtained and the amount of fluorescence was quantified to measure the extent of neuronal loss. Axonal degeneration progressively worsened from 30 to 90 days in mice expressing polyQ-Htt, compared to wild type Huntington littermates ($p < 0.001$). Our work will help evaluate molecular mechanisms underlying axonal degeneration in HD, including the role of the JNK pathway.

Q14
IL-10 Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS

Presenter(s)
Rahul Maheshwari, Illinois Mathematics and Science Academy
Sarah Martin, Illinois Mathematics and Science Academy

Advisor(s)
Nichole Mesnard, University of Illinois at Chicago
Julie Rowin, University of Illinois at Chicago

Amyotrophic lateral sclerosis (ALS) is a fatal motor neuron degenerative disease characterized by upper and lower motor neuron cell death. Transgenic mSOD1 mice are the representative mouse model for ALS, and develop comparable disease pathology to ALS patients. A series of responses, collectively known as Wallerian degeneration (WD), occur after an injury to a non-ALS motor axon. In WD, activated Schwann cells become activated, shut off IL-10 secretion, and have increased TNFα secretion, which recruits phagocytic macrophages into the damaged area to assist with clearing axonal debris. Successful WD allows regenerating axons to reinnervate motor end plates. Our hypothesis is that a response similar to WD occurs in mSOD1 ALS mice, and involves dysregulated activated Schwann cells and phagocytic macrophages. Wild type and mSOD1 mice gastrocnemius muscle tissue at ten weeks of age were examined for IL-10 expression. Protein expression patterns and concentration levels were examined using immunohistochemistry and enzyme-linked immunosorbent assays, respectively. Our immunohistochemistry results demonstrate below detectable IL-10 expression levels around mSOD1 gastrocnemius neuromuscular junctions compared to wild-type. The preliminary results could potentially indicate that a proinflammatory microenvironment surrounds neuromuscular junctions involving activated Schwann cells and phagocytic macrophages.

Q15

Tumor Necrosis Factor α Expression Surrounding Neuromuscular Junctions in the mSOD1 Mouse Model of ALS

Presenter(s)
Rahul Maheshwari, Illinois Mathematics and Science Academy
Sarah Martin, Illinois Mathematics and Science Academy

Advisor(s)
Nichole Mesnard, University of Illinois at Chicago
Julie Rowin, University of Illinois at Chicago

Amyotrophic lateral sclerosis (ALS) is a fatal motor neuron degenerative disease. The transgenic mSOD1 mouse model over expresses the human mutant SOD1 gene, similar to a portion of familial ALS patients, and exhibits pathological characteristics of ALS. In ALS, axonal withdrawal from target musculature precedes motor neuron cell death. Wallerian degeneration is a response involving activated Schwann cells and phagocytic macrophages around degenerating motor axons, which is mediated by a tightly regulated balance of TNFα, pro-inflammatory cytokine, and IL-10, an anti-inflammatory cytokine. We proposed that the axonal withdrawal in ALS may cause or be due to proinflammatory Wallerian degeneration activity surrounding ALS neuromuscular junctions. The objective of this investigation was to compare TNFα protein expression surrounding neuromuscular junctions in gastrocnemius muscle from mSOD1 mice to wild type. Immunohistochemistry and ELISA were used to detect protein expression patterns and protein concentration levels of TNFα on gastrocnemius muscle tissue of mSOD1mice at ten weeks of age. Using immunohistochemistry, we observed below detectable levels of TNF-α expression in wild-type gastrocnemius tissue, where as higher levels were seen in mSOD1 gastrocnemius muscle. Our preliminary results indicate that Schwann cells and macrophages are creating a proinflammatory microenvironment surrounding pre-symptomatic mSOD1 neuromuscular junctions.

Q16
Acute Seizure-Induced Microglia Activation in the Hippocampus of Postnatal Day 14 Mice

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

Advisor(s)
Patricia Fox, Children's Memorial Research Center
Sookyong Koh, Children's Memorial Research Center
Lauren Mlsna, Children's Memorial Research Center

Our laboratory studies the role of innate immunity in childhood epilepsy. Microglia, resident immune cells of the central nervous system, are strongly activated by prolonged seizures. We used *Cx3cr1*^{GFP} mice, whose parenchymal microglia are fluorescently labeled, to quantify the amount of microglia activation in the hippocampus at one, three, and five days following prolonged seizures in two different seizure models. One was a febrile seizure model where a lipopolysaccharide (LPS) injection was followed by hypothermia-induced seizures (30 min). The other one was LPS followed by kainic acid (KA)-induced stastus epilepticus (over 30 min long seizures). The brains were fixed in formaldehyde and sucrose solution so they could be properly sliced and mounted. The microglia activation was observed and captured as images at the intervals of interest. Through analysis of the images, it was found that the microglia activation in the LPS hypothermia seizures was noted at one day, but not in three days while the activation in the LPS KA persisted at one and three days to return to baseline at five days. Our results suggest that persistent microglia activation is related to duration of induced seizures. Our time course experiments will be helpful in designing future experiments exploring therapeutic efficacy of maternal care and environmental enrichment to reduce seizure-induced microglia activation.

Q17
Immunohistochemical Localization of Hyperpolarization-Activated and Cyclic Nucleotide-Gated Nonselective Cation Channels (HCN1-4) in the Mouse Brain

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

Advisor(s)
Dane Chetkovich, Northwestern University

Hyperpolarization-activated cation currents (Ih), which contribute to pacemaker activity as well as many other functions in the brain and heart, are generated by hyperpolarization-activated and cyclic nucleotide-gated nonselective cation channels (HCN1-4). In order to determine the distribution of Ih in the mouse brain, immunohistochemistry was performed to locate the HCN channels. HCN1-4 wild type mice were used in addition to knockout mice, which served as a negative control. Results from immunohistochemistry indicate that HCN1 is distributed in the hippocampus and HCN2 in the hippocampus and cerebellum. Knockout mice, as expected, did not reveal HCN1 or HCN2. These results coincide with previous studies on the distribution of HCN channels. Current studies and experiments being done include more specific antibodies and will reveal the true location of all four HCN channels, strengthening previous studies. The knowledge of the distribution of HCN channels gained from this study will assist future scientists in creating drugs for epilepsy since Ih currents and HCN channels become downregulated in patients with this disease.

Q18
Measuring Hemodynamic Response Function in Patients and Healthy Controls

Presenter(s)
Tonu Pius, Illinois Mathematics and Science Academy

Advisor(s)
Jennie Chen, Northwestern University
Todd Parrish, Northwestern University
Xue Wang, Northwestern University

The hemodynamic response function (HRF) is a response in blood flow after neuronal activation. It is predicted that the HRF would show a local delay or amplitude change in patients that have a tumor, a stroke, epilepsy, or an arteriovenous malformation (AVM) causing a temporary blood physiology change in the brain. In order to determine the effects of a cerebrovascular disease on the HRF, control subjects and patients were scanned in an function magnetic resonance imaging (fMRI) machine while performing a movement task; the individuals were asked to move their fingers rapidly in order to trigger the HRF. It was predicted that with the presence of a cerebrovascular disease the HRF will be delayed 5-6 seconds. The data collected from the fMRI was then processed in BrainVoyager into a three-dimensional model by overlaying the maps onto a structural scan; this model included the blood physiology change of the brain correlated with the movement task. The normalized data showed that the delay in the HRF varied in patients and healthy controls depending on the type of cerebrovascular disease. Although this study confirmed that the HRF changes with different diseases, a study including more subjects would be needed to validate these statements.

Q19
Characterization of Neuronal Human Antigen-R Protein Expression

Presenter(s)
Abhinav Reddy, Illinois Mathematics and Science Academy

Advisor(s)
Agnieszka Ardelt, University of Chicago
Randall Carpenter, University of Chicago

During ischemic stroke, a lack of blood flow leads to the deterioration of brain tissue and in effect bodily functions. Certain mRNA binding proteins, such as HuR, are hypothesized to be integral during and after ischemic stroke in neuroprotective and neuroreparative mechanisms. We hypothesized that transgenic expression of the HuR protein in neurons would lead to a decrease in ischemic lesion size and in turn a decrease in loss of functionality. Characterization of HuR expression was achieved through immunoflourescent staining for both endogenous and transgenic HuR protein in neurons. Hematoxylin and eosin (H&E) staining was used to identify lesion size and characterize the effects of transgenic HuR expression. Immunoflourescent staining showed that 95% of neurons in female mice and 90% in male mice were expressing transgenic HuR (including perilesional regions). The H&E staining showed that 24 hours after ischemia reperfusion the percent lesion size in transgenic females was larger than wild type females: 46.5% ± 1.3% (n=3) versus 32.9% ± 13.8% (n=10), respectively, with a p-value of 0.0164 (t-test). This data shows that the transgenic expression of HuR in neurons leads to an increase in ischemic lesion size, and therefore is ineffective in preventing brain tissue loss.

Q20
Comparing Mathematical and Verbal Semantic Memory in Epileptic Patients Through Invasive Neurophysiologic Brain Mapping

Presenter(s)
Carrie Sha, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

Very little is known about how memories are retrieved. Surgical removal of epileptic areas is an increasingly common method of treatment for seizures. However, patients undergoing surgery frequently suffer from postoperative memory defects. Twelve epilepsy patients were asked to answer basic arithmetic (for example, Seven times nine equals?) and verbal questions (for example, Who is your favorite singer?) to map their arithmetic and semantic memory areas. While answering these questions, the electrocorticographic brain activity was recorded focusing on gamma band power (70-100 Hz). To locate active cortical areas, gamma band dynamics were compared to the latency of their answers (voice-onset time). The medial temporal lobe was active during both the semantic and arithmetic tasks. However, semantic memory activity was widely distributed over the frontal and temporal lobes, whereas brain activity during the arithmetic task was concentrated over the frontal lobe. Answering verbal and arithmetic questions did not activate the parietal episodic memory areas. A better understanding of active mathematic and verbal memory areas could help physicians reduce postoperative memory deficits. Knowledge of the spatial distribution and temporal dynamics of neurophysiologic events during memory retrieval may allow a deeper understanding of this complicated and enigmatic human cognitive process.

Q21
The Development of Arithmetic Skills in an Epileptic Patient

Presenter(s)
Kalyani Sonarikar, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

Although the arithmetic abilities of young patients frequently improve over time, recurrent complex partial seizures often cause deterioration of cognitive abilities. The arithmetic development of an unusual postoperative epileptic patient was examined, with the patient's situation being unusual, in that she underwent two surgeries two years apart for mesial temporal lobe resection and disconnection of the anterior temporal lobe. The results of a semantic memory test involving arithmetic calculations were analyzed, along with electrocorticographic recordings from subdural electrodes placed on the patient's cerebral cortex prior to the two resections. A positive correlation between the latency of gamma band power (70-100 Hz) and the magnitude of difficulty of mathematical questions was observed, as well as the correlation between latency of voice-onset time and question difficulty. The analyses of data after both operations were compared, suggesting a decrease in gamma latency and a decrease in patient voice-onset time, supporting an improvement in arithmetic growth. Furthermore, patterns of distributed memory were identified prior to patient voice-onset time, implying a positive correlation between mental chronometry and arithmetic growth.

Q22
Modulation of Calcium Homeostasis on Amyloid-Beta Derived Diffusible Ligand-Treated Astrocytes

Presenter(s)
Shruthi Subramanian, Illinois Mathematics and Science Academy

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

Alzheimer's disease (AD) is characterized by a buildup of amyloid-beta derived diffusible ligands (ADDLs), causing atypical levels of intercellular calcium and synapse deterioration in the brain. This project tested calcium levels seen in astrocytes treated with ADDLs. A calcium assay was performed on live astrocytes. Immunocytochemistry was then performed to assess the change in protein activity by calcium using the antibodies phosphorylated adenosine monophospate-activated protein kinase (pAMPk) and phosphorylated protein kinase B (pPKB), both of which are activated downstream of intracellular calcium. Next, the plate was imaged and data on astrocyte size and puncta count, and fluorescent pAMKP and pPKB, was collected on each image through a thresholding process. Preliminary analysis shows that pPKB levels were increased compared to the neurobasal treated control group. The increase varied depending on the drug treatment. pAMPK levels were generally lower than the neurobasal treated control group with the exception of the cells treated with a 500 nanomolar concentration of ADDLs and vehicle. The addition of 2-methyl-6-(phenylethynyl) pyridine, an antagonist of calcium production, also did not seem to affect pAMPK levels. Further analysis is currently taking place in astrocytes and neurons. The results of this experiment will give further insight into the role astrocytes play in AD pathology.

