





April 2011

Dear IMSA Friends:

The Illinois Mathematics and Science Academy® (IMSA) strives "to ignite and nurture creative, ethical, scientific minds that advance the human condition," and the Student Inquiry and Research (SIR) Program is just one way that we do that. Through SIR and its partnerships, IMSA students engage in rich opportunities to pursue compelling questions of interest, conduct investigations, communicate findings, and ultimately impact society. *Inquiry Without Boundaries* reflects our students' infinite possibilities to explore their unique passions, develop new interests, and collaborate with experts around the globe. Their research experiences teach them about thinking and learning and prepare them for careers that may well not yet exist.

Through the Student Inquiry and Research Program, 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. In many cases, our students have already contributed to IMSA's mission and our goal to have IMSA students improve our global world. Evidence of our students' excellence, in all fields, is found within this proceedings book of our twenty-third annual IMSAloquium. Many of our students have already, in high school, published and presented at local, national, and international venues. This is truly *Inquiry Without Boundaries*.

In just over two decades, IMSA has become one of the premier institutions of its kind in our state, nation, and the world. As such, we have a responsibility to share our expertise with others. To address the field of education's growing demand for student research programs, IMSA hosted more than one-hundred area teachers at the 2011 STEM Student Research Leadership Forum aimed at supporting and fostering student research opportunities and an additional two-hundred at an inquiry-based professional development day. These are just some examples of how IMSA's faculty and staff share their talents and expertise with thousands of teachers and students each year.

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.

Sincerely,

U. May " M Lee

Glenn W. "Max" McGee President

Judy Schepplin

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-third Annual IMSAloquium April 21, 2011

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IMSAloquium cover designer is Chris Reader, IMSA staff member. The cover was inspired by *Science* (February 11, 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 85% of the class of 2011. 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
- Journal of Physical Chemistry
- Learning and Leading with Technology
- Nature
- NCSSSMST Journal
- The Science Teacher

"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
- Experimental Biology 2011
- Junior Academy of Science at AAAS
- Midwest Society of Pediatric Research
- NCSSSMST Student Research Symposium
- Rose-Hulman Institute of Technology Undergraduate Mathematics Conference
- Society for Integrative and Comparative Biology

Competitions (partial list)

- iBioGENEius
- Intel International Science and Engineering Fair 15 finalists since 2008
 - 1 fourth place (individual) category award, 1 (team) third place category award
- Intel Science Talent Search
 - 38 semi-finalists and 10 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)
 - 43 regional semi-finalists resulting in 6 regional finalists and 1 national semi-finalist

2010-2011 Student Recognition

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

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

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 Finalist¹*

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, IL

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, NJ*

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, IL*

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 Finalist¹; IJAS Region V ASM Materials Education Foundation Award; Intel International Science and Engineering Fair Finalist²

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 Winner³

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 Semifinalist

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, NJ*

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 Finalist¹

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 Finalist¹; IJAS Region V Yale Science and Engineering Association, Inc Award; Intel International Science and Engineering Fair Finalist²

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*³

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 Finalist¹; IJAS Region V US Army Grand Prize Winner

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 Finalist¹; IJAS Region V US Navy Award; Intel International Science and Engineering Fair Finalist²* Justine Ly: Endothelial Cell ICAM-1-dependent Signaling Negatively Regulates MCP-1 Production

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 Finalist¹; IJAS Region V US Army Award

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 Finalist¹

Lydia Matthews: The Role of Pigment Epithelium Derived Factor (PEDF) 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

 Daniel Pak: Harmaline and Sodium Benzoate, Food Processing By-Product and Preservative, Induced Mitochondrial Damages: A Possible Implication in Degerative Diseases
 Advisor: Youngmi Kim Pak; Kyung-Hee University
 Siemens Competition Regional Semi-Finalist; 70th Annual Intel Science Talent Search Semifinalist

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 Finalist¹

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*¹

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; Illinois Junior Academy of Sciences Project Exposition Finalist¹

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 Finalist¹

Katherine Shi: Endothelial Cell ICAM-1-dependent Signaling Negatively Regulates MCP-1 Production

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*¹

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 Finalist¹; IJAS Region V American Nuclear Society Award; IJAS Region V US Navy Award

 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 Finalist¹

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, NJ

Kenneth Wang: 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)

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*

1) The Illinois Junior Academy of Sciences (IJAS) State Project Exposition is May 7, 2011 in Champaign, Illinois

2) The Intel International Science and Engineering Fair is May 8-13, 2011 in Los Angeles, California

3) The 49th National Junior Science and Humanities Symposium is April 27 – May 1, 2011 in San Diego, California

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

IMSAloquium: Student Investigation Showcase April 21, 2011

Schedule of Sessions

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

IMSAloquium Poster Session

	Biochemistry	Title	Start Time	Room
A01 A02	Vidya Anjur Yan-Yang Feng	The Effect of Heat Shock Protein 27 on Actin Cytoskeleton Remodulation The Effects of Detergent Concentration on KRAS-4B Aggregation after Farnesylation	10:50 12:55	B-148 A-155
A03	Krishna Kudaravalli	Cytoprotective Effects of Nitric Oxide	1:20	B-110
A04	Justin Lee Sung Hwan Suh	Development of New Environment-Sensitive Fluorescent Probes	9:10	D-110
A05	Madhav Mohandas	Molecular Cloning of HA-Ubiquitin into pGEX-4T-1 Vector	8:45	A-133
A06	Sarah Salameh Urmi Sheth	Effect of Syndecan-1 and Syndecan-2 on Herpes Simplex Virus-1 Cell- Cell Fusion	2:10	B-148
A07	Samir Shah	Observing the Genetic Response of H358 and 1703 Adenocarcinoma Cell Lines to BMP-7 with qRT-PCR	9:35	D-103
A08	Stanley Yuan Vivian Zhang	Optimization of Sensing Efficacy for Protein Detection	10:25	KidsInst E-115
	Bioengineering	Title	Start Time	Room
B01	Lisa Akintilo Megan Wu	Determining Heat Load of Infrared Laser Radiation through Direct and Side-Firing Optical Fibers	9:35	A-131
B02	Ramya Rahu	Exploring the Effects of Adhesion and Programmed Cell Death on Tissue	9.35	A-133
D02	N: C	Morphogenesis	10.00	A 147
B03	Yiyun Cao	Design of Genetic Sequences Encoding a Matrix Metalloproteinase-2-	12:30	A-147
B04	Sharon Duval	An Ideal Inbred Line of Maize Useful for Producing Transgenic Maize via Micro Projectile-Mediated Gene Transfer Using Meristemic Tissue	10:50	A-155
B05	Eric Huang	Genetic Testing Ontology Construction	2:10	A-135
B06	Nilesh Kavthekar	Polystyrene Coating of Microfluidic Devices to Reduce Absorption	10:00	A-113
B07	Samuel Kwak	Development and Evaluation of a Prosthetic Ankle that Mechanically Adapts to Sloped Surfaces	2:10	A-147
B08	Madhav Mohandas	Effect of Mechanical Forces and Cleavage Plane Orientation on Epithelial Geometry and Topology	9:10	A-133
B09	Navdeep Singh	Electric Potentials Along Proteins and Their Effects on Ion Movement	8:45	A-121
B10	Sydney Valero	Surface Behaviors of HT-29 Colon Cancer Cells on P-/E-Selectin and Anti-EpCAM	9:35	A-151
B11	Candice Yi	Virtual Representation of the Human Central Nervous System	12:55	A-113
	Biology	Title	Start Time	Room
C01	Wendy Bindeman	The Expression of Ecotropic Virus Integration Site-1 in Seven Cancer Cell	10:25	B-108
CO2	Kamila Bond	The Function of Sox5 in the Neural Crest	10.00	Δ_133
C02 C03	Sonya Dave	Comparing E-cadherin Expression in Cancer Cells with Different Degrees	9:10	B-110
C04	Xin (Danny) Ding	The Effects of Hypoxia on Human Dermal Fibroblasts	10:00	B-110

	Biology	Title	Start Time	Room
C05	Sruthi Doniparthi	The Effect of 2-Cyano-3,12-Dioxooleana-1,9(11)-Dien-28-Oic Acid (CDDO) on Transforming Growth Factor-ß Induced Epithelial- Mesenchymal Transition in A549 Lung Epithelial Cells	11:15	B-133
C06	Xiangyun (Johnny) Duan	Effects of Modified Murine <i>Runx2</i> Expression on Embryonic Osteogenesis	10:25	A-155
C07	Christine Engbretson	The Mediation of Tumor Necrosis Factor by the Tight Junction Protein Occludin	11:15	A-155
C08	Lucija Filipac	Expression of Recombinant Malarial Parasite <i>Plasmodium falciparum</i> Acetyl-CoA Carboxylase in a Yeast-Based Screening System and Photometric Assays	10:50	A-119
C09	Hana Fouladi James Rea	The Effect of microRNA-200 on Prostate Cancer	1:20	A-155
C10	Nicholas Fung	The Effect of a High Fat Diet on Leukotriene B4 Levels in Pancreatic Lesions in Genetically Altered Mice	11:15	B-116
C11	Mukesh Gande Kyle Glasper	The Scientific Basis of Disease in Media: Werewolves, Vampires, and Zombies	11:15	B-148
C12	Andrew Go	Characterization of Genetic Pathways Leading to Therapy-Related Acute Myeloid Leukemia with Abnormalities of Chromosome Five	1:45	A-155
C13	Webster Guan	Pro-Inflammatory Regulatory T-cell Expression of a Foxp3 Splice Variant	1:20	B-108
C14	Eaton Guo	DNA Sequencing Protocol	10:50	B-110
C15	Dorcas Huang	The Effects of Sanitizers on the Survival of Stressed Salmonella enteritidis on Shelled Eggs	1:45	D-103
C16	Brielle James	A Comparison of Activity Budgets and Exhibit Usage of Western Lowland Gorillas	12:55	KidsInst E-115
C17	Lakshmi Katta Rhyston Mays	Cell Starvation in Prokaryotic and Eukaryotic Cells and the Initiation of Apoptosis in Eukaryotes	10:50	B-108
C18	Yoo (Jenny) Kim Jongmin Lee	Differential Effects of Histone Deacetylase Inhibitors on the Acetylation of Tubulin on Human Vascular Smooth Muscle Cell Cultures	9:35	B-116
C19	Hannah Koo	The Role of Dendritic Cells in the Development of Pro-Inflammatory T- Regulatory Cells in Colorectal Cancer	1:45	B-108
C20	Jacob Lahr Amanda Sul Connie Wang	MMS21 Reduction in HCT116 Cancer Cells Results in Hypersensitivity to Camptothecin	2:10	A-117
C21	Nolan Maloney	The Role of Reactive Oxygen Species in the Regulation of MYCN in Neuroblastoma	1:20	A-115
C22	Janani Mandayam Comar Sai Parepally	Auditory, Olfactory, and Pheromone Sensing in TRPML3 Deficient Mice	11:15	A-151
C23	Lydia Matthews	Estrogen as an Initiator of Breast Cancer	9:35	A-117
C24	Thitipong	The Effect of Ranolazine on T-Tubule Organization, Heart Disease, and	10:00	B-133
	Mongkolrattanothai Mahendra Reddy	Excitation-Contraction Reactions		
C25	Christine Mourafetis	The Effect of Fructo-Oligosaccharide on the Growth of <i>Bacillus</i> <i>coagulans</i> Under Conditions Similar to Those Found in the Digestive Tract	9:35	B-110
C26	Cassie Parks	Vimentin is Required for Non-Small Cell Lung Carcinoma Metastasis	8:45	A-151
C27	Irina Pushel	Role of Phosphoinositide 3'-Kinase $\text{C}2\beta$ in Intersectin-Mediated Signaling in Neuroblastoma	10:00	B-148
C28	Mahi Singh	Examining the Functionality of DNA Methyltransferase Protein DNMT3B in Myc-Driven Cancers in Mice	10:50	A-151
C29	Alexandra Smick	Stretch-Induced Gene Regulation	9:10	A-151

	Biology	Title	Start Time	Room
C30 C31	Andrew Ta Aaditya Tolappa	Effect of the Expression of Histamine Receptors on Mast Cells Investigating Inducible Resistance Observed in <i>Pseudomonas aeruginosa</i>	1:20 1:45	A-121 A-133
C32	Risun Udawatta	The Importance of Accelerated Cell Death 2 in the Mitochondria and Chloroplasts of <i>Arabidonsis</i>	9:35	D-110
C33	Sumana Vardhan	Role of TLR4 in Profibrotic TGF-ß Signal Transduction in Fibrosis	10:50	B-133
C34	Sonam Vyas	Identifying the Isoforms of Adenylyl Cyclase in Alveolar Epithelial Cells of <i>Rattus norvegicus</i> and <i>Homo sapiens</i> by Polymerase Chain Reaction	10:00	A-151
C35	Kelly Wallin	Variations in Characteristics of <i>Ginkgo biloba</i> Leaf Litter and Implications	2:10	A-121
C36	Xun Ming (Jenny) Wang	The Effect of Smallpox Vaccine-Elicited CD4+CD25+Foxp3+ T_{reg} Cells Expansion and Massive Accumulation in Infected Tissues and T_{reg} Cell's Role in Immune Homeostasis Against Tissues Destruction	10:50	D-110
C37	Jordan Williams	The Effect of Silver Ion on Sewage Treatment Bacteria	8:45	B-110
C38	Diana Xu	The Effects of Epigallocatechin-3-gallate on the Apoptosis of HT-29 Colorectal Cancer Cells	11:15	B-108
C39	Karthik Yarlagadda	Comparative Morphology of Lepidotrichia in Pectoral Fins Among Basal Actinopterygians	9:35	KidsInst E-115
C40	Candice Yi	Identifying Differences Between Normal and Cancerous Stem Cells	1:20	A-113
	Business	Title	Start Time	Room
D01	Naomi Liu Si Si	The Correlation Between Start-Up Fund, Product Type, and Monetary Success in Small Businesses	1:45	A-119
D02	Jay Patel Vivek Thakkar	How Power and Status Influence Reactions to Breaches of Trust	1:45	A-115
D03	Glen Richardson	The Profitability of Private Equity	8:45	LectHall B-206
	Chemistry	Title	Start Time	Room
E01	Matthew Kleinjan	The Healthiest Drink: Determining Antioxidant Content of Beverages	1:20	KidsInst E-115
E02	Mingyang (Jennifer) Li	Density Functional Theory Study of the Influence of VOx Promotion on the Mechanism of Alcohol Synthesis on Rhodium Catalysts	1:20	B-116
E03	Pan Luo	Effects of Molecular and Macroscopic Surface Modification on Wetting	10:50	A-133
E04	Elizabeth Ott	A Greener Catalyst for Biodiesel Synthesis	11:15	D-110
(Computer Science	Title	Start Time	Room
F01	Jason Chien Konrad Wrobel	Heuristic Analysis in Python Programming: Creating a Chess Engine	9:10	A-121
F02 F03	Samuel Haile Shantanu Jain	The Digital Detriment: Aspects of Computer Illiteracy Inquiry into the Applications of Computing, Web Access, and Mobile Device Integration in the Automotive Environment	10:25 10:50	A-121 D-103

	Computer Science	Title	Start Time	Room
F04	Nilesh Kavthekar Ted Li Joseph Wang	A Statistical Model for Analyzing Triphenyltetrazolium Chloride-Stained Myocardial Infarcts	10:25	A-113
F05 F06 F07	Derrick Miller Angus Nelson Gregary Pergrossi Zachary Pergrossi	Fooling the Hacker: A Study of Honeypots A Look into How to Make the World More Efficient Through Databases Three-Dimensional Landscape Generation and Erosion Simulation with Java	11:15 9:35 10:00	D-103 A-121 A-121
F08	Kevin Wang	Designing Game Design	9:10	LectHall B-206
	Economics	Title	Start Time	Room
G01	Paul Cladek	Cost-Benefit Analysis and Evaluation of Leadership in Energy and Environmental Design Certification	12:30	A-151
G02	Caitlyn Collett Samuel Weitekamp	The Gulf Oil Spill and Its Effects on the Global Economy	9:35	LectHall B-206
G03 G04	Inga Gurevich Joseph Hecker	Effects of the 9/11 Attacks on the Insurance Industry Growth of the Chinese Futures Markets	8:45 1:45	A-155 LectHall B-206
G05 G06	Zeno Jeong Harley Wang	The Role of the Federal Reserve Bank During the 2007 Recession High-Tech Industries and the Quality of Life: An Investigation of Chinese Cities	9:10 9:10	D-107 A-155
	Education	Title	Start Time	Room
H01	Sonia Bajaj	Multisensory Versus One-Modality Instruction in Bilingual Education with a Focus on Elementary-Aged Spanish Speakers	10:25	A-135
H02	Ayse Cetinkaya	Transgender Policies in High Schools	1:20	A-147
H03	Wen Li Chen	The Effect of Resident Physician Education on Patient Safety	12:55	D-103
H04	Grace Choi	A Study Aimed at Enhancing Students' Understanding of Newton's Three Laws	12:30	A-117
H05	Francis Cocjin	Comparing the Learning Styles of Gifted Monolingual and Bilingual Students	10:00	A-147
H06	Katia Colin Chibuzo Obasi	The Importance of English as a Second Language Programs and the Factors That Affect Their Success	10:50	LectHall B-206
H07	Eleanor Cory Allyson Milenkovic	Applying Teaching Models to a Science Curriculum for Elementary School Students in IMSA's Kids Institute	2:10	A-115
H08	Dominic Gentile Matthew Gietl	The Dropout Dilemma: Investigating Student Retention at the Illinois Mathematics and Science Academy	10:00	B-108
H09	Carlos Gomez Christopher Macias	Why are Hispanics Underrepresented in College?	10:00	AcadPit A-138
H10	Victoria Lo	Student Inquiry and Research at IMSA Chicago	12:55	A-115
H11	Alan Shramuk	The Effects of Inquiry-Based Pedagogy on Third Grade Students and Their Ability to Learn Higher Level Physics Concepts	10:25	LectHall B-206

	Engineering	Title	Start Time	Room
I01	Yusuf Aktan Matthew Tsao	Comparison of Dreiding and Universal Force Fields for Metal Organic Framework Simulation	12:55	A-133
I02	Justin Booth Brendan Mathias	The Design Process of a Roller Coaster	1:45	KidsInst E-115
I03	Wen Min Chen	The Physical and Thermodynamic Properties of Ni ₂ TiIn	10:50	A-149
I04	Dane Christianson	Engineering a Water Filter for Developing Countries: Optimizing Flow Rate	9:10	B-116
105	Logan Damiani Nathan Geldner	Far Horizons Near Space Balloons: Creating a Cut-Down System	2:10	A-151
I06	Henry Deng	Networks of Ultrasmall Pd/Cr Bilayer Nanowires: A New Type of High Performance Hydrogen Sensors	2:10	A-131
I07	Saarthak Gupta	Alternative Auscultation: The Audible Human Project	2:10	A-155
I08	Kenneth Harvey	The Construction of a Model Helicopter with a Unique Set of Interlocking	12:55	LectHall
T09	Peter Howes	A Design for a More Efficient Vertical Axis Wind Turbine	12.55	Б-200 D-110
I10	Aditya Karan	Understanding the Formation of Toroidal-Spiral Particle	1:45	A-147
I11	Samir Mishra Shobhit Roy	Optimizing the Conditions of Atomic Layer Deposition of Hafnium Oxide, HfO ₂	2:10	A-119
I12	Byron Mui	Thermodynamic and Physical Properties of Ni ₂ TiGa	1:20	A-149
I13	Jonathan Munoz	Roller Coasters: Pushing Human Limits	2:10	D-103
I14	Benjamin Richardson	Designing a Mixed-Use Facility on a Four Acre Plot of Land	2:10	D-110
I15	Madison Rogers	Architecting a Chicago-Based Environmentally Friendly Triplex	2:10	KidsInst E-115
I16	Yanchen Shi Douglas Zhu	Exploring Field Programmable Gate Array Time to Digital Converters in High Energy Physics	10:00	D-107
I17	Hyun Jin Song	Changing a Cell's Fate: New Cures for Diseases and Illnesses	9:10	AcadPit A-138
I18	Michael White	How the Ratios of Plastic Acrylic Balls in a Plastic Ball Phantom Affect the Consistency of the Phantom	1:45	B-148
I19	Joly Wu	Nanoelectrode Arrays for Energy Storage and Ultrasensitive Sensing Application	9:10	KidsInst E-115
I20	Baihan Yang	A Football Design to Enforce a Quick Release by a Quarterback	10:00	LectHall B-206
	English	Title	Start Time	Room
J01 J02	Monica Daniels Kathleen Gundry	A Continuous Change of the Aspirations of IMSA Students in Writing Writing an Educational and Engaging Script for Third through Fifth Grade	9:10 8:45	D-103 A-135
J03	Perry Nelson	Beginning the Process of Writing a Fantasy Novel	8:45	D-103

Env	vironmental Science	Title	Start Time	Room
K01	Michael Atten Rafael Gonzalez Cai O'Connell	International Collaborative Effort for the Creation of Renewable Energy Applications and Methodologies: Efficient Wind Power Production	10:50	AcadPit A-138
K02	Mitchell Bieniek	International Collaborative Effort for the Creation of Renewable Energy	11:15	AcadPit
K03	Benjamin Kuo	Exploring the Synergy of Wastewater Remediation and Bioenergy Production Through Nannochloropsis Cultivation	8:45	A-119
K04	Neel Patel Seth Zelman	Lighting of the Future: An Investigation of Light-Emitting Diode Efficiency	1:20	D-110
K05	Nishith Reddy	CdS/ZnS Quantum Dot-Photoexcited Glucose Oxidase Biosensor for Silver Ion Detection in Contaminated Aqueous Environments	9:35	A-115
K06	Vanya Yorgova	Designing a Building for the IMSA Energy Center that Runs on Only Solar and Wind Energy	1:45	D-110
	Fine Arts	Title	Start Time	Room
L01	Megan Czajka Connor Tomasko	Using Film as a Medium to Create a Documentary About Academic Integrity at IMSA	1:20	D-103
	History	Title	Start Time	Room
M01	Shelby Daniel- Wayman	Emotion in Journalism: Changes in Reporting Disasters and How They Affect Coverage	12:55	D-107
M02	Joscelyn Garcia	Latin American Women in Revolution: Mexico and Nicaragua in the Twentieth Century	9:35	A-135
M03	Miranda Herzog	Paint the Town Red: How Marxism Influences Politics Today	8:45	A-147
M04	Melissa O'Brien	Ethics in Legislation: The Search for the Basis of Ethics	8:45	D-107
M05	Kimberly Sherwin Jeannine Schulz	"O Jesus, Through the Immaculate Heart of Mary" Versus "What up, J.C.?":	10:50	A-115
M06	Sarah Weitekamp	Rural Electrification in the United States and Russia: Causes and Social	8:45	B-148
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	Law	Title	Start Time	Room
N01	Jennifer Crawford	Politics of Globalization: Crises, Economic Human Rights, and Inequality	1:20	A-117
N02	Diliana Dimitrova	A Western Legal Shift to Incorporate Indigenous Intellectual Knowledge	9:10	A-147
N03 N04	Vamika Venkatesan	Mass Incarceration and its Effects in Society Mandatory Death Penalty in Africa	1:45 1:45	A-117 A-121
	Mathematics	Title	Start Time	Room
O01	Shiladitya Bhattacharyya James Quigley Oscar To	Investigations in Open Symmetric Pentomino Problems	10:00	A-149
002	Marcelo Diop- Gonzalez	Questions in Computational Group Theory	8:45	B-116

	Mathematics	Title	Start Time	Room
003 004	Derek Hardin Adam Kalinich	On the Coloring of Graph Products Flipping the Winner of a Poset Game	1:45 1:20	A-135 LectHall B-206
O05 O06 O07 O08 O09	Jisoo Kim Corinne Madsen Matthew Rasmussen Rose Sloan Michael Teng Kevin Zhao	Investigating Flat Foldability of Box Pleated Origami Models An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Z_n Reading Differences Between Printed Books and E-Readers Stable Expansions of the Integers The Leader Mentality: The Importance of Scoring First in a Major League Baseball Game	9:35 1:45 9:35 10:25 10:50	A-149 A-149 A-155 D-107 A-117
	Medicine	Title	Start Time	Room
P01	Courtney Amegashie	The Comparison of Motility in Parent Versus High Nitric Oxide Adapted Cells	9:10	A-115
P02	Omotayo Balogun Kari Tyler	A Comparison of Zantac and Prevacid in the Treatment of Gastroesophageal Reflux in Premature Infants Diagnosed with Bronchopulmonary Dysplasia	10:25	B-116
P03	Madeline Booton	Ampicillin Resistance in <i>Escherichia coli</i> : Adaptation or Mutation?	12:30	B-108
P04	Seth Butcher	An Investigation of Periodontal Diseases	10:50	A-147
P05	Ajay Chatrath	Evaluating Computerized Tomography Scans Ordered from the Emergency Room for Suspected Pulmonary Embolism	10:25	A-149
P06	James Chen	Type 2 Diabetes Risk Factors at IMSA	10:25	B-148
P07	Nitin Chilukuri Ajay Pius Abhinav Reddy	Genetic Influences on Cellular Debris Handling in Systemic Lupus Erythematosus	9:35	B-148
P08	Samantha Donermeyer	Chest Computerized Tomography Imaging Findings in Patients With Localized Sarcoma	1:20	D-107
P09	Annie Guo	Comparison of Sun Protection Behavior and Tanning Habits in Adolescents Based on Age, Gender, and Skin Tone	9:10	A-113
P10	Annie Guo	What are the Consequences of the Loss of PAX3 Function in Melanoma?	9:35	A-113
P11	Jacob Henry	All About Influenza	10:25	B-110
P12	Ingrid Hsiung Pranusha Pinna	The Role of SRC Family Kinases in SDF-1/CXCR4-Mediated Progenitor Cell Homing	10:50	A-113
P13	Thomas Reith	Systems The Effect of Ford on the Cell Markers Log2, 41BB, and CBTAM in the	1:45	B-133
P15	liwon Kim	Anergic carEGR2 flox/flox T_H1 T-cell Clone The Pole of Two Selective K^+ Channels (K, and K) Expressed in	0.10	A 1/0
115	Jiwon Kim	Macrophages in the Secretion of IL-1ß when Macrophages are Induced by Anthrax Toxin	9.10	A-149
P16	Ifreke King	Factors Influencing Successful Weaning from Caffeine in Premature Infants Born before Thirty-four Weeks of Gestation Treated for Apnea	10:50	A-135
P17	Previn Kumar	Defining a Minimal Peptide Within HSP70 Required for Immune Activation	1:45	B-110
P18	Samantha Levin	Determining the Conditions Under Which Bioavailability of a Drug Increases	1:20	A-119
P19	Sarah Lisk	Mutations in the Insulin Gene as a Cause of Monogenic Diabetes	12:30	LectHall B-206
P20	Justine Ly Katherine Shi	Endothelial Cell Intercellular Molecule Regulation of Monocyte Chemoattractant Protein-1	8:45	A-117
P21	Daniel Matthews	Neonatal Diabetes due to Mutations in the KCNJ11 Gene	11:15	LectHall B-206

	Medicine	Title	Start Time	Room
P22	Hannah Miller	GD3 Synthase Vaccines as a Treatment for Melanoma	2:10	B-110
P23	Christina Momchev	Investigation Into Risk Factors of Heparin-Induced Thrombocytopenia	9:35	B-133
P24	Gina Qin	The Effect of Therapeutic Hypothermia on Mitochondrial Akt Phosphorylation and Pim-1 Expression in Murine Hemorrhagic Shock	12:55	B-148
P25	Nishith Reddy	The Effect of Transgenic A20 on Inflammation of the Intestinal Epithelium	10:00	A-115
P26	Ashley Ro Nikita Veera	Computerized Quantification of Pleural Effusion	10:00	KidsInst E-115
P27	Yasmeni Sandridge	Do Widened Pulse Pressures in Premature Infants Signify a Patent Ductus Arteriosus?	12:55	A-121
P28	Mehal Shah Divya Tankasala	Characterization of Methicillin-Resistant <i>Staphylococcus aureus</i> Clinical Isolates in Infants Within the First Thirty Days of Life	2:10	A-133
P29	Kevin Shi	Randomized, Prospective Comparison of Performance Using Standard Laparoscopy, Single-Incision Laparoscopy, and a Novel Bimanual Triangulating Platform	9:35	D-107
P30	Steven Suh	The Influence of Body Mass Index on the Outcome of Patients with Acute Myelocytic Leukemia Following Chemotherapy	8:45	D-110
	Neurobiology	Title	Start Time	Room
Q01	Ruchi Aggarwal Shruthi Subramanian	The Effects of Cell Demographics on Amyloid-Beta Derived Diffusible Ligand Binding and Toxicity	8:45	A-115
002	Unashruti Agrawal	Apolinoprotein E Effects on Synapse Volume in vivo	1.20	Δ_131
Q02 Q03	Christina Cheng	Isolation of Cholinesterases from Plaques and Tangles in Alzheimer's Disease	10:00	A-131 A-135
Q04	Ashley Chong	Using Hippocampal Morphometry to Detect Alzheimer's Disease Pathology in Primary Progressive Aphasia Patients	11:15	A-119
Q05	Sanggyu (Raymond) Chong Tonu Pius	Effects of Caffeine on Motor Excitability of Skeletal Muscles in the Hand and Arm as Measured by Navigated Transcranial Magnetic Stimulation	9:10	A-131
006	Iulianne	The Effects of Menstrual Cycle Phase on Memory in Naturally Cycling	1.20	A-151
Q 00	Crawford	Women	1.20	11 101
Q07	Justin Feng	Using Resting State Functional Connectivity as a Biomarker to Access the Treatment Effects in Chronic Stroke Patients	12:30	A-131
Q08	Brinda Gupta	Effect of 1-methyl-4-phenylpyridnium on Dopamine Neuron Loss in LPS Mouse Model of Parkinson's Disease	11:15	A-131
Q09	Janell Herrera	The Relationship Between Effect-Site Concentration of Propofol and Burst	1:45	D-107
-	Jessica	Suppression of the Electroencephalogram in Patients Undergoing		
	Ventenilla	Cerebrovascular Procedures		
Q10	Irene Jiang	The Effects of Late Life Depression on Executive Function in the Clock	12:55	A-119
011	TT1	Drawing Test	10.25	A 121
QII	Harsna	Index in Obstructive Sleep Appear Syndrome Detients	10:25	A-131
012	Jujjavarapu Harsha	Effect of Neurotoxin MPP+ on Additional Nigral Donaminergic Neuron	10.50	A-131
×14	Jujjavarapu	Loss in the MPTP Mouse Model of Parkinson's Disease	10.50	11 151
Q13	Timothy Klincewicz Areen Pitaktong	The Role of MAN2A2 Expression in Glioma Proliferation and Invasivity	11:15	A-121
Q14	Alekya Kothamasu	Progression of Performance Obtained During a Revolutionary Balance	8:45	A-149
-	Alexandra Roman	Exercise Regimen That Challenges Post-Stroke Survivors Beyond Their Limits of Stability		
Q15	Vignessh Kumar	Characterization of HuR Overexpression in a Post-Ischemic Penumbra	10:50	B-116

	Neurobiology	Title	Start Time	Room
Q16	Xiaoyu Li	Dopamine Regulation of Phosphorylation of Cone-Cone Gap Junctions in Ground Squirrel Retina	1:45	B-116
Q17	Egle Malinauskaite Paul Yuan	Mapping Verbal Memory Through Electrocorticographic Readings of Subdural Electrodes	2:10	A-149
Q18	Pujan Patel	Degradation and TRIP8b Maintenance of HCN1 and HCN2 Channels	1:45	A-113
Q19	Pujan Patel	Identification of Clathrin and Adapter Protein Interacting TRIP8b Splices	2:10	A-113
Q20	Nicole Runkle	Gender Differences of Neural Correlates Supporting Empathy in Schizophrenia	11:15	A-149
Q21	Shannon Tai Kelly Yom	Mouse Models in the Genomic Age	1:20	B-148
	Physics	Title	Start Time	Room
R01	Alexander Abbinante Wesley Bradley	Searching for a High Mass Standard Model Higgs Boson in 6.3 fb ⁻¹ of Data at the D0 Detector	10:25	A-147
R02	Natasha Arvanitis Laura Napierkowski	Detecting Cosmic Muons: Calibrating an Efficient Straw Chamber	8:45	AcadPit A-138
R03	Amber Betzold	Modeling the Strong Gravitational Lensing System, Clone, Using Data from the Hubble Space Telescope	10:25	A-119
R04	Stephanie Cheng	The Accuracy of Galaxy Cluster Mass Estimates Based on Weak Gravitational Lensing Techniques	1:45	A-131
R05	Mohammed Hayat	Differentiating Neutrino Events	1:20	A-135
R06	Holly Hernandez	Energy Calibration of Electron Antineutrino Using Boron-12 Beta Decays	11:15	A-135
R07	Shantanu Jain	Transfer Line Design from the Recycler Ring to the P150 Line for the Mu2e- Project at Fermi National Accelerator Laboratory	10:25	D-103
R08	Emil Khabiboulline	Modeling Quench Propagation in a System of Interconnected Superconducting Coils	1:45	AcadPit A-138
R09	Benjamin Kuo	Optimization of Event Selection for the Higgs Boson Sensitivity at the Collider Detector at Fermilab	9:10	A-119
R10	John Lee	Tracking the Construction and Performance of the NOvA Detector	12:30	B-116
KII	Kiwook Lee	Optimizing Nanometer-Scale Features	2:10	AcadPit
P1 2	Peter I 11	Dynamics of Two-Dimensional Granular Gases	2.10	A-138 B-116
R12	Erik Luo	An Automated Algorithm for Closed Orbit Correction	2.10 8·45	B-133
R14	Tuopu Ma	Determining the Optimal Silicon Photomultiplier Device to Measure High Energy Particle Collisions	9:10	B-133
R15	Eric Ordonez	Measuring Time Calibrations in Waveform Digitizing for Practical Positron Emission Tomography Applications	1:20	B-133
R16	Deokgeun Park	Calibration of Dark Energy Camera Charge-Coupled Device Images in the Dark Energy Survey Filter System Using Astronomical Standard Stars	2:10	B-133
R17	Jorge Quero	Operating Voltage of the Silicon Detectors in the Collider Detector at Fermilab	11:15	A-133
R18	Amir Safavi	Investigation of Radiation Cool-Down Curves and Development of Tools for Their Analysis	8:45	KidsInst E-115
R19	Michelle Suh	The Comparison of the Different Radiotherapy Neutron Sources in Various Facilities for the Optimal Result in Neutron Therapy	1:45	A-151
R20	Gary Wang	Using GALFIT and Lenstool to Analyze Gravitational Lenses	10:00	A-119