Q23
Using a Drosophila Melanogaster Model to Study ALS

Presenter(s)
Amanda Sul, Illinois Mathematics and Science Academy
Connie Wang, Illinois Mathematics and Science Academy

Advisor(s)
Xiaoping Chen, Northwestern University
Jane Wu, Northwestern University
Mengxue Yang, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease in which motor neurons lose their function and are no longer able to control muscle movement. TPD-43 is a RNA binding protein that has been implicated in the neurodegeneration of ALS patients. In this investigation, *Drosophila melanogaster* expressing human TDP-43 were used to model the human ALS disorder in order to assess the fly model with respect to the progression of neurodegeneration. In order to measure the neurodegeneration of the transgenic flies, multiple motility assays were used on both larval *Drosophila* and adult *Drosophila* to evaluate locomotive function of these transgenic flies. Flies with limited movement would indicate that the TDP-43 mutation successfully modeled human ALS neurodegeneration. The flies expressing TDP-43 mutation showed a significant decrease in mobility, which suggests that the model was successful in modeling human ALS. With a functional *Drosophila* model of ALS, research can continue into drug treatments and possible cures.

Q24
Effects of Misregulation of *GABRB3* Gene Expression in Relationship to Autism Related Behavior

Presenter(s)
Rebecca Wu, Illinois Mathematics and Science Academy

Advisor(s)
Williams Dietz, Children's Memorial Research Center
Laura Herzing, Children's Memorial Research Center

The *GABRB3* gene is thought to be vital for proper neurological development by encoding a receptor subunit for GABA, a major inhibitory neurotransmitter. We hypothesize that misregulation of *GABRB3* causes behavioral abnormalities linked to autism spectrum disorders (ASDs). To study the effects of *GABRB3* misregulation, using a 24-hour monitoring system (Noldus Phenotyper-Ethovision software) we analyzed the behavioral patterns of mouse lines developed to express abnormal levels of *GABRB3*. Analysis of the time spent in the center zone of testing arenas identified a period of time, midway through the dark (wake) cycle in which female mice with wild type (WT) *GABRB3* expression spent significantly less time in the center of the arena. Conversely, mice with decreased levels of expression (*GABRB3* HP mice) did not take such a break from the center ($p < 0.05$; student's t-test). Also, male HP mice seemed to immediately become active once the lights turned off, as measured by time in chamber center, while WT mice took longer to ease into activity. These abnormal behavioral patterns may indicate that HP mice are hyperactive compared with WT mice and /or show more persistence in activities, a feature common in ASDs.

Q25
The Role of Protein X in Eliminating SOD1 in Fibroblasts Derived from SOD1-G93A Transgenic Mice

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

Advisor(s)
Hasan Arrat, Northwestern University
Faisal Fecto, Northwestern University
Teepu Siddique, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a fatal disease characterized by the selective degeneration of both upper and lower motor neurons. The mutation of copper-zinc superoxide dismutase 1, or SOD1, has been shown to cause ALS in human patients. In mouse models, the overexpression of the SOD1 induces ALS-like symptoms whose severity correlates directly with the level of overexpression. In SOD1-linked ALS, mutant SOD1 has been shown to be a part of ubiquitin positive protein aggregates. Protein X is implicated in protein degradation via the proteasome and autophagy pathways which have been shown to degrade SOD1. To test the effect of protein X on SOD1 levels, SOD1-G93A fibroblasts were transfected with either an empty vector or a vector containing an insert which codes for protein X. Through ELISA immunoassays, it was demonstrated that fibroblasts which overexpressed protein X also contained lower amounts of SOD1 than control group fibroblasts. Future research will focus on determining whether SOD1 is eliminated by protein X through these degradation pathways or whether the effect is on the expression at the RNA level. The elimination of SOD1 by protein X may be used therapeutically to slow the progression of neurodegeneration in ALS patients.

R01
Photomultiplier Tube Calibration for the Use of Solid Xenon as a Particle Detector

Presenter(s)
Vidya Anjur, Illinois Mathematics and Science Academy

Advisor(s)
Jonghee Yoo, Fermi National Accelerator Laboratory

A photomultiplier tube (PMT) is typically used to detect very weak light signals, which can be displayed as electronic waveforms using an oscilloscope. In this experiment, a PMT gain calibration was performed for development of a low radioactive background detector using solid xenon. A PMT with twelve dynodes was placed in a steel container with a neutral density filter to reduce light exposure, and attached to a light-emitting diode, pulse generator, and oscilloscope, for a single photoelectron calibration. The container was then placed inside a cryochamber. Data was taken at both room temperature and 161 ^{o}K at voltages between 810-890 V. Gain was calculated for each voltage, and Gaussian fit curves were created for statistical analysis. The best voltage setting for this particular PMT at room temperature is between 860-870 V. For the cold temperature, the best setting is between 850-860 V. The total PMT gain in these ranges is about 4.089×10^6 electrons, with an error of 6.12%. Each time one electron enters the PMT, the outputted current includes ~4.1 million electrons.

R02
Determination of the Future of Neutrino Mass Hierarchy Experiments

Presenter(s)
Wesley Beck, Illinois Mathematics and Science Academy

Advisor(s)
Maury Goodman, Argonne National Laboratory

Neutrinos are small particles in the lepton sector that rarely interact with other particles. Many of its properties have yet to be discovered; prominent among these is their mass hierarchy. If it is found, it will help to determine other unknown properties accurately, and forge the way for new questions about neutrinos. In order to determine the future of neutrino experiments for finding the mass hierarchy, several long baseline experiments, such as the Long-baseline Neutrino Experiment (LBNE), Neutrinos at the Main Injector Off-Axis νe Appearance, Tokai to Kamioka, and the Main Injector Neutrino Oscillation Search, were reviewed to find their sensitivity to the mass hierarchy. Then, their sensitivity graphs were compared by using a program written in ROOT. The sensitivity was based on the restrictions of θ_{13} and the charge parity violating phase δ. Based on this analysis, LBNE has the highest sensitivity to the mass hierarchy out of the long-baseline neutrino experiments. In addition to these experiments, there is also an analysis of atmospheric and supernovae experiments for their sensitivity. The results of these analyses can help to determine the best path for experiments to measure the mass hierarchy.

R03
Minimizing Electrical Noise in the MicroBooNE Liquid Argon Time Projection Chamber and Developing an Algorithm for Event Classification

Presenter(s)
Emily Camras, Illinois Mathematics and Science Academy

Advisor(s)
Brian Rebel, Fermi National Accelerator Laboratory

The MicroBooNE experiment at the Fermi National Accelerator Laboratory will use a 170-ton liquid argon time projection chamber (LArTPC) to investigate neutrino interactions. Because the metal piping used to circulate liquid argon can act as an antenna to inject electrical noise into the LArTPC, it is necessary to electrically isolate the piping from the cryostat using dielectric insulators. The frequency response of four insulators of diameters 1.5, 2, 3, and 4 inches was tested in comparison to an uninsulated connection. All four insulators exceeded the requirement on reducing the power transmitted by more than 3 dB over the relevant frequency range from 1 kHz to 5 MHz. Additionally, an algorithm for classifying different types of neutrino events was developed. It was based on qualitative observations of computer-generated neutrino interactions. Users of this algorithm were able to distinguish electron neutrino charged current events from muon neutrino charged current and neutral current interactions with 85-90% efficiency and purity. This algorithm provides a method for users to classify neutrino events in the data MicroBooNE will generate.

R04
Searching for Dark Matter Using Charge Coupled Devices

Presenter(s)
Kathleen Chinetti, Illinois Mathematics and Science Academy

Advisor(s)
Thomas Schwarz, Fermi National Accelerator Laboratory

Only about twenty percent of all matter in the universe has been observed; the remaining eighty percent is dark matter. Most dark matter (DM) direct detection experiments search for high mass (50-100 GeV) DM particles. However, a novel dark matter experiment, dark matter in charge-coupled devices (DAMIC), has unique sensitivity to low mass dark matter (0-10 GeV) with nuclear recoil sensitivity less than 40 eVee. Unfortunately, several backgrounds to our dark matter signal can cause nuclear recoil, such as neutrons, cosmic rays, electrons, and X-rays. A data analysis code was built based on previously defined selection criteria and synchronized with other colleagues' analysis. Initial studies of the frequency of DM candidate events in a year's worth of data searching for a sinusoidal month-based dependence were inconclusive. Further studies were performed to understand and quantify backgrounds to our signal. An adapted analysis code was also created to study the angle of entrance of cosmic rays.

R05
The Future Now: Using Developing Rocket Technologies to Create the Ultimate Thrill Ride

Presenter(s)
Jasmine Davila, Illinois Mathematics and Science Academy
Quinn Gingerevans, Illinois Mathematics and Science Academy

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

There are many future technologies for rockets being theorized and studied currently. In this investigation, several of these were investigated for use in a recreational rocket. Research was done on aircraft engines and launch systems through reading scholarly articles. The criteria used to decide which technology to use were cost effectiveness, since current rocket systems are prohibitively expensive, and efficiency, since current systems waste a lot of fuel and parts of the body. Through the investigation, two main technologies were chosen: an electromagnetic rail launcher on the ground to accelerate the rocket to mach 3 and a dual mode scramjet to propel it upon leaving the rail. Additionally, at the altitude of seventy-five kilometers, the dual mode scramjet would turn off and a small solid-fuel rocket engine would boost it the rest of the way. An exploration into the costs of a launch, including fuel, maintenance and staff, is currently underway. This application of future technologies could be used to create a small recreational rocket with the ability to travel efficiently to the edge of space, creating a new market since the rocket would be able to launch frequently.

R06
Testing Correlations Between Nuclear Decay Rates and Earth-Sun Distance

Presenter(s)
Arjun Garg, Illinois Mathematics and Science Academy

Advisor(s)
Vadim Rusu, Fermi National Accelerator Laboratory

Previous work suggests possible correlations between nuclear decay rates and the Earth-Sun distance. We are validating the findings of the original experiment. In order to monitor the conditions in the system, we have built a circuit board with a BMP085 chip which will be used to detect the temperature and pressure over the course of the experiment so that we may keep it constant. The BMP085 chip was connected to a microcontroller through a data, a clock, a power, and a ground line. A 4.7 Ω resistor was used to connect the clock and data lines to the power. It was then programmed to calculate the temperature and pressure. If the temperature and pressure are monitored and kept constant, then we know that the results of the experiment will not be due to fluctuations in the temperature and pressure.

R07
Searching for the Standard Model Higgs Boson in the WH→WWW→lvjjjj Channel

Presenter(s)
Ethan Gordon, Illinois Mathematics and Science Academy

Advisor(s)
Michael Cooke, Fermi National Accelerator Laboratory
Ryuji Yamada, Fermi National Accelerator Laboratory

The Standard Model of Particle Physics accurately describes the fundamental particles that make up matter and how they interact. However, the Higgs boson, predicted to explain why some of these particles have mass, has not yet been observed. This search for the Higgs boson candidate events in final states with lepton, missing energy and at least four jets uses the full Tevatron Run II data set collected by the D0 detector at the Fermilab Tevatron Collider. To perform this search, we combine variables with little power to discriminate between Higgs boson candidates and background into one more powerful multivariate discriminant. After determining the most likely reconstruction of the Higgs boson based on decay products in a particular event, we added new variables to the analysis framework specific to the *WH→WWW→lvjjjj* process. In all, twenty-six variables were added to the framework. Later, an optimized subset of these variables were added to the list of inputs for the discriminate. As a result, the sensitivity of this channel improved by 5% at a Higgs mass of 130 GeV/c^2. Introducing this new, optimized channel will improve the sensitivity of the search for the Higgs boson at Fermilab and help expand the range of Higgs boson masses that are excluded at the 95% confidence level.

R08
Computer Simulation of Quenching in the High Field Superconducting Accelerator Magnet Made with Nb_3Sn Cable

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

Advisor(s)
Ryuji Yamada, Fermi National Accelerator Laboratory

Superconducting magnets create powerful magnetic fields by maintaining a state of no resistance. In order to keep a superconducting state, low temperatures must be maintained in the magnet at all times with liquid helium. Quenching starts when a piece of the magnet is disturbed suddenly by a force and its superconductivity is broken by the presence of heat causing the electrical current to go through the copper stabilizer instead of the superconductor, which heats the coil. The temperature of the magnet increases and if the heat is generated in excess amounts it may cause damage. My goal is to create an algorithm that measures the spread of heat during a quench and find the best conditions and methods to protect the magnet from being damaged. Our program shows the heat diffusion during the quench for our designed magnet. The graphs from our program provide results that show the heat distribution during the quench. Our program can display how the heat spreads through a magnet after quenching and we can change the parameters such as maximum temperature of the magnet. Quenching of poorly designed magnets could result in destruction of the magnet in seconds and the destruction of the surrounding magnets.

R09
Fourier Transform Infrared Imaging in Determining the Effectiveness of Trehalose as a Protectant

Presenter(s)
Aadam Ibrahim, Illinois Mathematics and Science Academy

Advisor(s)
Carolyn Hirschmugl, University of Wisconsin at Madison

Fourier transform infrared spectroscopy has recently become a much more powerful source of analysis as a result of an advance coupling multiple synchrotron beams with wide field detection. These advances allow for very high spatial and spectral resolution simultaneously in detecting chemicals. It is known that the sugar trehalose is good a protecting the structures of molecules such as proteins. Therefore, we performed high spatial resolution Fourier transform infrared spectroscopy on samples of dried droplets containing certain concentrations of the sugar trehalose and the protein albumin. This was done so as to determine the effect of protein on distribution of the compounds in the droplet. So far we have found that the material tends to concentrate towards the outside; however, the addition of trehalose is meant to make the structures more homogeneous. Our results found that addition of trehalose, contrary to what previous studies seem to show, made our droplets more heterogeneous. In order to properly see what trehalose does, we must look into higher concentration droplets in the future.

R10
Recycling Carbon Dioxide: Following Algae Response to High Concentration Carbon Dioxide Environments

Presenter(s)
Aadam Ibrahim, Illinois Mathematics and Science Academy

Advisor(s)
Mark Carlson, Illinois Mathematics and Science Academy
Carolyn Hirschmugl, University of Wisconsin at Madison

Algae are known to produce certain organic substances as protein, silica, carbohydrates, lipids, and phospholipids. There is interest in how much of these compounds algae make when exposed to carbon rich environments, similar to those of factory smoke stacks. These compounds alone can be used for such things as food substances to biofuel material. Infrared imaging analysis techniques allowed us to observe patterns of the *Thalassiosira weissflogi* algae species in producing the above compounds. An algal cell of this species was put into a flow cell with infrared transparent windows in order to keep that cell alive. Water infused with carbon dioxide was pumped into this flow cell. Scans were taken over a 10 hour period. A time lapse of the intensities of each corresponding functional group indicates that the phospholipids and protein fluctuate similarly, while the lipids, silica, and carbohydrates tend to decrease over time. Further analysis allows us to directly detect the concentration of each substance and how they vary with regard to the other substances. Results indicate that peak production of protein occurs at three different time points and corresponds to phospholipid peak production. Silica and carbohydrates reach their peak concentration towards the end of the time period. Lipids simply seem to fluctuate.

R11
Optimization of Focusing Lenses through Computational Modeling and Analysis of Related Quench Protection Issues

Presenter(s)
Emil Khabiboulline, Illinois Mathematics and Science Academy

Advisor(s)
Michael Tartaglia, Fermi National Accelerator Laboratory
Iouri Terechkine, Fermi National Accelerator Laboratory

As part of design efforts for a high intensity particle accelerator, the configuration of cryomodules in the injector section must be investigated. Specifically, the superconducting focusing lenses should be optimized to fit the criteria of focusing strength, size, and resilience to quenching. Computational modeling served as the primary tool in this study. Initial work, centered on defining the lens configuration, was followed by quench propagation analysis for the chosen design. After a comparison of several approaches, it was found that all requirements can be met if the lens operates at 5.5 K and employs 0.5 mm niobium-titanium superconducting strand. Eleven-thousand turns in the winding will provide the needed focusing strength of 4 T at 67 A. Two quench protection configurations were studied: one full coil with a dump resistor connected in series, and a segmented coil with resistors connected in parallel to each section. Results of the quench propagation modeling show that the initial design goals for focusing lenses can be met using both schemes, with each arrangement having specific advantages. The methods developed in this study and its outcomes will be used to design magnetic systems of larger scales.

R12
Studying Silicon Annealing Effects on the Collider Detector at Fermilab

Presenter(s)
Akram Khaja, Illinois Mathematics and Science Academy

Advisor(s)
Kyle Knoepfel, Fermi National Accelerator Laboratory

Over decades of incurring radiation damage from particle collisions, the silicon detector at Collider Detector at Fermilab has degraded, making it necessary for the depletion voltage to be increased to continue detection at optimal levels. Increasing the depletion voltage past a certain point is impractical and wastes energy, so any method through which the depletion voltage can be decreased is beneficial. One such method is through annealing, heating up the silicon detector and then allowing it to cool to help reduce the damage from radiation. Data about the voltage, current, temperature, and other statistics about the detector were collected throughout the process of annealing and then analyzed using Bash and Root programs. Code was created to gather the data, convert it to a useful form, and graph and fit it to determine if the depletion voltage decreased over time. From current analysis, annealing did help some of the modules of the silicon detector by lowering their bias currents. These results are important as they will help in the modeling of annealing employed at CERN.

R13
Screening For Contamination From Alpha Particle Decay In Materials for the Cryogenic Dark Matter Search

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

Advisor(s)
Lauren Hsu, Fermi National Accelerator Laboratory

Dark matter makes up 83% of the matter in the universe, but so far, no experiments have been able to determine its composition. The Cryogenic Dark Matter Search (CDMS) is one such experiment currently trying to detect the makeup of dark matter. In order for SuperCDMS, the next stage of the CDMS experiment, to reach sensitivity levels that are high enough to detect dark matter, the experiment needs to lower background radiation from trace contamination in materials near the detectors. Radiation mimics dark matter events by colliding with the germanium atoms that make up the detector, which makes it harder to determine the authenticity of possible dark matter interactions. One form of radiation CDMS is concerned with is alpha emission. In order to test for background radiation, the ultralo-1800 alpha detector was used to count the alpha emissivity of copper plates used to build the housing of CDMS dark matter detectors. Their overall alpha emissivity levels were 0.002 alphas/cm^2/hour, about equal to the background radiation of the alpha detector itself. Tests were then run to determine the sources of systematic error of the alpha detector. It was determined that the detector sensitivity was susceptible to changes to its interior, such as the addition of a Teflon sheet over the detector tray, and the fluctuation of the argon purge running through the detector. However, the changes in the detector were small enough that they did not affect our results significantly.

R14
Deflection Studies on the g-2 Vacuum Test Chamber Before and After Adding New Grooves

Presenter(s)
Emily Lindgren, Illinois Mathematics and Science Academy

Advisor(s)
Brendan Casey, Fermi National Accelerator Laboratory
Mandy Rominsky, Fermi National Accelerator Laboratory

The g-2 experiment sends muon beams through large vacuum chambers with grooved sides. In the grooves there are magnetic field probes. When vacuum is pulled on these chambers the walls deflect slightly inwards, moving the position of the probes. It is important to know the exact position of these, so as to be able to properly adjust data. To ensure accurate and precise knowledge of the magnetic field, it is desirable to deploy as many magnetic field probes as possible, which will require the addition of more grooves. A test vacuum chamber was used to test the effect of adding more grooves on the measured deflection. Five different test plates were machined with thicknesses calculated to be equivalent to the main vacuum system. Each plate had a different number of grooves, ranging from zero to four. A deflection gauge was used to measure the deflection experienced by each plate under vacuum. The measured deflections were consistent with expectations.

R15
Developing a Neutrino Interaction Identification Algorithm

Presenter(s)
Joshua Love, Illinois Mathematics and Science Academy

Advisor(s)
Shulamit Moed Sher, Fermi National Accelerator Laboratory

Experiments for studying neutrino interactions using liquid argon detectors are now being designed and built. A method is required to identify the type of neutrino interaction based on the signature left in the detector by the particles produced in the interaction. I codeveloped an algorithm to identify charged-current neutrino interactions, characterized either by a shower connected to the vertex of the interaction (indicative of an electron) or by a long straight track (indicative of a muon particle) and neutral-current interactions which do not display either of these traits. This algorithm can identify interactions with approximately 90% purity and 70% efficiency. After six months, the algorithm developed through a combination of calculations and trial and error by analyzing over twenty-five hundred simulated neutrino interactions in the MicroBooNE experiment. This algorithm may provide a basis for future identification algorithms and could be an important method for future neutrino detection as liquid argon detectors are built for studying the neutrinos.

R16
A Laboratory Model of Two-Dimensional Granular Collisions

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

Advisor(s)
Justin Burton, University of Chicago
Sidney Nagel, University of Chicago

Astrophysical and geophysical processes often involve large-scale flows of granular particles. Low-density granular gases are composed of nearly identical macroscopic particles, that is, large enough for inter-molecular forces to be negligible. In these gases, particles undergo inelastic collisions causing the system to lose kinetic energy over time. We have constructed one of the first large-scale laboratory models of a granular gas using a very flat, smooth aluminum plate with sloped boundaries. Our granular particles are pellets of solid carbon dioxide (dry ice), which float on a cushion of gas due to sublimation near the metal surface (Leidenfrost effect), essentially forming a two-dimensional granular gas. Using this model, we performed experiments using colliding clouds of dry ice particles. After analyzing the kinetic energy decay of the system using particle image velocimetry, we compared it to computer simulations, revealing an odd disparity between the long time behavior of the experiment versus the simulation. Although the simulations have a similar qualitative behavior as the experiment, there are significant differences in the energy decay between the simulations and the experiment. I will discuss these differences and how they relate to the energy lost per collision (that is, coefficient of restitution).

R17
Exploring Alternate Explanations for Dark Matter's Claims: Long Term Activation of Radiated Sodium Iodide Crystal

Presenter(s)
Kirti Munjeti, Illinois Mathematics and Science Academy

Advisor(s)
Hugh Lippincott, Fermi National Accelerator Laboratory

Dark matter is invisible matter that comprises about 25% of the universe. One piece of evidence for dark matter comes from observations of the relationship between the masses of galaxies and their luminosities and velocities, and these observations are confirmed at all cosmic scales. Physicists are trying to detect dark matter particles with terrestrial detectors. The dark matter (DAMA) experiment has observed annual modulation and claims that it is dark matter, which is not unreasonable since dark matter would produce annual modulation if it were detected. However, it is unclear whether those signals were caused by actual dark matter or other backgrounds. I am testing whether DAMA's claims are legitimate by setting up a similar lab apparatus to determine whether or not activations can occur after irradiating a sodium iodide crystal. In the process, I have tested and characterized three photomultiplier tubes (PMT) with two separate bases. Using LabView, I have created a data acquisition program to analyze the effects of irradiating a sodium iodide crystal. By using the characterized PMT and the data acquisition program, I will attempt to determine what effect radiation has on the sodium iodide crystal.