	Psychology	Title	Start Time	Room
S01	Uchenna Agwuncha	Correlation of Print Advertisements, Self-Concept, and Body Image in Adolescent Girls	11:15	A-113
S02	Jennifer Bailey	Examining Differences in Cognitive and Executive Functioning Scores in Patients with Autism Spectrum Disorders, ADHD, and Co-Occurring Autism and ADHD	9:35	AcadPit A-138
S03	Kirthi Banothu Brendan Wesp	An In-Depth Analysis in Decision Making Based Upon the Decision Making Index Scale	1:20	A-133
S04	Jessica Grady Michelle Jardine	Predicting the Mind of a Serial Murderer: The Success of Criminal Profiling in the Case of the Green River Killer	1:20	AcadPit A-138
S05	Carly Houdek Elaina Zintl	Awareness of Being Stared at: Investigations into the Possibility of a Sixth Sense	10:00	A-117
S06	Ethan Jacobs	The Effect of Parental Input on the Language and Reading Development of Children During Preschool	2:10	B-108
S07	Brittany Kwamin Whitney Kwamin	Features of Effective Support Programs for Pediatric Multiple Sclerosis	11:15	A-117
S08 S09	Paloma Ocola Patricia Walchessen	d-Amphetamine: Effects on Mood and Speech How Stress Affects Sleep in Elderly People with Cardiovascular Risk Factors	2:10 10:25	D-107 D-110
S10	Andrew Wentzel	An Exploration into Artificial Intelligence, the Human Mind, and Systems	2:10	LectHall B-206
	Social Science	Title	Start Time	Room
T01	Paul Angelillo Ryan Jordan Rhett Partida Rafael Rodriguez Samuel Simon	Nationalism in Spain: Catalonia and the Basque Country	12:55	A-135
T02	Cevdet Dogan Aditya Suresh	An Analysis of the Patient Protection and Affordable Care Act and its Effect on Physician Compensation and Health Insurance Companies	9:35	A-147
T03	Jonathan Henricks Thomas Lightfoot	IMSA, Parents, Expectations: Illinois Massive Stress Academy Stressing Out Over Nothing	12:30	KidsInst E-115
T04	Shawon Jackson Satoe Sakuma	Cultivating the Gifted Minority Leader	10:25	AcadPit A-138
T05	Rahul Maheshwari	Sharing Needles: The Implementation of a Syringe Exchange Program in Chicago	11:15	D-107
T06	Sarah Malik	Assessing Math Performance of Multilingual IMSA Sophomores	10:25	A-117
	Space Science	Title	Start Time	Room
U01	David Dailey Christopher Sartain	The Dinosaurs' Demise: An Investigation into the K-T Impact	8:45	A-131
U02	Ian Nodurft	Gravitational Interactions in Globular Clusters	12:55	B-133
	Theology	Title	Start Time	Room
V01	Kristopher Fernandez	A Comparison of Islam and Christianity: Religion's Institutions	10:25	A-115

Poster Map



Old Cafeteria/Commons



Diagram not to Scale

- * History continued: M04-M06
- * Law: N01-N04
- * Mathematics: O01-O09
- * Medicine: P01-P10
- continued

Poster Map Cafeteria							
A01	A07	B05		B11	C06		C12
A02	A08	B06		C01	C07		C13
A03	B01	B07		C02	C08		C14
A04	B02	B08		C03	C09		C15
A05	B03	B09		C04	C10		C16
A06	B04	B10		C05	C11		C17

C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31
C32	C33	C34	C35	C36	C37	C38	C39	C40	D01	D02	D03	E01	E02

E03	E04	F01	F02	F03	F04	F05	F06	F07	F08	G01	G02	G03	G04	G05	G06	H01	H02
Н03	H04	Н05	H06	H07	H08	H09	H10	H11	I01	I02	I03	I04	105	106	107	108	109

I14 I15	I16	I17	I18	I19	I20	J01	J02	J03	K01	K02	K03	K04	K05	K06

Old Cafeteria/Commons

I10
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I11
I12
I13

	Diagram Not to Scale	
* Biochemistry: A01-A08	* Economics: G01-G06	* History: M01-M03
* Bioengineering: B01-B11	* Education: H01-H11	continued
* Biology: C01-C40	* Engineering: I01-I20	
* Business: D01-D03	* English: J01-J03	
* Chemistry: E01-E04	* Environmental Science: K01-K06	
* Computer Science: F01-F08	* Fine Arts: L01	



Poster Map Math Study Area



* Theology: V01

IMSAloquium Schedule

8:45AM - 9:00AM

Room	Poster ID	
A-115	Q01	The Effects of Cell Demographics on Amyloid-Beta Derived Diffusible Ligand Binding and Toxicity Ruchi Aggarwal, Shruthi Subramanian, Gina Boylan, William Klein
A-117	P20	Endothelial Cell Intercellular Molecule Regulation of Monocyte Chemoattractant Protein-1
		Justine Ly, Katherine Shi, Guoquan Liu
A-119	K03	Exploring the Synergy of Wastewater Remediation and Bioenergy Production Through Nannochloropsis Cultivation Benjamin Kuo, Timothy Strathmann, Derek Vardon
A-121	B09	Electric Potentials Along Proteins and Their Effects on Ion Movement Navdeep Singh, Namrata Pandya, Phadmakar Patankar
A-131	U01	The Dinosaurs' Demise: An Investigation into the K-T Impact David Dailey, Christopher Sartain, Mark Hammergren
A-133	A05	Molecular Cloning of HA-Ubiquitin into pGEX-4T-1 Vector Madhav Mohandas, Richard Morimoto
A-135	J02	Writing an Educational and Engaging Script for Third through Fifth Grade Students Kathleen Gundry, Manuel Perez
A-147	M03	Paint the Town Red: How Marxism Influences Politics Today Miranda Herzog, Christian Nokkentved
A-149	Q14	Progression of Performance Obtained During a Revolutionary Balance Exercise Regimen That Challenges Post-Stroke Survivors Beyond Their Limits of Stability Alekya Kothamasu, Alexandra Roman, David Brown, Nicole Korda
A-151	C26	Vimentin is Required for Non-Small Cell Lung Carcinoma Metastasis Cassie Parks, Martha Kidd, Karen Ridge
A-155	G03	Effects of the 9/11 Attacks on the Insurance Industry Inga Gurevich, Krzysztof Ostaszeski, Richard Stalmack
AcadPit A-138	R02	Detecting Cosmic Muons: Calibrating an Efficient Straw Chamber Natasha Arvanitis, Laura Napierkowski, Brendan Casey, Mandy Rominski, Geoffrey Savage
B-110	C37	The Effect of Silver Ion on Sewage Treatment Bacteria Jordan Williams, Mark Carlson, Megan Schrementi
B-116	O02	Questions in Computational Group Theory Marcelo Diop-Gonzalez, Micah Fogel
B-133	R13	An Automated Algorithm for Closed Orbit Correction Erik Luo, Charles Thangaraj
B-148	M06	Rural Electrification in the United States and Russia: Causes and Social Consequences Sarah Weitekamp, Claiborne Skinner
D-103	J03	Beginning the Process of Writing a Fantasy Novel Perry Nelson, Tracy Townsend
D-107	M04	Ethics in Legislation: The Search for the Basis of Ethics Melissa O'Brien, Kimberly Sherwin, Lee Eysturlid

8:45AM – 9:00AM (continued)

D-110	P30	The Influence of Body Mass Index on the Outcome of Patients with Acute Myelocytic Leukemia Following Chemotherapy Steven Suh, Parameswaran Venugopal
KidsInst E-115	R18	Investigation of Radiation Cool-Down Curves and Development of Tools for Their Analysis Amir Safavi, Bruce Brown
LectHall B-206	D03	The Profitability of Private Equity Glen Richardson, Darrell Williams

9:10 AM - 9:25 AM

Room	Poster ID	
A-113	P09	Comparison of Sun Protection Behavior and Tanning Habits in Adolescents Based on Age, Gender, and Skin Tone Annie Guo, June Robinson
A-115	P01	The Comparison of Motility in Parent Versus High Nitric Oxide Adapted Cells Courtney Amegashie, Eftychia Gouvas, James Radosevich
A-119	R09	Optimization of Event Selection for the Higgs Boson Sensitivity at the Collider Detector at Fermilab Benjamin Kuo, Eric James, Sergo Jindariani
A-121	F01	Heuristic Analysis in Python Programming: Creating a Chess Engine Jason Chien, Konrad Wrobel, Mark Hoemmen, Namrata Pandya, Phadmakar Patankar
A-131	Q05	Effects of Caffeine on Motor Excitability of Skeletal Muscles in the Hand and Arm as Measured by Navigated Transcranial Magnetic Stimulation Sanggyu (Raymond) Chong, Tonu Pius, Todd Parrish, Xue Wang
A-133	B08	Effect of Mechanical Forces and Cleavage Plane Orientation on Epithelial Geometry and Topology Madhav Mohandas, Jie Liang
A-147	N02	A Western Legal Shift to Incorporate Indigenous Intellectual Knowledge Diliana Dimitrova, William Mock, Christian Nokkentved
A-149	P15	The Role of Two Selective K^+ Channels (K_{ir} and K_v) Expressed in Macrophages in the Secretion of IL-1 β when Macrophages are Induced by Anthrax Toxin Jiwon Kim, Irena Levitan, Johnson Thomas
A-151	C29	Stretch-Induced Gene Regulation Alexandra Smick, Karen Ridge, Micah Rogel
A-155	G06	High-Tech Industries and the Quality of Life: An Investigation of Chinese Cities Harley Wang, Richard Stalmack
AcadPit A-138	I17	Changing a Cell's Fate: New Cures for Diseases and Illnesses Hyun Jin Song, Vitali Metlushko
B-110	C03	Comparing E-cadherin Expression in Cancer Cells with Different Degrees of Invasiveness Using Immunofluorescence Sonya Dave, Carol Gu, Megan Schrementi
B-116	I04	Engineering a Water Filter for Developing Countries: Optimizing Flow Rate with Respect to Bacterial Sterilization Dane Christianson, Jongmin Lee, Mark Carlson
B-133	R14	Determining the Optimal Silicon Photomultiplier Device to Measure High Energy Particle Collisions Tuopu Ma, Jacob Anderson, Juliana Whitmore
D-103	J01	A Continuous Change of the Aspirations of IMSA Students in Writing Monica Daniels, Tracy Townsend

9:10 AM - 9:25 AM (continued)

D-107	G05	The Role of the Federal Reserve Bank During the 2007 Recession Zeno Jeong, Lee Eysturlid, Charles Steele
D-110	A04	Development of New Environment-Sensitive Fluorescent Probes Justin Lee, Sung Hwan Suh, Daesung Lee, Aditi Patil
KidsInst E-115	I19	Nanoelectrode Arrays for Energy Storage and Ultrasensitive Sensing Application Joly Wu, Ralu Divan
LectHall B-206	F08	Designing Game Design Kevin Wang, Jason Leigh

9:35 AM - 9:50	AM	
Room	Poster ID	
A-113	P10	What are the Consequences of the Loss of PAX3 Function in Melanoma? Annie Guo, Deborah Lang, Erica Littlejohn
A-115	K05	CdS/ZnS Quantum Dot-Photoexcited Glucose Oxidase Biosensor for Silver Ion Detection in Contaminated Aqueous Environments Nishith Reddy, Karl Rockne
A-117	C23	Estrogen as an Initiator of Breast Cancer Lydia Matthews, Robert Chatterton, Seema Khan
A-121	F06	A Look into How to Make the World More Efficient Through Databases Angus Nelson, Namrata Pandya, Phadmakar Patankar
A-131	B01	Determining Heat Load of Infrared Laser Radiation through Direct and Side- Firing Optical Fibers Lisa Akintilo, Megan Wu, Agnella Matic, Suhrud Rajguru, Claus-Peter Richter
A-133	B02	Exploring the Effects of Adhesion and Programmed Cell Death on Tissue Morphogenesis Ramya Babu, Jie Liang, Hammad Naveed
A-135	M02	Latin American Women in Revolution: Mexico and Nicaragua in the Twentieth Century Joscelyn Garcia, Kathryn Kadel, Eric Smith
A-147	T02	An Analysis of the Patient Protection and Affordable Care Act and its Effect on Physician Compensation and Health Insurance Companies Cevdet Dogan, Aditya Suresh, Christian Nokkentved
A-149	O05	Investigating Flat Foldability of Box Pleated Origami Models Jisoo Kim, Vincent Matsko
A-151	B10	Surface Behaviors of HT-29 Colon Cancer Cells on P-/E-Selectin and Anti- EpCAM Sydney Valero, Seungpyo Hong, Ja Myung
A-155	O07	Reading Differences Between Printed Books and E-Readers Matthew Rasmussen, Richard Stalmack
AcadPit A-138	S02	Examining Differences in Cognitive and Executive Functioning Scores in Patients with Autism Spectrum Disorders, ADHD, and Co-Occurring Autism and ADHD Jennifer Bailey, Scott Hunter
B-110	C25	The Effect of Fructo-Oligosaccharide on the Growth of <i>Bacillus coagulans</i> Under Conditions Similar to Those Found in the Digestive Tract Christine Mourafetis, Megan Schrementi
B-116	C18	Differential Effects of Histone Deacetylase Inhibitors on the Acetylation of Tubulin on Human Vascular Smooth Muscle Cell Cultures Yoo (Jenny) Kim, Jongmin Lee, Susan McCormick

9:35 AM - 9:50 AM (continued)

B-133	P23	Investigation Into Risk Factors of Heparin-Induced Thrombocytopenia Christina Momchev, Cynthia Fisch, Rada Ivanov
B-148	P07	Genetic Influences on Cellular Debris Handling in Systemic Lupus Erythematosus Nitin Chilukuri, Ajay Pius, Abhinav Reddy, Timothy Niewold
D-103	A07	Observing the Genetic Response of H358 and 1703 Adenocarcinoma Cell Lines to BMP-7 with qRT-PCR Samir Shah, Jeffrey Borgia
D-107	P29	Randomized, Prospective Comparison of Performance Using Standard Laparoscopy, Single-Incision Laparoscopy, and a Novel Bimanual Triangulating Platform Kevin Shi, Eric Hungness, B. Fernando Santos
D-110	C32	The Importance of Accelerated Cell Death 2 in the Mitochondria and Chloroplasts of <i>Arabidopsis</i> Risun Udawatta, Gopal Pattanayak
KidsInst E-115	C39	Comparative Morphology of Lepidotrichia in Pectoral Fins Among Basal Actinopterygians Karthik Yarlagadda, Neil Shubin, Natalia Taft
LectHall B-206	G02	The Gulf Oil Spill and Its Effects on the Global Economy Caitlyn Collett, Samuel Weitekamp, Robert Kiely

10:00 AM - 10:15 AM

Room	Poster ID	
A-113	B06	Polystyrene Coating of Microfluidic Devices to Reduce Absorption Nilesh Kavthekar, David Thomas Eddington
A-115	P25	The Effect of Transgenic A20 on Inflammation of the Intestinal Epithelium Nishith Reddy, David Boone
A-117	S05	Awareness of Being Stared at: Investigations into the Possibility of a Sixth Sense Carly Houdek, Elaina Zintl, David Evenson
A-119	R20	Using GALFIT and Lenstool to Analyze Gravitational Lenses Gary Wang, Sahar Allam, Huan Lin
A-121	F07	Three-Dimensional Landscape Generation and Erosion Simulation with Java Gregary Pergrossi, Zachary Pergrossi, Namrata Pandya, Phadmakar Patankar
A-133	C02	The Function of Sox5 in the Neural Crest Kamila Bond, Carole LaBonne, Kara Nordin
A-135	Q03	Isolation of Cholinesterases from Plaques and Tangles in Alzheimer's Disease Christina Cheng, Katherine Gasho, Changiz Geula
A-147	H05	Comparing the Learning Styles of Gifted Monolingual and Bilingual Students Francis Cocjin, Christian Nokkentved, Purva Rushi
A-149	O01	Investigations in Open Symmetric Pentomino Problems Shiladitya Bhattacharyya, James Quigley, Oscar To, Vincent Matsko
A-151	C34	Identifying the Isoforms of Adenylyl Cyclase in Alveolar Epithelial Cells of <i>Rattus norvegicus</i> and <i>Homo sapiens</i> by Polymerase Chain Reaction Sonam Vyas, Emilia Lecuona, Humberto Trejo, Christine Vohwinkel
AcadPit A-138	H09	Why are Hispanics Underrepresented in College? Carlos Gomez, Christopher Macias, Jose Palos
B-108	H08	The Dropout Dilemma: Investigating Student Retention at the Illinois Mathematics and Science Academy Dominic Gentile, Matthew Gietl, Donald Dosch, Barbara Miller

10:00 AM - 10:15 AM (continued)

B-110	C04	The Effects of Hypoxia on Human Dermal Fibroblasts Xin (Danny) Ding, Megan Schrementi
B-133	C24	The Effect of Ranolazine on T-Tubule Organization, Heart Disease, and Excitation-Contraction Reactions Thitipong Mongkolrattanothai, Mahendra Reddy, James Kelly, Amanda Nahhas, Matthew O'Toole, Andrew Wasserstrom
B-148	C27	Role of Phosphoinositide 3'-Kinase C2β in Intersectin-Mediated Signaling in Neuroblastoma Irina Pushel, John O'Bryan
D-107	I16	Exploring Field Programmable Gate Array Time to Digital Converters in High Energy Physics Yanchen Shi, Douglas Zhu, Jin Wu
KidsInst E-115	P26	Computerized Quantification of Pleural Effusion Ashley Ro, Nikita Veera, Samuel Armato
LectHall B-206	I20	A Football Design to Enforce a Quick Release by a Quarterback Baihan Yang, Matthew Spenko

10:25 AM - 10:40 AM

Room	Poster ID	
A-113	F04	A Statistical Model for Analyzing Triphenyltetrazolium Chloride-Stained Myocardial Infarcts
		Nilesh Kavthekar, Ted Li, Joseph Wang, Shu Q. Liu
A-115	V01	A Comparison of Islam and Christianity: Religion's Institutions Kristopher Fernandez, Robert Kiely
A-117	T06	Assessing Math Performance of Multilingual IMSA Sophomores Sarah Malik, David Evenson, Christopher Kolar
A-119	R03	Modeling the Strong Gravitational Lensing System, Clone, Using Data from the Hubble Space Telescope Amber Betzold, Huan Lin
A-121	F02	The Digital Detriment: Aspects of Computer Illiteracy Samuel Haile, Namrata Pandya
A-131	Q11	Continuous Positive Airway Pressure: A Study in the Change of Body Mass Index in Obstructive Sleep Apnea Syndrome Patients Harsha Jujjavarapu, Sarah Zallek
A-135	H01	Multisensory Versus One-Modality Instruction in Bilingual Education with a Focus on Elementary-Aged Spanish Speakers Sonia Bajaj, Cherie Esposito, Jose Palos, Manuel Perez, Aracelys Rios
A-147	R01	Searching for a High Mass Standard Model Higgs Boson in 6.3 fb ⁻¹ of Data at the D0 Detector Alexander Abbinante, Wesley Bradley, Ryuji Yamada
A-149	P05	Evaluating Computerized Tomography Scans Ordered from the Emergency Room for Suspected Pulmonary Embolism Ajay Chatrath, Arun Jagannathan
A-155	C06	Effects of Modified Murine Runx2 Expression on Embryonic Osteogenesis Xiangyun (Johnny) Duan, Ming Ding, Qiping Zheng
B-108	C01	The Expression of Ecotropic Virus Integration Site-1 in Seven Cancer Cell Lines Wendy Bindeman, Donald Dosch

10:25 AM - 10:40 AM (continued)

B-110	P11	All About Influenza Jacob Henry, Megan Schrementi
B-116	P02	A Comparison of Zantac and Prevacid in the Treatment of Gastroesophageal Reflux in Premature Infants Diagnosed with Bronchopulmonary Dysplasia Omotayo Balogun, Kari Tyler, Maliha Shareef
B-148	P06	Type 2 Diabetes Risk Factors at IMSA James Chen, Sowmya Anjur, Rebecca Lipton
D-103	R07	Transfer Line Design from the Recycler Ring to the P150 Line for the Mu2e- Project at Fermi National Accelerator Laboratory Shantanu Jain, Meiqin Xiao
D-107	O08	Stable Expansions of the Integers Rose Sloan, David Marker
D-110	S09	How Stress Affects Sleep in Elderly People with Cardiovascular Risk Factors Patricia Walchessen, Kathryn Reid
KidsInst E-115	A08	Optimization of Sensing Efficacy for Protein Detection Stanley Yuan, Vivian Zhang, Liaohai Leo Chen
LectHall B-206	H11	The Effects of Inquiry-Based Pedagogy on Third Grade Students and Their Ability to Learn Higher Level Physics Concepts Alan Shramuk, Tracy Miller

10:50 AM - 11:05 AM

Room	Poster ID	
A-113	P12	The Role of SRC Family Kinases in SDF-1/CXCR4-Mediated Progenitor Cell Homing Ingrid Hsiung, Pranusha Pinna, Gangjian Qin
A-115	M05	"O Jesus, Through the Immaculate Heart of Mary" Versus "What up, J.C.?": Protestantism from Reformation to Modern Day Jeannine Schulz, Robert Kiely
A-117	O09	The Leader Mentality: The Importance of Scoring First in a Major League Baseball Game Michael Teng, Kevin Zhao, Christopher Kolar
A-119	C08	Expression of Recombinant Malarial Parasite <i>Plasmodium falciparum</i> Acetyl-CoA Carboxylase in a Yeast-Based Screening System and Photometric Assays Lucija Filipac, Piotr Gornicki, Robert Haselkorn
A-131	Q12	Effect of Neurotoxin MPP+ on Additional Nigral Dopaminergic Neuron Loss in the MPTP Mouse Model of Parkinson's Disease Harsha Jujjavarapu, Paul Carvey
A-133	E03	Effects of Molecular and Macroscopic Surface Modification on Wetting Pan Luo, Gaby Avila-Bront, Steve Sibener
A-135	P16	Factors Influencing Successful Weaning from Caffeine in Premature Infants Born before Thirty-four Weeks of Gestation Treated for Apnea Ifreke King, Patricia Hummel, Christine Sajous
A-147	P04	An Investigation of Periodontal Diseases Seth Butcher, Dean Lodding
A-149	I03	The Physical and Thermodynamic Properties of Ni ₂ TiIn Wen Min Chen, Song Chen, Yoonsung Chung, Susan Meschel, Philip Nash
A-151	C28	Examining the Functionality of DNA Methyltransferase Protein DNMT3B in Myc- Driven Cancers in Mice Mahi Singh, Lucy Godley, Janet Lepore, Aparna Vasanthakumar

10:50 AM - 11:05 AM (continued)

A-155	B04	An Ideal Inbred Line of Maize Useful for Producing Transgenic Maize via Micro Projectile-Mediated Gene Transfer Using Meristemic Tissue Sharon Duval, Eric Johnson
AcadPit A-138	K01	International Collaborative Effort for the Creation of Renewable Energy Applications and Methodologies: Efficient Wind Power Production Michael Atten, Rafael Gonzalez, Cai O'Connell, Glenn "Max" McGee, Aracelys Rios
B-108	C17	Cell Starvation in Prokaryotic and Eukaryotic Cells and the Initiation of Apoptosis in Eukaryotes Lakshmi Katta, Rhyston Mays, Donald Dosch
B-110	C14	DNA Sequencing Protocol Eaton Guo, Jamie Tweedle
B-116	Q15	Characterization of HuR Overexpression in a Post-Ischemic Penumbra Vignessh Kumar, Agnieszka Ardelt, Randall Carpenter
B-133	C33	Role of TLR4 in Profibrotic TGF-ß Signal Transduction in Fibrosis Sumana Vardhan, Swati Bhattacharyya, John Varga
B-148	A01	The Effect of Heat Shock Protein 27 on Actin Cytoskeleton Remodulation Vidya Anjur, Jody Martin, Margaret McShane
D-103	F03	Inquiry into the Applications of Computing, Web Access, and Mobile Device Integration in the Automotive Environment Shantanu Jain, James Gerry
D-110	C36	The Effect of Smallpox Vaccine-Elicited CD4+CD25+Foxp3+ T_{reg} Cells Expansion and Massive Accumulation in Infected Tissues and T_{reg} Cell's Role in Immune Homeostasis Against Tissues Destruction Xun Ming (Jenny) Wang, Wei Chen
LectHall B-206	H06	The Importance of English as a Second Language Programs and the Factors That Affect Their Success Katia Colin, Chibuzo Obasi, Paula Altekruse, Rosemary Gabriel

11:15 AM - 11:30 AM

A-113 S01 Correlation of Print Advertisements, Self-Concept, and Body Image in Ad	olescent
Girls Uchenna Agwuncha, Deborah McGrath	
A-117 S07 Features of Effective Support Programs for Pediatric Multiple Sclerosis Brittany Kwamin, Whitney Kwamin, Christopher Kolar	
A-119 Q04 Using Hippocampal Morphometry to Detect Alzheimer's Disease Patholog Primary Progressive Aphasia Patients Ashley Chong, Emily Rogalski, Lei Wang	gy in
A-121 Q13 The Role of MAN2A2 Expression in Glioma Proliferation and Invasivity Timothy Klincewicz, Areen Pitaktong, Roger Kroes	
A-131 Q08 Effect of 1-methyl-4-phenylpyridnium on Dopamine Neuron Loss in LPS Model of Parkinson's Disease Brinda Gupta, Paul Carvey, Bill Hendey	Mouse
A-133 R17 Operating Voltage of the Silicon Detectors in the Collider Detector at Ferr Jorge Quero, John Freeman, Michelle Stancari	nilab
A-135 R06 Energy Calibration of Electron Antineutrino Using Boron-12 Beta Decays Holly Hernandez, Michelangelo D'Agostino, Maury Goodman	
A-149 Q20 Gender Differences of Neural Correlates Supporting Empathy in Schizoph Nicole Runkle, Matthew Smith	nrenia

11:15 AM - 11:30 AM (continued)

A-151	C22	Auditory, Olfactory, and Pheromone Sensing in TRPML3 Deficient Mice Janani Mandayam Comar, Sai Parepally, Andrew Castiglioni, Jaime Garcia-Añoveros, Natalie Remis
A-155	C07	The Mediation of Tumor Necrosis Factor by the Tight Junction Protein Occludin Christine Engbretson, Christopher Weber
AcadPit A-138	K02	International Collaborative Effort for the Creation of Renewable Energy Applications and Methodologies: <i>Miscanthus</i> Butanol Conversion Mitchell Bieniek, Garrett Flack, Glenn "Max" McGee, Aracelys Rios
B-108	C38	The Effects of Epigallocatechin-3-gallate on the Apoptosis of HT-29 Colorectal Cancer Cells Diana Xu, Donald Dosch
B-116	C10	The Effect of a High Fat Diet on Leukotriene B4 Levels in Pancreatic Lesions in Genetically Altered Mice Nicholas Fung, Kevin Adrian, Paul Grippo
B-133	C05	The Effect of 2-Cyano-3,12-Dioxooleana-1,9(11)-Dien-28-Oic Acid (CDDO) on Transforming Growth Factor-ß Induced Epithelial-Mesenchymal Transition in A549 Lung Epithelial Cells Sruthi Doniparthi, John Varga, Jun Wei
B-148	C11	The Scientific Basis of Disease in Media: Werewolves, Vampires, and Zombies Mukesh Gande, Kyle Glasper, Sowmya Anjur
D-103	F05	Fooling the Hacker: A Study of Honeypots Derrick Miller, James Gerry
D-107	T05	Sharing Needles: The Implementation of a Syringe Exchange Program in Chicago Rahul Maheshwari, James Victory
D-110	E04	A Greener Catalyst for Biodiesel Synthesis Elizabeth Ott, Justin Notestein
LectHall B-206	P21	Neonatal Diabetes due to Mutations in the KCNJ11 Gene Daniel Matthews, Siri Atma Greeley

12:30 PM - 12:45 PM

Room	Poster ID	
A-117	H04	A Study Aimed at Enhancing Students' Understanding of Newton's Three Laws Grace Choi, Linda Brazdil
A-131	Q07	Using Resting State Functional Connectivity as a Biomarker to Access the Treatment Effects in Chronic Stroke Patients Justin Feng, Todd Parrish, Xue Wang
A-147	B03	Design of Genetic Sequences Encoding a Matrix Metalloproteinase-2-Degradable Synthetic Recombinant Protein Yiyun Cao, Jason Buhrman, Richard Gemeinhart, Mary Tang
A-151	G01	Cost-Benefit Analysis and Evaluation of Leadership in Energy and Environmental Design Certification Paul Cladek, Stephen Berry, Theodore Steck
B-108	P03	Ampicillin Resistance in <i>Escherichia coli</i> : Adaptation or Mutation? Madeline Booton, Donald Dosch
B-116	R10	Tracking the Construction and Performance of the NOvA Detector John Lee, Jonathan Paley
KidsInst E-115	T03	IMSA, Parents, Expectations: Illinois Massive Stress Academy Stressing Out Over Nothing Jonathan Henricks, Thomas Lightfoot, Tracy Rogers

12:30 PM - 12:45 PM (continued)

LectHall	P19	Mutations in the Insulin Gene as a Cause of Monogenic Diabetes
B-206		Sarah Lisk, Siri Atma Greeley

12:55 PM - 1:10 PM

Room	Poster ID	
A-113	B11	Virtual Representation of the Human Central Nervous System Candice Yi, Andreas Linninger
A-115	H10	Student Inquiry and Research at IMSA Chicago Victoria Lo, Michelle Kolar
A-119	Q10	The Effects of Late Life Depression on Executive Function in the Clock Drawing Test Irene Jiang, Melissa Lamar
A-121	P27	Do Widened Pulse Pressures in Premature Infants Signify a Patent Ductus Arteriosus? Yasmeni Sandridge, Jonathan Muraskas, Cristina Vega
A-133	I01	Comparison of Dreiding and Universal Force Fields for Metal Organic Framework Simulation Yusuf Aktan, Matthew Tsao, Randall Snurr, Chris Wilmer
A-135	T01	Nationalism in Spain: Catalonia and the Basque Country Paul Angelillo, Ryan Jordan, Rhett Partida, Rafael Rodriguez, Samuel Simon, Jose Palos, Eric Smith
A-155	A02	The Effects of Detergent Concentration on KRAS-4B Aggregation after Farnesylation Yan-Yang Feng, Vadim Gaponenko
B-110	P14	The Effect of <i>Egr2</i> on the Cell Markers Lag3, 41BB, and CRTAM in the Anergic carEGR2 flox/flox T_H1 T-cell Clone Alex Kim, Yan Zheng
B-133	U02	Gravitational Interactions in Globular Clusters Ian Nodurft, Mark Subbarao
B-148	P24	The Effect of Therapeutic Hypothermia on Mitochondrial Akt Phosphorylation and Pim-1 Expression in Murine Hemorrhagic Shock Gina Qin, Terry Vanden Hoek
D-103	H03	The Effect of Resident Physician Education on Patient Safety Wen Li Chen, David Mayer
D-107	M01	Emotion in Journalism: Changes in Reporting Disasters and How They Affect Coverage Shelby Daniel-Wayman, James Victory
D-110	109	A Design for a More Efficient Vertical Axis Wind Turbine Peter Howes, Branson Lawrence
KidsInst E-115	C16	A Comparison of Activity Budgets and Exhibit Usage of Western Lowland Gorillas Brielle James, Debra Kutska
LectHall B-206	108	The Construction of a Model Helicopter with a Unique Set of Interlocking Blades Kenneth Harvey, Austin Kramer, Francisco Ruiz
1:20 PM – 1:35 PM