R18
R&D for the Tracking Detector for Fermilab's Muon g-2 Experiment

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

Advisor(s)
Brendan Casey, Fermi National Accelerator Laboratory
Mandy Rominsky, Fermi National Accelerator Laboratory

Fermilab's new muon g-2 experiment is designed to make high-precision measurements of the magnetic moment of the muon in order to test the validity of the Standard Model. The experiment is currently undergoing detector research and development. The objective of this investigation was to design and test various parts of the tracking detector system for the g-2 experiment. The tracking detector is made of straws, which consist of a long, metallic cylinder with a sense wire in the middle. The straws are filled with gas that becomes ionized when a charged particle passes through. This sends a signal down the wire to electronics, so we can determine the path the particle took. The research with vacuums and straws culminated in building g-2's first straw prototype out of eight aluminum and copper straws, each of which is ten centimeters long. Building this prototype gave the collaboration a sense of the most efficient building methods and designs, which will be applied to our next prototypes. These prototypes will be tested by the g-2 experiment to prepare for the construction of this new experiment.

R19
Analysis of the Globular Cluster NGC1851 Using the Dark Energy Survey Filter Set

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

Advisor(s)
Tom Diehl, Fermi National Accelerator Laboratory
Douglas Tucker, Fermi National Accelerator Laboratory

The Dark Energy Survey (DES) will use a new camera, the dark energy camera (DECam), to study details of the expansion history of the Universe. DECam will use a Sloan Digital Sky Survey (SDSS)-like filter set in g, r, i, z, and Y-bands and red-sensitive charge coupled devices (CCDs). Prior to the survey, DES scientists accumulated images in the southern hemisphere using a small test camera called PreCam, which used DECam CCDs and small DECam filters as part of a standard star calibration program. Among the objects observed was globular cluster NGC1851. PreCam images of NGC1851 were processed and analyzed. The calibrated PreCam data was used to produce a Hertzsprung-Russell (HR) diagram, which was then used to estimate the distance, age, and metallicity. The analysis yielded the following estimates for NGC1851: a distance of 12±1 kilo-parsecs, an age of >13Gyr (best estimate 13.5 Gyr), and a metallicity [Fe/H] of between -2.27 and -1.49 (best estimate -1.79).

R20
Measurement of Galaxy Masses via Galaxy-Galaxy Lensing in the Sloan Digital Sky Survey Data

Presenter(s)
Savanna Rutas, Illinois Mathematics and Science Academy

Advisor(s)
Huan Lin, Fermi National Accelerator Laboratory
Marcelle Soares-Santos, Fermi National Accelerator Laboratory

Gravitational lensing is the deflection of light resulting from warping of space by any type of mass. It can be used to measure the mass of a lens along the line of sight. In the weak regime, gravitational lensing results in small shape distortions of distant galaxies by the lens. Galaxy-galaxy lensing is a special case of weak lensing where the lens is a galaxy. By extracting data from Stripe 82 of the Sloan Digital Sky Survey (SDSS), we used galaxy-galaxy lensing to calculate the masses of luminous red galaxies (LRGs) at redshift z=0.2-0.7 and luminous blue galaxies at z=0.2-0.4. We ran cuts on the absolute magnitudes of the galaxies, calculated their shear profiles, completed a mass fitting, and then measured their masses as a function of luminosity, color, and morphology. Typical LRGs have masses larger than 10^{12} solar masses, while blue galaxy masses are smaller. Our results indicate that the LRG masses do not vary with redshift. We also found that a brighter absolute magnitude corresponds to a larger average mass. Our analysis extends to a redshift never before analyzed with SDSS data (z= 0.7).

S01
IMSA Students' Attitudes Towards Interracial Relationships

Presenter(s)
Wei-en Chu, Illinois Mathematics and Science Academy
Cherish Kim, Illinois Mathematics and Science Academy
Alexandra Maffei, Illinois Mathematics and Science Academy

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

Our study focuses on teen attitudes toward pursuing interracial romantic relationships at the Illinois Mathematics and Science Academy (IMSA). IMSA is a residential school with above average student diversity. This initially led us to believe that students are more likely to be open to involvement in interracial dating relationships. A review of the literature on interracial dating suggested that the most common factors influencing interracial romantic relationships are gender, race, and political affiliation. We constructed a survey of nine multiple choice questions, which were sent to the entire student body via LimeSurvey.org. The survey questions explored actual attitudes, perceptions, and involvement in interracial dating relationships. We received a very large response rate that helped in establishing the statistical validity of our survey results. A series of Chi-square tests of independence were used to analyze the data. Our analysis confirms our hypothesis regarding interracial dating in the diverse IMSA environment, with some surprising results on the perceptions and attitudes toward same race dating.

S02
Effects of Personality, Gender, and Age on Spatial Relations Ability

Presenter(s)
Victoria Etherton, Illinois Mathematics and Science Academy

Advisor(s)
Joan Chiao, Northwestern University
Mark Schurgin, Northwestern University

Spatial relation, the skill to visualize and analyze the relations between signs and shapes, has many more real-life applications than meets the eye. Specifically, individuals who experience difficulty with spatial relations problems also may have difficulty problem-solving in a range of higher educational topics including geography, history, and science. However, since this ability is not widely examined, the correlations between spatial relations and other factors have not yet been discovered. Therefore, I hypothesize that individual and group differences, such as personality, gender, and age may affect spatial relation ability. To test this, participants completed an online NEO-FI personality trait survey testing neurotic, extroverted, agreeable, open, and conscientious tendencies and a spatial relations test as indicators for spatial relations ability. Results demonstrate that neuroticism, a personality trait typically associated with negative emotions, is significantly negatively correlated with spatial relations ability ($R = -0.32$, $p < 0.05$) while other big five traits such as extroversion and openness did not ($p > 0.05$). Furthermore results indicate no effects of gender or age on spatial relations ability ($p > 0.05$). In conclusion, this study implies important correlations to consider for students and teachers in educational settings.

S03
The Effects of Previous Drug Experience on Responses to 3,4-methylenedioxymethamphetamine

Presenter(s)
Mallory Giger, Illinois Mathematics and Science Academy

Advisor(s)
Harriet de Wit, University of Chicago
Matt Kirkpatrick, University of Chicago

There are individual differences to the mood-related acute effects of 3,4-methylenedioxymethamphetamine (MDMA, ecstasy). One possible explanation for this is an individual's previous drug history, but there are no data to support or refute this. Thus, our lab conducted two within-subject, double-blind studies during which healthy adult volunteers (N=30, N=21) received placebo or MDMA (0.75 mg/kg and 1.50 mg/kg). We also obtained extensive drug use histories before the start of study participation. Participants completed mood questionnaires before and repeatedly after administration. During the sessions, a dose-related response was observed in both studies on prosocial and euphoric measures, such as sociability, elation, and liking the drug. Contrary to our predictions, however, there was no relationship between acute subjective effects of MDMA and past alcohol, marijuana, or MDMA usage. There are many possible reasons for this result, including the true absence of an effect, an insufficient sample size, or a relatively limited range of past drug use in this sample. Future studies on the relationship between previous drug experience and the effects of MDMA might include a larger sample or a wider range of previous drug use history.

S04
Determination of Factors that Affect the Success of Rumors

Presenter(s)
Riley Helm, Illinois Mathematics and Science Academy

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

Rumors are a part of human psychology that involves people listening to and spreading unverified information whether they believe it or not. Significant research has been put into rumors. The aim of this study was to find out what factors play into the success or failure of a rumor in the micro-environment of IMSA. Over the past few weeks, the IMSA population has taken part in a deception study examining these factors. This investigation involved researching what makes a rumor believable, memorable, and spreadable. Three rumors were constructed which were spread across the IMSA campus via three student carriers. After four weeks of incubation, the campus was asked to complete a survey to detail whether students had heard said rumors, and what led to them believing and spreading said rumors, or rejecting the rumors completely. The data collected via the survey was then analyzed using Chi-squared and Kruskul Wallace tests to find what factors were most important in the success of these rumors. These factors will be discussed.

S05
Perceptual Learning in Synthetic Speech with Interference

Presenter(s)
Corey Hornbeck, Illinois Mathematics and Science Academy

Advisor(s)
Shannon Heald, University of Chicago

For recognition of speech to occur, individuals must learn how acoustic information (what one hears) maps to phonetic knowledge. Previous literature shows that individuals are able to quickly learn to understand synthetic speech that possesses novel acoustic to phonetic relationships. However, it is unclear how robust this learning is against interference (from learning a competing speech synthesizer with a different acoustic to phonetic mapping) or if individual differences in working memory moderate the amount of perceptual learning on a speech synthesizer and/or interference from a competing speech synthesizer. The current investigation therefore examines the relationship between perceptual learning, working memory, and interference, using a simple pretest-training-posttest paradigm. Our results showed that training on a competing speech synthesizer hinders word recognition performance on the original speech synthesizer, suggesting that the perceptual learning of the original speech synthesizer was not robust against interference. Additionally we found that while high working memory individuals did not significantly differ in initial understanding of the original speech synthesizer from low working memory people, they learned the original speech synthesizer significantly more. Taken together, the results provide a useful framework to understand why we see perceptual learning decreases across a day until sleep is achieved in long-term perceptual learning studies.

S06
Examining the Levels of Overexcitabilities of IMSA Sophomores

Presenter(s)
Taylor Imburgia, Illinois Mathematics and Science Academy

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

Gifted people have been shown to have higher developmental potential, making them more likely to experience above average reactions to stimuli. These characteristics have been classified as overexcitabilities (OEs) separated into five areas: psychomotor, sensual, intellectual, imaginational, and emotional. The OE levels between IMSA males and females and between IMSA students (who are interested in science, technology, engineering, and mathematics) and Ohio gifted students were examined using the Overexcitabilty Questionnaire II (OEQII). Data from seventy IMSA sophomores was analyzed using descriptive statistics, ANOVA, and the Bonferroni Correction method to control error. Results showed that the IMSA females' sensual and emotional levels were significantly higher than IMSA males'. Additionally, both IMSA males and females exhibited significantly lower imaginational OE levels than the Ohio gifted students. This study will hopefully spark awareness of overexcitabilities in the gifted population, allow students to understand their own feelings and behaviors and help the IMSA community to more effectively assist students in handling OEs.

S07
How Self Perception Differs From Observer Perception in Classmates

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

Advisor(s)
Joan Chiao, Northwestern University
Mark Schurgin, Northwestern University

Many people believe they present themselves to the world in a certain way, but often their perception of themselves is not reflected in the observations that other people perceive, an effect known as the self-serving bias. Humans tend to think more highly of their traits compared to their peer's qualities. To determine whether there is a discrepancy between self and observer perception for different traits, I asked pairs of participants to respond to questions asking both about their personality and their partner's personality for nine distinct traits. Results show that people perceive their own degree of emotionality-rationality, narcissism, popularity and adherence to social norms differently compared to the way their partner perceives them. Additionally, results show effects of gender on exaggeration, popularity, and self-other perception. Females were more likely to report greater likelihood of exaggeration, popularity, and accuracy in self-other perception compared to males. There was a gender difference in effect of familiarity on self-other perception. Higher familiarity ratings in males correlated with increased familiarity in self-other judgments for popularity, reliability of self-other perception, and egotism. Understanding better how social perception differs between people will help individuals improve social interactions.

S08
Culture and Color: Evidence for Cultural Diversity in Color Perception

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

Advisor(s)
Joan Chiao, Northwestern University

Hundreds of years ago, the Eastern and Western Hemispheres had relatively little contact; now, people living in distinct nations are more likely to encounter one another due to globalization. Because Western and Eastern cultures often pose conflicting values, it is unclear the extent to which culture affects how people perceive color across distinct nations, such as the United States and Japan. I hypothesized that Eastern perceptions of color may differ from Western perceptions. To test this hypothesis, I conducted a cross-national study with an online semantic differential followed by a revised version of the Suinn-Lew acculturation scale in the US and Japan. In the online study, participants rated colors on a seven point Likert scale (1 = negative; 7 = positive). Results demonstrate that across cultural contexts, people perceived the color white more positively as a function of acculturation to heritage culture; however, there was a cultural difference with the color blue because Americans who reported greater acculturation to Western values perceived blue as more positive, whereas Japanese who reported greater acculturation to Eastern values perceived blue as more negative.