Room	Poster ID	
A-113	C40	Identifying Differences Between Normal and Cancerous Stem Cells Candice Yi, Morris Kletzel, Marie Olszewski
A-115	C21	The Role of Reactive Oxygen Species in the Regulation of MYCN in Neuroblastoma Nolan Maloney, Naohiko Ikegaki, Xao Tang
A-117	N01	Politics of Globalization: Crises, Economic Human Rights, and Inequality Jennifer Crawford, Steven Ramirez
A-119	P18	Determining the Conditions Under Which Bioavailability of a Drug Increases Samantha Levin, Robert Kimura
A-121	C30	Effect of the Expression of Histamine Receptors on Mast Cells Andrew Ta, Paul Bryce, Julie Schweinfurth
A-131	Q02	Apolipoprotein E Effects on Synapse Volume <i>in vivo</i> Upashruti Agrawal, MaryJo LaDu, Kevin Laxton, Leon Tai
A-133	S03	An In-Depth Analysis in Decision Making Based Upon the Decision Making Index Scale Kirthi Banothu, Brendan Wesp, Rebecca White
A-135	R05	Differentiating Neutrino Events Mohammed Hayat, Maury Goodman
A-147	H02	Transgender Policies in High Schools Ayse Cetinkaya, Daniel Gleason
A-149	I12	Thermodynamic and Physical Properties of Ni ₂ TiGa Byron Mui, Song Chen, Yoonsung Chung, Susan Meschel, Philip Nash
A-151	Q06	The Effects of Menstrual Cycle Phase on Memory in Naturally Cycling Women Julianne Crawford, Pauline Maki, Antonia Savarese, Mary Winters
A-155	C09	The Effect of microRNA-200 on Prostate Cancer Hana Fouladi, James Rea, Olga Volpert
AcadPit A-138	S04	Predicting the Mind of a Serial Murderer: The Success of Criminal Profiling in the Case of the Green River Killer Jessica Grady, Michelle Jardine, James Bondi, Steven Bongardt
B-108	C13	Pro-Inflammatory Regulatory T-cell Expression of a Foxp3 Splice Variant Webster Guan, Khashayarsha Khazaie
B-110	A03	Cytoprotective Effects of Nitric Oxide Krishna Kudaravalli, Sumit Sahni, Douglas Thomas
B-116	E02	Density Functional Theory Study of the Influence of VOx Promotion on the Mechanism of Alcohol Synthesis on Rhodium Catalysts Mingyang (Jennifer) Li, Randall Meyer
B-133	R15	Measuring Time Calibrations in Waveform Digitizing for Practical Positron Emission Tomography Applications Eric Ordonez, Chien Kao
B-148	Q21	Mouse Models in the Genomic Age Shannon Tai, Kelly Yom, Kay Grennan, Chun-Yu Liu
D-103	L01	Using Film as a Medium to Create a Documentary About Academic Integrity at IMSA Megan Czajka, Connor Tomasko, Adam Kotlarczyk, Spencer Parsons
D-107	P08	Chest Computerized Tomography Imaging Findings in Patients With Localized Sarcoma Samantha Donermeyer, James Nachman
D-110	K04	Lighting of the Future: An Investigation of Light-Emitting Diode Efficiency Neel Patel, Seth Zelman, Branson Lawrence

1:20 PM - 1:35 PM (continued)

KidsInst E01	The Healthiest Drink: Determining Antioxidant Content of Beverages
E-115	Matthew Kleinjan, Anita White
LectHall O04	Flipping the Winner of a Poset Game
B-206	Adam Kalinich, Lance Fortnow

1:45 PM - 2:00 PM

Room	Poster ID	
A-113	Q18	Degradation and TRIP8b Maintenance of HCN1 and HCN2 Channels Pujan Patel, Dane Chetkovich
A-115	D02	How Power and Status Influence Reactions to Breaches of Trust Jay Patel, Vivek Thakkar, Nathan Yan, Keith Murnighan, Hetal Patel
A-117	N03	Mass Incarceration and Its Effects in Society Haley Ramirez, James Carey
A-119	D01	The Correlation Between Start-Up Fund, Product Type, and Monetary Success in Small Businesses Naomi Liu, Si Si, David Winkin
A-121	N04	Mandatory Death Penalty in Africa Vamika Venkatesan, Sandra Babcock, Brook Miscoski
A-131	R04	The Accuracy of Galaxy Cluster Mass Estimates Based on Weak Gravitational Lensing Techniques Stephanie Cheng, James Annis
A-133	C31	Investigating Inducible Resistance Observed in <i>Pseudomonas aeruginosa</i> Strains from Cystic Fibrosis Patients Aaditya Tolappa, Bill Kabat
A-135	O03	On the Coloring of Graph Products Derek Hardin, Hemanshu Kaul
A-147	I10	Understanding the Formation of Toroidal-Spiral Particle Aditya Karan, Ying Liu
A-149	O06	An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Z_n Corinne Madsen, Noah Prince
A-151	R19	The Comparison of the Different Radiotherapy Neutron Sources in Various Facilities for the Optimal Result in Neutron Therapy Michelle Suh, Thomas Kroc
A-155	C12	Characterization of Genetic Pathways Leading to Therapy-Related Acute Myeloid Leukemia with Abnormalities of Chromosome Five Andrew Go, Michelle LeBeau, Angela Stoddart
AcadPit A-138	R08	Modeling Quench Propagation in a System of Interconnected Superconducting Coils Emil Khabiboulline, Iouri Terechkine
B-108	C19	The Role of Dendritic Cells in the Development of Pro-Inflammatory T-Regulatory Cells in Colorectal Cancer Hannah Koo, Khashayarsha Khazaie
B-110	P17	Defining a Minimal Peptide Within HSP70 Required for Immune Activation Previn Kumar, Jared Klarquist, Caroline Le Poole, Jeffrey Mosenson
B-116	Q16	Dopamine Regulation of Phosphorylation of Cone-Cone Gap Junctions in Ground Squirrel Retina Xiaoyu Li, Steven DeVries
B-133	P13	Calculating the Detection Efficiency of Positron Emission Tomography Systems Vijay Jayaram, Thomas Reith, Chien Kao

1:45 PM - 2:00 PM (continued)

B-148	I18	How the Ratios of Plastic Acrylic Balls in a Plastic Ball Phantom Affect the Consistency of the Phantom Michael White, Beverly Lau, Robert Nishikawa
D-103	C15	The Effects of Sanitizers on the Survival of Stressed Salmonella enteritidis on Shelled Eggs Dorcas Huang, Jill Vogan, Wei Zhang
D-107	Q09	The Relationship Between Effect-Site Concentration of Propofol and Burst Suppression of the Electroencephalogram in Patients Undergoing Cerebrovascular Procedures Janell Herrera, Jessica Ventenilla, Mehmet Ozcan, Guy Weinberg
D-110	K06	Designing a Building for the IMSA Energy Center that Runs on Only Solar and Wind Energy Vanya Yorgova, Branson Lawrence
KidsInst E-115	t I02	The Design Process of a Roller Coaster Justin Booth, Brendan Mathias, Brooke Schmidt
LectHal B-206	1 G04	Growth of the Chinese Futures Markets Joseph Hecker, Doug Adams

2:10 PM - 2:25 PM

Room	Poster ID	
A-113	Q19	Identification of Clathrin and Adapter Protein Interacting TRIP8b Splices Pujan Patel, Dane Chetkovich, Ye Han
A-115	H07	Applying Teaching Models to a Science Curriculum for Elementary School Students in IMSA's Kids Institute Eleanor Cory, Allyson Milenkovic, Julie Dowling
A-117	C20	MMS21 Reduction in HCT116 Cancer Cells Results in Hypersensitivity to Camptothecin Jacob Lahr, Amanda Sul, Connie Wang, Nathan Ellis, Alex Kwako
A-119	I11	Optimizing the Conditions of Atomic Layer Deposition of Hafnium Oxide, HfO ₂ Samir Mishra, Shobhit Roy, Christos Takoudis, Runshen Xu
A-121	C35	Variations in Characteristics of <i>Ginkgo biloba</i> Leaf Litter and Implications Kelly Wallin, Kevin Boyce
A-131	I06	Networks of Ultrasmall Pd/Cr Bilayer Nanowires: A New Type of High Performance Hydrogen Sensors Henry Deng, Zhili Xiao
A-133	P28	Characterization of Methicillin-Resistant Staphylococcus aureus Clinical Isolates in Infants Within the First Thirty Days of Life Mehal Shah, Divya Tankasala, Bill Kabat
A-135	B05	Genetic Testing Ontology Construction Eric Huang, Simon Lin
A-147	B07	Development and Evaluation of a Prosthetic Ankle that Mechanically Adapts to Sloped Surfaces Samuel Kwak, Stefania Fatone
A-149	Q17	Mapping Verbal Memory Through Electrocorticographic Readings of Subdural Electrodes Egle Malinauskaite, Paul Yuan, Vernon Leo Towle
A-151	I05	Far Horizons Near Space Balloons: Creating a Cut-Down System Logan Damiani, Nathan Geldner, Geza Gyuk, Ken Walczak
A-155	I07	Alternative Auscultation: The Audible Human Project Saarthak Gupta, Thomas Royston

2:10 PM - 2:25 PM (continued)

AcadPit A-138	R11	Optimizing Nanometer-Scale Features Kiwook Lee, David Czaplewski
B-108	S06	The Effect of Parental Input on the Language and Reading Development of Children During Preschool Ethan Jacobs, Ozlem Ece Demir
B-110	P22	GD3 Synthase Vaccines as a Treatment for Melanoma Hannah Miller, Jared Klarquist, Caroline Le Poole
B-116	R12	Dynamics of Two-Dimensional Granular Gases Peter Lu, Justin Burton, Sidney Nagel
B-133	R16	Calibration of Dark Energy Camera Charge-Coupled Device Images in the Dark Energy Survey Filter System Using Astronomical Standard Stars Deokgeun Park, Tom Diehl, Douglas Tucker
B-148	A06	Effect of Syndecan-1 and Syndecan-2 on Herpes Simplex Virus-1 Cell-Cell Fusion Sarah Salameh, Urmi Sheth, Deepak Shukla
D-103	I13	Roller Coasters: Pushing Human Limits Jonathan Munoz, Samuel Smith, Eric Hawker
D-107	S08	d-Amphetamine: Effects on Mood and Speech Paloma Ocola, Harriet de Wit, Margaret Wardle
D-110	I14	Designing a Mixed-Use Facility on a Four Acre Plot of Land Benjamin Richardson, Steven Vasilion
KidsInst E-115	I15	Architecting a Chicago-Based Environmentally Friendly Triplex Madison Rogers, Jesse McGrath, Clay Sewell
LectHall B-206	S10	An Exploration into Artificial Intelligence, the Human Mind, and Systems Andrew Wentzel, Mike Ososky

A01 The Effect of Heat Shock Protein 27 on Actin Cytoskeleton Remodulation

Presenter(s)

Vidya Anjur, Illinois Mathematics and Science Academy

Advisor(s)

Jody Martin, Loyola University Margaret McShane, Loyola University

The role played by heat shock protein 27 (Hsp27) in regulating apoptosis and necrosis in muscle has led to further research on the mechanism by which expression of Hsp27 increases cell resistance to oxidative stress. This project examines the cytoskeletal components of cells after they have undergone stress, and the effects of Hsp27 upon them. Using an actin cytoskeleton *in-vivo* assay kit, ratios of G- and F-actin were examined in smooth muscle cells that either have undergone stress or have not. These ratios will illustrate the integrity of the actin cytoskeleton within cells. Treatments of hydrogen peroxide, an oxidative stress inducer, and various inhibitors, which prevent the phosphorylation of Hsp27, were administered to plates of muscle cells. Trials were conducted for different time periods to determine the change in actin ratios over time. Gel electrophoresis, immunodetection, and NIH image quantification software were used to analyze the actin and Hsp27 in each condition. After data were analyzed, it was found that oxidative stress treatments had a greater amount of F actin, but in treatments that had been pretreated with inhibitor, there was a higher amount of G actin. This work provides more information on the structural integrity of muscle cells and the mechanisms that prevent cell damage.

A02

The Effects of Detergent Concentration on KRAS-4B Aggregation after Farnesylation

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

Advisor(s)

Vadim Gaponenko, University of Illinois at Chicago

The post-translational modification of the C-terminus hypervariable region of KRAS-4B is important in the function of this GTPase as an oncogenic protein, but currently, there are no efficient modes of preparing complete, post-translationally modified KRAS-4B for biochemical and biophysical studies. The purpose of this experiment was to explore one mode of preparing fully-modified versions of this protein, so it can be more easily acquired for further investigation. To mimic the post-translationally modified region hypothesized to be most responsible for KRAS-4B's oncogenic behavior. We used spectrophotometry to evaluate the protein's aggregation behavior after the addition of the farnesyl-cysteine residues, and compared the absorbance plots of samples containing different concentrations of detergent. It was seen that more dilute concentrations of detergent caused the protein aggregation to start later and to progress at a slower rate. Total aggregation was also diminished as detergent concentrations were diluted. These results show that varying detergent concentrations may lead us to a more efficient mode of preparing KRAS-4B. However, further investigation should be done to evaluate the precise concentrations for optimizing the amount of usable protein.

A03 Cytoprotective Effects of Nitric Oxide

Presenter(s)

Krishna Kudaravalli, Illinois Mathematics and Science Academy

Advisor(s)

Sumit Sahni, University of Illinois at Chicago Douglas Thomas, University of Illinois at Chicago

Lipid peroxidation and DNA damage can lead to various pathophysiological conditions like cancer and neurodegenerative disorders. This can occur through the formation of strong oxidizing species such as hydroxyl radical. Free iron can be dangerous because it can increase the formation of hydroxyl radicals through its reaction with hydrogen peroxide (H_2O_2). Previous studies have shown that the free radical nitric oxide (NO) can react with cellular iron and thiols to form dinitrosyl iron complexes (DNIC), which are thought to be inert. We tested this theory by treating cells with NO using the NO-donor molecule Sper/NO followed by exposure to H_2O_2 . We then measured the formation of hydroxyl radicals using a specific dye (dihydrorhodamine 123) which reacts with hydroxyl radical. We also measured the ability of NO to protect against cell death caused by H_2O_2 treatment. We observed that pretreatment of cells with nitric oxide (200 μ M Sper/NO for 1 hour) lead to a 20% decrease in hydroxyl radical production and a 30% decrease in cell death. This study demonstrates that nitric oxide has antioxidant properties by suppressing hydrogen peroxide induced oxidative stress. These results could play a role in the understanding of diseases that are involved with oxidative stress.

A04 Development of New Environment-Sensitive Fluorescent Probes

Presenter(s)

Justin Lee, Illinois Mathematics and Science Academy Sung Hwan Suh, Illinois Mathematics and Science Academy

Advisor(s)

Daesung Lee, University of Illinois at Chicago Aditi Patil, University of Illinois at Chicago

Cell functions rely heavily on lipids. Fluorophores can be used to monitor these lipids and help researchers gain a better view of membrane mediated cellular processes. Commercially available fluorophores are currently used, but they have several limitations. In order to overcome these limitations, we have taken existing fluorophore cores and used them to synthesize our new fluorophores by altering functional groups. Our fluorophores are equipped with a group that is capable of reacting with a cystine on proteins. When the protein binds to a lipid, a change in fluorescence can be observed. To make our fluorophores, we set up a number of reactions which were monitored by using thin layer chromatography. After working up the reactions, the products were purified using column chromatography. A number of fluorophores are too big in size to fit in their receptor sites or its fluorescent intensities are too low. On the basis of the unfavorable behaviors of the fluorophores prepared so far, we are trying to further modify their structures to improve fluorescent behaviors. The limitations are not overcome, but we are continuing in our search.

A05 Molecular Cloning of HA-Ubiquitin into pGEX-4T-1 Vector

Presenter(s)

Madhav Mohandas, Illinois Mathematics and Science Academy

Advisor(s)

Richard Morimoto, Northwestern University

Ubiquitin is a regulatory protein, expressed in all eukaryotes, that serves to direct protein disposal and recycling. In this study restriction enzyme directed ligation is used to clone the gene HA-ubiquitin into the vector pGEX-4T-1. This serves as a preliminary step to observe the behavior of ubiquitin when placed in varied environments. Once the gene is successfully inserted into the vector, the resulting plasmid can be placed in bacterial cells and be used to express the desired protein. Plasmid DNA was gathered by introducing the plasmid to DH5alpha bacterial cells through transformation. Restriction digestion using Eco RI/Xho I confirmed the insertion of the ubiquitin encoding gene into the pGEX-4T-1. Sequencing the plasmid has given good results, and the majority of the base pairs are matching. At this point the plasmid can be used to express proteins in bacterial cells. Once the protein is gathered and purified, ubiquitin interaction with other proteins in the cells of different organisms can be observed. The behavior of ubiquitin in heat shock, or stressed conditions can also be studied.

A06

Effect of Syndecan-1 and Syndecan-2 on Herpes Simplex Virus-1 Cell-Cell Fusion

Presenter(s)

Sarah Salameh, Illinois Mathematics and Science Academy Urmi Sheth, Illinois Mathematics and Science Academy

Advisor(s)

Deepak Shukla, University of Illinois at Chicago

Herpes simplex virus-1 (HSV-1) utilizes cell-cell fusion to infect several cells at once. The proteoglycans syndecan-1 and syndecan-2 may help in facilitating cell-cell fusion. A cell-cell fusion assay, in which effector cells were transfected with the glycoproteins gD, gB and gH-gL and a T7 polymerase and target cells were transfected with luciferase and nectin-1, displayed cell-cell fusion through expression of luciferase. A syncytial cell assay was also used, in which the nuclei of target cells were dyed with cyan fluorescent protein and the cytosols of effector cells were dyed with red fluorescent protein, and the creation of a syncytial cell is indicated by a cell with red cytoplasm and blue nuclei. Over-expression of the syndecans on target cells increased cell-cell fusion. In general, over-expression of syndecan-1 on target cells increased cell-cell fusion the most, while over-expression of syndecan-2 on effector cells decreased cell-cell fusion the most. This information could be useful in future medicines that may make use of the syndecans' effect to slow HSV-1 spread. The cause of these results remains unknown, so future studies may focus on understanding how syndecan-1 and syndecan-2 can affect cell-cell fusion.

A07 Observing the Genetic Response of H358 and 1703 Adenocarcinoma Cell Lines to BMP-7 with qRT-PCR

Presenter(s)

Samir Shah, Illinois Mathematics and Science Academy

Advisor(s)

Jeffrey Borgia, Rush University Medical Center

Metastasis, the diffusion of cancerous cells through the body and subsequent formation of secondary tumors, is distinguished by a series of phenotypic metamorphoses that resemble the common cellular process of epithelial to mesenchymal transition (EMT) present in wound healing and embryogenesis. Bone morphogenetic protein 7 (BMP-7) is a cytokine known to counteract the EMT pathway whose activation is distinguishing of epithelial plasticity. In this study we show the effects of BMP-7 treatment on two adenocarcinoma lines: H358 which has a generally epithelial natural phenotype; and 1703 which has a naturally mesenchymal phenotype, compared to untreated controls. The cells were processed using an EDTA-based lysis buffer. RNA extracts were performed with a Qiagen RNeasy mini-kit and then reverse transcribed into cDNA after an Invitrogen DNase treatment. We visualized the genetic response of the H358 and 1703 cell lines to exposure of the BMP-7 cytokine with real-time quantitative polymerase chain reaction. In this review we investigated the genetic effects of the BMP-7 cytokine which is proposed to be a fundamental messenger within the EMT-based metastasis model. This research will lead to a better understanding of the mechanism behind cancer metastasis and because exogenous BMP-7 is known to counteract EMT *in vitro*, BMP-7 may represent a novel treatment molecule for malignant plasticities.

A08

Optimization of Sensing Efficacy for Protein Detection

Presenter(s)

Stanley Yuan, Illinois Mathematics and Science Academy Vivian Zhang, Illinois Mathematics and Science Academy

Advisor(s)

Liaohai Leo Chen, Rush University Medical Center

A target-specific micelle based biosensor is being developed. The sensor platform encapsulates dye molecules using micelles, which can be released to amplify ligand-receptor or antibody-antigen complexes in solution in a modified enzyme-linked immunosorbent assay. Single-variable modifications allow for construction of standard curves, which may be superimposed to detect the optimal conditions. These variables include pH, components of buffer mixture, and concentration of dye molecules. Micelles are obtained from a simultaneous, ongoing study, but are observed through use of an atomic force microscope to check for proper shape formulation. The expectation is that the optimized micelles will be a feasible detector for cell surface biomarker proteins in dengue and HIV viruses from human sera samples.

B01 Determining Heat Load of Infrared Laser Radiation through Direct and Side-Firing Optical Fibers

Presenter(s)

Lisa Akintilo, Illinois Mathematics and Science Academy Megan Wu, Illinois Mathematics and Science Academy

Advisor(s)

Agnella Matic, Northwestern University Suhrud Rajguru, Northwestern University Claus-Peter Richter, Northwestern University

Contemporary cochlear implants use electrical currents to stimulate neurons. Current spread in tissue makes spatially selective stimulation difficult. Infrared neural stimulation is an alternative method that may increase the number of independent channels at the implant electrode. Each laser pulse delivered to tissue deposits heat, which may cause thermal damage. The goal of our study was to determine how to minimize radiant energy and find the maximum pulse rate of a laser used in this stimulation method. Thermochromic ink was used as an indicator of temperature change. It was mixed into an agarose solution. Once gelled, it modeled cochlear tissue. The agar was irradiated through a direct and angled fiber. Videos of single-pulse and repetitive radiation using a direct fiber were captured and analyzed using a custom-written MATLAB program. Direct laser videos indicated that single-pulse radiation caused a narrow, cylindrical-shaped beam profile, while the repetitive radiation caused a wide, circular beam profile. Side-firing laser videos indicated that due to the reflective properties of air-glass-water interfaces there is additional radiation in a direction opposite the desired tissue. Our study shows that use of a side-firing fiber in a cochlear implant has potential, but its excess stimulation demonstrates a need for improvement.

B02

Exploring the Effects of Adhesion and Programmed Cell Death on Tissue Morphogenesis

Presenter(s)

Ramya Babu, Illinois Mathematics and Science Academy

Advisor(s)

Jie Liang, University of Illinois at Chicago Hammad Naveed, University of Illinois at Chicago

Apoptosis, or programmed cell death, is an important component in the development of many multicellular organisms. Cells die in response to a variety of stimuli and during apoptosis they do so in a controlled, regulated fashion. The goal in this investigation was to explore the effects of cell adhesion and apoptosis on tissue morphogenesis by incorporating it into an existing computer program that simulated the growth of *Drosophila* cell tissue. The first step was to incorporate cell-to-cell adhesion in the simulation. At this point in the study, incorporating apoptosis into the same program has been completed. Simulation runs showed clearly that cell adhesion had no effect on the geometric pattern of the cells within *Drosophila* tissue. The percentage of cells with different edge counts did not show any noticeable difference between simulations that included adhesion and those that did not. The effect of apoptosis is still being studied through simulation runs.

B03 Design of Genetic Sequences Encoding a Matrix Metalloproteinase-2-Degradable Synthetic Recombinant Protein

Presenter(s)

Yiyun Cao, Illinois Mathematics and Science Academy

Advisor(s)

Jason Buhrman, University of Illinois at Chicago Richard Gemeinhart, University of Illinois at Chicago Mary Tang, University of Illinois at Chicago

Protein-engineered biomaterials are a promising possibility for targeted drug therapy against glioblastoma multiforme, a highly invasive brain tumor that causes the overactivation of matrix-metalloproteinases (MMPs). When MMPs encounter a recombinant protein polymer scaffold consisting of repeating units of MMP cleavage sites, the scaffold will be degraded, releasing the chemotherapeutic agents contained within. In this study, the sequence for the protein polymer was generated using primer extension polymerase chain reaction (PCR), ligated into a cloning vector, and transformed into *Escherichia coli*. PCR was then performed on extracted DNA to add the desired restriction enzyme sites, after which the insert was isolated by digestion in preparation for ligation into an expression vector. Sequences consisting of up to five repeats were confirmed to have been created and prepared for restriction enzyme digestion. This result demonstrates that primer extension PCR is a viable, novel method for the expedited creation of polymer protein genes. In the future, this method will be used to generate sequences of various lengths in order to determine the optimal length for protein gelling and formation of a scaffold that may become an effective treatment for brain tumors.

B04

An Ideal Inbred Line of Maize Useful for Producing Transgenic Maize via Micro Projectile-Mediated Gene Transfer Using Meristemic Tissue

Presenter(s)

Sharon Duval, Illinois Mathematics and Science Academy

Advisor(s)

Eric Johnson, USDA-ARS

The reproductive organs of a plant cell are found in the second layer of the shoot apical meristem. A genetic transformation of meristem tissue would result in a gene transformation that would be passed down to further generations. Seeds were germinated in MS medium and placed on ML1G1 plates for callus induction. After visible callus induction occurred, the plates were transferred to ML1C2 medium. Thus far in the investigation, B104 is a strong inbred line of maize that successfully produced callus material.

B05 Genetic Testing Ontology Construction

Presenter(s)

Eric Huang, Illinois Mathematics and Science Academy

Advisor(s)

Simon Lin, Northwestern University

Genetic tests have advanced greatly in terms of availability and popularity in recent years. Several companies now offer consumers affordable tests that can link single nucleotide polymorphisms (SNPs), a type of genetic mutation, to risks for diseases, traits, and ancestry. The purpose of this study was to construct a genetic testing ontology to facilitate effective communication between parties involved in genetic testing and as a reference for researchers in the field. First, background research was conducted to understand the central concepts involved in genetic testing. A general structure for the ontology was planned through the drafting of a flowchart. The ontology, constructed using the Protégé 4 software, features concepts such as genes, diseases, SNPs, and genotypes. This ontology only serves as a framework and will be continually amended in the future to take into account new developments in the field of genetic testing. One proposed method of more efficiently constructing the ontology is to use data mining in order to gather information, instead of manually researching and inserting it into the ontology. In the future, a more complete ontology could be implemented in a search engine that allows consumers to investigate relationships between genetic testing results and their implications.

B06

Polystyrene Coating of Microfluidic Devices to Reduce Absorption

Presenter(s)

Nilesh Kavthekar, Illinois Mathematics and Science Academy

Advisor(s)

David Thomas Eddington, University of Illinois at Chicago

Polydimethylsiloxane (PDMS) is a biocompatible and moldable material frequently used for microfluidic experiments, but is also hydrophobic and porous, and thus absorbs small particles in its fluid channels. Thin film coating of PDMS with polystyrene (PS) in toluene solution was optimized to best minimize the absorption of these particles. The channels of standard dual Y-channel PDMS devices were spin coated with PS solution at variable spin speeds and PS solution concentrations. The device coatings were tested by flushing rhodamine, a fluorescent, hydrophobic dye, through the channel and quantifying penetration of the PS coat using ultraviolet imaging. The findings showed that only devices of the highest concentration tested, 5% solution, significantly reduced rhodamine absorption when compared to control devices (which lacked PS coating). It was observed that coatings of 5% PS concentration significantly reduced channel width while lower concentrations did not coat the channel completely. The spin speed of the coating did not significantly influence coating effectiveness. It was concluded that only using 5% PS solution when spin coating PDMS would provide coats effective for reducing absorption, but would still cause significant channel variation. Solutions in the range of 0.5% to 5% PS concentration should be further investigated for viable coating.

B07 Development and Evaluation of a Prosthetic Ankle that Mechanically Adapts to Sloped Surfaces

Presenter(s)

Samuel Kwak, Illinois Mathematics and Science Academy

Advisor(s)

Stefania Fatone, Northwestern University

Ankle adaptability is lost when a person with transtibial amputation uses a commercially-available prosthetic ankle, causing stress on leg joints, especially when walking on slopes. This calls for a prosthetic ankle that mimics the adaptability of a normal human ankle. A prosthetic ankle prototype that mechanically adapts to sloped surfaces, fitted on a subject with transtibial amputations, walked across level ground and a 5° ramp with his non-adapting prosthetic ankles and the prototype adaptable ankle. Skin-mounted markers were used to record the three-dimensional position of various joints. OrthoTrak and Matlab software were used to generate lower limb joint angles and moments. The subject answered two questionnaires regarding balance confidence and mobility. When using the adaptable ankle, ankle motion increased for all walking conditions, knee and hip flexion decreased when going uphill, and a greater change in set-point on sloped surfaces compared to the non-adapting prosthetic ankles. Lack of balance confidence may be due to an infrequent slipping of the clutch mechanism within the adaptable ankle that reduced performance reliability. Further verification of these results and a redesign of the ankle to address performance reliability are required.

B08

Effect of Mechanical Forces and Cleavage Plane Orientation on Epithelial Geometry and Topology

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

Advisor(s)

Jie Liang, University of Illinois at Chicago

Epithelial geometry and topology is known to be conserved among many diverse groups of organisms. The dominance of hexagons in simple epithelial sheets has been observed since the start of the twentieth century. This distribution is also thought to have functional importance in the regulation of morphogenesis and prevention of cancer formation. Several models that simulate the process of epithelial morphogenesis have been proposed in the past, which show that this distribution is a direct result of cell proliferation. These models however, are biologically unrealistic and have many constraints. Here, we propose a mechanical model that takes into account cell shape, size, and cleavage plane orientation to accurately simulate the process of cell proliferation. We are able to achieve a very high percentage of hexagons, characteristic of plant epithelia, which was previously thought to be not possible. Our model proves that cleavage plane orientation and the forces that act on a cell both have a high influence in the patterns that govern epithelium. This model stands as an improvement on previous geometric and topological models for simulating proliferating epithelia.

B09 Electric Potentials Along Proteins and Their Effects on Ion Movement

Presenter(s)

Navdeep Singh, Illinois Mathematics and Science Academy

Advisor(s)

Namrata Pandya, Illinois Mathematics and Science Academy Phadmakar Patankar, Illinois Mathematics and Science Academy

Proteins found in living organisms act on specific substrates in biologically significant ways based on amino acid sequence. The amino acids comprising a protein become charged in solutions of differing acidity, and as a result give the protein a net distribution of charge that affects the ways in which it interacts with its substrate. By analyzing the electrical field lines generated by these charges, electrostatic forces acting on nearby ions are found. Through the use of computer models, motion of these ions is predicted and compared with the location of structural motifs of any given protein. The organization of amino acid sequences and associated charges has been programmed, and three-dimensional coordinates of proteins are being determined. Through the use of charges and ions, and preliminary effects of charge on ion motion have been calculated. From this, it can be seen that the organization of charge along a protein directs an ion in solution to specific locations. Based on this principle, computer aided drug design and biochemical research can predict and analyze structures of various proteins and modify them based on electrostatic parameters.

B10

Surface Behaviors of HT-29 Colon Cancer Cells on P-/E-Selectin and Anti-EpCAM

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

Advisor(s)

Seungpyo Hong, University of Illinois at Chicago Ja Myung, University of Illinois at Chicago

Circulating tumor cells (CTCs) interact with the endothelium in blood vessels during metastasis, causing CTC extravasation via a physiological process called cell rolling. When a cell circulates in a blood vessel, its ligands on the cell surface bind with the receptors of an endothelial cell. This binding is weak and cannot hold the cell against the blood flow. Instead, the cell rolls along the blood vessel wall, making and breaking multiple interactive bonds. To identify the interaction of HT-29 colon cancer cells with endothelial cells, biomimetic surfaces were functionalized with P- and E-selectin proteins, which induce different responses in HT-29. Faster rolling velocities occur on P-selectin than on E-selectin. In comparison, HT-29 cells showed stationary binding on anti-EpCAM-immobilized surfaces because of strong bindings of cancer cell antibodies to epithelial cell adhesion molecules. An understanding of cellular responses on various adhesive proteins is the first step towards developing a CTC detection device.

B11 Virtual Representation of the Human Central Nervous System

Presenter(s)

Candice Yi, Illinois Mathematics and Science Academy

Advisor(s)

Andreas Linninger, University of Illinois at Chicago

Currently, it is difficult to predict how drugs will distribute within the human body to alleviate central nervous system (CNS) diseases. To create better predictions, a three dimensional model of the cerebrospinal fluid (CSF) space around the human spinal was created in addition to a model of the human brain. This model will be used for future simulations of drug delivery. This model was also exported into a virtual reality environment where any user can interact with the three dimensional model to better understand the complex architecture and estimate drug injection locations. This work may eventually lead towards effective treatment options for patients suffering from brain diseases using computational models. The model will help students learn about the CNS anatomy, and the virtual world will also enable users to visualize the complex flow patterns of the CSF within the CNS.

C01

The Expression of Ecotropic Virus Integration Site-1 in Seven Cancer Cell Lines

Presenter(s)

Wendy Bindeman, Illinois Mathematics and Science Academy

Advisor(s)

Donald Dosch, Illinois Mathematics and Science Academy

The ecotropic virus integration site-1 (*EVI1*) gene is a transcriptional repressor implicated in the control of cell proliferation and frequently over-expressed in cancerous cells. I investigated the expression of this gene across seven cancer cell lines of varying morphologies. The tested lines included myeloid leukemia lines Kasumi-3, U-937, MOLT-4, and CEM; breast cancer line MCF-7; colorectal cancer line HT-29; and glioblastoma line M059K. Kasumi-3 and HT-29 are documented to have high *EVI1* expression. Protein concentrations were normalized with respect to actin using SDS-polyacrylamide gel electrophoresis and Western blotting. Western blots used to test for expression of the target protein, EVI1, have shown one unidentified band present in HT-29, though no consistent differences in expression have been detected among the other lines. The expression of this protein may be below the detection threshold of this blotting system, making visualization of the protein difficult. Currently, the concentrations are being renormalized with respect to actin. Following this normalization, final EVI1 blots will be conducted.