S09

The Relationship of Daily Activities to the States of Mind and Academic Performances of Illinois Mathematics and Science Academy Students Enrolled in Physiology and Disease or Biophysics Courses

Presenter(s)
Natalie Runkle, Illinois Mathematics and Science Academy

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

Relationships exist between teenagers' activities, self-satisfaction, and academic performances. This study's purpose was to examine daily activities of IMSA students taking Physiology and Disease (PAD) and Biophysics, and to study relationships between these activities and students' reported moods and final grades. An electronic survey was created to measure hours spent by subjects in various activities and to examine subjects' locations, moods, and companions at specific times. This survey was distributed nine times to thirty-two volunteer subjects. A final survey was created and administered; subjects reported a final grade in PAD or Biophysics. Because of the unexpectedly narrow grade distribution, it was impossible to look for behaviors that contributed to grade variation. Relationships between reported activities and reported moods were analyzed using binary logistic regression. A significant relationship was found between subjects' good moods and the amount of homework performed on a given night. An additional hour of homework decreased the likelihood of a good mood to seventy percent of the baseline. Contributions of sports, sleep, video games, socializing, internet, hobbies, and idleness were controlled for and not statistically significant. These results provide information connecting students' activities and their states of mind and can be used to improve time management.

S10

The Influence of Anticipated Gender-Specific Roles on the Career Aspirations of Female IMSA Students

Presenter(s)
Sydney Tomasko, Illinois Mathematics and Science Academy

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

There is a disparity in America regarding the number of women employed in certain high-paying careers. This study focuses on how female IMSA students may choose their future careers, knowing that in their adult lives, there will be factors that influence them to choose more flexible and less time-consuming careers. A survey was created and administered to female IMSA students. The focus was to ask which careers they find themselves capable of performing well in, and then what careers they would consider when they think of getting married and having children. The implications of this study directly relate to the careers that women gifted in math and science will choose. This study will increase awareness in the factors that cause women to choose certain careers, and possibly influence their future career decisions.

S11
Ways of Discussing Mother Nature: Differences in Sharing Learned Information About the Menstrual Cycle Among Adolescent Girls in Residential Versus Commuter Schools

Presenter(s)
Jessica Ventenilla, Illinois Mathematics and Science Academy

Advisor(s)
Sowmya Anjur, Illinois Mathematics and Science Academy
David Evenson, Illinois Mathematics and Science Academy
Christopher Kolar, Illinois Mathematics and Science Academy

Adolescent girls experiencing the menstrual cycle for the first time may consult adults, peers, and available media for more information on women's health and what to expect when entering this stage of life. It has been observed that mutual sharing of information about the menstrual cycle helps teens deal with puberty better. A ten question survey was constructed to identify any differences in sharing menstrual cycle information between adolescent girls in residential and commuter school communities. The survey will be administered to fifty high school girls from a commuter school and fifty high school girls in a residential school to observe differences, if any, between how adolescent girls share information with each other and what resources they utilize based on their environment. By observing how girls handle menarche both physically and academically, it may be possible to gather information on whether families and the school system are meeting teens' expectations in terms of providing accurate and helpful information about the menstrual cycle.

S12
The Effect of Homelessness on Executive Functions in Homeless Youth

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

Advisor(s)
Scott Hunter, University of Chicago

Executive functions (EF) like inhibition, mental flexibility, and problem solving do not completely develop until adulthood. For young adults, significant stressors, like homelessness, can have a significant impact on the development of EF, leading to cognitive difficulties. This study examined the effect of time spent homeless on the development of EF in fifty-two youth living in Chicago shelters (26 males/26 females, mean age is 19, 85% African-American). EF was measured using select subtests from the Delis-Kaplan Executive Function System (D-KEFS), the Iowa Gambling Task (IGT), and the Tower of London, Drexel University Edition (TOL-DX). Demographic information was collected through interview. Results revealed a significant negative correlation between a visual scanning task and the longest homeless period, and a significant positive correlation between number of homeless episodes last year and a Number Sequencing task. MANOVA and regressions were not significant. Lack of significant findings may be due to the impact of potential moderating factors, including educational status and intelligence quotient. There may be relationships between homelessness and EF development, however our sample size may be too small; larger sample size could elucidate potential relationships between time spent homeless and the development of EF.

T01
Culture Shocked: A Study of How Differences in Cultural Values Impact International Collaboration

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

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

Technology has shrunk the globe, ushering in an era of rapid globalization and the problems that come with it. These global problems will require global solutions, and students in schools today will be the ones to solve them. Nations will need to collaborate to thrive, and, while filled with enormous potential, international collaboration faces several challenges. In an effort to understand these challenges, a series of interviews was constructed for Chinese and American students, teachers, and scientists. The interviews examined the differences between the cultures and education systems of China and the United States to evaluate how they either promote or impede international collaboration, ultimately suggesting methods for overcoming these impediments. This study determined the largest barriers affecting international collaboration include different languages, respect for intellectual property, additional time commitments, distribution of workload and resources, and prejudices against and stereotypes of other countries and cultures. These barriers, along with the disparities in cultures across the globe, make collaboration difficult, yet the common ground of knowledge, commitment to partnership, and passion for education can surmount these obstacles. This study's recommendations will assist students, educators, and scientists in developing productive collaborative relationships with their colleagues around the world.

T02
An Examination of the Polish American Experience

Presenter(s)
Sophia Baramidze, Illinois Mathematics and Science Academy

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

The Polish Americans display many characteristics similar to the immigrant groups of today. We want to pick out those qualities and compare them to the conditions of a group of immigrants in the current United States. The main source of information comes from a literature review. So far we have found that a troubled home country and promising opportunities lured many Polish to emigrate from Poland to the United States. Once in the US, many Polish faced the challenges of low wages, labor-oriented jobs, and ridicule from other Americans. The patterns from a hundred years ago are clearer in hindsight, but if we can take what we know about the Polish then, and apply it to today, then we may be able to foresee the same struggles in another group.

T03
The State of Somalia: The United Nations in Practice and in Theory Since the Decolonization Era

Presenter(s)
Sharadyn Ciota, Illinois Mathematics and Science Academy

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

This inquiry was to investigate how internal conflicts have international effects using the collapse of Somalia as the primary example. Internal conflict in Africa has become an interest of the world powers and the United Nations mainly since the era of decolonization. The United Nations developed policies on how to handle internal conflict that were viewed as an international threat. This study used textual analysis of international theory as well as United Nations documents. The literature of how the United Nations should work in theory was compared to the documents that represented how the United Nations executed peace keeping in the case of Somalia. It was found that, in theory, the United Nations cannot intervene with peace keeping forces unless it has consent from both of the warring parties. In the case of Somalia, the United Nations failed to abide by the peace keeping policies. The United Nation's efforts to improve the state and stability of Somalia both from the United Nations and non-governmental organizations failed, and the world is still dealing with the effects of the tragedy in Somalia.

T04
An International Energy Assessment: The Benefits and Pitfalls of Nuclear Power in the Modern Age

Presenter(s)
Richard Fafara, Illinois Mathematics and Science Academy
Alexander Stratton, Illinois Mathematics and Science Academy

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

Nuclear power is an important alternative energy source that is frequently misunderstood by the general populace. The purpose of this study is to show the advantages and disadvantages of nuclear power in the United States today. During the first portion of our study we drew upon background research in order to gain a better understanding of the basic technologies of nuclear power. In the second portion of our study, we have researched domestic and international politics of nuclear power, as well as the relevant economic and environmental issues. We have found that although nuclear power is clouded in controversy, the benefits far outweigh the risks. The news media exaggerate the concerns of radiation, nuclear disasters, and proliferation. In reality, nuclear power provides an environmentally friendly energy source with zero emissions that can one day be the cure to the world's fossil fuel addiction. However, there are legitimate reasons to be concerned with disposal of nuclear waste. By showing that it is a safe, clean, and efficient alternative energy source, we hope to erase previous misconceptions about nuclear power.

T05
Eurovision, the Ultimate European Song Contest: Talent or Politics?

Presenter(s)
Inga Gurevich, Illinois Mathematics and Science Academy
Alexandra Roman, Illinois Mathematics and Science Academy

Advisor(s)
Lee Eysturlid, Illinois Mathematics and Science Academy
Christian Nokkentved, Illinois Mathematics and Science Academy

The Eurovision Song Contest debuted in 1956, bringing Europe together for a grandiose international song competition. Annually, countries belonging to the European Broadcasting Union are represented with a single musical performance. After two semifinals and a final, a winning country is determined based on votes from the live audience and viewers throughout Europe. Our research study focused on collecting voting data from all the participating countries from 1991 to 2009. Votes that fell into the top twenty-fifth percentile and the bottom twenty-fifth percentile were analyzed in order to find trends. Two important patterns emerged in the research. First, strong voting blocs exist within the countries of the former Soviet Union, as well as the Scandinavian and Balkan regions. These blocs are based on cultural and political ties. An apparent difference appears between Western and Eastern European countries as well. Since the Eastern European countries are relatively new to the contest, they try to have more influence by working together. This study shows that while Eurovision is not purely about politics, neither is it purely about talent; it's a combination of international events, voting blocs, and captivating performances.

T06
Beauty Advertisement and its Effects on the Body Image of Female IMSA Students

Presenter(s)
Gina Jung, Illinois Mathematics and Science Academy
Madison Schroeder, Illinois Mathematics and Science Academy

Advisor(s)
Amanda Gray, Illinois Mathematics and Science Academy
Lauren Lutz, Illinois Mathematics and Science Academy

The association between low-self esteem and poor body image is almost a uniquely female trait. When women see images that show thinness in a positive light, as in beauty advertising, they are more likely to think poorly enough of their bodies to develop an eating disorder. While these cases are relatively rare and extreme, they underline the power beauty advertising holds on the psyche of females. This study seeks to further uncover the influence of beauty advertising on women, specifically female students at the Illinois Mathematics and Science Academy (IMSA). IMSA was chosen as the location of the study because of its nature as an accelerated, residential high school, which may alter the perception of beauty advertising by the girls who attend the school. A survey has been created for a sample of female IMSA students and seeks to find if the amount of advertisements seen by a participant affects her self esteem. Furthermore, it is designed to show if other factors, beyond advertisement, alter participants' body image and if they use different methods, such as exercise, starvation, or dieting, to address these feelings. Results may lead to recommendations for improvement of residential programming at IMSA.

T07
The Significance of the Latino Vote in the Presidential Election of 2012

Presenter(s)
Itzel Lopez, Illinois Mathematics and Science Academy
Uriel Ramirez, Illinois Mathematics and Science Academy

Advisor(s)
Juan Andrade, US Hispanic Leadership Institute
Marcos Popovich, US Hispanic Leadership Institute

The growth of the Latino population, combined with increased Latino voter registration and voter turnout, has led to increased Latino political influence in the U.S. Focusing on the sixteen major electoral vote states where 91% of Latino voters are concentrated, this study analyzed the influence of Latino voters in presidential elections by reviewing Census data, election results, exit polls, and national surveys. These sixteen states have a combined total of three-hundred electoral votes, well above the two-hundred and seventy needed to win. To win, Democratic presidential candidates must garner over 70% of the Latino vote. Conversely, the key for Republican presidential candidates to win is to deny their Democratic opponents a strong majority of Latino votes. Thus, both Republican and Democratic presidential candidates must obtain significant support from Latino voters in order to win the presidency. Because Latino voters possess substantial influence in presidential elections, the 2012 presidential candidates must direct significant time and resources towards winning over Latino voters. The 2012 presidential candidates must address issues that are most important to Latino voters, such as education, jobs, health care, and immigration.