C02 The Function of Sox5 in the Neural Crest

Presenter(s)

Kamila Bond, Illinois Mathematics and Science Academy

Advisor(s)

Carole LaBonne, Northwestern University Kara Nordin, Northwestern University

Sox5 is a gene that codes for a transcription factor that regulates the development of the neural crest, a migratory cell population which differentiates into diverse groups of important cells in vertebrates. In this experiment, a domain that allows for dimerization called the coiled-coil domain, was removed to determine the effect on the neural crest. *Xenopus laevis* embryos were injected with Sox5 mRNA lacking the coiled-coil domain and analyzed for changes in the extent of neural crest development. We found that embryos injected with Sox5 deletion construct mRNA, had a massive increase in ectopic Sox9 expression within the *Xenopus laevis* embryos. In stark contrast to this, when wild type Sox5 is injected into embryos, a reduction in Sox9 expression is visualized in *Xenopus laevis* embryos. Sox9 is a member of the SoxE family of proteins that is critical in determining chondrocyte, glial cell, and melanocyte cell populations. This data suggests that dimeric Sox5 (wild type) represses Sox9 expression whereas when the dimerization domain is deleted the repression is alleviated.

C03

Comparing E-cadherin Expression in Cancer Cells with Different Degrees of Invasiveness Using Immunofluorescence

Presenter(s)

Sonya Dave, Illinois Mathematics and Science Academy Carol Gu, Illinois Mathematics and Science Academy

Advisor(s)

Megan Schrementi, Illinois Mathematics and Science Academy

Recent studies investigating the correlation between tumor invasiveness and the expression of E-cadherin in cancer cells show conflicting results. In two studies, the glycoprotein E-cadherin, which allows cell-to-cell adhesion, was completely removed from the cell line. The first study showed that E-cadherin contributes to the inflammatory breast cancer (IBC) phenotype. The second study suggested E-cadherin loss enables the invasive phenotype of breast cancer, showing that E-cadherin is crucial in suppressing cancer progression. Our study compares the expression of E-cadherin affects cancer invasiveness. Adherent MCF-7 cells and non-adherent CEM cells were sustained using standard cell culture procedures. In immunofluorescent staining, a fluorescently marked secondary antibody binds to the primary antibody, which binds to the E-cadherin. The fluorescence emitted by the secondary antibody indicates the amount of E-cadherin present in the cells. The benefit of this research will be a more specific understanding of cancer progression. We expect that our immunofluorescence results will help determine the relationship between E-cadherin and cancer cell invasiveness.

C04 The Effects of Hypoxia on Human Dermal Fibroblasts

Presenter(s)

Xin (Danny) Ding, Illinois Mathematics and Science Academy

Advisor(s)

Megan Schrementi, Illinois Mathematics and Science Academy

Despite our world's medical advancements, some wounds do not heal without leaving behind scars. Deciphering the mechanism through which dermal fibroblasts aid in the dermis healing process will improve wound healing outcomes. The scab that forms on top of a wound functions to protect the wound from infesting pathogens as well as create a hypoxic (low oxygen levels) environment. This experiment will test the effect of hypoxia on dermal fibroblasts. Using an *in vitro* cell culture of dermal fibroblasts and performing scratch assays will imitate wound formation and as a result, wound healing. By comparing the growth and migration of dermal fibroblasts in hypoxia and normoxia, I can measure the effects of hypoxia on these cells. I expect there to be a faster migration towards and across the wound when the cells are in hypoxia compared to those in normoxia. In addition, I expect the cells in hypoxia to divide faster than the cells in normoxia. If after counting cells (cell growth) and reviewing the pictures of the wounds (cell migration), and both of these increase, then I can conclude that dermal fibroblasts work more efficiently under hypoxia, and wound healing will be more efficient under hypoxia.

C05

The Effect of 2-Cyano-3,12-Dioxooleana-1,9(11)-Dien-28-Oic Acid (CDDO) on Transforming Growth Factor-ß Induced Epithelial-Mesenchymal Transition in A549 Lung Epithelial Cells

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

Advisor(s)

John Varga, Northwestern University Jun Wei, Northwestern University

Studies have shown that transforming growth factor- β (TGF- β) mediates epithelial-mesenchymal transition (EMT), a process that causes epithelial cells to rapidly differentiate and proliferate into fibroblasts and myofibroblasts, factors of pulmonary fibrosis. By binding to its receptors, TGF- β induces Smad2/3 phosphorylation and modulates its target gene expression. A drug, 2-cyano-3,12-dioxooleana-1,9(11)-dien-28-oic acid (CDDO), shows potential for inhibiting TGF- β 's effect on fibroblast differentiation, and of interest is whether it can inhibit EMT in A549 lung epithelial cells. A549 cells were cultured in the presence and absence of TGF- β for 24 hours. The epithelial and mesenchyml markers were measured by real-time qPCR at the mRNA level and by Western blot at the protein level. After incubation, TGF- β stimulated collagen production by approximately 40-fold showing that EMT was present. Once CDDO was added, collagen expression was reduced to approximately 20-fold. When incubated for 30 minutes cells induced by TGF- β in the presence and absence of CDDO, data showed similar amounts of Smad phosphorylation, which was significantly reduced with CDDO after 24 hours. The results show that CDDO attenuates the EMT induced by TGF- β in A549 epithelial cells by blocking Smad phosphorylation.

C06 Effects of Modified Murine *Runx2* Expression on Embryonic Osteogenesis

Presenter(s)

Xiangyun (Johnny) Duan, Illinois Mathematics and Science Academy

Advisor(s)

Ming Ding, Rush University Medical Center Qiping Zheng, Rush University Medical Center

In mammals, endochondral osteogenesis is responsible for long bone formation, and is crucial to fetal skeletal development. *Runx2* plays a major regulatory role in osteoblast differentiation and bone formation, and its spatial and temporal expression is vital to proper bone formation. Transgenic and knockout mouse models provided the tools to demonstrate the effects of genetically modified *Runx2 in vivo*. Polymerase chain reaction (PCR) and gel electrophoresis indicated mouse genotype using genomic DNA extracted from the liver, enabling data to be sorted into control and mutant groups. Quantitative real-time PCR allowed measurement of mRNA levels, which represent gene expression in mutant mice and their littermate controls. Skeletal staining allowed visual examination, revealing marked differences in the number of ossification centers, and ossification magnitude. Histological examination of the uppaired Student's t-test showed significant differences in gene expression between mutant and littermate control group. The differences shown in the data are supported by histological examination of tissue samples. The conclusions drawn in this study may have applications in the study of bone disorders, such as cleidocranial dysplasia or achondroplasia.

C07

The Mediation of Tumor Necrosis Factor by the Tight Junction Protein Occludin

Presenter(s)

Christine Engbretson, Illinois Mathematics and Science Academy

Advisor(s)

Christopher Weber, University of Chicago

In epithelial cell membranes, various integral proteins form structures called tight junctions which form a barrier at the intercellular space, and moderate the flux of necessary molecules and ions through paracellular pathways. One tight junction protein, occludin, appears to be responsible for barrier modulation by tumor necrosis factor (TNF), an inflammatory cytokine that is increased in diseases, such as inflammatory bowel disease. In this study, epithelial cells were transfected with occludin siRNA to create an occludin-knockdown strain; this reduced tight junction barrier function while blocking the ability of TNF to alter the tight junction barrier. Occludin-knockdown cells were then transfected with a gene expressing siRNA-resistant occludin tagged with green fluorescent protein which was detected in post-transfected cells. Expression of occludin restored TER to control levels and restored epithelial sensitivity to TNF. Therefore, occludin appears to mediate the effect of TNF on tight junction barrier function.

C08

Expression of Recombinant Malarial Parasite *Plasmodium falciparum* Acetyl-CoA Carboxylase in a Yeast-Based Screening System and Photometric Assays

Presenter(s)

Lucija Filipac, Illinois Mathematics and Science Academy

Advisor(s)

Piotr Gornicki, University of Chicago Robert Haselkorn, University of Chicago

Mosquitoes are constantly developing resistance to commonly used drugs against the malaria parasite *Plasmodium falciparum*, creating the need for new, effective drugs that will stop the spread of this deadly disease. In particular, drugs targeting the enzyme acetyl-CoA carboxylase (ACC) necessary for parasite fatty acid synthesis in the liver stage of human infection could prevent the growth of malarial parasites. To begin in the development of such a drug, my project will accomplish the first step: expression of recombinant *Plasmodium* ACC in insect cells and yeast cells, followed up by protein purification and enzymatic assays. These vectors can then be used as models for the testing of chemical inhibitors of malaria chosen from chemical libraries. Using a synthesized gene with codons optimized for expression in insect cells and in yeast, as of yet my experiments have included cutting DNA with restriction enzymes, separating DNA fragments by gel electrophoresis, ligating DNA together, sequencing DNA construction to verify its structure, and propagating plasmids in *E. coli*. The long-term goal of this project, finding potential chemical inhibitors of *Plasmodium falciparum*, could lead to the development of new and effective drugs that will fight against malaria.

C09

The Effect of microRNA-200 on Prostate Cancer

Presenter(s)

Hana Fouladi, Illinois Mathematics and Science Academy James Rea, Illinois Mathematics and Science Academy

Advisor(s)

Olga Volpert, Northwestern University

In normal prostates, all epithelial cell growth is controlled by testosterone (androgen), which binds and activates androgen receptor (AR), a transcription factor inside the cells. In prostate cancer, cells fall into three main categories: androgen-inducible, androgen-independent, and androgen-repressible. Most therapies available target androgen-inducible cells. These treatments interfere with the making of testosterone or its activity inside the cells. Although a large portion of the tumor cells die after therapy, androgen-repressible cells remain and thrive. While we were working in the Volpert lab, the AR anticancer action was for the first time linked with cellular senescence, which is a special type of cell death. We identified the molecules turned on by AR, and causing the senescence, as small non-coding RNA, called microRNA (miRNA). One of the main miRNA induced by AR is miR-200. When introduced in the prostate cancer cells, called PC-3, that have no AR, it caused senescence. We have generated another prostate cancer cell line, LNCaP, where we knocked down AR using genetically engineered, safe viral particles. Now we will introduce miR-200 in these cells. If they die by senescence, it means that miR-200 could be used for the treatment of prostate cancers that are resistant to other therapies.

C10 The Effect of a High Fat Diet on Leukotriene B4 Levels in Pancreatic Lesions in Genetically Altered Mice

Presenter(s)

Nicholas Fung, Illinois Mathematics and Science Academy

Advisor(s)

Kevin Adrian, Northwestern University Paul Grippo, Northwestern University

Leukotriene B4 (LTB4), a product of arachidonic acid (an omega-6 fatty acid) metabolism employing 5lipoxygenase (5-Lox), is a commonly found leukotriene within the pancreas, often associated with inflammation and the propagation of cancer cells. Past studies have found high levels of LTB4 in cancer cells and that absence of LTB4 in cultured cells induced apoptosis. In pursuit of further understanding of LTB4's role in carcinogenesis, genetically altered mice with induced pancreatic precancer lesions were fed diets high in omega-3 and omega-6 fatty acids for 12 and 16 months. We hypothesized that the mice that were exposed to an omega-6 diet would have higher serum levels of LTB4 than mice administered omega-3 enriched diets. Using an enzyme-linked immunosorbent assay, we calculated the amount of LTB4 levels within the mice. In the 12 month FVB6 mice, we observed lower levels of LTB4 in mice given omega-3 than those given the control and omega-6 diets. However, this effect was not observed in El-Kras mice, as the levels were similar throughout all three groups. This seems to suggest that expression of mutant Kras confers resistance to the effects of omega-3 fatty acids on LTB4 levels, which is a direction of a future study.

C11

The Scientific Basis of Disease in Media: Werewolves, Vampires, and Zombies

Presenter(s)

Mukesh Gande, Illinois Mathematics and Science Academy Kyle Glasper, Illinois Mathematics and Science Academy

Advisor(s)

Sowmya Anjur, Illinois Mathematics and Science Academy

Throughout history, there are examples of myths involving terrifying creatures, based on the strange symptoms of diseases that the people of the time were unable to offer explanations about. A careful examination of these myths shows that there is some truth behind the legends, and indeed a scientific basis for the formerly inexplicable diseases. In this study we investigated the connection between the portrayal of vampires, werewolves and zombies to their corresponding diseases through an analysis of peer-reviewed articles, movies and historical evidence. Through our research, we found that there was not much of a connection between werewolves and hypertrichosis which only matched the physical, but not the mental description of a werewolf. As for vampires and the porphyria diseases, there's some truth in the history behind vampires but there is not a significant amount of evidence. In recent history, the symptoms of porphyria have appeared in media, such as photosensitivity, but there are no documented occurrences before the twentieth century. Zombies have a distinct connection to science with tetrodotoxins, which is sometimes referenced to as "zombie powder." In conclusion, connections exist between disease discovered in recent history and representation in media.

C12 Characterization of Genetic Pathways Leading to Therapy-Related Acute Myeloid Leukemia with Abnormalities of Chromosome Five

Presenter(s)

Andrew Go, Illinois Mathematics and Science Academy

Advisor(s)

Michelle LeBeau, University of Chicago Angela Stoddart, University of Chicago

Therapy-related acute myeloid leukemia (t-AML), a complication of chemotherapy used for treating cancers, is often characterized by a deletion of the long arm of chromosome 5 (5q). In order to identify genes that may cooperate with Egr1 haploinsufficiency, a gene located in the deleted segment of 5q, we conducted a retroviral mutagenesis screen, which identified a candidate gene, Evi1. Previously, we cloned retroviral integrations upstream of Evi1 in several Egr1 heterozygous (Egr1+/-) mice. We developed a polymerase chain reaction method to easily test for integration in myeloid neoplasms in more mice. Evi1 expression was elevated in 16/33 (48%) of Egr1+/- mice, but only 5/17 (29%) of Egr1 wildtype mice, due to retroviral insertions in most cases. We next wanted to determine if haploinsufficiency of Egr1 and high Evi1 levels cooperate to promote proliferation and self renewal of hematopoietic stem cells. We performed a serial replating assay and found that more colonies grew when Egr1 levels were decreased and Evi1 expression was high. In t-AML, Evi1 is likely a cooperating cancer gene, with haploinsufficient Egr1, since our *in vitro* data suggests that Evi1 expression is increased in Egr1+/- diseased mice and self-renewal of Evi1-expressing progenitors may be enhanced by haploinsufficiency of Egr1.

C13

Pro-Inflammatory Regulatory T-cell Expression of a Foxp3 Splice Variant

Presenter(s)

Webster Guan, Illinois Mathematics and Science Academy

Advisor(s)

Khashayarsha Khazaie, Northwestern University

In humans, regulatory T-cells (Tregs) express a *Foxp3* isoform, characterized by a splice excision of exon 2, a region that inhibits the expression of RORgt, a transcription factor that drives IL-17 in proinflammatory Tregs. In mice with polyps, Tregs express RORgt, and therefore we hypothesize that these Tregs have a similar splice variation of exon 2. We first verified that Tregs from polyp-bearing mice produce IL-17 while healthy Tregs do not, by transferring these cells into lymphopenic mice and following the transferred cells *in vivo*. We detected the transferred cells in the small bowel of recipient mice and found increased production of IL-17 in the *Foxp3* donor cells derived from polyp-bearing mice, whereas *Foxp3* donor cells from healthy mice failed to produce any IL-17. Second, we harvested cDNA from Tregs from polyp-bearing mice and used polymerase chain reaction to detect the presence of exon 2. We detected no exon 2 splice variant of the cDNA in the Tregs from either healthy or polyp-bearing mice by submitting the cDNA to PCR amplification of the region of interest, but quantitative PCR data is still pending. In conclusion, our data suggests that pro-inflammatory Tregs do not express the splice variant.

C14 DNA Sequencing Protocol

Presenter(s)

Eaton Guo, Illinois Mathematics and Science Academy

Advisor(s)

Jamie Tweedle, Illinois Mathematics and Science Academy

DNA sequencing is used to find the order of the nucleotide bases adenine, guanine, cytosine, and thymine in a sequence of DNA. This technique is used for many medical and research applications, such as the profiling of gene expression. Currently the investigation has been trying to develop a protocol for the DNA sequencer that students of IMSA and Illinois may use. So far experiments have been conducted using DNA isolated from different sources such as plant and human as well as different methods of extracting DNA in order to determine one procedure that will yield the most effective and successful results, as well as one that will be appropriate enough for students to follow and learn. Results at this point, however, have been inconclusive due to various problems analyzing data and getting good sequencing results. In the process, however, much has been learned much about the scientific process and working with DNA and lab work. In the near future, hopefully the investigation will yield good results on the sequences so that an effective procedure may be finalized for biology students to learn how DNA sequencing works and the processes involved.

C15

The Effects of Sanitizers on the Survival of Stressed Salmonella enteritidis on Shelled Eggs

Presenter(s)

Dorcas Huang, Illinois Mathematics and Science Academy

Advisor(s)

Jill Vogan, Illinois Institute of Technology Wei Zhang, Illinois Institute of Technology

All eggs must be sprayed with an approved sanitizer before distribution. However, recent outbreaks of illness caused by *Salmonella enteritidis* have been traced to the contamination of shelled eggs. The goal of this investigation was to examine the effects of a chlorine-based oxidative disinfectant, and a quaternary ammonium compound, on *Salmonella enteritidis* on eggshells. Eggs were inoculated with stationary phase *Salmonella enteritidis* suspended in phosphate buffered saline (PBS), and then dipped into a 200 ppm bleach sanitizer, 400 ppm bleach sanitizer, 200 ppm quaternary ammonium compound, or 400 ppm quaternary ammonium compound. Each shell was washed with PBS, and shell wash solutions were diluted and plated on xylose lysine deoxycholate agar. After incubation, the number of colony forming units on each plate was counted, and the total amount of bacteria on the egg was calculated. No significant difference was found between the two types of sanitizers. The amount of bacteria on eggs treated with 200 ppm bleach, 200 ppm quaternary ammonium, and 400 ppm quaternary ammonium decreased, however the reduction was less than expected. The results indicated that the sanitizers used were ineffective. The bacteria were also stressed prior to experimentation, which would activate the stress-induced response genes in the bacteria.

C16 A Comparison of Activity Budgets and Exhibit Usage of Western Lowland Gorillas

Presenter(s)

Brielle James, Illinois Mathematics and Science Academy

Advisor(s)

Debra Kutska, Brookfield Zoo

Western lowland gorillas (*Gorilla gorilla gorilla gorilla*) are an endangered gorilla species native to Central Africa. The wild gorillas' day consists of waking, morning feeding, resting, afternoon feeding, sleeping, and moving throughout the bush. A behavioral study of Brookfield Zoo's gorilla troop was created to analyze exhibit space usage and whether behavior varied between individuals and time of day. Individual activity budgets and exhibit usage of six gorillas were compared. Individual gorillas were observed for 45 minute sessions, using focal scan sampling with one minute increments. Specific behaviors, defined by an ethogram, were recorded along with the exhibit area being used. Data analysis showed that resting is the main activity for adults, but not juveniles. Expectantly, juveniles were also observed engaging in a larger variety of activities than adults. Females were seen self-grooming more often than males. Additionally, time of day was found to have no major effect on behavior - resting and feeding are the first and second most common activities no matter the time. The exhibit-usage paired activity budgets may provide a better understanding of gorilla behavior for keeper staff and the analysis of troop's behavior may enhance the guest experience, outlining times of day when the gorillas are most active.

C17

Cell Starvation in Prokaryotic and Eukaryotic Cells and the Initiation of Apoptosis in Eukaryotes

Presenter(s)

Lakshmi Katta, Illinois Mathematics and Science Academy Rhyston Mays, Illinois Mathematics and Science Academy

Advisor(s)

Donald Dosch, Illinois Mathematics and Science Academy

Cells require a variety of nutrients in order to sustain life. This experiment explores the effect of starvation on both eukaryotic and prokaryotic cells. *E. coli* cells were starved in solutions of M9 salts media that contained dilutions of an essential salt, disodium phosphate. In the first trial, *E. coli* cells showed a decline in growth in greater dilutions of disodium phosphate, but the media contained a precipitate that could have altered the rate of bacterial growth. The eukaryotic cells were grown in RPMI-1640 and starved by diluting the concentration of fetal calf serum. Numbers of cells after a week's growth increased roughly proportional to the fetal calf serum concentration until 15%, but the number decreased at 20% for both U-937 and CEM. Western blot analysis of U-937, CEM, and MCF-7, grown in different concentrations of FCS, are in progress to determine if apoptosis was initiated.

C18

Differential Effects of Histone Deacetylase Inhibitors on the Acetylation of Tubulin on Human Vascular Smooth Muscle Cell Cultures

Presenter(s)

Yoo (Jenny) Kim, Illinois Mathematics and Science Academy Jongmin Lee, Illinois Mathematics and Science Academy

Advisor(s)

Susan McCormick, University of Chicago

In the United States, many patients who are diagnosed with renal disease require hemodialysis, a procedure, which utilizes arterio-venous grafts. However, 60.7 percent of all arterio-venous graft results in failure. The cost for revision of these arterio-venous grafts for the United States is over 1 billion dollars per year. The majority of these graft failures are caused by stenosis with the underlying cause being intimal hyperplasia. Histone deacetylase inhibitors (HDACi) have recently been utilized to treat cancer. Research has shown that the HDACi inhibits proliferation of cancer cells. In this study, human vascular smooth muscle cells were treated with two different HDACis, MS-275 and Vorinostat. Vorinostat, a pan inhibitor, inhibits all histone deacetylases while MS-275 preferentially inhibits HDAC1. Western blot analysis showed that these drugs differentially affected the acetylation of tubulin. These results will be beneficial in determining which HDACi will be most preferable in the treatment of intimal hyperplasia.

C19

The Role of Dendritic Cells in the Development of Pro-Inflammatory T-Regulatory Cells in Colorectal Cancer

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

Advisor(s)

Khashayarsha Khazaie, Northwestern University

Studies have shown that the Tregs present in APC mice, a mouse model of polyposis, fail to control the pre-cancerous polyp formation while the dendritic cells (DC), which function to drive T cell activation and differentiation, express high levels of pro-inflammatory surface molecules. In order to establish a correlation between these two subtypes and their phenotypes in cancer, we used immunofluorescence staining and microscopy. We first harvested and created frozen sections of the small bowel of both healthy and polyposis mice and prepared serial sections using a cryostat. These slides were co-stained with combinations of antibodies, including IL-17 and FoxP3 to verify the presence of pro-inflammatory Tregs, CD11c and FoxP3 to verify the close proximity of resident DCs and Tregs, or CD11c and OX40L to verify the presence of pro-inflammatory DCs. We used TissueGnostics to systematically photograph the samples for subsequent fluorochrome analysis. Our analysis has just recently begun, and we predict our data will suggest the close proximity of pro-inflammatory dendritic cells with pro-inflammatory Tregs in polyposis. Our preliminary results suggest a higher frequency of co-localized IL-17 and FoxP3. Once investigated further, the conclusion of this study would lead to a heightened understanding of the strangely dysfunctional immune response to cancer.

C20 MMS21 Reduction in HCT116 Cancer Cells Results in Hypersensitivity to Camptothecin

Presenter(s)

Jacob Lahr, Illinois Mathematics and Science Academy Amanda Sul, Illinois Mathematics and Science Academy Connie Wang, Illinois Mathematics and Science Academy

Advisor(s)

Nathan Ellis, University of Illinois at Chicago Alex Kwako, University of Illinois at Chicago

Homologous recombination (HR) is a high fidelity mechanism used to repair double strand breaks (DSB) in DNA. The MMS21 protein is a SUMO E3 ligase protein that functions in HR. In this investigation, we used small interfering RNA to knock down MMS21 and tested the efficiency of the HR repair pathway in cancer cells. We treated HCT 116 colon cancer cells with the DNA damaging agent, camptothecin (CPT), which generates DSBs. Each concentration was plated separately and cell survival was calculated by cell colony count. The cloning efficiency at each concentration of CPT was divided by the no treatment cloning efficiency to create a standard efficiency percentage, which was comparable between the four trials. Preliminary analysis of the data suggests that MMS21 deficiency results in higher CPT-induced cell death rate. Cells with reduced MMS21 exhibited 28% less colony formation efficiency than the negative control. The lower efficiency of colony formation in cells with reduced MMS21 indicates a hypersensitivity to DSBs generated by CPT. These data suggest that MMS21 plays an important role in DSB repair. Further studies should test whether the hypersensitivity of cells with reduced MMS21 to CPT is caused by a defect in HR repair.

C21

The Role of Reactive Oxygen Species in the Regulation of MYCN 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 a childhood cancer, and amplification of the MYCN proto-oncogene is associated with the worst outcome of this disease. As *MYCN* amplification leads to its over-expression, high-level expression of MYCN is thought to cause aggressive tumor behavior. By using Western blot analysis, we have identified compounds (FCCP, OSU-03012 and salinomycin,) that destabilize MYCN protein in neuroblastoma cells. Notably, ascorbic acid, an anti-oxidant, abolishes the effect of these compounds on MYCN stability. Our recent data also suggest that a common effect of the above compounds appears to be the inhibition of mitochondrial function. It is known that inhibition of mitochondrial oxidative phosphorylation increases the production of reactive oxygen species (ROS), including superoxide, hydroxyl radical, and hydrogen peroxide. Anti-oxidants are known to quench ROS. Subsequently, we have found that forced over-expression of pVHL, an E3 ubiquitin ligase, in neuroblastoma cells results in reduction of MYCN protein levels. Together these data suggest that the effect of the above compounds on MYCN stability is mediated by ROS and that pVHL is potentially involved in MYCN degradation initiated by ROS generation. This research will enhance our understanding of the functions of MYCN and pVHL, laying groundwork for therapeutic strategies against neuroblastoma.

C22 Auditory, Olfactory, and Pheromone Sensing in TRPML3 Deficient Mice

Presenter(s)

Janani Mandayam Comar, Illinois Mathematics and Science Academy Sai Parepally, Illinois Mathematics and Science Academy

Advisor(s)

Andrew Castiglioni, Northwestern University Jaime Garcia-Añoveros, Northwestern University Natalie Remis, Northwestern University

TRPML3, a member of the transient receptor potential mucolipin subfamily, is an inwardly-rectifying Ca²⁺-permeable cation channel. A gain-of-function mutation of this gene results in the deafness and vestibular defects in the *Varitint-waddler mouse*. Consequently, it has been hypothesized that TRPML3 mediates auditory transduction. Reverse transcriptase quantitative polymerase chain reaction, immunohistochemistry, and *in situ* hybridization data confirm cochlear expression and show significant signal in the olfactory epithelium and vomeronasal organ-sensory organs responsible for auditory, olfactory, and pheromone sensing respectively. Auditory measures and behavioral tests were used to detect defects in hearing, pheromone-mediate behavior, and olfaction. We find no differences in overall behavior; however, the *Trpml3^{-/-}* mice fail to exhibit decreased latency to attack upon pheromone exposure, which is observed in *Trpml3^{+/+}* counterparts. Furthermore, we find that TRPML3 is not essential for auditory function, but hearing threshold levels suggest a subtle, frequency-independent auditory defect. Lastly, the olfactory test showed no difference between *Trpml3^{-/-}* and *Trpml3^{+/+}* mice, indicating that *Trpml3* is not essential for smell.

C23

Estrogen as an Initiator of Breast Cancer

Presenter(s)

Lydia Matthews, Illinois Mathematics and Science Academy

Advisor(s)

Robert Chatterton, Northwestern University Seema Khan, Northwestern University

Breast cancer is one of the most prevalent cancers among women in the United States. Endogenous estradiol may promote breast cancer by increasing proliferation. We hypothesize that catechol estrogen metabolites, which accumulate in the breast, are capable of bringing about errors in DNA synthesis by oxidative stress and increase in the rate of DNA synthesis. Thus, the resulting mutations may initiate breast cancer. The mRNA expression of proliferating cell nuclear antigen (PCNA) will provide a measure of the effect of the estrogens on proliferation. The relationship between estrogens and PCNA will be adjusted statistically for the potentially opposing effects of NRF-1/2, MnSOD, BTG2, and TP53. In order to investigate the expression patterns of these five genes between high and low-risk group of women, we have been extracting total RNA from random fine needle aspirate specimens from the two groups, and checking concentration and quality of eluted RNA, using the a Norgen Biotek purification lit. RNA has been significantly degraded with RNA integrity numbers less than five. By running reverse transcriptase-polymerase chain reaction assays, we will be able to determine if the DNA has been mutated, which would suggest that these metabolites create errors in the DNA and that estrogen may play a role in initiating breast cancer.

C24 The Effect of Ranolazine on T-Tubule Organization, Heart Disease, and Excitation-Contraction Reactions

Presenter(s)

Thitipong Mongkolrattanothai, Illinois Mathematics and Science Academy Mahendra Reddy, Illinois Mathematics and Science Academy

Advisor(s)

James Kelly, Northwestern University Amanda Nahhas, Northwestern University Matthew O'Toole, Northwestern University Andrew Wasserstrom, Northwestern University

The organizational index value states how close to perfectly straight and evenly spaced the T-tubules of a heart muscle cell are organized. The organizational index study was based on the hypothesis that T-tubules of a cell become less organized, and eventually disappear, as the development of heart failure occurs. The organizational index was found through analysis of cells from a confocal microscope and the software programs, ImageJ and MatLab. The data showed that an increase in the number of cells with low T-tubule organization values corresponded with the progression of heart failure. A drug called ranolazine is currently used to treat chest pain but may actually present a medical breakthrough. The effect of this drug on the heart was studied mainly through organizational index calculations and echocardiograms. Initial results suggest that ranolazine affects the development of heart failure by increasing the intensity of the late sodium ion wave in the T-tubule cell. The increased intensity wave helps the heart return to its completely relaxed state and prevents the heart from having to work harder with each excitation-contraction cycle. In rat heart, this slows the progression of heart failure and hypertrophy, an increase in cell size. The discoveries revealed by this study show that ranolazine could be the key to slowing or preventing the progression of heart failure, and therefore, could be a drug which will improve cardiovascular health in the human population.

C25

The Effect of Fructo-Oligosaccharide on the Growth of *Bacillus coagulans* Under Conditions Similar to Those Found in the Digestive Tract

Presenter(s)

Christine Mourafetis, Illinois Mathematics and Science Academy

Advisor(s)

Megan Schrementi, Illinois Mathematics and Science Academy

This study focused on the effectiveness of fructo-oligosaccharide in aiding the growth of *Bacillus coagulans*, an endospore-forming probiotic found in the human intestine. Previous research has shown that fructo-oligosaccharide significantly increases the growth of other probiotics, such as various strains of *Lactobacilli*, in environments similar to those found in the digestive tract, but research is lacking on endospore-forming probiotics. The effectiveness of fructo-oligosaccharide on *B. coagulans* was tested by cultivating the bacteria with and without fructo-oligosaccharide in solutions similar to intestinal juice and measuring the bacterial concentration. The effect of fructo-oligosaccharide on the rate of spore germination was measured by heat-treating bacterial samples with and without fructo-oligosaccharide and measuring the bacterial concentration after the spore germination. The bacterial concentrations of all samples were measured with a Spectrophotometer 20. In both experiments, there was positive correlation in bacterial growth between the samples with and without fructo-oligosaccharide. Based on the results, fructo-oligosaccharide exhibits no positive or negative effect on the growth of *B. coagulans* under conditions found in the digestive tract, or on the rate of endospore germination. Though fructo-oligosaccharide positively affects growth of non-endospore-forming probiotics, no effect was found on the growth rate of *B. coagulans*.

C26

Vimentin is Required for Non-Small Cell Lung Carcinoma Metastasis

Presenter(s)

Cassie Parks, Illinois Mathematics and Science Academy

Advisor(s)

Martha Kidd, Northwestern University Karen Ridge, Northwestern University

Vimentin, an intermediate filament that constitutes a cell's cytoskeleton, is known to be a facilitator of cell migration. Here, the role of vimentin in non-small cell lung cancer metastasis was studied in terms of migration and invasion. The Boyden Chamber Assay was used to measure the directional invasive properties of cells through a porous membrane plated with Matrigel, a synthetic basement membrane. Fetal bovine serum (10%) was used as a chemoattractant. The assay was run for 24 hours on four different cell lines: A549, vimentin-null A549, H460, and vimentin-null H460. Western blot analysis, however, showed that the total expression of vimentin protein was unchanged between the cell lines. A549 cells have assembled vimentin filaments, where H460 cells have disassembled vimentin, which was shown through immunoflourescent confocal microscopy. The rate of invasiveness was 10% in A549 cells, 0.4% in H460 cells, and 0.7% and 0.5% in vimentin-null A549 and H460 cells, respectively. These results show that vimentin, particularly assembled vimentin, is required for cancer cell invasion and migration in non-small cell lung carcinoma cells.