T08
IMSA's Understanding of the Abortion Issue

Presenter(s)
John McGuire, Illinois Mathematics and Science Academy

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

Abortion is a very controversial issue in America. Both pro-life and pro-choice activists make many arguments about this issue; many of their arguments are based on scientific data that is often inconsistent from study to study. Abortion research is ample; however studies on abortion tend to focus on the woman's experience or the health risks that could be associated with the abortion procedure and not on how well the public understands the science behind the abortion issue. In this study, I examined the public understanding of the abortion process and the research surrounding abortion. Specifically, I chose to study the general Illinois Mathematics and Science Academy (IMSA) population. I wrote a survey based on two research topics: What are people saying online about specific abortion issues? and What does scientific literature say about this issue? After researching the issues discussed and finding scientific literature that discusses the same issue, I created a survey to see how well students at IMSA understand the important abortion literature. I am still in the process of releasing this survey at the time of this writing. Survey results will be discussed.

T09
The Representation of Female and Male Cross-Dressing in Popular Culture

Presenter(s)
Perry Nelson, Illinois Mathematics and Science Academy

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

Cross-dressing, particularly as a method of disguise, has been used as a storytelling device for centuries, both for women and men. However, it is usually the case that men dressed as women are present for comedic purposes, and women dressed as men are figures of drama. The dichotomy of these differing narrative choices implies that women gain power when dressing like men, but men are degraded by looking like women. This investigation, looking at the differences between how genders are portrayed when dressing like the opposite sex, further explores this occurrence. Twelve different stories of varied media types, including novels, films, and a television episode, all containing cross-dressing have been reviewed and analyzed for any sexist bias, and then compared against each other for noticeable patterns among them. It is evident from this that there are several misogynistic tropes that appear frequently in cross-dressing scenarios, which is indicative of a broader chauvinistic culture that pervades our society.

T10
The Veteran Struggle: Returning to Civilian Life

Presenter(s)
Maura Slattery, Illinois Mathematics and Science Academy
Hannah Swerbenski, Illinois Mathematics and Science Academy

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

The stressors within the combat environment are drastically different from civilian stresses. This stress leaves active soldiers subject to non-typical stress and traumatizing experiences. Permanent change inflicted by these experiences can be physical and emotional. In order to evaluate what permanent changes veterans underwent, we analyzed news articles, online videos, movies, published papers, and statistics. Through this research, we have noted a consistent and prominent change in returning war veterans. We explored interaction with spouse and family, care and support available to veterans adjusting to civilian life, unusually hyperactive alert responses and other Post Traumatic Stress Disorder symptoms, and other daily difficulties caused by physical injuries. Through our research, we evaluated trends among all veterans, and struggles unique to individuals. Veterans typically face different types of stress from civilians, and their ability and methods of coping with this abnormal stress vary. In many cases, this stress causes unhealthy, abnormal behaviors, and in some cases, influences not only the veterans, but those in close relation to veterans. Further, veterans often don't receive adequate assistance in their adjustment to civilian life. Identifying the major problems that returning veterans face, will help improve care and treatment available for them.

T11
Invisible Wounds: The Implications of Closed Head Injury Caused by High Explosives

Presenter(s)
Ian Wilkinson, Illinois Mathematics and Science Academy

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

Every time a soldier in Afghanistan exits his base to perform a mission or a high school football player jogs onto the field, they run the risk of experiencing closed head injuries. By analyzing studies, interviews, books, news articles, and personal narratives, I've come to understand many implications of traumatic brain injuries (TBIs) in the military. TBIs represent the quintessential modern combat injury. Though combatants have experienced head trauma since the introduction of warfare, proportionally more soldiers than ever before suffer and live with the impact of TBIs. The cost of veterans' medical care is increasing rapidly; the Department of Veterans Affairs medical budget was $51 billion in 2011 alone. Soldiers experience difficulty with re-adjusting to civilian life. Because of their TBIs, many suffer from loss of hearing, smell, or sight, and irritability, difficulty sleeping, and so forth for the rest of their lives. The research conducted in this investigation, as well as that in others like it, provides a foundation for the understanding of the lives of our modern veterans and for future policy decisions of the government that cares for them.

T12
Education Systems in China and Their Effect on Leadership Development

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

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

As the world becomes more interconnected, people from different nations are learning and interacting more than ever. The Chinese education system and its effects on the development of China's leaders is the object of this study. An examination of different Chinese curricula and educational strategies demonstrates the stress placed by the Chinese system on particular leadership qualities. In general, the Confucian attitude pervades the Chinese education system, and the culture as a whole. This mentality has a huge effect on leadership development. Traditionally, the exam centered education in China has led to a strong emphasis on rote learning and memorization. This has influenced leaders in China, as there is a mentality of simply following directions. From accounts and interviews about the current Chinese education system, China's education system is being overhauled to adapt to the modern world. It aims to develop a balanced person, as opposed to just teaching facts. As shown by current leaders in China, this is correlated with what Chinese leaders believe to be the most important qualities to have. Understanding how leaders in China have developed could be beneficial when working with them; a lot could even be learned from them.

U01
Connection Between Pressure and Molecular Hydrogen in Galaxies

Presenter(s)
Jose Hernandez, Illinois Mathematics and Science Academy

Advisor(s)
Robert Feldmann, Fermi National Accelerator Laboratory
Nick Gnedin, Fermi National Accelerator Laboratory

Most stars in the Universe are formed out of molecular gas. Observations have found an empirical relationship between the abundance of cosmic gas that is in molecular form, and the total pressure in a diverse set of galaxies, but the origin of this connection continues to puzzle astronomers. In this project we study, theoretically, how the abundance of the molecular gas depends on the galactic environment, in particular the chemical composition and the intensity of cosmic ultraviolet radiation. We analyzed a set of computer simulations that model wide variations in galactic environment and compared these theoretical models to the observational data. We found a good match to the observed relation between the molecular gas and the total galactic pressure for some galactic environments. However, our primary result is that any such relation is dependent on the galactic environment. We make a theoretical prediction that the observed relation will be modified in dwarf galaxies and in galaxies observed at large distances (and, hence, at the early stages of their formation). These predictions will be checked by future observations with a new large radio telescope (Atacama Large Millimeter Array, or ALMA) being built by the international consortium in Chile.

2010-2011 Student Recognition

The below accomplishments are a summary from the 2010-2011 academic year

Ruchi Aggarwal: Characterizations of BACE1 Endocytosis
Advisors: Virginie Buggia-Prevot and Gopal Thinakaran; University of Chicago
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb.16-20, 2011 in Washington DC

Ruchi Aggarwal: The Effects of Cell Demographics on ADDL Binding and Toxicity
Advisors: William Klein, Gina Boylan, Anil Wadhwani and Pascale Lacor; Northwestern University
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition gold award

Courtney Amegashie: Effect of High Nitric Oxide Microenvironments on Oral Cancer Cell Migration
Advisor: James Radosevich; University of Illinois at Chicago
Presented at University of Illinois at Chicago College of Dentistry Clinic and Research Day, March 10, 2011 in Chicago, Illinois

Stephanie Cheng: Stellar Nursery: The Relationship between a Spiral Galaxy's Bar and Its Star Formation
Advisors: Lucy Fortson, Geza Gyuk, and Mark Subbarao; Adler Planetarium
Presented at NCSSSMST Student Research Symposium, June 6-9, 2010 in Hoboken, New Jersey

Dane Christianson: Engineering a Water Filter for Developing Countries: Varying Lateral Thickness to Optimize Flow Rates
Advisors: Mark Carlson and Sarah O'Leary-Driscoll; Illinois Mathematics and Science Academy
Presented at WaterCon 2011, March 22-23, 2011 in Springfield, Illinois

Henry Deng: Networks of Ultrasmall Pd/Cr Bilayer Nanowires - A New Type of High Performance Hydrogen Sensor
Advisors: Zhili Xiao, Hsien-Hau Wang, and Michael Latimer; Argonne National Laboratory
Illinois Junior Academy of Sciences Project Exposition Finalist and IJAS Region V ASM Materials Education Foundation Award; IJAS State Competition: gold award, Best in Category Materials Science, Chicago Section of the American Nuclear Society - Superior Achievement in Science and Technology;
Intel International Science and Engineering Fair Finalist

Victor Duan: A Novel Clustering Method via Nucleotide-Based Fourier Power Spectrum Analysis
Advisor: Stephen Yau; University of Illinois at Chicago
70th Annual Intel Science Talent Search Semi-finalist; Chicago Region Junior Science and Humanities Symposium Finalist and Second Place Winner

Brinda Gupta: Effect of 1-methyl-4-phenylpyridnium on Dopamine Neuron Loss in LPS Mouse Model of Parkinson's Disease
Advisors: Paul Carvey, Bill Hendey, Toia Giuseppe, and Aditi Patel; Rush University Medical Center
IJAS Region V Society for In Vitro Biology Award

Derek Hardin: On Potentially Planar Graphic Degree Sequences
Advisor: Noah Prince; Illinois Mathematics and Science Academy
Siemens Competition Regional Semi-Finalist; 70th Annual Intel Science Talent Search Semi-Finalist

Mohammed Hayat: Neutrino Oscillations and the NOvA Experiment
Advisors: Maury Goodman, Sarah Budd, and Michelangelo D'Agostino; Argonne National Laboratory
Presented at NCSSSMST Student Research Symposium, June 6-9, 2010 in Hoboken, New Jersey

Dorcas Huang: The Effects of Sanitizers on the Survival of Stressed *Salmonella enteritidis* on Shelled Eggs
Advisors: Wei Zhang and Jill Vogan; Illinois Institute of Technology
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award

Eric Huang: Proteasome Inhibition of Lithocholic Acid Derivatives
Advisor: Chin Ho Chen; Duke University
Siemens Competition Regional Finalist; Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb.16-20, 2011 in Washington DC; Chicago Region Junior Science and Humanities Symposium Finalist

Aditya Karan: Understanding the Formation of Torodial Spiral Particle
Advisor: Ying Liu; University of Illinois at Chicago
IJAS Region V National Society of Professional Engineers Award

Emil Khabiboulline: Modeling of Quench Protection Techniques in Superconducting Solenoid Magnets
Advisors: Iouri Terechkine and MicahelTartaglia; Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences Project Exposition Finalist and IJAS Region V Yale Science and Engineering Association, Inc Award; IJAS State Competition: gold award, Best in Category Physics; *Intel International Science and Engineering Fair Finalist; Special Award winner:* European Organization for Nuclear Research-CERN - all expense paid trip to CERN summer 2011

Vignessh Kumar: Characterization of HuR Overexpression in a Post-Ischemic Penumbra
Advisors: Agnieszka Ardelt and Randall Carpenter; University of Chicago
Chicago Region Junior Science and Humanities Symposium Finalist and First Place Winner

Samuel Kwak: Development and Evaluation of a Prosthetic Ankle that Mechanically Adapts to Sloped Surfaces
Advisors: Stefania Fatone and Eric Nickel; Northwestern University
Illinois Junior Academy of Sciences Project Exposition Finalist, IJAS Region V US Army Grand Prize Winner; IJAS State Competition: gold award

Kiwook Lee: Optimizing Nanometer-Scale Features
Advisors: David Czaplewski, Katherine Becker, Leonidas Ocala, and Joshi Imre; Argonne National Laboratory
Illinois Junior Academy of Sciences Project Exposition Finalist, IJAS Region V US Navy Award; IJAS State Competition: gold award; Intel International Science and Engineering Fair Finalist

Justine Ly: Endothelial Cell ICAM-1-dependent Signaling Negatively Regulates MCP-1Production
Advisor: Guoquan Liu; University of Illinois at Chicago
Co-author of abstract presented at Experimental Biology 2011 April 9-13, 2011, Washington D.C.
(Guoquan Liu, **Katherine Shi**, **Justine Ly**, Aaron T. Place, Farnaz Bakshi, Richard D. Minshall)