C27 Role of Phosphoinositide 3'-Kinase C2β in Intersectin-Mediated Signaling in Neuroblastoma

Presenter(s)

Irina Pushel, Illinois Mathematics and Science Academy

Advisor(s)

John O'Bryan, University of Illinois at Chicago

Intersectin is a protein centrally involved in the regulation of cell proliferation and survival, and has been observed to play a significant role in the AKT signaling pathway. It has likewise been shown to interact with phosphoinositide 3'-kinase class 2beta (PI3K C2 β), however the question remains of whether this is the specific PI3K involved in AKT regulation. By using shRNA to knock out PI3K C2 β -expressing genes in neuroblastoma cells, the effects of this particular PI3K and its interaction with intersectin (ITSN) can be studied in detail. Throughout the course of this investigation, knockout shRNA was designed and ordered for three different PI3K oligos, then successfully cloned into the vector pSUPER, and prepared for preliminary transfection into human embryonic 293T cells. These, together with the IMR-5 neuroblastoma cells, will be used to determine the effects of PI3K C2 β and its interaction with ITSN as well as their role in AKT signaling and cell proliferation. Experimentation will continue within these two cell lines and *in vivo* expression of proteins will be monitored, as well as *in vitro* observation on the effects of mice with a protein knocked out.

C28

Examining the Functionality of DNA Methyltransferase Protein DNMT3B in Myc-Driven Cancers in Mice

Presenter(s)

Mahi Singh, Illinois Mathematics and Science Academy

Advisor(s)

Lucy Godley, University of Chicago Janet Lepore, University of Chicago Aparna Vasanthakumar, University of Chicago

DNA methylation is the attachment of a methyl group to specific cytosines in the genome and is known to be altered in cancer cells. Dnmt3b is a DNA methyltransferase, an enzyme that adds methyl groups to DNA. It has been shown that aberrant transcription of DNMT3B is common in human cancers. When one copy of Dnmt3b was removed from the genome of an Eµ-Myc mouse (Eµ-Myc/Dnmt3b+/-), mediastinal lymphomas developed at a frequency of almost 100%. To understand the mechanism behind this result, it was important to determine if removing one copy of Dnmt3b affected the functionality of the remaining Dnmt3b allele. To determine if the remaining allele has acquired any mutations, the sequence of the intact Dnmt3b allele from the resulting tumors was analyzed. Additionally, the DNA methylation activity was tested by examining the methylation of repetitive elements. Both the sequence and repetitive element methylation analyses support the conclusion that there is no difference between the catalytic activity of Dnmt3b in the Eµ-Myc/Dnmt3b+/- and Eµ-Myc mice. This suggests that although Dnmt3b plays a significant role in cancer formation, the observed acceleration in Eµ-Myc/Dnmt3b+/- tumors is not due to a mutation or change in the function of the remaining allele of Dnmt3b.

C29 Stretch-Induced Gene Regulation

Presenter(s)

Alexandra Smick, Illinois Mathematics and Science Academy

Advisor(s)

Karen Ridge, Northwestern University Micah Rogel, Northwestern University

One of the functions of alveolar epithelial cells is to sustain cyclic stretch during normal breathing. When lungs are subject to mechanical ventilation, many of the alveolar cells are unable to withstand high volumes of stretch, leading to cell death. Certain genes may play a role in maintaining cell integrity and signaling the apoptotic pathway. This experiment aims to determine the expression of the gene vimentin after varying degrees of mechanical stretch of A549 and PASMC cells. Polymerase chain reaction was first used to determine the expression of vimentin before and after stretch. Western blots were used to determine vimentin protein concentration. The live-dead assay was used to determine cell viability during stretch. PCR results show an increase in vimentin mRNA in stretched A549 cells. Stretch increases vimentin protein expression for cytoprotective purposes. Overall, the conclusion that vimentin expression increases after stretch may play an important role in treating patients who are using mechanical ventilation systems.

C30 Effect of the Expression of Histamine Receptors on Mast Cells

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

Advisor(s)

Paul Bryce, Northwestern University Julie Schweinfurth, Northwestern University

Mast cells are immune cells that, through the release of granules containing histamine, are involved in allergic responses. Histamine mediates its effects through four receptors: histamine 1 (H1R), histamine 2 (H2R), histamine 3 (H3R), and histamine 4 receptor (H4R). Mast cells express these receptors, whose functions remain unknown. We are questioning whether autocrine feedback might alter cell development, growth, or function. Mast cells were generated from bone marrow of mice lacking specific receptors (H2R, H1R/H2R) or histamine synthesis (histidine decarboxylase). These were counted and checked for purity each week by histology (toluidine blue staining for morphology) and flow cytometry (for mast cell-specific surface markers FccRI, and c-Kit). RNA was also isolated and histamine receptor gene expression was analyzed through real-time reverse transcriptase-polymerase chain reaction. The effect of the various knockouts was compared to wild type mast cells with normal histamine receptor expression. Initial studies demonstrated that mast cells were able to develop in the absence of the histamine receptors, suggesting these were not necessary for mast cell development. However, variable numbers of mast cells were observed. Currently, further experiments on mast cells are ongoing to repeat this and to explore the effects on mast cell growth rate and function.

C31 Investigating Inducible Resistance Observed in *Pseudomonas aeruginosa* Strains from Cystic Fibrosis Patients

Presenter(s)

Aaditya Tolappa, Illinois Mathematics and Science Academy

Advisor(s)

Bill Kabat, Children's Memorial Research Center

Recent experiments suggested that resistance to certain antibiotics in *Pseudomonas aeruginosa* is linked with the over-expression of efflux pump proteins mexA, mexC, mexE, and mexX, of β -lactamase ampC, and the under-expression of porin oprD. Inducible resistance was observed in Kirby-Bauer assays inoculated with *P. aeruginosa* strains from cystic fibrosis (CF) patients, between aztreonam and three carbapenems: imipenem, ertapenem, and miropenem. DNA was extracted from fourteen experimental strains of *P. aeruginosa* from CF patients and two control strains using QIAGEN QIAamp kit. Polymerase chain reaction was conducted on three experimental and two control strains. Preliminary results revealed that one strain clearly expressed mexX, while the other two and the controls did not. Additionally, one of the controls clearly expressed mexC, while none of the others did. That control also appeared to express oprD more prevalently than the other four. Two experimental strains and one control appeared to express mexE more prominently than did the remaining two isolates. At this time, no conclusions can be drawn, as PCR procedures so far have yielded ambiguous amplified products that may have been primer dimers. If the mechanism of inducible resistance is confirmed, it may indicate resistance gene expression that may have treatment implications for CF patients.

C32

The Importance of Accelerated Cell Death 2 in the Mitochondria and Chloroplasts of Arabidopsis

Presenter(s)

Risun Udawatta, Illinois Mathematics and Science Academy

Advisor(s)

Gopal Pattanayak, University of Chicago

Programmed cell death (PCD) is a physiological cell death process involved in the selective purging of cells. PCD occurs due to extreme stress from the environment, which includes loss of nutrients, increased sunlight, and diseases. In the plant, *Arabidopsis*, accelerated cell death 2 (ACD2) modulates PCD. When ACD2 was not present, *Arabidopsis* was found to have a much shorter lifespan due to an increase of PCD, and when ACD2 was hyperactive, the plant had a much longer lifespan and little or no PCD. At a microscopic level, ACD2 localizes to the mitochondria and chloroplast. In order to find whether acd2 is more important in the mitochondria and chloroplast, two transgenic plants were created - mitochondria-targeted *Arabidopsis* and chloroplast-targeted *Arabidopsis*. Our research so far points towards acd2 being more important in chloroplasts than mitochondria. Qualitatively, more plant death can be seen in the mitochondria targeted plants.

C33 Role of TLR4 in Profibrotic TGF-ß Signal Transduction in Fibrosis

Presenter(s)

Sumana Vardhan, Illinois Mathematics and Science Academy

Advisor(s)

Swati Bhattacharyya, Northwestern University John Varga, Northwestern University

Systemic sclerosis (SSc), a potentially fatal disease of unknown cause, is characterized by fibrosis with collagenous scar tissue formation in the skin and lungs. The primary collagen-producing cells are activated by a ubiquitous cytokine transforming growth factor- β (TGF- β), showing that TGF- β plays a prominent role in the pathogenesis of SSc. Recent data also show that toll-like receptor 4 (TLR4) expression was found to be elevated in SSc patients' skin tissue. This project aims to delineate the role of TLR4 in TGF- β signaling and skin fibrosis, using real-time quantitative PCR and Western blotting. We found that TLR4 ligand lipopolysaccharide synergistically enhanced TGF- β mediated collagen protein and mRNA production, and stimulated fibroblasts differentiation to myofibroblasts, which also produce collagen. TLR4 inhibitor, CLI095, blocked collagen stimulation and myofibroblast differentiation. Moreover, TLR4 mutant mice lacking functional TLR4 produced less collagen. These results suggest the importance of the role of TLR4 in TGF- β mediated profibrotic responses. Therefore, blocking TLR4 expression or biological activity using the TLR4 inhibitor CLI095 appears to be a potential strategy to control pathological fibrogenesis.

C34

Identifying the Isoforms of Adenylyl Cyclase in Alveolar Epithelial Cells of *Rattus norvegicus* and *Homo sapiens* by Polymerase Chain Reaction

Presenter(s)

Sonam Vyas, Illinois Mathematics and Science Academy

Advisor(s)

Emilia Lecuona, Northwestern University Humberto Trejo, Northwestern University Christine Vohwinkel, Northwestern University

Lung edema is caused when too much fluid is present in the lungs. Recent research shows that the second messenger cyclic adenosine monophosphate (cAMP) can be used in the treatment of lung edema. cAMP is produced by the enzyme adenylyl cyclase (AC). We propose that by identifying which isoforms of AC are present in the lung cells, a treatment for lung edema can be developed. Human lung cells from the A549 line and rat lung cells were used. First mRNA was isolated by using an RNeasy kit. The mRNA was converted into cDNA using the enzyme reverse transcriptase. cDNA was amplified by PCR by the use of specific primers for each AC isoform. Lastly, results were analyzed by gel electrophoresis. The results show that the A549 cells expressed isoforms 1, 2, 3, 4, and 6 (version 2). The results also show that rat cells expressed isoforms 2, 6 (version 2), and 7. Other results are pending. These findings can potentially lead to a future treatment for lung-related problems such as lung edema.

C35 Variations in Characteristics of *Ginkgo biloba* Leaf Litter and Implications

Presenter(s)

Kelly Wallin, Illinois Mathematics and Science Academy

Advisor(s)

Kevin Boyce, University of Chicago

Previous research has demonstrated that variations in the height of *Ginkgo biloba* trees are translated into differences in various characteristics of their leaves. This experiment investigated the relationship between tree height and three properties of leaves: vein density, distal perimeter, and the number of vein endings. Leaves were collected from two distinct groups of trees; the first included young and small but rapidly growing trees, and the other a single ancient and stable large specimen. Shed leaves were collected from the ground in autumn, mimicking the fossil record. Analysis of the gathered data revealed that the young trees possessed larger leaves with more vein endings and a lower vein density. This suggests that the small trees have an overbuilt xylem system providing more water to each growing leaf. Furthermore, the morphologically distinct leaves of actively growing branches are much more common on the small rapidly growing trees than in the large tree. The variations in these characteristics suggest that when looking at leaf fossils of *Ginkgo* and other plants of similar habit, large and small individuals and overall vegetation type may be distinguishable with an adequate sample size.

C36

The Effect of Smallpox Vaccine-Elicited CD4+CD25+Foxp3+ T_{reg} Cells Expansion and Massive Accumulation in Infected Tissues and T_{reg} Cell's Role in Immune Homeostasis Against Tissues Destruction

Presenter(s) Xun Ming (Jenny) Wang, Northwestern University

Advisor(s)

Wei Chen, University of Illinois at Chicago

Developed and found in the thymus and peripheral lymphoid tissue, natural CD4+CD25+ Foxp3 T regulatory cells (T_{reg}) typically have the function of regulating the immune homeostasis and maintaining self tolerance. Recent studies have raised the possibility that T_{reg} cells may be manipulated, either by increasing T_{reg} numbers or enhancing their suppressive function, for treating autoimmune diseases. I helped to conduct tests such as immunofluorescent staining, one-color and two-color immunohistochemistry staining, and hematoxylin and eosin (HE) staining. Flow cytometric analysis showed that there were higher number of T_{reg} cells present in Dryvax-vaccinated (test) group than saline-vaccinated (control) group. Results from the immunofluorescence and immunohistochemistry showed that T_{reg} cells were present in the lymph nodes of the test samples, but absent in those of the control group, while the tissue from the Dryvax-vaccinated group remained relatively normal. In conclusion, the results show that T_{reg} cells may possess the ability to enhance the immune system. However, further research must be conducted to confirm that this is true.

C37 The Effect of Silver Ion on Sewage Treatment Bacteria

Presenter(s)

Jordan Williams, Illinois Mathematics and Science Academy

Advisor(s)

Mark Carlson, Illinois Mathematics and Science Academy Megan Schrementi, Illinois Mathematics and Science Academy

The commercial and consumer use of silver in nanoparticle and ionic form has increased in recent years due to its strong antimicrobial properties. This can potentially lead to an increase in the amount of silver runoff which can end up in municipal waste water treatment facilities. Consequently, this runoff can affect the bacteria that are used to treat sewage. To analyze this, bacteria were extracted from a drain build-up remover, grown up in pure culture, and identified using standard biochemical tests. Using these bacteria, a growth curve was generated to find the effect of silver ion on them. Three flasks were prepared with media and identified bacteria. Silver nitrate was added to one flask and sodium nitrate was added to another. Since media already contains sodium, the nitrate in sodium nitrate served as a control for the nitrate in silver nitrate. Preliminary data showed that silver ion does inhibit bacterial growth. Future experiments will further quantify the effect of silver ion on the bacteria used in this experiment and provide a minimal inhibitor concentration value which may in turn impact the waste water industry.

C38

The Effects of Epigallocatechin-3-gallate on the Apoptosis of HT-29 Colorectal Cancer Cells

Presenter(s)

Diana Xu, Illinois Mathematics and Science Academy

Advisor(s)

Donald Dosch, Illinois Mathematics and Science Academy

Epigallocatechin-3-gallate (EGCG) is a potent antioxidant found in green tea. Antioxidants protect cells from substances which can induce cancer and cause other diseases. EGCG was introduced to cultures of HT-29 colorectal cells. The EGCG dosage effect on HT-29 cell growth was determined using concentrations ranging from 0.05 mM to 0.40 mM. The resulting concentration curve consists of EGCG at 0.06 mM, 0.12 mM, and 0.30 mM. These cultures were observed for apoptosis and changes in growth. Western blots are used to find the presence of apoptotic proteins in cells of each concentration. These apoptotic proteins include c-Jun and caspase-3. Cells were observed for the presence of actin in order to normalize the cell samples. In general, greater concentrations of EGCG demonstrated less cell growth. The amount of actin present in each of the concentrations was similar. Currently, Western blots are being prepared to test for caspase-3 and c-Jun in cells of each of the different concentrations. Natural anticancer ingredients are significant to cancer research because they do not have as many harmful side effects as chemotherapy. It would be optimal to find natural anticancer ingredients which fight cancer aggressively without dangerous side effects.

C39 Comparative Morphology of Lepidotrichia in Pectoral Fins Among Basal Actinopterygians

Presenter(s)

Karthik Yarlagadda, Illinois Mathematics and Science Academy

Advisor(s)

Neil Shubin, University of Chicago Natalia Taft, University of Chicago

The Actinopterygii, or ray-finned fishes, is the most speciose group of vertebrates with significant diversity in morphology and behavior. This group is named for the bony fin rays (lepidotrichia) that support the fins, yet we know very little about these structures. Understanding the morphology of the lepidotrichia is important because it defines the relative stiffness and flexibility of the fin. The goal of this study is to examine the morphological variation of lepidotrichia in four species at the base of the Actinopterygian evolutionary tree. Previous studies have identified three characters that contribute to fin ray function: the presence or absence of joints, the shape of the lepidotrichia in cross section, and the presence or absence of distal branching. AMIRA, a software platform, was used to identify and describe these characters from a computerized tomography scan of a fin from each species: *Amia calva, Acipenser brevirostrum, Lepisosteus osseus*, and *Polypterus senegalus*. So far, one scan has been completely measured, and the other three are in the process of being measured. We expect that these results will show that there is a morphological difference between the lengths of the lepidotrichia among these fish.

C40

Identifying Differences Between Normal and Cancerous Stem Cells

Presenter(s) Candice Yi, Illinois Mathematics and Science Academy

Advisor(s)

Morris Kletzel, Northwestern University Marie Olszewski, Northwestern University

Stem cells can differentiate into a variety of cells in our bodies and are capable of self-renewal and proliferation. However, if their growth or proliferation goes unchecked, they may become cancer stem cells and can cause tumors to return even after chemotherapy treatment. It is unclear how to differentiate between a cancerous and a normal stem cell, partially because they have more similarities than differences and because there are no specific markers to identify each. In this study, normal and cancerous cells were cultured to determine whether they contained stem cells and to identify characteristics that differed between them. The cells were grown on culture plates and proliferation was observed over an extended period of time. It was found that the cancerous cells proliferated more compared to the normal cells. In some weeks, the cell count for cancer cells doubled, whereas the normal's was halved. This stark difference in growth is a characteristic that sets the cells apart and is also typical of cancer cells - uncontrolled proliferation. Other characteristics, such as gene expression markers, could be compared for further differences. The cell samples obtained from the plating experiments can be used for further testing to show such differences and characteristics of the two cells.

D01 The Correlation Between Start-Up Fund, Product Type, and Monetary Success in Small Businesses

Presenter(s)

Naomi Liu, Illinois Mathematics and Science Academy Si Si, Illinois Mathematics and Science Academy

Advisor(s)

David Winkin, Illinois Institute of Technology

Two factors that contribute to the success or failure of a new business are start-up funding and product type. We looked to determine the correlation between start-up fund, product type, and success in small businesses by interviewing professionals in various aspects of entrepreneurship, as well as conducting research on online databases such as Business Source Premier and the Kauffman Foundation website which contained surveys and qualitative data concerning the success of small businesses. Based on our interviews, it seems that there are benefits and drawbacks to different kinds of funding. There are no financial repercussions when receiving venture capitalist funding; however, they expect a greater return on their contribution than a bank loan. Angel investors too, do not have any repercussions if their investment fails. However, both venture capitalist and angel funding is difficult to obtain. Consequently, many businesses often start off with funding from their savings or family contributions. We also found that most successful businesses currently sell products that are involved in the field of software, because these products are scalable and grow sales quickly. It seems that receiving funding from venture capitalists and having a technology-related product are two characteristics that are often found in successful businesses.

D02

How Power and Status Influence Reactions to Breaches of Trust

Presenter(s)

Jay Patel, Illinois Mathematics and Science Academy Vivek Thakkar, Illinois Mathematics and Science Academy Nathan Yan, Illinois Mathematics and Science Academy

Advisor(s)

Keith Murnighan, Northwestern University Hetal Patel, Northwestern University

The study of organizational behavior largely involves examining interpersonal interactions, a major component of which is trust. It is believed that parties may be dissimilar on dimensions, such as power and status, which could affect their reactions to breaches of trust. In light of this, this study utilizes a variation of the Prisoner's Dilemma game, administered to students across the IMSA campus, in order to uncover what determines reactions to breaches of trust and how reactions differ when competing against individuals of varying power and status. In this specific variation, each participant is given the option to compete or comply with an opponent of differing power and status for a series of twenty rounds. In order to quantify responses to breaches of trust, the "opponent" is a predetermined program with set orders to compete at two specific rounds and comply for the rest. It is expected that individuals with higher power and lesser status, relative to the individual partaking in the simulation, will receive more backlash than other opponents.

D03 The Profitability of Private Equity

Presenter(s)

Glen Richardson, Illinois Mathematics and Science Academy

Advisor(s)

Darrell Williams, Loop Capital

In the financial world, money managers invest the money of their clients, manage those investments on behalf of their clients, and liquidate those investments at the appropriate time in order to give those clients attractive financial returns. There are many money managers within the different asset classes. One of the main asset classes is "alternative" investments; typically investments made in this class are in private entities, as opposed to publicly traded stocks and bonds. Within the alternative class, money managers specialize in real estate, venture capital, private equity, private debt, and other sub-classes. The purpose of this investigation is to examine why private equity is often considered to be one of the best investment choices. On the macro level, private equity has proven to be the best investment option when compared to other major equities. On the micro level, there are a variety of investment strategies that have proven to be successful. Overall, this study takes an in-depth look at some of the key aspects of private equity.

E01 The Healthiest Drink: Determining Antioxidant Content of Beverages

Presenter(s)

Matthew Kleinjan, Illinois Mathematics and Science Academy

Advisor(s)

Anita White, Illinois Mathematics and Science Academy

In numerous studies, antioxidants have been found to give significant health benefits when consumed. Antioxidants help to neutralize free radicals, which damage cells in the body and can lead to heart disease, cancer, and autoimmune diseases. Today many beverages advertise that they contain antioxidants, but which beverage contains the greatest amount? To investigate, I analyzed the antioxidant content of a variety of beverages. Total phenolic content and ferric reducing antioxidant power (FRAP) were measured in each beverage using a microplate procedure. Preliminary analysis of twelve beverages, including fruit juices, fruit smoothies, flavored waters, and sports drinks, indicate that pomegranate juice has the highest antioxidant content with a phenolic content of 14.28 mg gallic acid equivalents/100 g of beverage and 3.01 mmol Fe² iron reducing equivalents/100 g of drink. In general, fruit juices and antioxidant branded flavored waters contained the highest amounts of antioxidants while sports drinks contained almost no antioxidants. My initial findings suggest that pomegranate juice will provide the greatest health benefit when consumed due to its high levels of antioxidants.
E02

Density Functional Theory Study of the Influence of VOx Promotion on the Mechanism of Alcohol Synthesis on Rhodium Catalysts

Presenter(s)

Mingyang (Jennifer) Li, Illinois Mathematics and Science Academy

Advisor(s)

Randall Meyer, University of Illinois at Chicago

Rhodium heterogeneous catalysts have been found to display the ability to catalyze alcohol synthesis from syngas. Understanding the reaction at a molecular level is vital in the process of developing improved catalysts with higher selectivity to higher alcohols. In this study, calculations using density functional theory (DFT) have been carried out in order to investigate the efficacy of vanadium oxide promoted rhodium (Rh) catalyst for alcohol synthesis. Our study focused on two steps in the synthesis process: CO bond cleavage and carbon insertion, which have previously been identified by Liu and Choi. We have calculated the thermodynamics for adsorption of different molecules/intermediates atop the catalyst surface, including CH_2O , CH_3O , HCO, and COH groups in order to gain insight into the mechanics of these two important steps. The results show that the carbon insertion step may be more favorable through formaldehyde rather than through methoxy, contrary to previous claims made by Liu and Choi. The study will determine why the promotion of vanadium oxide on the Rh (111) complex has a positive effect on the synthesis of alcohol.

E03

Effects of Molecular and Macroscopic Surface Modification on Wetting

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

Advisor(s)

Gaby Avila-Bront, University of Chicago Steve Sibener, University of Chicago

Surface wetting is an emerging field that studies the interfacial relationships between liquids and their solid substrates. It is determined by the properties of the solid surfaces, including their structure, composition, and functional groups, among other factors. The polymer primarily involved in this study was poly(styrene-*block*-methyl methacrylate) [PS-*b*-PMMA], a diblock copolymer, along with irradiated PS-*b*-PMMA. The most notable difference between the two are the empty PMMA domains in the photomodified version, which were removed upon exposure to ultraviolet radiation. This causes a larger discrepancy between the heights of the polystyrene domains, resulting in higher corrugation in the irradiated PS-*b*-PMMA. PS-*b*-PMMA was also modified by depositing PbS nanoparticles in order to examine any change in wettability resulting from a macroscopic modification. Different types of self-assembled monolayers on gold substrates were studied to observe the effects of molecular modification on wetting. Atomic force microscopy and scanning tunneling microscopy were then used to investigate the various samples' surface morphologies at a microscopic and molecular level. After measuring the contact angles formed between a droplet of water and the polymer surfaces, it was found that PS-*b*-PMMA yielded angles around 100° and irradiated PS-*b*-PMMA resulted in contact angles greater than 100°.

E04 A Greener Catalyst for Biodiesel Synthesis

Presenter(s)

Elizabeth Ott, Illinois Mathematics and Science Academy

Advisor(s)

Justin Notestein, Northwestern University

Recently, the demand for biodiesel has grown because of its non-petroleum origins and the ability to use domestic soy oil, yet the cost and environmental impact of its synthesis remain areas of concern for commercial use. Two inexpensive solid catalysts, heat-treated eggshell and 1% titanium oxide on silicate, were used instead of typical sodium methoxide or potassium methoxide soluble catalysts. In small vial reactors, the variables of time, temperature, catalyst weight loading, methanol to soybean oil ratio, and method of mixing were examined. Conversion was measured by changes in refractive index. Conversion increased approximately linearly with time, which may indicate either a zero-order or first-order reaction mechanism; insufficient data was collected to discriminate models. At 65°C, the conditions that yielded the highest conversion were 6:1 methanol:oil, and 9 weight percent catalyst loading. Increasing temperature to 100°C was found to be the most effective parameter in increasing biodiesel yield. The data does suggest that this system performs well with these solid catalysts, but the catalyst identity was less important. By using these more naturally occurring solid catalysts, the cost and environmental impact of biodiesel synthesis can be effectively reduced, because using a solid catalyst significantly lessens the amount of waste produced.

F01

Heuristic Analysis in Python Programming: Creating a Chess Engine

Presenter(s)

Jason Chien, Illinois Mathematics and Science Academy Konrad Wrobel, Illinois Mathematics and Science Academy

Advisor(s)

Mark Hoemmen, Sandia National Laboratory Namrata Pandya, Illinois Mathematics and Science Academy Phadmakar Patankar, Illinois Mathematics and Science Academy

Chess has been a battleground between man and machine. It is a game with simple rules but an unfathomable number of possibilities; perfect criteria for artificial intelligence programming. This investigation focuses on understanding the mechanisms chess engines use to select their moves accurately and efficiently. The Python language was used to program an original engine. First, an interface was created to allow the engine to communicate with a human. It is a standard chessboard layout with all the rules of chess incorporated. Then the engine was programmed to employ a minimax function which lets it analyze a few moves ahead to a terminal position. From there, it works its way backwards, selecting what it considers the best possible moves by both players along the way. It determines which moves are the best through a heuristics system. Moves which lead to better positions are given more points and the move with the highest points is played. This investigation's ultimate goal is to program the engine to be able to change heuristic values by itself.

F02 The Digital Detriment: Aspects of Computer Illiteracy

Presenter(s)

Samuel Haile, Illinois Mathematics and Science Academy

Advisor(s)

Namrata Pandya, Illinois Mathematics and Science Academy

Computers affect people's lives in several ways, from being used in school or the workforce, to personal use at home or while traveling. During my investigation, I researched the effects of computer literacy on the economic, technological, and social aspects of people's lives. I reviewed articles and data pertaining to how computers used in the workforce affected people's financial status. I also researched the Global Competitiveness Index (GCI) which measures how innovation in computers and technology affect countries' economies. In the United States, the results show that those who are computer literate and use computers at their job make higher salaries compared to those who are computer illiterate; this effect extends to the international level, where countries with highly innovative and technological labor forces have a much more successful economy. The positive effects are also present on a social level. In the public school system, schools that have computers available to students have a higher average graduation rate than those which do not have computers. As computers become ubiquitous and more powerful, their impacts on education, society, personal lives, and business will continue to grow. The results from the GCI show that being able to capably use a computer provides a significant competitive advantage in today's society.

F03

Inquiry into the Applications of Computing, Web Access, and Mobile Device Integration in the Automotive Environment

Presenter(s)

Shantanu Jain, Illinois Mathematics and Science Academy

Advisor(s)

James Gerry, Illinois Mathematics and Science Academy

In-car technology has consistently been behind that of mobile devices. Recent powerful mobile devices such as the Motorola Droid and the iPhone have allowed users constant internet access and a platform on which to run mobile applications, but the driver has been unable to benefit from these innovations. The driver remains unable to access information, communications, and entertainment with the ease and flexibility of a mobile device user. The investigation initially focused on implementing the hardware and software in a prototype. The investigator proposed a hardware configuration that addressed the issues of idle-time power consumption, startup and shutdown control, user interface flexibility, and multi-zone media capabilities. For software, development began on a plug-in for the OpenMobile platform that linked the navigation software to the user interface. However, after extensive software testing and exhaustive diagramming and analysis of the flow of data in an automobile's context, it was found that a cloud-based application platform comprehensively addressed the issues faced in automotive-computing. This solution leverages rich internet applications such as Pandora and Google Maps to deliver content incar. By unlocking data from the car and allowing developers to leverage it in their software, this idea could allow for a new wave of innovation in automotive computing.

F04 A Statistical Model for Analyzing Triphenyltetrazolium Chloride-Stained Myocardial Infarcts

Presenter(s)

Nilesh Kavthekar, Illinois Mathematics and Science Academy Ted Li, Illinois Mathematics and Science Academy Joseph Wang, Illinois Mathematics and Science Academy

Advisor(s)

Shu Q. Liu, Northwestern University

Measuring the ratio between infarcted and intact myocardium is an essential procedure for evaluating the progression of myocardial infarction. In current research, myocardial infarction is commonly evaluated by using a hand-tracing method. However, such an approach does not provide accurate and reproducible measurements because of intra- and inter-observer errors. In this investigation, we developed a computerized statistical model and a MATLAB language-based program that can be used to measure myocardial infarcts accurately and reproducibly. The MATLAB language-based program was used to analyze images of triphenyltetrazolium chloride- (TTC) stained myocardial tissue cross-sections and to statistically define intact and necrotic tissue based on pixel red/green/blue values in order to estimate the percentage of the infarcted tissue. Preliminary results suggest that the statistical model determines the ratio with a higher degree of consistency than the traditional, hand-tracing method. Potential implications of this study may be widespread use of the statistical model to quantify infarct characteristics, rather than hand-based methods. This can be significant for research, in which measurements can be made more accurately, consistently, and reproducibly. The effects of certain stimuli on myocardial infarct development can be quantified with more certainty.

F05

Fooling the Hacker: A Study of Honeypots

Presenter(s)

Derrick Miller, Illinois Mathematics and Science Academy

Advisor(s)

James Gerry, Illinois Mathematics and Science Academy

With computer exploitation and hacking becoming more prevalent, new techniques must be devised to gain information on not only the attacks, but the hackers themselves. For this reason, machines explicitly made to get hacked and log information, known as honeypots, have seen a rise in interest. However, due to possible legal and security ramifications, honeypots are a touchy subject in the area of computer security. This investigation follows the creation of a low-level interaction honeypot while determining what kinds of meaningful data can be safely extracted from an attack. At the same time, all difficulties and challenges are noted. Using the "honeyd" honeypot program, test servers have been set up on IMSA's Advanced Computing Association sub-network so they can log any attacks that occur. The entire process of the honeypot's creation has been documented in detail. In addition, data such as the attacked service, the attacker's operating system, and even the attacker's top level domain has been able to be gathered safely. Through the work of this investigation, more comprehensive documentation for the creation and ethical use of honeypots can be made. With such documentation, honeypots could be seen as a safe and legitimate tool in the area of network security.

F06 A Look into How to Make the World More Efficient Through Databases

Presenter(s)

Angus Nelson, Illinois Mathematics and Science Academy

Advisor(s)

Namrata Pandya, Illinois Mathematics and Science Academy Phadmakar Patankar, Illinois Mathematics and Science Academy

Databases can be used for organizing and tracking data that can assist a business in its daily operations. They are meant to be structured and used in a certain fashion. They are almost entirely different from spreadsheets, although they do look similar. The project consisted of creating a database that would be easily adaptable to any company that sells a product. Although this database could be modified to meet any company's needs, I specifically designed one that would tailor to a food catering company similar to Sodexo. The database was modeled directly after the essential things that they have to track: their employees, their suppliers, their products, their customers, and their profit. The main aspects of this investigation revolve around the data that can be quantized; for example keeping track of employee wages and weekly food supplies. Through research and examining other databases, an ideal structure of a database was constructed that prevents many common errors such as redundant data and unnecessary tables. This is important because it means that a user can find the necessary information quickly without having to browse through useless data, thus making a company more efficient and profitable.

F07

Three-Dimensional Landscape Generation and Erosion Simulation with Java

Presenter(s)

Gregary Pergrossi, Illinois Mathematics and Science Academy Zachary Pergrossi, Illinois Mathematics and Science Academy

Advisor(s)

Namrata Pandya, Illinois Mathematics and Science Academy Phadmakar Patankar, Illinois Mathematics and Science Academy

Game and graphics technology advances all the time, generating new methods to carry out new tasks. In the computer graphics industry, software-generated environments are used in game worlds and simulations as a tool to quickly finish hours of tedious work that used to be done by hand. In order to gain further understanding of how this type of software works, we have programmed a three-dimensional terrain generator with Java using a Perlin noise weighted random function and a fluid simulation method we developed. Our generator begins by calculating a land surface using a two-dimensional Perlin noise function and then simulates erosion to smooth and carve it. Through trial and error, extensive programming, and research, we have produced a finished graphical application that generates and displays water and pseudo-random terrain while allowing the user to explore outward in a large area. Our program is capable of generating a wide variety of software landscapes that demonstrate the advantages of this common industry technique. Throughout our research we have learned a tremendous amount about computer programming and software graphics; the result being our finished application.

F08 Designing Game Design

Presenter(s)

Kevin Wang, Illinois Mathematics and Science Academy

Advisor(s)

Jason Leigh, University of Illinois at Chicago

Due to the growth of the video game industry, it has been increasingly difficult to develop games that meet the standards of today's gamers. The aim of this study is to understand how to simplify game development by designing an environment for creating games. This project, Gravity Game Studio, involved designing a low-level framework that interprets a tree of commands into code and then compiles the code into an application. This framework was then coupled with a graphical user interface written in C# that the user can use to design their application visually instead of programmatically. The software incorporates a visual designer that translates actions into code, making it easier and faster to translate ideas into application. Since Gravity Game Studio is based on such a low-level system, it allows for flexible functionality within the usage and hierarchy of the application. This study yielded software that simplified and sped up the game creation process through the visual editor while maintaining the flexibility of creating a game from scratch through the low-level framework. This led to the discovery of new ways to aid in production and will continue to do so throughout the development of this software.

G01

Cost-Benefit Analysis and Evaluation of Leadership in Energy and Environmental Design Certification

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

Advisor(s)

Stephen Berry, University of Chicago Theodore Steck, University of Chicago

Despite improvements in efficiency, growing energy needs worldwide has driven the increasing reliance on non-sustainable international resources; in particular fossil fuels and water. The U.S. Green Building Council, a non-profit organization of professionals in the building industry, has implemented the Leadership in Energy and Environmental Design (LEED) certification system in order to encourage environmentally-friendly (green) building design in both residential and commercial sectors. I have undertaken a critique of the LEED program, its present effectiveness, and prospects for the near future. Through a cost benefit analysis and qualitative study of the policy surrounding green construction practices, I determined a set of parameters which show where a LEED certification delivers triple market bottom-line gains. That is, circumstances under which LEED certification promotes environmental, social, and (most importantly for the program's growth) financial advances. My study identifies conditions under which LEED green building certification is a prudent and, often times, strong investment. My results indicate that the growth seen in the LEED program advances an emerging green building revolution that will cause dramatic shifts in building industry practices. It would seem to be in the interest of today's building professionals to consider the implications of this emerging paradigm.

G02 The Gulf Oil Spill and Its Effects on the Global Economy

Presenter(s)

Caitlyn Collett, Illinois Mathematics and Science Academy Samuel Weitekamp, Illinois Mathematics and Science Academy

Advisor(s)

Robert Kiely, Illinois Mathematics and Science Academy

After researching the oil industry and environmental cleanup, including studying about the history of the oil industry, oil spill cleanup, oil rig technology, macroeconomic effects, and how geopolitics affect the oil industry, the study focused on studying how the Gulf of Mexico oil spill effected the geopolitical view on the oil industry and how life in the United States could change as a result. Through research, the study found that domestically, most of the changes were reforms of the oil industry in the United States. These reforms included safety on the rigs, making it so that check-ups on important equipment are more frequent and environmental reforms so that the effects could be mitigated in the future. This angle showed how far behind technologies for cleaning up afterwards are behind drilling technologies and how the moratorium on deepwater Gulf oil could be detrimental because of domestic oil's importance for the U.S. Geopolitically, the study focused on how the spill changed the perception of other current events like the wars for democracy erupting throughout Africa. Ultimately the question became whether or not this disaster can fundamentally change the world's view of oil. In retrospect, the conclusion was that this disaster had little effect on the perception of oil globally or domestically.

G03 Effects of the 9/11 Attacks on the Insurance Industry

Presenter(s)

Inga Gurevich, Illinois Mathematics and Science Academy

Advisor(s)

Krzysztof Ostaszeski, Illinois Mathematics and Science Academy Richard Stalmack, Illinois Mathematics and Science Academy

On September 11th, 2001 the World Trade Centers in New York collapsed as a result of a terrorist attack and caused an estimated 40.2 billion dollars in insured losses. My study aimed to see how individual sectors of the insurance industry were impacted. Most claims came from the following insurance sectors: personal property, commercial property, business interruption, workers compensation, personal auto, and commercial auto. To estimate the price changes for the different types of insurance, the Producer Price Index (PPI) was used. Economic strength was estimated by the US gross domestic product, consumer confidence index, interest index, investment in bonds index, and the US Dollar Index. The PPI data showed those insurance types that directly suffered claims due to 9/11 and the ones that were unrelated to 9/11 all followed a similar trend from 1998 to 2005. The biggest rise in prices was between 2001 and 2003. The consumer confidence index, interest index, and the stock market index were all inversely related to the insurance prices. The only direct result that the catastrophe had on the insurance industry was the creation of the Terrorism Risk Insurance Act; otherwise it was an indirect influence through the economy. My results conclude that all sectors of the industry fluctuated in a very similar pattern, even the ones not affected by the attack.

G04 Growth of the Chinese Futures Markets

Presenter(s)

Joseph Hecker, Illinois Mathematics and Science Academy

Advisor(s)

Doug Adams, Aardvark Trading

When the People's Republic of China first attempted to utilize futures contracts, they experienced many challenges. However, as the Chinese government and citizens continue to learn from these problems, the Chinese futures markets have undergone tremendous growth. The purpose of my investigation was to discover the growth factors of the Chinese futures and financial markets in general, and I observed my advisor's company as it looked to establish an office in China. My research also involved literary review and discussions with my advisor on a regular basis. I discovered that commodity consumption in China is massive, demanding risk management in case the commodities were to ever be negatively affected. The government would like the markets to increase price transparency, as well as decrease prices in general. By 2020, China plans for Shanghai to economically rival New York City and London. However, this bold move calls for the Yuan to be deregulated, in the hope that it will become a global reserve currency in the future. The current growth path of the Chinese futures markets can provide a success recipe for countries in economic distress, as well as affect the future of foreign investment in China.

G05 The Role of the Federal Reserve Bank During the 2007 Recession

Presenter(s)

Zeno Jeong, Illinois Mathematics and Science Academy

Advisor(s)

Lee Eysturlid, Illinois Mathematics and Science Academy Charles Steele, Illinois Mathematics and Science Academy

In 2010, the U.S. government formally announced that the aftershock of the 2007-08 financial crisis was over. During the three years of recession, not only was the U.S. economy damaged, but countries around the world were similarly affected. The chairman of the Federal Reserve Bank, Ben Bernanke, implemented numerous monetary policies in order to alleviate the effects of the crisis. The Federal Reserve's monetary policies were supported by expansionary fiscal policies. By looking at the dates when the monetary and fiscal policies were implemented and effects on measures such as gross domestic product, inflation, and unemployment rates, we can evaluate the effectiveness of the policies. So far, we have studied the pros and cons of the monetary policy and how it works in tandem with fiscal policy. Also, we found raw data from the websites of the International Monetary Fund and the Federal Reserve Bank of Chicago. However, we need to learn more about how monetary and fiscal policy work. By analyzing and evaluating the results of the monetary and fiscal policies used, we can draw implications and suggest which policies work and which do not for an economy facing recession.

G06 High-Tech Industries and the Quality of Life: An Investigation of Chinese Cities

Presenter(s)

Harley Wang, Illinois Mathematics and Science Academy

Advisor(s)

Richard Stalmack, Illinois Mathematics and Science Academy

This study investigates the correlation and possible relationship between the quality of life and high-tech industrial sectors present in the Chinese cities of Tianjin, Beijing, and Shanghai; Hainan was selected as a control city. China's recent economic success has implicated a change in the development of country. Numerical data was retrieved from the National Bureau of Statistics of China, and scholarly articles were found at various online sources. The statistics of GDP, healthcare, education, and per capita annual income are compared against the establishment of high-tech industries, and a correlation can be drafted and observed. The results of analysis have shown that there is a positive correlation observed between the independent variable and each dependent one. The correlations, however, were not relatively consistently high for the test cities in the areas of education and GDP. There was no correlation between the number of enterprises and healthcare or education for any of the test cities; however the correlation of the control was relatively high. Based on other investigations, this study is mapping a definite relationship between the factors involved. The test results also shed light upon the relevance of people's livelihoods to economic development.

H01

Multisensory Versus One-Modality Instruction in Bilingual Education with a Focus on Elementary-Aged Spanish Speakers

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

Advisor(s)

Cherie Esposito, McCleery Elementary School Jose Palos, Illinois Mathematics and Science Academy Manuel Perez, Illinois Mathematics and Science Academy Aracelys Rios, Illinois Mathematics and Science Academy

Previous studies indicate that English as a Second Language (ESL) elementary students benefit from being literate in their native language before learning English. Consequently, the bilingual classes at McCleery Elementary teach reading and writing in Spanish before introducing English. This study compares the effectiveness of two teaching methods in the bilingual classroom: One-modality versus multisensory. In this study, first and second grade students were asked to spell Spanish words after being taught by either of the two methods. Spelling tests were administered and scores were collected for each child. Students' results were compared with their method of instruction. Preliminary results suggest the multisensory method is more effective in teaching Spanish spelling words to bilingual, elementary students. This is significant because it may enhance bilingual teachers' effectiveness in the classroom.

H02 Transgender Policies in High Schools

Presenter(s)

Ayse Cetinkaya, Illinois Mathematics and Science Academy

Advisor(s)

Daniel Gleason, Illinois Mathematics and Science Academy

Schools function primarily to educate students by providing a safe and hospitable environment conducive to learning. However, flaws can be found in policies and structures of schools, especially regarding less well-known issues such as transgender youth. Although schools have an obligation to all students, regardless of gender expression, most schools lack a specific plan of action regarding transgender students. Transgender policies specifically in place in high schools were compiled and analyzed for general themes and overlaps. Organizations experienced with transgender youth were contacted for specific advice for experience with successful and unsuccessful policies. Using this information, policy recommendations were made. Transgender rights are a growing movement and must be acknowledged as a legitimate concern for schools. Ideal policies would stress a choice for the student through equal access to facilities and activities regardless of assigned gender. The importance of strict anti-harassment and assault guidelines must be supplemented with staff training and potential student seminars on gender variance. Transgender individuals cannot be ignored when constructing school policies and as required by law to protect all students, schools must include facilities, programs, and consequences specifically geared towards transgender students and transgender violence to ensure the safety and comfort of all students.

H03 The Effect of Resident Physician Education on Patient Safety

Presenter(s)

Wen Li Chen, University of Illinois at Chicago

Advisor(s)

David Mayer, University of Illinois at Chicago

In 2006, the University of Illinois at Chicago (UIC) implemented an online reporting system that tracked adverse events, near misses, and unsafe conditions in order to better understand medical error occurrences in hopes of improving patient safety. Of the fifteen-hundred reports filed in 2006 to 2008, none of the reports came from resident physicians. As a response, in 2008, UIC educated resident physicians on patient safety and reporting. This investigation examined the effect of educational intervention on the utilization of the online medical resident reporting system by monitoring the number of reports that resident physicians filed and examining medical scenarios. On average, resident physicians filed twenty-five reports per quarter during the patient safety course from the first quarter of the 2009 fiscal year to the fourth quarter of the 2009 fiscal year. After the patient safety course, resident physicians filed an average of 115 reports per quarter from the first quarter of the 2010 fiscal year to the second quarter of the 2011 fiscal year. In addition, resident physicians were actively reporting which led to changes in hospital personnel protocol. The increase in the number of reports filed by resident physicians and protocol changes suggest that education is a valuable tool that promotes patient safety.

H04 A Study Aimed at Enhancing Students' Understanding of Newton's Three Laws

Presenter(s)

Grace Choi, Illinois Mathematics and Science Academy

Advisor(s)

Linda Brazdil, Northwestern University

The aim of this inquiry is to develop methods to enhance Chicago Public High School students' learning of Newton's three laws. This is done by modifying the Meaningful Science Consortium's project-based tenth grade physics course lessons. Specific modifications included having students draw force body diagrams that allow students to identify forces, their locations, and their effects on motion and direction, as well as explanations of the mathematical equations involved. These changes were made because a fundamental understanding of forces is necessary to fully understand later lessons such as circular motion and to complete the final project in which students design their own roller coasters. Modifications were incorporated without changing the flow of the 7E (elicit, engage, explore, explain, elaborate, evaluate, extend) model of the course. Changes were added into engage, explore, and explain sections to foster students' thinking. It is expected that these modifications will improve students' abilities to answer questions on the quarterly exam dealing with balanced and unbalanced forces, those using F=ma, and those asking for interpretations of diagrams. Teachers will teach half of their classes using unmodified lessons and the other half using the modified lessons. Their students' responses on specific questions will then be compared.

H05

Comparing the Learning Styles of Gifted Monolingual and Bilingual Students

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

Advisor(s)

Christian Nokkentved, Illinois Mathematics and Science Academy Purva Rushi, Illinois Mathematics and Science Academy

Studies have been performed that establish and delineate the differences in learning styles of monolingual and bilingual students, but not many have explored the differences between gifted students in both categories. A survey called the Perceptual Learning Styles Preference Questionnaire created by Dr. Joy Reid of the University of Maui was distributed to every student currently studying at the Illinois Mathematics and Science Academy. All students took surveys with the same questions. The survey produced numerical values for the learning style preference of the participants such as visual, tactile, kinesthetic, group, individual, and auditory learning. A two-way ANOVA test with one dependent variable and one independent variable will be performed on the results to see if there is any significant difference between the learning styles of the two groups. Any findings can be used to help high school teachers use more effective methods to teach their gifted bilingual students.

H06

The Importance of English as a Second Language Programs and the Factors That Affect Their Success

Presenter(s)

Katia Colin, Illinois Mathematics and Science Academy Chibuzo Obasi, Illinois Mathematics and Science Academy

Advisor(s)

Paula Altekruse, Illinois Mathematics and Science Academy Rosemary Gabriel, George B. Swift Elementary School

Unfortunately, providing a good English as a Second Language (ESL) program to the rapidly increasing number of English language learners is proving difficult for certain schools. In order to provide an understanding of how different factors affect the success of ESL programs, this study examined three factors: teacher qualifications, student-specific factors, and type of program implemented. Our study included surveying a population of high school students in an attempt to correlate specific student-related factors to student performance and growth. Research showed a trend between teacher qualifications and type of course. In addition, type of program varied among different student populations. Both research and field study results demonstrated that student sub-factors like background, process of entering this country, household income, and age at program enrollment influence their performance. Students who started younger fared better, as did wealthier students, students whose families came voluntarily, and students from more developed countries. Overall, the results indicate that for an ESL program to succeed, as student-specific factors are not likely to change, schools should implement valid programs and hire qualified teachers mindful of students' situations. In the future, our research could potentially increase awareness in those responsible for ESL regulation.

H07

Applying Teaching Models to a Science Curriculum for Elementary School Students in IMSA's Kids Institute

Presenter(s)

Eleanor Cory, Illinois Mathematics and Science Academy Allyson Milenkovic, Illinois Mathematics and Science Academy

Advisor(s)

Julie Dowling, Illinois Mathematics and Science Academy

This investigation studies various teaching models established by educational psychologists and the inquiry-based teaching styles of current IMSA students teaching within IMSA's Kids Institute program. It aims to apply these teaching models to new science curriculum, to be taught in the spring in Kids Institute FunShops to third through sixth grade students. Information on educational psychology was gathered through reading scholarly articles regarding learning spectrums, inquiry-based learning, and so forth. An original observation sheet, catering to the unique setting of a Kids Institute classroom, was developed that addressed topics such as teachers' enthusiasm, preparedness, and the use of questions for clarification. It can be used to analyze teaching styles and their effects on class participation and understanding. Six new curricula, written about topics in chemistry and physics, were designed to focus on inquiry-based learning and will give teachers the opportunity to teach to the class as a whole as well as provide one-on-one guidance. It is hoped that these curricula will improve class participation and interest in Kids Institute classes and serve as effective models for teaching scientific concepts to younger students in the future.

H08

The Dropout Dilemma: Investigating Student Retention at the Illinois Mathematics and Science Academy

Presenter(s)

Dominic Gentile, Illinois Mathematics and Science Academy Matthew Gietl, Illinois Mathematics and Science Academy

Advisor(s)

Donald Dosch, Illinois Mathematics and Science Academy Barbara Miller, Illinois Mathematics and Science Academy

IMSA'S current retention rate is lower than what is expected. Many steps have been taken to increase retention by implementing programs such as Sophomore Navigation. However, many students still elect to withdraw from IMSA for academic, social, and personal reasons. In our investigation, we asked students to give reasons for possible withdrawal in a more specific manner than just academic, personal, and social reasons. To accomplish this, we created a survey that questioned students about different aspects of their IMSA experience, and also about their desire to leave IMSA and what steps they have taken to withdraw. In our data analysis, we took the students' responses to questions about their life at IMSA and compared them to their desire to withdraw. In this way, we were able to determine what parts of the IMSA experience, such as living away from home, academic rigor, the social environment, and so forth. created a desire to leave. With these specific reasons in mind, we looked at IMSA's policies to see which of them contributed to student withdrawal and suggested ways to modify the practices to boost retention.

H09

Why are Hispanics Underrepresented in College?

Presenter(s)

Carlos Gomez, Illinois Mathematics and Science Academy Christopher Macias, Illinois Mathematics and Science Academy

Advisor(s)

Jose Palos, Illinois Mathematics and Science Academy

The underrepresentation of Hispanics in U.S. colleges is an ongoing issue with many factors that impede them from following their American dream. We decided to implement a literature investigation to answer this question. Printed books, online resources such as databases, electronic books and statistics from other surveys have been located using the extensive resources on IMSA's library website. Some resources included the United States Census Bureau, Pew Hispanic, the Hispanic Scholarship Fund, the National Center for Education Statistics, and so forth. We found that the most common reasons for the under representation of Hispanics in college are due to family views, economic issues, and immigration status. The family has a great impact on the student's decision when enrolling in a higher education. When it comes to education, most Hispanics think of it as a privilege and prefer to work before furthering their education. Hispanics are one of the poorest ethnic groups in the United States. The average income per family is about \$35,000, in comparison to an average of \$60,000 for Asians. Finally, a person's immigration status can affect the student's decision when enrolling in a college. If the student is illegal then he/she would most likely not be able attend college. A combination of factors accumulate to affect the under representation of Hispanic students in our nation's universities and colleges.

H10 Student Inquiry and Research at IMSA Chicago

Presenter(s)

Victoria Lo, Illinois Mathematics and Science Academy

Advisor(s)

Michelle Kolar, Illinois Mathematics and Science Academy

Currently, the Illinois Mathematics and Science Academy (IMSA) offers students unique research opportunities through the Student Inquiry and Research (SIR) program. Students participating in the program complete a year-long investigation, either on-campus or off-campus. SIR investigations are conducted on Inquiry Days, where students on-campus meet and research with their advisor(s), and students working off-campus travel to their SIR location and meet and research with their advisor(s). IMSA Chicago, located in the city, will provide students more access to resources and facilities in completing off-campus SIR investigations. By studying IMSA Aurora's current SIR program, and other high schools with an inquiry-based research program, I identified vital components in creating a recommendation for the SIR program at IMSA Chicago. Through a survey, I collected responses about students' on-campus SIR experiences versus off-campus SIR experiences. Analyzing this data set, I found correlations between the time spent on students' SIR investigations, the biggest challenges students face, and the opportunities students are provided in their on-campus SIR investigations versus off-campus SIR investigations. Using IMSA's current SIR program and survey responses, I have created a recommendation for the SIR program at IMSA Chicago.

H11

The Effects of Inquiry-Based Pedagogy on Third Grade Students and Their Ability to Learn Higher Level Physics Concepts

Presenter(s)

Alan Shramuk, Illinois Mathematics and Science Academy

Advisor(s)

Tracy Miller, Illinois Mathematics and Science Academy

The goal of this research is to test and analyze the effect of inquiry-based teaching pedagogy on children, specifically third-graders, and their ability to understand advanced physics concepts. To test the ability of students to learn through inquiry-based learning, a lesson plan was researched and prepared. A survey was also designed for IMSA Fusion, a group of Illinois STEM educators, asking for their professional opinion and/or experience on teaching children through inquiry-based pedagogy. Various studies and articles suggest that children can not only learn more easily with inquiry-based teaching methods, but also are able to learn and understand more difficult concepts. The research team is curious to see whether this project substantiates these studies. If so, this may lead to a better overall understanding of STEM education in the student and adult population of the United States and further the study of STEM subjects in the world at large.

I01 Comparison of Dreiding and Universal Force Fields for Metal Organic Framework Simulation

Presenter(s)

Yusuf Aktan, Illinois Mathematics and Science Academy Matthew Tsao, Illinois Mathematics and Science Academy

Advisor(s)

Randall Snurr, Northwestern University Chris Wilmer, Northwestern University

Metal organic frameworks have shown promise in filtering CO_2 , from the air as a solution to global warming. However, thousands of possible molecule combinations and framework geometries for these metal organic frameworks (MOF) must be tested via computer simulation to find the chemical structure that will maximize CO_2 retention. Simulation results of thirteen MOFs from Dreiding and Universal force field simulation models are compared to actual experimental data to determine the differences between the two force fields in simulating CO_2 behavior in MOFs, and which is more accurate. The initial study has been expanded to research the process of trapping methane, hydrogen, and nitrogen gasses by similar molecular simulations. Preliminary results of CO_2 retention (at partial pressures ranging from 0.05 bar to 0.5 bar) show agreement between the Dreiding and Universal force field within ~20% in all MOFs except those containing palladium or vanadium atoms where the predictions vary by a factor of two. Currently, the full simulation process (with partial pressures ranging from 0.5 bar to 40 bar) is not complete and results with analysis will not be available until the data is ready for examination.

I02 The Design Process of a Roller Coaster

Presenter(s) Justin Booth, Illinois Mathematics and Science Academy Brendan Mathias, Illinois Mathematics and Science Academy

Advisor(s)

Brooke Schmidt, Illinois Mathematics and Science Academy

Having been on many roller coasters, we were curious as to how they are designed. The purpose of our project was to determine the steps necessary in designing a roller coaster, and then to design a roller coaster ourselves. We researched roller coaster designs to see where they started. We began our design by establishing the height of our initial hill, and using the data we researched, we determined the total energy the coaster has at the top of the hill. Using this information, we were able to design segments of our coaster on the program Autodesk Inventor. In the end, we combined all of these separate pieces into one finished product. By this method, we were able to determine the process by which a roller coaster can be designed.

I03 The Physical and Thermodynamic Properties of Ni₂TiIn

Presenter(s)

Wen Min Chen, Illinois Mathematics and Science Academy

Advisor(s)

Song Chen, Illinois Institute of Technology Yoonsung Chung, Illinois Institute of Technology Susan Meschel, Illinois Institute of Technology Philip Nash, Illinois Institute of Technology

Heusler alloys are composed of elements in the form X_2YZ where X and Y are transition metals and Z is a non-magnetic metal or a semiconductor. Compounds based on the Heusler structure have many interesting properties such as ferromagnetism and thermal or magnetic shape memory. Ni₂TiIn, a Heusler alloy, was first synthesized and then its crystal structure was examined using X-ray diffraction and electron dispersive analysis. The compound was also subjected to a variety of physical tests (such as Vickers hardness test) to measure its physical properties. The alloy was found to be very brittle and could not be subjected to significant stress without cracking. Its thermodynamic properties were measured using a calorimeter. The heat content of Ni₂TiIn was found to be 13 ± 6.7 kJ/mole of atoms and the heat of reaction for Ni2TiIn was found to be -9.32 ± 0.7 kJ/mole of atoms. Due to the brittle nature and other properties of Ni2TiIn, only future research will find practical uses for it.

I04

Engineering a Water Filter for Developing Countries: Optimizing Flow Rate with Respect to Bacterial Sterilization

Presenter(s)

Dane Christianson, Illinois Mathematics and Science Academy Jongmin Lee, Illinois Mathematics and Science Academy

Advisor(s)

Mark Carlson, Illinois Mathematics and Science Academy

The necessity for sanitary water in developing countries is a well-known problem. The purpose of the investigation is to develop an effective yet economical water filter that supplies at least 40 liters per day, kills 99.9% of bacteria, and costs less than 20 dollars. Ceramic filters were created using clay mixed with MetamucilTM or sawdust to make the fired filter more porous. Nanoparticle silver was added as a germicide. Conical filters were formed by pressing the clay mixture between two plastic funnels. The filters were later coated with silver and fired in a kiln. After firing, the cones were mounted vertically in 3 inch diameter polyvinyl chloride tubing, into which water was poured. Flow rates and bacterial disinfection were then analyzed. Previously, our cone filters had shown 99.99% killing at low flow rates. Our goal this year was to determine whether that could be maintained at higher flow rates. Although effectiveness did fall with increasing flow, recently a rate of 50 L/day with 99.9% killing was achieved, meeting our primary goal. A detailed field analysis remains to be conducted under realistic conditions. Efforts must also be made to increase the water storage capacity of the filter.

105 Far Horizons Near Space Balloons: Creating a Cut-Down System

Presenter(s)

Logan Damiani, Illinois Mathematics and Science Academy Nathan Geldner, Illinois Mathematics and Science Academy

Advisor(s)

Geza Gyuk, Adler Planetarium Ken Walczak, Adler Planetarium

High altitude balloons (HAB) are an inexpensive and effective data-collecting alternative to satellites. The purpose of this project was to examine and improve upon HAB design. In order to gain greater control of the descent, a system needed to be developed to jettison the payload from the balloon on command. Through research, it was found that the safest and most effective method was to run a strong electrical current through conductive yet highly resistant nichrome wire, rapidly generating heat, allowing it to burn through the connection between the balloon and the payload. The first design was composed of four capacitors, a transistor, a length of nichrome wire, and held by composite board. While this cut the necessary connection, the preparation proved to be arduous and time-consuming. The next step was to improve the design by making it more easily reproducible, reusable, reliable, and more compact by transferring the design onto a custom integrated circuit board. This may be used in future HAB launches, expediting the scientific progress. Simplifying the retrieval of near-space balloons prevents damage to the payload and in the long term increases the accessibility of HAB missions for research.

I06

Networks of Ultrasmall Pd/Cr Bilayer Nanowires: A New Type of High Performance Hydrogen Sensors

Presenter(s)

Henry Deng, Illinois Mathematics and Science Academy

Advisor(s)

Zhili Xiao, Argonne National Laboratory

Hydrogen sensors have become the subject of intensified studies in recent years due to their tremendous importance to hydrogen fuel applications. Recent studies have shown that nano-palladium sensors are very quick and efficient; in particular, the research group previously devised a new fabrication method that allowed for the creation of quick and highly inexpensive nanowire network sensors. In this study, palladium/chromium (Pd/Cr) nanowire network hydrogen sensors were created using the novel fabrication method and then tested. This method utilizes the design of commercially available filtration membranes to create a nanonetwork structure. By layering nanoscopic amounts of palladium and chromium onto the membrane, a nanowire network structure of palladium/chromium bilayer can be formed. The results obtained were very promising. The first major advantage the Pd/Cr sensor has is sensing capabilities from 0.1% hydrogen to 100% hydrogen concentrations; it solves the 3% saturation issue found in the pure Pd sensor. The second major advantage the new sensor has over the pure Pd sensor is a significantly shorter response time. Finally, the new sensor costs less to create while still maintaining the high efficiency design provided by the nanofabrication method.

I07 Alternative Auscultation: The Audible Human Project

Presenter(s)

Saarthak Gupta, Illinois Mathematics and Science Academy

Advisor(s)

Thomas Royston, University of Illinois at Chicago

As the pedagogy of auscultation has declined, a suitable replacement must be found. Piezoelectric sensor arrays are a viable alternative as they are cheap, easy to use, and more objective than traditional auscultation methods. The Acoustic and Vibrations Laboratory (AVL) at the University of Illinois at Chicago is working on software that will make the use of these sensors easier and more visual by outputting the expected piezoelectric display with specific patient parameters set. A computerized mechanical model of the human torso was created for this endeavor by using computerized tomography scans taken from the Visible Human Project. The main structures in the torso were separated, meshed, and had their mechanical properties differentiated. Going forward, the AVL hopes to apply select mechanical properties to the geometric model, and eventually use this model in conjunction with respiration simulation in order to construct an audible "map" of the human torso to aid in disease detection.

I08

The Construction of a Model Helicopter with a Unique Set of Interlocking Blades

Presenter(s)

Kenneth Harvey, Illinois Mathematics and Science Academy Austin Kramer, Illinois Mathematics and Science Academy

Advisor(s)

Francisco Ruiz, Illinois Institute of Technology

The designs of modern helicopters are based on many generations of improvement over Leonardo Da Vinci's original concept. Unfortunately, they are inefficient; a major problem being that the tail rotor, which prevents spinning caused by the single main rotor, is wasteful and uses much of the engine's output that could otherwise be put toward thrust. A model is in development for a dual-interlocking-rotor design that will not require a tail rotor for stability. An extant, small-scale, electric model had a problem with two gears designed to synchronize the rotation of the axles and blades. They were too far apart to mesh correctly, and often skipped teeth. Two new gears are now installed on the current frame that will mount and mesh properly. The re-mounting of the blades is the only task remaining before the motor housing is complete. The motors will be tested for speed and power prior to a test flight. If this design passes the prototype stage, it will improve the efficiency and reduce the size of future helicopters. These effects could turn air travel into a more practical and common form of transportation.

I09 A Design for a More Efficient Vertical Axis Wind Turbine

Presenter(s)

Peter Howes, Illinois Mathematics and Science Academy

Advisor(s)

Branson Lawrence, Illinois Mathematics and Science Academy

Wind power is becoming a more popular source of energy in the world. As fossil fuels run out, wind turbines are a logical choice for a reliable means of generating power. The purpose of this investigation is to create and test alternative vertical axis wind turbine designs. Advertised efficiency of vertical-axis turbines is often higher than the actual efficiency. Research shows the design to be tested results in electrical production much closer to the advertised number compared to the production of other designs. Small scale models of the existing turbine and the potential turbine will be tested to observe their electrical output under realistic wind conditions. The turbine that produces a larger average electrical output is more efficient and better suited to supply IMSA with energy. Currently, small-scale design models have been constructed for comparison, and testing will commence shortly. If my investigation is successful, IMSA will be able to generate more power from nature rather than relying on commercial sources.

I10 Understanding the Formation of Toroidal-Spiral Particle

Presenter(s)

Aditya Karan, Illinois Mathematics and Science Academy

Advisor(s)

Ying Liu, University of Illinois at Chicago

For the treatment of complex diseases, such as brain cancer, delivery of multiple compounds with synergistic effects is ideal. However, no current technology can separately control the release mechanics while multiple compounds are enclosed. The toroidal-spiral particle's unique internal structure makes it a candidate for a novel drug delivery system. The goal of this study was to determine the conditions under which the toroidal-spiral particle forms. Millimeter-sized drops of polyethylene glycol were sedimented in a solution containing glycerol, ethanol, and water, during which the viscous force sheared the drop to form the toroidal-spiral structure and the surrounding solution was enveloped into the channel. At higher Reynolds number and at higher drop heights, the particle was unable to form at the higher viscosity ratios that lower Reynolds number and lower drop height solutions could form the particle in. This information is being used in the laboratory to understand the self-loading capabilities and the release mechanics of the toroidal-spiral particle with the ultimate goal of using it for effective drug delivery.

I11 Optimizing the Conditions of Atomic Layer Deposition of Hafnium Oxide, HfO₂

Presenter(s)

Samir Mishra, Illinois Mathematics and Science Academy Shobhit Roy, Illinois Mathematics and Science Academy

Advisor(s)

Christos Takoudis, University of Illinois at Chicago Runshen Xu, University of Illinois at Chicago

High k technology is on the verge of replacing traditional SiO films for use in next generation nanoelectronics, such as complementary metal oxide semiconductors (CMOS) and dynamic randomaccess memory (DRAM). From all the metal oxides, hafnium oxide (HfO₂) is the most favorable in terms of its large band offset to silicon (1.5 eV), negligible leakage current, and good thermal stability with Si. Atomic layer deposition (ALD) is widely considered as one of the most powerful fabrication techniques of CMOS devices and DRAM cells due to its precise thickness control and excellent conformal deposition. In this project, tetrakis(diethylamino) hafnium (TDEAH) with ozone as an oxidizer was used to deposit ultra thin HfO₂ films on Si(100) substrates by ALD. To explore ALD-type growth, we investigated different deposition conditions, such as the pulse and purge durations of both metal precursor and ozone and temperatures. The thickness of the deposited film was measured by a spectra ellipsometer. From our data, we determined the purge and pulse times as well as the ALD temperature window that would optimize growth rate, indicating that the deposition process is an ALD-type self-limiting growth. With these conditions, we can develop efficient methods of fabricating HfO₂ thin films.

I12 Thermodynamic and Physical Properties of Ni₂TiGa

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

Advisor(s)

Song Chen, Illinois Institute of Technology Yoonsung Chung, Illinois Institute of Technology Susan Meschel, Illinois Institute of Technology Philip Nash, Illinois Institute of Technology

This experiment has found thermodynamic and physical properties of the Heusler alloy, Ni₂TiGa. This information will be used as reference for future application of this alloy. The Heusler alloy was first synthesized through Arc melting and powder pellets. The resulting sample is then inspected up close to reassure that it is truly the Heusler Alloy. Once that is confirmed, the sample undergoes various tests, for example calorimetry, X-ray diffraction, and many more. Through calorimetry, the measured enthalpy of formation was 37.7 ± 2.8 kJ/atom. Through X-ray diffraction, the measured lattice parameter was 5.8885 Å. The thermal expansion coefficient, found through dilatometry, was 14.15 x 10⁻⁶ per °C. The melting point, found through differential scanning calorimetry, was around 1100-1150 °C. Through the hardness test, the measured hardness was 444.96 ± 14.73 Hv. More properties, such as heat content at different temperatures and stress, still need to be obtained. Overall, Heusler alloys tend to have ferromagnetism and shape memory, which can be used to make stents, eyeglasses frames, and so forth. But at the same time, with the brittleness of this alloy, applications are limited. One possible way to overcome this is to mold it into thin strips which are layered together to increase its strength and hardness.