Corinne Madsen: An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Z_n
Advisor: Noah Prince; Illinois Mathematics and Science Academy
Siemens Competition Regional Semi-Finalist; 70th Annual Intel Science Talent Search Semi-Finalist

Egle Malinauskaite: Mapping Verbal Memory Areas in Epileptic Patients Through Electrocorticographic Readings of Subdural Electrodes
Advisor: Vernon Leo Towle; University of Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist and IJAS Region V US Army Award; IJAS State Competition: gold award, Best in Category Health Science

Janani Mandayam Comar: Auditory and Pheromone Sensing in Trpml3 Knockout Mice
Advisor: Jaime Garcia-Anoveros; Northwestern University
Siemens Competition Regional Semi-Finalist; Chicago Region Junior Science and Humanities Symposium Finalist; *Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award*, Best in Category Cellular and Molecular Biology

Lydia Matthews: The Role of Pigment Epithelium Derived Factor in the Expression of p21 and p27 in Pancreatic Cancer
Advisor: Paul Grippo; Northwestern University
Presented at the International Student Science Fair, September 13-17, 2010 in Adelaide, Australia

Jacob Miller: Metal Alkoxide Functionalization in Metal-Organic Frameworks for Enhanced Ambient-Temperature Hydrogen Storage
Advisor: Rachel Getman; Northwestern University
Published in The Journal of Physical Chemistry C (2011) *Vol.* 115 *No.5, pp 2066–2075* (Rachel B. Getman, **Jacob H. Miller, Kenneth Wang**, and Randall Q. Snurr)

Madhav Mohandas: Effect of Mechanical Forces and Cleavage Plane Orientation on Epithelial Geometry and Topology
Advisor: Jie Liang; University of Illinois at Chicago
Chicago Region Junior Science and Humanities Symposium Finalist; *IJAS Region V Intel Excellence in Computer Science Award*

Madhav Mohandas: Climate-Based Predictive Modeling of Seasonal Influenza Outbreaks
Regional Finalist in the Young Epidemiology Scholarship

Daniel Pak: Harmaline and Sodium Benzoate, Food Processing By-Product and Preservative, Induced Mitochondrial Damages: A Possible Implication in Degenerative Diseases
Advisor: Youngmi Kim Pak; Kyung-Hee University
Siemens Competition Regional Semi-Finalist; 70th Annual Intel Science Talent Search Semi-Finalist

Daniel Pak: Specific Cellular Uptake of Targeted Liposomes in Cancer Cells
Advisor: Seungpyo Hong; University of Illinois at Chicago
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb.16-20, 2011 in Washington DC

Sai Parepally: Auditory and Pheromone Sensing in Trpml3 Knockout Mice
Advisor: Jaime Garcia-Anoveros; Northwestern University
Siemens Competition Regional Semi-Finalist; Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award, Best in Category Cellular and Molecular Biology

Areen Pitaktong: The Role of MAN2A2 Expression in Glioma Proliferation and Invasivity
Advisors: Roger Kroes, Mary Schmidt, and Joseph Moskal; Northwestern University
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award, National Anti-Vivisection Society - Best Advancement in the Humane or Alternative to the Use of Animals in Research

Peter Purnyn: Smartphone Applications
Advisors: Pat Patankar and Namrata Pandya; Illinois Mathematics and Science Academy
Presented at the International Student Science Fair, September 13-17, 2011 in Adelaide, Australia

Nishith Reddy: CdS/ZnS Quantum Dot-Photoexcited Glucose Oxidase Biosensor for Ag+ Detection in Contaminated Aqueous Environments
Advisor: Karl Rockne; University of Illinois at Chicago
Chicago Region Junior Science and Humanities Symposium Finalist; US Stockholm Junior Water Prize second place; presented at the 84th Annual Water Environment Federation Technical Exhibition and Conference, October 15 - 19, 2011 in Los Angeles, California

Nishith Reddy: The Effect of Transgenic MA20 on Inflammation of the Intestinal Epithelium
Advisor: David Boone; University of Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist

Nicole Runkle: Paracingulate Gyrus Influences Cognition, Negative Symptoms, and Personality in Schizophrenia
Advisors: Matthew Smith and Lei Wang; Northwestern University
Siemens Competition Regional Semi-Finalist; Presented at the Eighth Annual RITS Super Science Fair, Nov 1-6, 2010 in Kyoto, Japan; 70th Annual Intel Science Talent Search Semi-Finalist

Mehal Shah: Characterizations of BACE1 Endocytosis
Advisors: Virginie Buggia-Prevot and Gopal Thinakaran; University of Chicago
Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb.16-20, 2011 in Washington DC

Mehal Shah: Characterization of Methicillin-Resistant *Staphylococcus aureus* Clinical Isolates from Newborn Infants
Advisor: Bill Kabat; Children's Memorial Research Center
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award, Best in Category Microbiology, South Central Association for Clinical Microbiology - Outstanding Achievement in Clinical Microbiology

Katherine Shi: Endothelial Cell ICAM-1-dependent Signaling Negatively Regulates MCP-1Production
Advisor: Guoquan Liu; University of Illinois at Chicago
Co-author of abstract presented at Experimental Biology 2011 April 9-13, 2011, Washington D.C.
(Guoquan Liu, **Katherine Shi, Justine Ly**, Aaron T. Place, Farnaz Bakshi, Richard D. Minshall)

Mahi Singh: Effect of *Dnmt3b* Deficiency on DNA Methylation Status of *Myc*-Induced Mediastinal Lymphomas
Advisors: Lucy Godley, Janet LePore, and Aparna Vasanthakumar; University of Chicago *Presented at the International Student Science Fair, Sept 13-17, 2010 in Adelaide, Australia*

Shruthi Subramanian: The Effects of Cell Demographics on ADDL Binding and Toxicity
Advisor: William Klein, Gina Boylan, Anil Wadhwani and Pascale Lacor; Northwestern University
Illinois Junior Academy of Sciences Project Exposition Finalist;IJAS State competition gold award

Michelle Suh: The Comparison of the Different Radiotherapy Neutron Sources in Various Facilities for the Optimal Result in Neutron Therapy
Advisor: Thomas Kroc; Fermi National Accelerator Laboratory
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS Region V American Nuclear Society Award; IJAS Region V US Navy Award; IJAS State competition silver award, Chicago Section of the American Nuclear Society - Superior Achievement in Science and Technology

Divya Tankasala: Characterization of Methicillin-Resistant *Staphylococcus aureus* Clinical Isolates from Newborn Infants
Advisor: Bill Kabat; Children's Memorial Research Center
Illinois Junior Academy of Sciences Project Exposition Finalist; IJAS State Competition: gold award, Best in Category Microbiology, South Central Association for Clinical Microbiology - Outstanding Achievement in Clinical Microbiology

Sumana Vardhan: Biology of Bone Development in Leukemia Patients
Advisor: Kimberley Dilley; Northwestern University
Presented at NCSSSMST Student Research Symposium, June 6-9, 2010 in Hoboken, New Jersey

Kenneth Wang: Metal Alkoxide Functionalization in Metal-Organic Frameworks for Enhanced Ambient-Temperature Hydrogen Storage
Advisor: Rachel Getman; Northwestern University
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Paul Yuan: Mapping Verbal Memory Through Electrocorticographic Readings of Subdural Electrodes
Advisor: Vernon L. Towle; University of Chicago
Siemens Competition Regional Semi-Finalist; Presented at the Eighth Annual RITS Super Science Fair, Nov 1-6, 2010 in Kyoto, Japan; Chicago Region Junior Science and Humanities Symposium Finalist

Johannes Zhou: Discovery of Novel Phytoconstituents for Anticancer from the Aerial Parts of *Cimicifuga fetida*
Advisors: Hongjie Zhang and Norman R Farnsworth; University of Illinois at Chicago
Presented at the Eighth Annual RITS Super Science Fair, Nov. 1-6, 2010 in Kyoto, Japan

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Q08	124	Brinda Gupta	09:10	B-133
G03	81	Saarthak Gupta	10:25	A-135
T05	153	Inga Gurevich	10:25	D-110

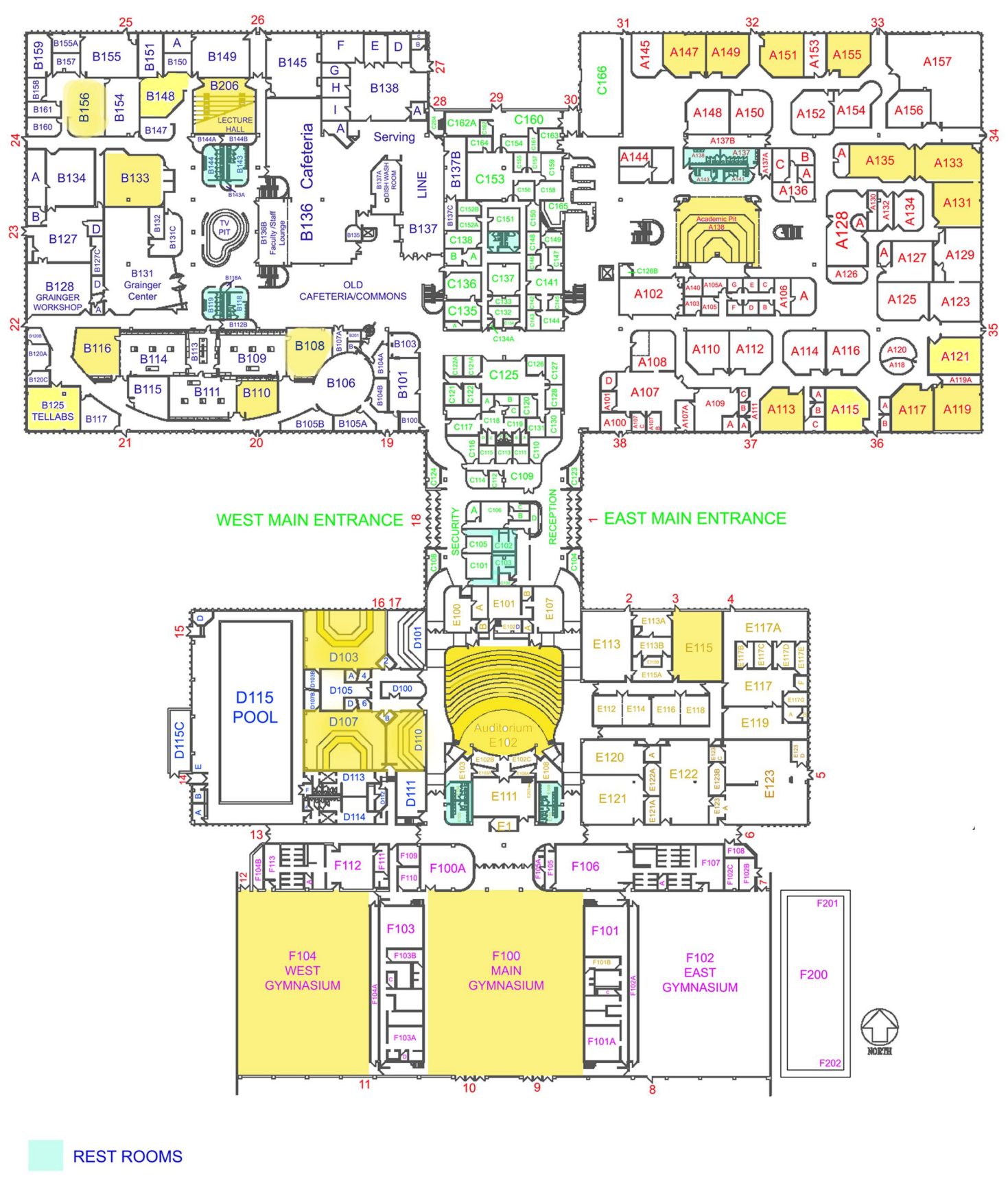
C12	53	Katherine Havighorst	1:45	B-108
S04	146	Riley Helm	09:10	D-107
P11	108	Rachel Hermes	09:10	A-151
U01	157	Jose Hernandez	2:10	B-133
Q09	124	Grant Herrman	11:15	B-148
K05	94	Bryan Hoffman	10:00	D-107
P12	109	Rae Hohle	1:45	A-133
Q10	125	Kevin Hong	11:15	Kids Inst. E-115
S05	147	Corey Hornbeck	2:10	A-115
C13	54	Dorcas Huang	1:45	A-149
C14	54	Jennifer Huang	10:25	A-117
C15	55	Jimmy Huang	10:50	A-131
R08	138	Jimmy Huang	11:15	A-131
C16	56	Seneca Hutson	12:55	D-103
R10	139	Aadam Ibrahim	1:20	D-103
R09	139	Aadam Ibrahim	2:10	A-135
A01	38	Osazomon Imarenezor	12:55	A-135
S06	147	Taylor Imburgia	1:45	Kids Inst. E-115
P13	109	Eun Ji Jeong	08:45	A-151
N02	100	Mindy Jian	08:45	A-155
G04	82	Irene Jiang	09:35	D-110
C17	56	Tejas Joshi	10:00	B-148
K03	93	Harsha Jujjavarapu	1:20	D-110
T06	153	Gina Jung	10:00	Kids Inst. E-115
I05	87	Aditya Karan	1:45	A-151
C18	57	Kaylee Karumanchi	10:25	D-107
M02	98	Connor Kasch	1:45	A-115
Q11	125	Lakshmi Katta	10:25	Acad. Pit A-138
G05	82	Samuel Kaufman	1:20	Kids Inst. E-115
B02	41	Nilesh Kavthekar	10:00	A-113
R11	140	Emil Khabiboulline	08:45	A-133
B03	42	Akram Khaja	08:45	A-121
R12	140	Akram Khaja	09:10	A-121
S01	145	Cherish Kim	08:45	Kids Inst. E-115
C19	57	Jiwon Kim	10:50	B-148
Q12	126	Kathryn Kim	12:55	D-110
C14	54	Melissa Kim	10:25	A-117
Q13	127	Sooyeon Kim	09:35	A-155
I06	87	Keith Kimberling	1:45	A-155
C20	58	Hannah Koo	10:25	A-149
C12	53	Brooke Kottkamp	1:45	B-108