I13 Roller Coasters: Pushing Human Limits

Presenter(s)

Jonathan Munoz, Illinois Mathematics and Science Academy Samuel Smith, Illinois Mathematics and Science Academy

Advisor(s)

Eric Hawker, Illinois Mathematics and Science Academy

As magnetic launchers and steel polymer continue to replace chain lifts and wooden tracks, modern roller coasters push the limits of human safety by subjecting us to the most physically intensive forces. When designing these mechanical monsters, engineers must consider a wide range of variables to not only protect the health of the passengers, but also meet the demands of thrill seekers. Our research explores the risks posed by the nauseating inversions and physics of steel coasters. We researched and outlined the physical restrictions of roller coasters, the architectural aspects, and starting mechanisms and then incorporated our data in a computer-designed model. By simulating the kinematics of roller coasters with computer software, we researched the ideal roller coaster; one that grants the most satisfying experience while not exceeding human capacities. Thus far, we applied our background knowledge of human tolerance levels to various roller coaster elements and maximized their potential. Our current model mimics the elements typical of a modern day hypercoaster and eases their restricting safety regulations. While our design is still in progress, we hope our final blueprint will push the limits of inversions, starting mechanisms, and drops typical in roller coaster construction.

I14 Designing a Mixed-Use Facility on a Four Acre Plot of Land

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

Advisor(s)

Steven Vasilion, Vasilion Architects

We seek to design a practical, efficient, and creative mixed-use facility on a four-acre plot of land. This is an actual site that is practically empty, and the owner wants to develop it. Our design needs to include retail and office space, a larger banquet hall to replace the one currently on the site, and condo units variable in size. Applicable city zoning laws and requirements were identified, and exterior designs were made using Google Sketchup, and then condensed down to one final layout. Subsequently, designs of the floor plans for the condo units were begun in AutoCAD. We expect to also have designed the interior layout for the banquet facility, office and retail spaces, and a lobby for the banquet facility and residential area. We designed a site that is pleasing to the owner, city, and ourselves, although it was challenging to get every aspect to fit together. Our results will be presented to the owner and the city, and if the ideas we had are well-liked, they may be implemented in the near future for the design of the site.

I15 Architecting a Chicago-Based Environmentally Friendly Triplex

Presenter(s)

Madison Rogers, Illinois Mathematics and Science Academy

Advisor(s)

Jesse McGrath, McGrath Architects, P.C Clay Sewell, Illinois Mathematics and Science Academy

Multi-family homes make up 18% of residential housing in the U.S. and 21% of carbon emissions come from residential housing. Environmentally friendly technologies have been invented, which people have become captivated with, though they have yet to be fully integrated within these complexes. A green solution has been designed in hopes of making a tri-family complex a Passive House; a net zero energy building that utilizes solar gain and renewable resources in order to reduce energy costs by 90%. The pre-fabricated design will be affordable to all incomes, increasing the availability to the general public. Mayor Daley's Chicago Green Homes initiative provided a context for this study, in hopes of moving Chicago towards being a greener city. The complex has been designed to fit on a standard 25 foot x 125 foot Chicago lot, complying with governmental codes. In addition to the architectural design, a sense of appreciation for the architectural process has been gained: problem solving while staying true to the vision and understanding the applications of green technology. It is hoped that this research will enhance the public's perception of and appreciation for the integration of green technology into residential housing, thereby limiting one's carbon footprint in the world.

I16

Exploring Field Programmable Gate Array Time to Digital Converters in High Energy Physics

Presenter(s)

Yanchen Shi, Illinois Mathematics and Science Academy Douglas Zhu, Illinois Mathematics and Science Academy

Advisor(s)

Jin Wu, Fermi National Accelerator Laboratory

Field programmable gate arrays (FPGA) are used today in many electronics, including high energy physics and medical physics detectors. FPGA time to digital converters (TDC) measure small time differences by measuring signal delays. In our investigation, we tested the signal delay between two signals in these FPGA TDCs in search of ways to reduce error and increase efficiency. Data were taken and the signal delays versus standard deviations were graphed in order to observe the level of precision of the FPGA. Multiple fine structures were observed throughout our plot of signal delays versus standard deviations; these structures are still to be understood. Overall, our data showed that standard deviation decreased when the time differences were measured using multiple channels. In addition, using a more stable power supply also reduced the standard deviation. These results provide design guidelines when applications of high precision time measurements are necessary.

I17 Changing a Cell's Fate: New Cures for Diseases and Illnesses

Presenter(s)

Hyun Jin Song, Illinois Mathematics and Science Academy

Advisor(s)

Vitali Metlushko, University of Illinois at Chicago

The goal of this research, which is 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. As a first step, we used atomic force microscopy to image cells in a liquid environment, a normal environment for living human cells. Second, 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. Finally, our colleagues from the UIC College of Medicine tested the relationship between different fabricated ECM topographies and how different cells, ranging from normal to cancerous cells, responded to the fabricated ECM environment. Initial results demonstrated that fabricated ECM topographies in fact influenced the cells' life. A possible extension to this experiment would be to influence the ultimate cell types that stem cells become using ECM topographies.

I18

How the Ratios of Plastic Acrylic Balls in a Plastic Ball Phantom Affect the Consistency of the Phantom

Presenter(s)

Michael White, Illinois Mathematics and Science Academy

Advisor(s)

Beverly Lau, University of Chicago Robert Nishikawa, University of Chicago

Phantoms are used as a replacement to human body parts for the purpose of testing with radiation. The phantom being used in these experiments was meant to be a substitute for the human breast for testing mammography and tomosynthesis machines. The β value of these phantoms is a measure of the phantoms' consistency. We decided to test the extreme ratios: all balls of one out of the five sizes, with one phantom for each size. We took images using a mammography machine, and then analyzed the β values given by graphs provided by a Python program. What we found was that the ratios had an effect on the β values, with averages varying up to 0.22. We also found that the periodograms were never truly radially symmetrical, while the program used to calculate β assumed radially symmetrical power spectra. Also, a mixed bag of balls that we tested along with the radicals had a β value about equal to the average of the β values of the extremes. T-tests still need to be conducted in order to gauge the statistical significance of the difference in β values. We concluded that ratios of balls do have an effect on β .

I19 Nanoelectrode Arrays for Energy Storage and Ultrasensitive Sensing Application

Presenter(s)

Joly Wu, Fermi National Accelerator Laboratory

Advisor(s)

Ralu Divan, Argonne National Laboratory

Typical fabrication processes for nano-architectured electrodes employ lithographic techniques followed by dry or wet etching. The limited exposure time (40 h/ cm² area by e-beam lithography) for high dense arrays of nanoelectrodes can be overcome via interference lithography. This technique offers the advantage of submicron resolution over large sample areas. This project aimed to optimize the parameters of interference lithography. Substrates (silicon, quartz, glass), coated with positive and negative photoresists (S1805, SU-8, ma-N 405), resulted in a thickness range of 100 nm -10 μ m. Using Lloyd's two-mirror set-up and a HeCd laser ($\lambda = 325$ nm, 30 mW), samples were exposed at different angles (16°, 18°, 20°) and time intervals (10 - 2000 sec) in order to obtain the 250 nm structure size needed for nanoelectrodes. After development, different hard mask metals (Al, Cr, Pt) were used for silicon etching via reactive ion etching. Silicon wafers coated with negative resist ma-N 405 and exposed for 2000 seconds at 18° currently produces the combination of parameters easiest to replicate with consistent results. Thus, a simple, maskless, and efficient way to fabricate silicon nanopillar electrodes has been developed. The nanoelectrodes fabricated by this optimized process have potential applications in energy storage and ultrasensitive sensing purposes.

I20 A Football Design to Enforce a Quick Release by a Quarterback

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

Advisor(s)

Matthew Spenko, Illinois Institute of Technology

The goal of this project is to design and develop a novel football which enforces a quick release by the quarterback. The football measures the time between when it is snapped by the center and released by the quarterback. This football will be used by recreational players who want to enforce a time limit on the quarterback and competitive players who need to practice a quick release. To accomplish this, the football utilizes a PIC[®] microcontroller that flashes a light-emitting diode if the quarterback holds the ball too long. A prototype has been developed utilizing a standard football modified with a small circuit. The prototype is complete and was tested in the field. The trials were not successful due to fabrication issues regarding the mechanical robustness of the circuit. Specifically, the wires became entangled, which caused short circuits. Additionally, the PIC[®] failed during testing due to unknown reasons, and needed to be reprogrammed. Current work is centered on improving the robustness of the prototype so an accurate evaluation can be performed. Along with the prototype, we prepared a survey and will obtain feedback to further improve the design.

J01 A Continuous Change of the Aspirations of IMSA Students in Writing

Presenter(s)

Monica Daniels, Illinois Mathematics and Science Academy

Advisor(s)

Tracy Townsend, Illinois Mathematics and Science Academy

This investigation focuses on what type of short story would best describe the changes that IMSA students go through. The genres of stories that I am choosing from are fiction and nonfiction. Interviews were used to find information to write about. Short stories are written in the two forms to determine which style gets the idea across better. The investigation was changed to focus more on short stories rather than a book. An interview consent form has been completed and three subjects were interviewed. Half of one of the fiction stories has been written. The remainder of that story is being completed, as well as the other stories.

J02

Writing an Educational and Engaging Script for Third through Fifth Grade Students

Presenter(s)

Kathleen Gundry, Illinois Mathematics and Science Academy

Advisor(s)

Manuel Perez, Illinois Mathematics and Science Academy

Science and scriptwriting rarely coincide beyond the science fiction. This inquiry focused on writing and developing an educational script for the 45 minute IMSA on Wheels (IoW) show to effectively teach third through fifth graders about electricity and magnetism. Altering the current disjointed eleven science demonstrations into a show with a coherent plot and clear explanations required research into scriptwriting techniques and educational storytelling. Other aspects of the original script needed altering or more reviewing for the new script also. Further analysis will hopefully reveal that the revised script improved the elementary school students' retention and understanding of electricity and magnetism. Educating the children remains the ultimate objective of this exploration; the show should make learning about science fun.

J03 Beginning the Process of Writing a Fantasy Novel

Presenter(s)

Perry Nelson, Illinois Mathematics and Science Academy

Advisor(s)

Tracy Townsend, Illinois Mathematics and Science Academy

This investigation explores the writing process by beginning work on a fantasy novel. Characters and a plot were developed, as well as a portion of the text, in order that the writer could see how different aspects of the book fit together. Although the year began with only a detailed setting and structure for the worlds the story takes place in, through extensive discussion and some research, three-dimensional characters and a plot that allows them to grow were developed. Joseph Campbell's investigation of the hero's journey, or the monomyth, was especially helpful. Discussion of various writing approaches led to a decision to write portions of the novel selectively and out of order to maximize character development. Many ideas grew out of this method, as well as a greater understanding of the characters and their roles in the story. The writing and problem-solving skills developed through this inquiry project will allow the writer to complete this novel and overcome any future challenges to the project.

K01

International Collaborative Effort for the Creation of Renewable Energy Applications and Methodologies: Efficient Wind Power Production

Presenter(s)

Michael Atten, Illinois Mathematics and Science Academy Rafael Gonzalez, Illinois Mathematics and Science Academy Cai O'Connell, Illinois Mathematics and Science Academy

Advisor(s)

Glenn "Max" McGee, Illinois Mathematics and Science Academy Aracelys Rios, Illinois Mathematics and Science Academy

More and more, the world is moving toward cleaner, renewable power sources. This shift in global focus promises a brighter future for generations to come. In order to move with these shifts, and in an effort to develop innovative ways for production of this cleaner energy, this investigation focused on wind energy and turbine blade designs. It examined several variables affecting power output of turbines including blade surface area, mass, and shape. Measuring voltage and current to find the average power output over three minutes was the criterion for determining the best blade design. By testing each blade design at different angles to the wind direction, it was determined that larger surface area, combined with a blade angle of twenty degrees, produced the highest power output. It was also found that the most powerful blade shapes had the lowest mass, making those designs economically advantageous. These findings provide yet another step forward in improving the efficiency of wind turbine design and show promise for a viable solution to one of the world's greatest problems: clean, renewable power.

K02 International Collaborative Effort for the Creation of Renewable Energy Applications and Methodologies: *Miscanthus* Butanol Conversion

Presenter(s)

Mitchell Bieniek, Illinois Mathematics and Science Academy Garrett Flack, Illinois Mathematics and Science Academy

Advisor(s)

Glenn "Max" McGee, Illinois Mathematics and Science Academy Aracelys Rios, Illinois Mathematics and Science Academy

Fuel costs and environmental issues have driven the shift towards renewable resources. Butanol production using bacteria has been suggested as one solution. The fermentation of butanol using glucose extracted from the switchgrass *Miscanthus giganteus* was researched. Simple sugars were derived from 50 gram *Miscanthus* samples using a combination of milling, acid hydrolysis, and high pressure heating. The first sample was tested quantitatively for glucose through titration and found to be about 16 g/L. The ideal concentration is 40 g/L, therefore conditions will be varied to optimize production. The bacterium *Clostridium beijerinckii* produced butanol from simple sugars anaerobically. The butanol produced in this study is awaiting analysis by assay, which will be related to the concentration of glucose. Both the economic feasibility and environmental friendliness of this process were also regarded. Consideration was given to the starting material selection based on the environmental impact of their syntheses. The power consumption of the butanol production method we utilized was also estimated, to determine if the process could be made entirely green. This methodology for producing butanol shows promise as a viable solution to one of the world's greatest problems: clean, renewable power.

K03 Exploring the Synergy of Wastewater Remediation and Bioenergy Production Through Nannochloropsis Cultivation

Presenter(s)

Benjamin Kuo, Illinois Mathematics and Science Academy

Advisor(s)

Timothy Strathmann, University of Illinois at Urbana-Champaign Derek Vardon, University of Illinois at Urbana-Champaign

Among current world problems, the water and energy crises are two of the biggest. Use of algae has the potential to impact this. Due to its plant-like nature, algae can participate in the water treatment processes by helping to remove harmful chemicals from fertilizer run off, such as nitrates, ammonia, and phosphates. Lipids isolated from algae can also be converted into biofuel. This study focused on the use of Nannochloropsis, a less studied algae, in both wastewater filtration and biofuel production. The algae were grown in varying concentrations of wastewater pre-filtered with 0.45- μ m membranes to remove sediments and bacteria that could interfere with results. Neutral lipid levels were tracked fluorometrically using Red Nile Dye. Nannochloropsis grew only marginally better in concentrations of 75% and 100% lipid than 25% or 50%, but it was clear that wastewater supports algae growth. Lipid analysis suggests that higher biomass does not necessarily result in higher lipid contents. The algae also effectively removed ammonia, though phosphorous tests were inconclusive. Unlike this study, others state higher concentrations do not necessarily equate to better biomass productions, but they focused on biomass, not lipid content, which differs here. Further work must clearly be done, but this technology continues to show promise.

K04

Lighting of the Future: An Investigation of Light-Emitting Diode Efficiency

Presenter(s)

Neel Patel, Illinois Mathematics and Science Academy Seth Zelman, Illinois Mathematics and Science Academy

Advisor(s)

Branson Lawrence, Illinois Mathematics and Science Academy

Light-emitting diodes (LED) have become increasingly popular due to their ability to provide sufficient lighting with only a small amount of power. This project attempted to develop a solution to maximize energy efficiency in lighting by designing an LED bulb that runs on little energy, while providing an adequate amount of light. An experiment was conducted to determine the flaws in consumer lighting. A prototype design was then developed to eliminate the complications identified in these lights using information gathered from testing incandescent, fluorescent, and LED bulbs. Experiment results showed that the Accent 1.2 watt bulb proved most efficient with an average of 47.801 lumens per watt compared to the next highest 44.373 average lumens per watt. The prototype avoided the LED directionality problem by spreading light throughout the room, though it significantly decreased the average lumens per watt ratio to 8.682. Results also showed the benefits of adding a diffuser lens to an LED bulb, increasing the brightness of the prototype from 3.004 average lumens per watt to 8.682 average lumens per watt. This project proves that LEDs are the new wave of lighting and that they are worth the savings in energy, despite their initial cost.

K05 CdS/ZnS Quantum Dot-Photoexcited Glucose Oxidase Biosensor for Silver Ion Detection in Contaminated Aqueous Environments

Presenter(s)

Nishith Reddy, Illinois Mathematics and Science Academy

Advisor(s)

Karl Rockne, University of Illinois at Chicago

The increasing use of silver as an antimicrobial agent in commercial textile and pharmaceutical products has raised concern for potential cytotoxicity in contaminated groundwater and surface water. The objective of this study was to develop a biosensor for silver ion (Ag^+) detection using CdS/ZnS core-shell quantum dot-photoexcited glucose oxidase as a biological recognition element with optically quantified signal transduction by spectroscopy. Biosensors are favored over alternative chemical methods because they are potentially more sensitive, specific, and timely for on-site analysis. The proposed biosensor is based upon exploiting the known inhibition of the enzyme glucose oxidase by Ag^+ with quantum dot reporting mechanism. The enzymatic reaction was characterized with absorbance and kinetics. A significant correlation ($R^2 = 0.96161$, df = 4, p = 0.000560) was established between Ag^+ concentration and D-(+)-glucose absorbance. Photoexcitation by quantum dots resulted in a shorter equilibration time ($k = -0.3262 \text{ min}^{-1}$). The results suggest the feasibility of using a quantum dot-photoexcited glucose oxidase inhibition biosensor for Ag^+ detection. Further interference studies with factors such as enzyme degradation, pH, temperature, and other contaminants are needed before field applications

K06

Designing a Building for the IMSA Energy Center that Runs on Only Solar and Wind Energy

Presenter(s)

Vanya Yorgova, Illinois Mathematics and Science Academy

Advisor(s)

Branson Lawrence, Illinois Mathematics and Science Academy

This scientific investigation is to design a building for the IMSA Energy Center that would be solely operated on wind and solar energy throughout the year. In order to do this project, solar and wind energy output totals were recorded from the currently installed equipment at IMSA for all months. Once energy output data was analyzed, a review of literature was undertaken for ideas with design and practical energy systems. The combination of data analysis and literature review yielded the best way of passively and actively constructing the IMSA building from the ground up to conserve as much energy as possible. A design of the house using Google SketchUp is in progress; this will include a design for the structure of the building, compass orientation, a floor plan, a passive and active heating system, and an electrical power system. The importance of this investigation is that the information gathered is essential for the creation of energy efficient homes across the country. This project also has the potential to result in a lower carbon footprint for IMSA and others.

L01 Using Film as a Medium to Create a Documentary About Academic Integrity at IMSA

Presenter(s)

Megan Czajka, Illinois Mathematics and Science Academy Connor Tomasko, Illinois Mathematics and Science Academy

Advisor(s)

Adam Kotlarczyk, Illinois Mathematics and Science Academy Spencer Parsons, Northwestern University

The goal of this investigation was to investigate how film can be used as a medium to portray a particular subject or idea. The students created a documentary in order to discover how the visual arts can convey an idea in a different manner than writing a research paper or essay. Various documentaries and films about high school students, including *The Breakfast Club* and *High School*, helped them gain an understanding of the process that professional filmmakers often use to express a certain idea. Students and staff at IMSA, such as Dr. Devol and Ms. Townsend, were interviewed in order to gain many different views and ideals about academic integrity. The film portrays the nature of IMSA students visually in addition to verbally through footage of the school. In the final stages, the students created a thoughtful outline of all of the interviews, and edited them together to formulate a documentary that should successfully depict their conclusions about academic integrity at IMSA. The skills and knowledge obtained from this investigation can be used to help students at IMSA utilize film in their own classes in order to evoke emotion and artistic style from a particular argument or viewpoint.

M01

Emotion in Journalism: Changes in Reporting Disasters and How They Affect Coverage

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

Advisor(s)

James Victory, Illinois Mathematics and Science Academy

After Hurricane Katrina, controversy erupted over the use of emotion in journalism. Some argued that the coverage of the storm was far less impartial than any journalism before it, while others argued over whether this emotion was useful. I have compared news articles and video footage from Hurricane Katrina with those of Hurricane Camille to determine if there has been a change in emotionalism in reporting and whether this change has affected the quality of the reporting. These videos, as well as a comparison of the use of emotionally charged words in the articles, led me to conclude that journalists after Hurricane Katrina were much less reserved. This problem was especially pronounced in the video coverage, where multiple reporters abandoned objectivity to plead for storm victims on camera. Their distress prevented them from delivering thorough and accurate coverage of the events. The comparison of these two storms indicates that journalists must endeavor to return to a less emotional style of reporting if they wish to provide quality news coverage of disasters.

M02 Latin American Women in Revolution: Mexico and Nicaragua in the Twentieth Century

Presenter(s)

Joscelyn Garcia, Illinois Mathematics and Science Academy

Advisor(s)

Kathryn Kadel, Illinois Mathematics and Science Academy Eric Smith, Illinois Mathematics and Science Academy

In the past century there have been two influential revolutionary movements in the Latin American countries of Mexico and Nicaragua: the Mexican Revolution and the Sandinista Revolution. In both revolutions, a significant number of women from different backgrounds were involved and had great influence in the outcomes. This investigation focuses on the opportunities and limitations women had before and after the revolutionary events, as well as the methods and motives for their involvement. These women defied the social norms of machismo, where women were expected to be child-bearers and housewives. Many women broke cultural barriers in the time of change in their countries and displayed considerable courage. Though their motives might differ, in the end women improved their situation in the countries as a result of revolutionary activity. Men realized that women were able to accomplish great things and gave them more respect. Overall, as women showed increasing bravery and challenged their treatment at home.

M03 Paint the Town Red: How Marxism Influences Politics Today

Presenter(s) Miranda Herzog, Illinois Mathematics and Science Academy

Advisor(s)

Christian Nokkentved, Illinois Mathematics and Science Academy

In 1848, Marx and Engels published *The Communist Manifesto*, a pamphlet outlining the views of the young Communist Party. This system of thought took Europe by storm, spawning multiple Socialist and Communist ideologies which ultimately resulted in the creation of the world's first Marxist state. This year marks the twentieth anniversary of the collapse of the Soviet Union, but Marxist thought and its derivations still subtly influence the fields of philosophy and political theory. This investigation is a literature review of Socialist thought from Marx through the German and Russian Socialists of the mid-1900s. The texts used in this study include both primary and secondary sources. Through this study, I have discovered how the theoretical roots of Marxism paved the way for political systems and economic theories around the world. The examination of these theories reveals how their ideas still permeate politics today. Ultimately, this is a history of ideas: the story of Socialism told through a spectrum of Marxist philosophies.

M04 Ethics in Legislation: The Search for the Basis of Ethics

Presenter(s)

Melissa O'Brien, Illinois Mathematics and Science Academy Kimberly Sherwin, Illinois Mathematics and Science Academy

Advisor(s)

Lee Eysturlid, Illinois Mathematics and Science Academy

Ethics in legislation plays a critical role in today's society because it shapes people's opinions on the effectiveness of their government. Last year we found that as a result of the perceptions of scandals in government, people have lost faith in their elected officials. To extend the study, we created surveys based upon our research and consultation with our outside expert. We distributed surveys to both Illinois state legislators and Illinois Mathematics and Science Academy parents. Our sample sizes for the parents and legislators were 158 and thirty-one respectively. Our findings showed a statistically significant difference in the legislators' and parents' perspectives on the capability of the general public to make informed decisions. In addition, legislators have less confidence in the public's knowledge of ethics than IMSA parents, despite the fact that both samples have similar educational backgrounds. This study suggests that both legislators and citizens are concerned about ethical standards in government but have distinctly different opinions on how to make improvements in the ethical values of public officials.

M05

"O Jesus, Through the Immaculate Heart of Mary" Versus "What up, J.C.?": Protestantism from Reformation to Modern Day

Presenter(s) Jeannine Schulz, Illinois Mathematics and Science Academy

Advisor(s)

Robert Kiely, Illinois Mathematics and Science Academy

In matters of faith, it is fundamental to understand where beliefs originated. Modern Protestant values and ideas stem from the Protestant Reformation and have been continually evolving since the early 1500's. My study investigates the beginning of Protestantism and its transformation through the centuries into distinct denominations. Through examining historical and theological accounts, as well as primary texts written by early Christian forefathers (Luther, Calvin, and so forth), I look at the theology behind Luther's separation from the Roman Catholic Church. I have explored key biblical texts and their varying interpretations, and have also found evidence that suggests the initial reasoning for the Protestant Reformation didn't solely come from varying conclusions made about the texts, but also from the political controversy in the Catholic Church. The aftermath of this initial division triggered others to break away from the Catholic Church and/or Luther and start their own denomination of Christianity based on their personal beliefs. This trend of divisions has continued to the hundreds of different sects and denominations present in modern day Protestantism.

M06 Rural Electrification in the United States and Russia: Causes and Social Consequences

Presenter(s)

Sarah Weitekamp, Illinois Mathematics and Science Academy

Advisor(s)

Claiborne Skinner, Illinois Mathematics and Science Academy

Electricity's introduction to rural areas drastically alters people's lives. Comparing Russia and the United States in the first decades of the twentieth century underlines the dramatic social effects of electrification comprehensively. Through analysis of oral histories, primary sources, and literature reviews, this project examined the changes electrification brought to rural people. In America, rural electrification's delay widened the divide between urban and rural societies, yet the transition is more complex than presumed. Unlike Russia's citizens, rural Americans were ready for grid electrification, thanks to their earlier exposure to small generators. While private utilities failed to utilize the public market, viewing only short-term losses, farmers clamored for larger-scale electrification. Created in 1935 by Franklin D. Roosevelt, the Rural Electrification Administration, along with the Tennessee Valley Authority, served this purpose, establishing farmer-owned cooperatives and encouraging the production of affordable appliances. In Russia, however, rural electrification was not widely adopted because small generator use was not widespread, and therefore that vital first step towards extensive rural electricity consumption never occurred. Rural electrification's importance is long lasting: while Russia's failure to furnish agricultural modernization through electrification devastated its agriculture industry, today's American agriculture industry arose through electricia modernization.

N01

Politics of Globalization: Crises, Economic Human Rights, and Inequality

Presenter(s)

Jennifer Crawford, Illinois Mathematics and Science Academy

Advisor(s)

Steven Ramirez, Loyola University

The current model of globalization is faulty. The purpose of this research was to determine how politics continues to influence policies governing globalization, the extent of the infringement on economic human rights, the political effects and causes of the subprime mortgage crisis, and the extent of growing inequality between the elite and the average citizens. There are three main problems with globalization today. First, people cannot move freely, but jobs can. Second, export-led growth has influenced global inequality and a distorted aggregate demand, increasing incentive for over-consumption in developed countries. Third, there is a transnational governing class of elites whose interests are separated from those of the average person. After researching these problems, it is necessary to conclude that a new form of globalization is needed, one that addresses the needs of the majority. One sound solution is to adapt the International Monetary Fund to become a global reserve bank that engages in fractional reserve banking to invest in infrastructure and human rights worldwide, driving a shift from export-led growth to innovation-led growth. Another sound solution is to empower people to move freely.

N02 A Western Legal Shift to Incorporate Indigenous Intellectual Knowledge

Presenter(s)

Diliana Dimitrova, Illinois Mathematics and Science Academy

Advisor(s)

William Mock, The John Marshall Law School Christian Nokkentved, Illinois Mathematics and Science Academy

The focus of this research project has been on intellectual property rights and concepts in relation to indigenous knowledge, because indigenous communities often have their information unfairly used by for-profit corporations. This project provides an analysis of current legal intellectual property concepts in existence and the need for a shift in order to incorporate indigenous knowledge protection needed by indigenous communities. The method of investigation has been literature review, and the results have indicated a need for a new type of intellectual protection. Such methods of protection are already used in some parts of the world such as Peru, and a proposed solution would be for the establishment of a world intellectual property database to which indigenous communities could submit their knowledge for protection and record. This would allow for monetary benefits to indigenous groups, as well as providing protection and a record of their information that they may not otherwise have. The implications of this study are wide, for indigenous communities from all over the world have had information unfairly used by for-profit corporations, and an intellectual property agreement would greatly benefit such communities.

N03 Mass Incarceration and Its Effects in Society

Presenter(s) Haley Ramirez, Illinois Mathematics and Science Academy

Advisor(s)

James Carey, Loyola University

Currently, the United States boasts the highest incarceration rate in the world with a minority incarceration rate considerably higher than that of any other country. Chicago has one of the most over populated prisons in the nation. My research has primarily consisted of literature review focused on the reasons for the drastic rise in the incarceration, the laws and provisions constructed for this political atmosphere, and how these affect society. It has also included trips to the courthouse and interviews with several members of the justice system. Since the 1980s, the United State's incarceration rate has been rising at an alarming pace (about 975% from 1982 to 1990). Drug crimes are the largest contributor to the rising incarceration rate. The War on Drugs created laws such as the three-strike law, which caused a rise in violent crimes as well as created lifelong felons. These felons cannot vote, hold certain jobs, or take advantage of government programs such as welfare, which makes it hard for those leaving prisons to support themselves. This population is disproportionally made up of minorities. This creates a sector of society, mostly minorities, which has no voice in the government.

N04 Mandatory Death Penalty in Africa

Presenter(s)

Vamika Venkatesan, Illinois Mathematics and Science Academy

Advisor(s)

Sandra Babcock, Northwestern University Brook Miscoski, Northwestern University

If a country has mandatory death penalty, that means that there is a penal code on record and that it is currently in use. When a country has a mandatory death penalty, courts are required to sentence offenders to death without considering aggravating and mitigating factors to the offense. This inquiry focused on researching the mandatory death penalty in Africa. A database was created containing information about cases and laws from ninety-two countries. Findings showed a gradient of maintaining and implementing a mandatory death penalty among many countries in Africa. Kenya, Uganda, and Malawi all do not have a mandatory death penalty because during cases, the courts have deemed the mandatory death penalty unconstitutional. Lesotho, Botswana, and Zimbabwe use the mandatory death penalty at discretion. Lesotho rarely ever uses the mandatory death penalty, but Zimbabwe ends up turning to the mandatory death penalty for a myriad of reasons, including murder, terrorism, and adultery. Understanding the history and nature of the mandatory death penalty in Africa can help combat the mandatory death penalty in other African court cases.

O01 Investigations in Open Symmetric Pentomino Problems

Presenter(s)

Shiladitya Bhattacharyya, Illinois Mathematics and Science Academy James Quigley, Illinois Mathematics and Science Academy Oscar To, Illinois Mathematics and Science Academy

Advisor(s)

Vincent Matsko, Illinois Mathematics and Science Academy

The fundamental nature of pentominoes has puzzled scholars and recreational enthusiasts alike for centuries. The twelve pieces, easily envisioned as Tetris pieces with five blocks instead of four, have given rise to a variety of problems. People have successfully derived rectangles of every possible dimension, and even determined the number of possible piece arrangements for each rectangle. Solomon Golomb's 1960 publication, *Polyominoes*, formalized solution methods for many pentomino problems, most notably tiling and symmetry arguments. Despite the discovered solutions to many pentomino problems, a large number of problems still remain unsolved. The focus of our investigation was the twin pentomino problem, which asked for the maximum height of identical structures made from six pentominoes. Currently, the maximum known height is h = 16. Our investigation attempted to find solutions to this problem both through proof and through exhaustion. Over the course of the investigation, we successfully formalized several arguments regarding the nature of the problem, including the necessary location of the "I" piece, the impossibility of twins with pieces that are only tangent at one side unit, and a problem regarding axes of symmetry. Our presentation will be focused on these proofs and the possibility of determining the maximum height of symmetric twins.

O02 Questions in Computational Group Theory

Presenter(s)

Marcelo Diop-Gonzalez, Illinois Mathematics and Science Academy

Advisor(s)

Micah Fogel, Illinois Mathematics and Science Academy

While all information about a group is theoretically contained in its finite presentation, it is often difficult to compute useful facts about a group from a given presentation. For instance, determining whether a group is finite, or even trivial, from a presentation is known to be computationally complex (NP-complete or harder, depending on the exact question being asked). During this investigation, we probed the limits of this complexity by studying groups with very simple presentations and determining just how large and complex the group could get. In particular, we examined groups with simple presentations to determine whether they were abelian and whether we could determine the order. This would tell us whether we could get very large, very complicated groups with very small presentations. While the group presented by <a, b | a^3 , ab^2a > can be reduced to a group of small order. If a very small presentation could produce groups with orders comparable to extremely fast-growing functions such as that of Ackermann, we would know that the problem of computing information about even the simplest of groups from their presentation would be computationally infeasible.