B04	42	Krishna Kudaravalli	10:25	A-121
C21	58	Dipen Kumar	1:20	B-133
E04	73	Nishita Kumar	12:55	D-107
Q07	123	Previn Kumar	10:00	Lect. Hall B-206
C22	59	Vignessh Kumar	1:45	D-103
P14	110	Vignessh Kumar	2:10	D-103
I07	88	Benjamin Kuo	11:15	D-103
C23	59	Shannon Kurian	1:20	A-117
E05	74	Joshua Lam	2:10	B-148
K07	95	Clare Leahy	12:55	Lect. Hall B-206
M03	99	Mia Leckie	1:45	D-107
A02	38	Jenny Lee	10:50	A-133
B05	43	John Lee	09:10	A-133
K02	93	Olivia Legan	11:15	D-110
E06	74	Grace Li	1:45	B-148
E07	75	Jingfei Li	08:45	D-107
R13	141	Jingfei Li	10:25	B-110
E03	73	Mingyang (Jennifer) Li	2:10	Kids Inst. E-115
P15	111	Shelly Li	08:45	A-117
Q03	120	Ted Li	10:00	Acad. Pit A-138
Q04	121	Ted Li	10:50	Acad. Pit A-138
P16	111	Xiaoyu Li	1:45	A-113
B06	43	Claire Liang	12:55	B-148
F04	78	Jason Lin	09:35	A-135
R14	141	Emily Lindgren	08:45	A-131
C24	60	Sarah Lisk	08:45	D-110
C25	60	Christine Liu	08:45	B-110
T07	154	Itzel Lopez	12:55	A-119
E06	74	Lily Lou	1:45	B-148
R15	142	Joshua Love	10:25	B-108
R16	142	Peter Lu	10:50	A-135
O01	101	Erik Luo	10:00	A-135
S01	145	Alexandra Maffei	08:45	Kids Inst. E-115
C16	56	Amanda Magyar	12:55	D-103
Q14	128	Rahul Maheshwari	1:45	Lect. Hall B-206
Q15	129	Rahul Maheshwari	2:10	Lect. Hall B-206
C04	47	Egle Malinauskaite	10:25	B-148
A03	39	Nolan Maloney	1:20	A-119
C26	61	Sirisha Manam	10:25	A-115
C27	61	Anuj Marathe	08:45	A-147
Q14	128	Sarah Martin	1:45	Lect. Hall B-206

Q15	129	Sarah Martin	2:10	Lect. Hall B-206
P17	112	Daniel Matthews	10:50	A-155
T08	154	John McGuire	10:50	Kids Inst. E-115
C28	62	Aalap Mehta	09:35	B-133
C29	62	Aalap Mehta	10:00	B-133
S07	148	Eva Meyer	10:50	Lect. Hall B-206
P07	106	Jackson Michuda	1:20	A-115
K08	96	Ashwin Mitra	1:45	D-110
A04	40	Madhav Mohandas	09:35	B-110
P18	112	Tahir Mohideen	10:00	A-133
A05	40	Kyle Mou	09:35	D-107
I08	88	Byron Mui	1:45	A-119
R17	143	Kirti Munjeti	2:10	A-119
C30	63	Vamsikrishna Naidu	10:50	D-110
R18	143	Laura Napierkowski	09:10	A-131
T09	155	Perry Nelson	09:10	A-149
R19	144	Deokgeun Park	10:50	A-117
K09	96	Hyun Bin Park	1:45	A-135
Q16	130	Bindi Patel	10:50	A-151
Q01	119	Dhruv Patel	10:25	A-119
C23	59	Monica Patel	1:20	A-117
Q17	130	Shivani Patel	09:10	A-147
P19	113	Viveka Patel	12:30	B-108
H03	84	Sandy Perez	09:10	A-155
M03	99	Agnel Philip	1:45	D-107
I09	89	Zoe Phillips	09:35	A-121
C31	63	Areen Pitaktong	11:15	Acad. Pit A-138
Q04	121	Areen Pitaktong	10:50	Acad. Pit A-138
B04	42	Ajay Pius	10:25	A-121
Q18	131	Tonu Pius	10:00	A-119
E08	75	Ashley Radee	11:15	D-107
T07	154	Uriel Ramirez	12:55	A-119
P20	114	Saieesh Rao	12:55	A-121
P21	114	Brooke Ray	1:20	A-121
Q19	131	Abhinav Reddy	12:30	Kids Inst. E-115
P22	115	Mahendra Reddy	1:45	B-133
B07	44	Nishith Reddy	10:50	B-133
C32	64	Nishith Reddy	11:15	B-133
S08	148	Jennifer Ren	11:15	Lect. Hall B-206
C33	64	Sabrina Roberts	1:45	A-121
H01	83	Mariela Rodriguez	10:00	A-147

T05	153	Alexandra Roman	10:25	D-110
S09	149	Natalie Runkle	08:45	D-103
R20	144	Savanna Rutas	09:35	A-113
I10	89	Amir Safavi	11:15	A-155
C34	65	Sarah Salameh	08:45	A-149
Q13	127	Sidra Salman	09:35	A-155
K01	92	Christopher Sartain	09:10	Acad. Pit A-138
I08	88	Justin Sass	1:45	A-119
T06	153	Madison Schroeder	10:00	Kids Inst. E-115
I11	90	Robert Schurz	12:30	A-131
Q20	132	Carrie Sha	09:35	A-133
Q06	122	Joan Shang	11:15	A-119
E09	76	Richard Shen	1:20	B-108
C34	65	Urmi Sheth	08:45	A-149
C35	65	Navika Shukla	1:20	A-113
P23	115	Ross Skelly	09:10	B-108
Q11	125	Maura Slattery	10:25	Acad. Pit A-138
T10	155	Maura Slattery	09:35	A-147
Q21	132	Kalyani Sonarikar	08:45	A-135
I12	90	Hyun Jin Song	09:10	A-119
P24	116	Nicholas Srivastava	1:20	A-131
I13	91	Kyle Stanevich	12:55	Kids Inst. E-115
T04	152	Alexander Stratton	12:55	A-115
J01	92	Karolyn Stromdahl	11:15	A-151
Q22	133	Shruthi Subramanian	12:30	A-151
B08	44	Nathan Suek	09:35	A-131
E02	72	Michelle Suh	1:45	A-117
C36	66	Steven Suh	09:35	B-148
Q23	133	Amanda Sul	12:30	Lect. Hall B-206
T10	155	Hannah Swerbenski	09:35	A-147
C06	49	Andrew Ta	1:45	Acad. Pit A-138
C37	66	Tai	10:50	A-113
C43	69	Shannon Tai	11:15	A-113
P25	116	Adekore Taiwo	10:25	Lect. Hall B-206
C38	67	Arjun Tambe	1:20	A-135
C39	67	Lee Tang	10:00	B-110
G05	82	Matthew Tennenhouse	1:20	Kids Inst. E-115
C06	49	Aaditya Tolappa	1:45	Acad. Pit A-138
S10	149	Sydney Tomasko	09:10	Kids Inst. E-115
C40	68	Riva Trivedi	1:45	A-131
B09	45	Matthew Tsao	11:15	A-135

S11	150	Jessica Ventenilla	10:25	Kids Inst. E-115
P26	117	Rohan Verma	2:10	A-131
P27	118	Rheanna Vimawala	2:10	A-133
H04	84	Sonam Vyas	08:45	Acad. Pit A-138
M04	99	Caitlin Walczyk	09:10	D-110
K01	92	Samuel Walder	09:10	Acad. Pit A-138
Q23	133	Connie Wang	12:30	Lect. Hall B-206
O02	101	David Wang	12:55	A-133
P05	105	Jiachen Wang	1:20	A-147
E10	76	Yuanhao Wang	10:50	D-103
L02	97	Henry Ward	09:10	A-113
P12	109	Aditi Warhekar	1:45	A-133
N02	100	Heidi Warning	08:45	A-155
H02	83	Ashley Washington	09:35	Kids Inst. E-115
C41	68	Malia Wenny	10:00	A-149
C42	69	Andrew Wentzel	10:25	A-147
F05	79	Andrew Wentzel	2:10	Acad. Pit A-138
B10	45	Nathaniel White	11:15	A-121
T11	156	Ian Wilkinson	10:50	A-147
B10	45	Brent Wu	11:15	A-121
Q24	134	Rebecca Wu	10:50	A-149
I14	91	Summer Wu	11:15	A-117
C43	69	Shohei Yamakawa	11:15	A-113
F06	79	Matthew Yang	2:10	A-147
C44	70	Karthik Yarlagadda	10:50	B-108
C43	69	Satya Yerrabolu	11:15	A-113
D01	71	Evan Yin	08:45	Lect. Hall B-206
C45	70	Kelly Yom	2:10	A-121
T12	156	Stanley Yuan	10:50	A-115
I12	90	Jennifer Zhang	09:10	A-119
S12	150	Kevin Zhang	2:10	A-149
Q25	134	Vivian Zhang	1:20	Acad. Pit A-138
P28	118	Yifu Zhang	08:45	A-119
C46	71	Jeffrey Zhao	1:20	B-148
P17	117	Douglas Zhu	10:50	A-155
K07	95	Elaina Zintl	12:55	Lect. Hall B-206
F02	77	Ivan Zlatanov	1:45	A-147


WEST MAIN ENTRANCE
EAST MAIN ENTRANCE
SECURITY
RECEPTION
B136 Cafeteria
Serving LINE
OLD CAFETERIA/COMMONS
B131 Grainger Center
B128 GRAINGER WORKSHOP
B125 TELLABS
LECTURE HALL
TV PIT
Academic Pit
D115 POOL
Auditorium E102
F104 WEST GYMNASIUM
F100 MAIN GYMNASIUM
F102 EAST GYMNASIUM
F200
NORTH
REST ROOMS