O03 On the Coloring of Graph Products

Presenter(s) Derek Hardin, Illinois Mathematics and Science Academy

Advisor(s)

Hemanshu Kaul, Illinois Institute of Technology

The chromatic number of graph products has been one of the most studied fields in chromatic graph theory. The Hedetniemi Conjecture purports to characterize the chromatic number of graph tensor products as the minimal chromatic number of the factor graphs. This conjecture has gone without a proof, though substantial progress has been made on subcases and weaker variants. In this paper, the extant results about the Hedetniemi Conjecture are extended to Mycielski graphs and generalized to subcases of the repeated application of strong products and Cartesian products to factor graphs. Since graphs possess unique factorizations over the Cartesian product operation and the strong product operation, a full characterization of this case would prove the Hedetniemi Conjecture. Throughout the investigation, inductive proof techniques are developed that might prove applicable in such an extension, mostly through the investigation of repeated application of the strong and Cartesian product operations. This project has significant implications for the general chromatic structure of graphs, as well as, on a broader scale, for bandwidth allocation and scheduling algorithms.
O04 Flipping the Winner of a Poset Game

Presenter(s)

Adam Kalinich, Illinois Mathematics and Science Academy

Advisor(s)

Lance Fortnow, Northwestern University

Partially-ordered set games, also called poset games, are a class of two-player combinatorial games. The playing field consists of a set of elements, some of which are greater than other elements. Two players take turns removing an element and all elements greater than it, and whoever takes the last element wins. Examples of poset games include Nim and Chomp. I investigated the complexity of computing which player of a poset game has a winning strategy. I gave an inductive procedure that modifies poset games to change the nim-value which informally captures the winning strategies in the game. For a generic poset game G, I described a method for constructing a game $\neg G$ such that the first player has a winning strategy if and only if the second player has a winning strategy on G. This solved the long-standing problem of whether this construction can be done efficiently. This construction also allowed me to reduce the class of Boolean formulas to poset games, establishing a lower bound on the complexity of poset games.

O05 Investigating Flat Foldability of Box Pleated Origami Models

Presenter(s)

Jisoo Kim, Illinois Mathematics and Science Academy

Advisor(s)

Vincent Matsko, Illinois Mathematics and Science Academy

An origami model is said to be flat foldable if the model can lie on a two-dimensional surface. This trait, important in creating the basic structures of origami models, is related to the crease pattern formed by the model. In this investigation, box pleating - origami designing method that uses simple angles - was studied and used to design origami models. The crease patterns formed by the box pleated models were then analyzed in terms of their lengths and angles formed. Variations of angular and parity of the creases were created by changing the initial approach to the box pleating technique. As a result, a simple box pleating procedure was developed and some of the flat foldable crease patterns were explained in terms of angle measurements and geometry of the creases. This explanation of flat foldability through two-dimensional mathematic indicates that there may be a way to dictate all the necessary rules to freely transform a paper into two dimensions, which would lead to more possibilities in designing origami models in the future.

O06 An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in \mathbf{Z}_n

Presenter(s)

Corinne Madsen, Illinois Mathematics and Science Academy

Advisor(s)

Noah Prince, Illinois Mathematics and Science Academy

The Erdös-Ginzburg-Ziv (EGZ) theorem is an important theorem in additive number theory which states that any sequence of 2n-1 elements from Z_n has a subsequence of length n that sums to 0. The EGZ theorem has been generalized to Z_n^2 by Reiher and to finite abelian groups in a much stronger form by the Ballobàs-Leader theorem. This investigation was focused on extending the EGZ Theorem to non-zero sums in Z_n . We found that the problem behaved differently in three situations: when n is prime, when n and x are coprime, and when n and x are not coprime. For the case when n is prime, we proved that, for any nonzero element x from Z_p , a sequence of 2p-2 elements has a p-length sum to x. For the case when n and x are not coprime, we proved that, if q is the smallest prime factor dividing n, a sequence of (n-1)*(n/q) q-1 elements from Z_n has a n-length sum to x. For the third case when n and x are not coprime, we believe it can be simplified to the form of summing to $y^{h-1} \mod y^h$ where r is a prime, for which we conjecture that $2y^h - 2$ is the sequence length needed.

O07 Reading Differences Between Printed Books and E-Readers

Presenter(s)

Matthew Rasmussen, Illinois Mathematics and Science Academy

Advisor(s)

Richard Stalmack, Illinois Mathematics and Science Academy

As e-reading technology improves, more and more people are reading e-books, and perhaps these e-readers could be adopted for educational use. In order to investigate how well these e-readers can be used in comparison to printed books and each other, subjects read short stories by F. Scott Fitzgerald on an iPadTM, a KindleTM, and a printed book. They then took a survey on how comfortable the devices were to use and read in comparison to one another and the printed book. While the initial goal was to have fifteen subjects complete testing and surveying in order to have a sufficient body of evidence to determine differences in reading speed, readability, and comfort, testing has not yet been completed with that many subjects. However, anecdotal evidence and initial testing results indicate that the iPadTM is more difficult to read from than the KindleTM or the printed book. Once testing is finished, the data on reading speed, comfort, and readability will be analyzed using multivariable regression. It will be interesting to see if the initial observations hold up after multivariable analysis is conducted, and if a difference between the KindleTM and printed book emerges. The information produced by this investigation could help to indicate whether or not the adoption of e-readers for use in educational settings would be useful.

O08 Stable Expansions of the Integers

Presenter(s)

Rose Sloan, Illinois Mathematics and Science Academy

Advisor(s)

David Marker, University of Illinois at Chicago

This investigation examined whether a model with the integers, addition, and a predicate can be stable. In particular, I added a predicate for powers of two and a predicate for numbers that are equal to two raised to its own power a whole number of times. I looked at quantifier elimination in these models, looking particularly at eliminating quantifiers from formulas of the form $\exists x(P(x) \& P(mx ny))$ where m and n are constants. I was able to find a general solution for formulas of this form when P is a predicate for powers of two, but it relied on an additional function dependent on ordering. When P is a predicate for two raised to its own power a whole number of times, many equations of the form $\exists x(P(x) \& P(mx ny))$ have simple quantifier-free equivalents, but in other cases, quantifier elimination appears to be impossible. In particular, it is likely impossible to eliminate quantifiers from the formula $\exists x(P(x) \& P(x y))$ where P any predicate similar to those I looked at. These results show that this problem cannot be solved through a quantifier elimination approach.

009

The Leader Mentality: The Importance of Scoring First in a Major League Baseball Game

Presenter(s)

Michael Teng, Illinois Mathematics and Science Academy Kevin Zhao, Illinois Mathematics and Science Academy

Advisor(s)

Christopher Kolar, Illinois Mathematics and Science Academy

We investigate the probability of a Major League Baseball team winning a baseball game after scoring first in that game given different parameters, such as which era the game was played in (for example, the steroids era versus the post-steroids era) and whether the game was a regular season game or a playoff game. Using data extracted from Retrosheet's online databases, we find the record of every Major League Baseball team between 1950 and 2010 after scoring first. We compare these records between and within years in order to determine the significance of scoring first in a baseball game. We show that the probability of winning the game after scoring first is approximately 65%, although this fluctuated and differed between eras. We further show that there is a negative correlation between the number of runs scored and the significance of scoring first in a game. We present the probability of winning a Major League Baseball game after scoring first and discuss possible implications this may have on the way the game of baseball is played and managed.

P01 The Comparison of Motility in Parent Versus High Nitric Oxide Adapted Cells

Presenter(s)

Courtney Amegashie, Illinois Mathematics and Science Academy

Advisor(s)

Eftychia Gouvas, University of Illinois at Chicago James Radosevich, University of Illinois at Chicago

Nitric oxide (NO) is a free radical, recognized for its role in carcinogenesis and tumor growth. Our laboratory has previously adapted several cancer cell lines to high nitric oxide (HNO) levels by gradually exposing the cells to increasing concentrations of a NO donor. This cell line model represents what is seen clinically in NO expression. It has been shown that cell migration rates are a measure of tumor aggressiveness. In this study, we compare the migration velocity of several cancer cell line pairs to determine if NO influences tumor cell migration. Overall, the HNO cell lines exhibited a faster migration rate than their corresponding parent cell lines. The results herein suggest that cells growing in high NO microenvironments have greater metastatic potential than cells growing in relatively lower NO microenvironments. Cell migration rates varied among the locations tested, and between pairs. As such, little can be concluded here about the effect of cell line origin on the migration rates of cancer cells. Future work will focus on validating the *in vivo* use of NO expression as a biomarker for predicting the aggressiveness of tumors as well as several other human tumors.

P02

A Comparison of Zantac and Prevacid in the Treatment of Gastroesophageal Reflux in Premature Infants Diagnosed with Bronchopulmonary Dysplasia

Presenter(s)

Omotayo Balogun, Illinois Mathematics and Science Academy Kari Tyler, Illinois Mathematics and Science Academy

Advisor(s)

Maliha Shareef, Loyola University

We investigated the effectiveness of Prevacid (lansoprazole) in comparison to Zantac (ranitidine) in the treatment of gastroesophageal reflux (GER) in premature infants with chronic bronchopulmonary dysplasia (BPD). Traditionally, Prevacid is the preferred method of treatment in neonates; however whether it is truly more effective is unknown. We gathered information between the years of 2005-2009 from the Loyola University Medical's Neonatal Intensive Care Unit database. In order to determine the effectiveness of the two drugs, we collected information pertaining to: gestational age, delivery method, Apgar scores (1 and 5 minutes), start and end dates of Prevacid or Zantac treatment, and severity of GER with regards to apnea and bradycardia for each patient. From an initial analysis of the data, it was concluded that frequency of apnea and bradycardia would be a better measure of the severity of GER than incidence of apnea and bradycardia, which we initially collected. In light of this change, the analysis of the data is ongoing. Our hope is that our study will be able to help doctors choose the best treatment option for infants inflicted with GER.

P03 Ampicillin Resistance in *Escherichia coli*: Adaptation or Mutation?

Presenter(s)

Madeline Booton, Illinois Mathematics and Science Academy

Advisor(s)

Donald Dosch, Illinois Mathematics and Science Academy

Wild-type *Escherichia coli* is a bacterium that is susceptible to ampicillin. Any resistance that *E. coli* could demonstrate could either be induced through a physiological change or a genetic mutation. Using Kirby-Bauer tests, wild-type *E. coli* was exposed to ampicillin, and colonies exhibiting resistance were isolated and grown for a three day recovery period without ampicillin. The isolates were then re-exposed to ampicillin to determine if the resistance had changed. After determining that the resistance to ampicillin seemed to be a permanent change, the isolated colonies were tested against different antibiotics that have different mechanisms, like inhibiting cell wall or protein synthesis, and statistical analysis on the zones of the other antibiotics has been done to gain insight into the mechanism of resistance. Since antibiotic resistance in *E. coli* could help avoid future problems with antibiotic resistant bacteria.

P04 An Investigation of Periodontal Diseases

Presenter(s)

Seth Butcher, Illinois Mathematics and Science Academy

Advisor(s)

Dean Lodding, Smiles for Life Dental

Several aspects of periodontal disease were investigated, including discovering the most resilient strains of disease causing bacteria and determining the usefulness of follow up procedures. A brief excursion was made into endodontics to search for factors that may lead to root canal procedures. For the periodontal side, patient dental pocket-depth records were evaluated before and after periodontal treatment to determine change in depth. These results were then analyzed to determine a connection to the specific strains of bacteria present before the procedure and the improvement in the patient. The results of this investigation are preliminary, as more data will have to be collected before any conclusive results can be found. Thus far, results have only been linked to individual strains of bacteria. Future results will include connections between improvement and several combinations of bacteria. The investigation should result in guidelines for periodontal bacteria resilience. Once more data has been analyzed, the investigation will have obtained resilience strengths of ten different strains of bacteria and the strength of combinations of those ten strains. This knowledge can be applied to dental offices to determine the severity of patient conditions and to prescribe treatments of appropriate strength.

P05 Evaluating Computerized Tomography Scans Ordered from the Emergency Room for Suspected Pulmonary Embolism

Presenter(s)

Ajay Chatrath, Illinois Mathematics and Science Academy

Advisor(s)

Arun Jagannathan, Riverside Medical Center

Although computerized tomography (CT) scans are useful for diagnosing illnesses, there is increasing concern of overuse throughout the United States, resulting in excessive radiation exposure to patients. CT scans performed for suspected pulmonary embolism from the emergency room are especially overused, since approximately only two percent of these scans have a positive result. One hundred of these scans ordered from one hospital's emergency room were evaluated using the Geneva model. The Geneva model uses clinical symptoms to assign a numerical value that reflects the probability of the patient having pulmonary embolism. CT results were correlated with D-dimer tests, which indicate probable blood clot formation. Although D-dimer tests were positive more often than CT scans, CT scans were much more accurate. The results suggest that the number of CT scans could be reduced by performing CT scans in the emergency room when a patient's Geneva model score is greater than two, the patient has a positive D-dimer result, or the patient cannot have a D-dimer test performed.

P06 Type 2 Diabetes Risk Factors at IMSA

Presenter(s)

James Chen, Illinois Mathematics and Science Academy

Advisor(s)

Sowmya Anjur, Illinois Mathematics and Science Academy Rebecca Lipton, University of Chicago

The goal of this study is to construct a questionnaire exploring whether or not a stressful academic environments such as IMSA's bring with them increased exposure to factors that can potentially predispose a student to develop type 2 diabetes (T2D) later on in life. Although there are many studies that detail T2D risk factors, there are few that include non-traditional risk factors like stress, and almost no examples that relate these risk factors to academic environments. A thorough literature review was completed, upon which the survey was then based. The survey was constructed by combining Cohen's Perceived Stress Scale questionnaire with selected questions from the National Youth Risk Behavior Survey created by the Centers for Disease Control and Prevention. At present, the survey to assess diabetes risk factors has been finalized and tested, but data collection has not yet begun. We plan to administer the survey to current and former IMSA students using an anonymous, web-based format. This will yield prevalence of self-reported risk factors among participating IMSA members, by age and gender, which will be discussed during the presentation. Ultimately, this investigation will begin to examine the connection between academic environments and type 2 diabetes risk factors that literature has implied, but not confirmed.

P07 Genetic Influences on Cellular Debris Handling in Systemic Lupus Erythematosus

Presenter(s)

Nitin Chilukuri, Illinois Mathematics and Science Academy Ajay Pius, Illinois Mathematics and Science Academy Abhinav Reddy, Illinois Mathematics and Science Academy

Advisor(s)

Timothy Niewold, University of Chicago

Systemic lupus erythematosus, a multi-system autoimmune disorder, has uncertain causes. Although much research has tried to identify the cause of lupus, no definitive correlations have been made. A theory exists that certain genetic factors related to the removal of cellular debris may predispose individuals to lupus. This study examined the race, gender, age, and C-reactive protein (CRP), CR2, FC γ RIIA, and FC γ RIIIA gene presence in 287 lupus patients. Logistic regression was used to determine correlations between these and the cytokine and antibody levels of the patients. Preliminary data analysis revealed in the African-American patients there were correlations between age and the CR2 gene on anti-ribonucleoprotein levels as well as age and the CRP and CR2 genes on anti-DNA levels. In the Hispanic patients there were correlations between age and the FC γ RIIIA, CRP, and CR2 genes on anti-DNA levels. Analysis is ongoing to confirm these correlations and will test for similar correlations among Caucasian and Asian patients. These correlations are potential pathways in determining future prognosis and treatment options, particularly through considering specific genetic and ancestral factors.

P08

Chest Computerized Tomography Imaging Findings in Patients With Localized Sarcoma

Presenter(s)

Samantha Donermeyer, Illinois Mathematics and Science Academy

Advisor(s)

James Nachman, University of Chicago

Some patients with a localized sarcoma (no metastases at diagnosis) develop pulmonary metastases after going off initial chemotherapy treatment. Lung metastasis after therapy completion is the main cause of treatment failure. The goal of this study is to assess the benefits and risks of using chest computerized tomography (CT) scans at defined intervals to search for metastases. Chest CT scans are more sensitive, less specific, and expose patients to higher doses of radiation compared to chest X-rays. We reviewed all off therapy chest CT scans for fifty patients whose chest CT at off therapy revealed no pulmonary nodules. Nine out of fifty (18%) never developed pulmonary nodules. Eight of fifty (16%) had nodules identified which initially or subsequently met criteria for biopsy and had proven metastatic disease. Thirty three of fifty (66%) developed at least one pulmonary nodule which never met biopsy criteria. The high percentage of false positive scans raises the question about the utility of chest CT scanning in off-therapy patients. A randomized trial of chest X-ray versus CT scanning for off-therapy follow-up is unlikely to be performed. Therefore, data on more patients followed with CT scans would be helpful in deciding follow-up for future patients.

P09

Comparison of Sun Protection Behavior and Tanning Habits in Adolescents Based on Age, Gender, and Skin Tone

Presenter(s)

Annie Guo, Illinois Mathematics and Science Academy

Advisor(s)

June Robinson, Northwestern University

Of all skin cancers, melanoma is the deadliest form and the one most linked to sun-related habits and behaviors in patients. In the past decade, people have become increasingly aware of sun protection. The objective of this study was to view adolescent perspectives toward tanning habits and sun protection behavior based on gender, age, and natural skin tone. We surveyed 107 high school students between the ages of 16-years old and 18-years old attending prom in a western suburb of the Chicagoland region. Our results demonstrated that younger subjects tended to have healthier Sun habits than older subjects. Establishing how adolescents take precautionary steps towards sun protection can help future investigations determine preventative measures for sun safety.

P10

What are the Consequences of the Loss of PAX3 Function in Melanoma?

Presenter(s)

Annie Guo, Illinois Mathematics and Science Academy

Advisor(s)

Deborah Lang, University of Chicago Erica Littlejohn, University of Chicago

The transcription factor PAX3 is over-expressed in primary melanoma tumors compared to benign lesions, and its role in promoting the cancer phenotype is poorly understood. To elucidate the function of PAX3 in tumor progression we created a melanoma cell line, TR5, that silences PAX3 upon induction. The TR5 line constitutively expresses a shRNA transcript targeting PAX3 as well as a shRNA repressor. In the presence of tetracycline the repressor is inhibited and the transcript silences PAX3. During our cell counts we observed significant growth arrest and no evidence of apoptosis in treated TR5 cells compared to untreated. Morphology changes were observed when PAX3 was knocked down in the TR5 cells. Their cytoplasm width and dendritic number and length dramatically changed, resembling a more differentiated cell type. The data suggests that PAX3 plays a role in melanoma progression by promoting cell growth and preventing terminal differentiation.

P11 All About Influenza

Presenter(s)

Jacob Henry, Illinois Mathematics and Science Academy

Advisor(s)

Megan Schrementi, Illinois Mathematics and Science Academy

Influenza is the leading preventable killer in the world. New shots and drugs are being formed to help kill the virus by destroying the essential proteins of the virus, neuraminidase and hemagglutinin. New methods for the flu shot are being developed such as a universal shot that would be able to protect against all strains of the virus and last for longer than ten years. There is an abundance of research, publications and reference material accessible. Using the large reference database available at IMSA, I am compiling a paper that summarizes the different works about influenza and discusses ways of fighting the virus. My compilation will focus on the infectious process, treatment, and vaccine development. I have focused my search of these topics, using primary documents and from those I have been able to more thoroughly explain the causes and problems of influenza. I have also researched more effective ways to treat the virus. Coming up with ways to relate and assemble information from different articles is the majority of my work.

P12 The Role of SRC Family Kinases in SDF-1/CXCR4-Mediated Progenitor Cell Homing

Presenter(s)

Ingrid Hsiung, Illinois Mathematics and Science Academy Pranusha Pinna, Illinois Mathematics and Science Academy

Advisor(s)

Gangjian Qin, Northwestern University

Ischemic heart disease is one of the leading causes of death in America and caused by ischemic tissue in the myocardium. CXCR4 is a G protein-coupled receptor with a ligand, stromal cell derived factor 1 (SDF-1), that correlates directly with progenitor cell (PC) mobilization to ischemic tissue. This experiment focuses on the interaction of cells in the stem cell pathway, particularly, the role of Src family kinases (SFK) in SDF-1/CXCR4-mediated progenitor cell homing. Using bone marrow mononuclear cells from CXCR4BAC-eGFP transgenic mice, cell culturing, Western blot, Boyden chamber assay, fluorescent tags, and histology staining, we found that *in vitro*, SDF-1/CXCR4 activates SKF and that SFK phosphorylation is required for PC homing; *in vivo*, we confirmed that SFK are needed for recruitment of BM PCs to areas of ischemic myocardium through the SDF-1/CXCR4 pathway. SFK are crucial in SDF-1/CXCR4-mediated BM progenitor cell homing in respect to the ischemic cardiac tissue which may prove useful for tissue repair.

P13 Calculating the Detection Efficiency of Positron Emission Tomography Systems

Presenter(s)

Vijay Jayaram, Illinois Mathematics and Science Academy Thomas Reith, Illinois Mathematics and Science Academy

Advisor(s)

Chien Kao, University of Chicago

Positron emission tomography (PET) detection systems, which detect high frequency gamma rays, are faced with several major obstacles. While certainly advanced, they commit a great deal of error when measuring output energy and time data due to the microcosmic nature of particles involved. In our investigation, we sought to develop a statistical quantification of this error and display it in standard histogram form. The histogram for energy shows how much the measured light energy deviates from the ideal 511 keV value, which is the pure energy of one gamma ray emitted by positron-electron annihilation. The energy resolution that can be calculated from this histogram, measuring the mean deviance from the expected energy value, was the outcome of our investigation. By setting the maximum at 511 keV, we could determine a scaling factor for the specific scenario. Using this factor, the same histogram was generated for the time aspect of detection; thousands of annihilation reactions take place in a small span and timing resolution should be on the order of picoseconds. Extrapolation from these statistical tests helped generate a complete picture of PET detection efficiency.

P14

The Effect of Egr2 on the Cell Markers Lag3, 41BB, and CRTAM in the Anergic carEGR2 flox/flox $T_{\rm H}1$ T-cell Clone

Presenter(s)

Alex Kim, Illinois Mathematics and Science Academy

Advisor(s)

Yan Zheng, University of Chicago

Previous studies have shown that certain tumors can cause anergy in T cells, preventing activation. One gene that has been known to regulate anergy in these T cells is the Egr2 gene. Using micro array, research has shown that three cell markers, CRTAM, 41BB, and LAG3 are regulated by the Egr2 gene. In this study, the expression of these cell markers on the mRNA level of development of a wild type T cell and an Egr2 knock out was determined using real time PCR. The results showed that the upregulation of the cell markers occurred on cells with the Egr2 gene intact, while upregulation did not occur the cells where the Egr2 gene was deleted. These results suggest that the three cell markers are Egr2 dependent. The correlation between the three cell markers and the Egr2 gene suggest that these three cell markers have something to do with the anergy of T-cells. Future studies can determine the expression on the protein level of expression and eventually determine the function of the cell markers.

P15

The Role of Two Selective K^+ Channels (K_{ir} and K_v) Expressed in Macrophages in the Secretion of IL-1 β when Macrophages are Induced by Anthrax Toxin

Presenter(s)

Jiwon Kim, Illinois Mathematics and Science Academy

Advisor(s)

Irena Levitan, University of Illinois at Chicago Johnson Thomas, University of Illinois at Chicago

Anthrax lethal toxin (LeTx), a virulence factor of *Bacilillus anthracis*, leads to inflammatory responses, such as increased secretion of the pro-inflammatory cytokine, interleukin (IL)-1 β , in alveolar macrophages. Previous studies have shown that LeTx exposure causes K⁺ efflux-mediated increase in IL-1 β secretion in macrophages through an unknown mechanism. We hypothesize that the two potassium channels, inwardly-rectifying K⁺ channel (K_{ir}) and outwardly-rectifying voltage-gated K⁺ channels (K_v), which are expressed in macrophages may play a role in LeTx induced IL-1 β secretion. Thus, we employed the whole-cell patch clamping technique to study K_{ir} and K_v channel activities on LeTx stimulation (with and without K channels' blockers), and enzyme linked immunosorbent assay (ELISA) to measure IL-1 β secretion on LeTx exposure. Then, we observed that LeTx activates both K_{ir} and K_v channels and that these channels are required for K⁺ efflux-mediated IL-1 β secretion in macrophages. We hope that with our findings, therapeutic agents against these two target channels can be developed in macrophages to block inflammatory responses involving IL-1 β secretion.

P16

Factors Influencing Successful Weaning from Caffeine in Premature Infants Born before Thirtyfour Weeks of Gestation Treated for Apnea

Presenter(s)

Ifreke King, Illinois Mathematics and Science Academy

Advisor(s)

Patricia Hummel, Loyola University Christine Sajous, Loyola University

Apnea of prematurity is a common problem in premature babies born before 34 weeks of gestation. This condition, treated with caffeine, improves as the babies get older. Physicians usually try to wean the infants off caffeine at around 34 weeks but are not always successful. In order to determine what factors determine successful weaning from caffeine, we collected necessary data on infants from the NICU's official records on infants born between August 15, 2006 and August 15, 2010. In total, the number of premature infants was 696. So far in my investigation I have found that the average number of premature infants that were treated with caffeine was 74.2%, the percentage of infants who failed weaning was 22%. Attempts to correlate factors with the success rate of weaning are ongoing. Alternatively, the benefits of moving the weaning date are being considered.

P17 Defining a Minimal Peptide Within HSP70 Required for Immune Activation

Presenter(s)

Previn Kumar, Illinois Mathematics and Science Academy

Advisor(s)

Jared Klarquist, Loyola University Caroline Le Poole, Loyola University Jeffrey Mosenson, Loyola University

Inducible heat shock protein 70 (HSP70i) is over-expressed in stressed cells and plays a vital role in dendritic cell (DC) initiated auto-immune vitiligo. The purpose of this investigation is to find what region of HSP70i is critical for accelerated depigmentation and for development of a humoral response to the molecule. Two functionally different regions of HSP70 were separately introduced into expression plasmids HSP70i₁₋₃₇₇ (AM) and HSP70i₃₂₀₋₆₄₂ (LV), and used to vaccinate groups of five C57BL/6 mice in combination with target antigen TRP-2. The DNA was introduced to the mice by weekly gene gun vaccination in six groups: AM TRP-2, LV TRP-2, HSP70 TRP-2, TRP-2, HSP70 or vector DNA. After five weeks, the LV TRP-2 but not AM TRP-2 vaccinated mice showed depigmentation far superior to HSP70 TRP-2. In Western blots, mouse serum was used to probe protein from transfected COS cells. The HSP70 TRP-2 and LV TRP-2 mice developed antibodies to HSP70, whereas AM TRP-2 vaccinated mice did not. These data identify the C-terminal, peptide-binding region as vital to autoimmunity. This data is in concordance with HSP70i₄₃₅₋₄₄₇ described by this group as a peptide that may be blocked from binding DCs to prevent autoimmunity.

P18

Determining the Conditions Under Which Bioavailability of a Drug Increases

Presenter(s)

Samantha Levin, Illinois Mathematics and Science Academy

Advisor(s)

Robert Kimura, Rush University Medical Center

Pharmaceutical companies have trouble designing oral drugs that are absorbed in large enough quantities to be effective. In most cases the bioavailability, the percentage of the administered drug that reaches the blood stream, must be greater than thirty percent. By using a mathematical model on the computer that involves data from a previously performed experiment involving rats, I observed how bioavailability values changed when I varied certain conditions under which the experiment was run. Variables that were tested include V_{max} , the maximum speed at which metabolism occurs in the intestines; V_{max} of the liver; renal excretion; and the time of absorption. The data was also run for three different scenarios: the drug given intravenously over thirty minutes, the drug given orally and released over thirty minutes, and the drug given orally and time released over twelve hours. The first half of my investigation was spent learning the methodology and derivations behind the computer model which was used. My final results are currently pending. It is intended that these results give guidance to pharmaceutical companies to the conditions under which their drug should be administered.

P19 Mutations in the Insulin Gene as a Cause of Monogenic Diabetes

Presenter(s)

Sarah Lisk, Illinois Mathematics and Science Academy

Advisor(s)

Siri Atma Greeley, University of Chicago

As the prevalence of diabetes increases worldwide, a minority of patients are learning that they have a monogenic form of diabetes caused by mutations in any one of a variety of genes. Such mutations in the gene encoding insulin (*INS*) can cause permanent neonatal diabetes (PND) resulting from a deformed insulin protein leading to increased beta-cell destruction. DNA samples from a family with PND were screened for *INS* mutations by amplification by polymerase chain reaction, followed by sequencing and analysis with Mutation Surveyor software. A heterozygous mutation in exon one of the *INS* gene, which caused an amino acid change (G32S), was found in a diabetic mother diagnosed at 9 weeks of age and was inherited in a dominant fashion by her son who was diagnosed at 52 weeks of age. This supports the hypothesis that PND can be caused by mutations in the *INS* gene. Discovery of such an underlying monogenic cause will inform genetic counseling of familial recurrence risk and could eventually lead to differences in treatment. Although a specific medication for this type is not currently in use, one that specifically targets the disease process could lead to improved diabetes control and reduced health care costs.

P20

Endothelial Cell Intercellular Molecule Regulation of Monocyte Chemoattractant Protein-1

Presenter(s)

Justine Ly, Illinois Mathematics and Science Academy Katherine Shi, Illinois Mathematics and Science Academy

Advisor(s)

Guoquan Liu, University of Illinois at Chicago

Monocyte chemoattractant protein-1 (MCP-1) is a protein that induces chemotaxis, a process that attracts monocytes to areas of inflammation. We hypothesized that intercellular adhesion molecule 1(ICAM-1) indirectly regulates MCP-1 expression. To test this, we ran Western blots with lung tissue lysates from wild type and ICAM-1 knockout mice to determine MCP-1 expression. Our results showed greater MCP-1 expression in ICAM-1 knockout compared to the control, implying that ICAM-1 inhibits MCP-1 production in the lungs. We then used siRNA to silence the ICAM-1 gene in human umbilical vein endothelial cells (HUVECs). Using an enzyme-linked immunosorbent assay method, we found that TNF α induced MCP-1 secretion was increased, suggesting that ICAM-1 inhibits MCP-1 expression in endothelial cells. Furthermore, transfection of HUVEC with wild type and phospho-mimicking ICAM-1 mutant (Y518D) inhibited TNF α -induced MCP-1 production compared to cells transfected with phosphorylation-defective ICAM-1 mutant (Y518F). We have extended our study to uncover the proteins involved in the signaling pathway between ICAM-1 and MCP-1. This data is still pending, but if the ICAM-1/MCP-1 signaling pathway is uncovered, a pharmaceutical drug to subdue inflammation in the lungs can be developed.

P21 Neonatal Diabetes due to Mutations in the *KCNJ11* Gene

Presenter(s)

Daniel Matthews, Illinois Mathematics and Science Academy

Advisor(s)

Siri Atma Greeley, University of Chicago

Neonatal diabetes diagnosed in the first six months of life is likely to have an underlying monogenic cause. Mutations may be found in any one of a number genes affecting the insulin producing β -cells in the pancreas. *KCNJ11* is a gene that encodes the Kir6.2 protein that forms part of the ATP-sensitive potassium channel that is critical for insulin secretion. DNA samples were amplified using PCR and then checked by gel electrophoresis. Samples were then purified and sequenced and data was analyzed using Mutation Surveyor software. DNA from both diabetic and non-diabetic individuals in a family with a history of neonatal diabetes was sequenced. Two diabetic family members, father and daughter, had the rare heterozygous mutation E227K/E in amino acid 227 in *KCNJ11*. The non-diabetic mother did not have this mutation. All family members shared the common polymorphism E23K/E. Since only one allele is mutated, the daughter inherited the disease-causing E227K mutation in an autosomal dominant fashion. This supports the hypothesis that neonatal diabetes can be caused by mutations in the *KCNJ11* gene, which may be passed on to children of affected individuals. This has important treatment implications since their diabetes may respond to oral sulfonylurea medication instead of insulin.

P22 GD3 Synthase Vaccines as a Treatment for Melanoma

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

Advisor(s)

Jared Klarquist, Loyola University Caroline Le Poole, Loyola University

Melanoma is a deadly skin cancer caused by mutations of melanocytes located primarily in the skin. Melanoma cells overexpress the molecule ganglioside D3 (GD3). This investigation aims to determine whether a vaccination of DNA coding for GD3 synthase causes an NKT-cell mediated anti-tumor response in mice that are injected with melanoma cells. Three groups of mice underwent five weekly vaccinations of genes coding for human GD3 synthase and adjuvant HSP70i, positive control genes encoding TRP-1 and HSP70i, or empty vector DNA. Positive control mice showed depigmentation, a characteristic of autoimmunity, while GD3 synthase-vaccinated mice did not. Eight weeks later the mice underwent a tumor challenge and tumor development data was analyzed suggesting delayed tumor development in mice vaccinated with GD3 synthase genes compared to mice vaccinated with empty vector genes. GD3 synthase vaccination was uniquely associated with natural killer T cell infiltration of tumors. This suggests that the vaccine can have anti-tumor potential when combined with potent adjuvant treatment. This is significant, as anti-tumor vaccines such as the positive control used in this investigation, frequently cause autoimmunity. The lack of depigmentation in GD3 synthase-vaccinated mice indicates that this treatment can separate autoimmunity from anti-tumor immunity.

P23 Investigation Into Risk Factors of Heparin-Induced Thrombocytopenia

Presenter(s)

Christina Momchev, Illinois Mathematics and Science Academy

Advisor(s)

Cynthia Fisch, Resurrection Medical Center Rada Ivanov, Resurrection Medical Center

Two of the six hospitals in the Resurrection Health Care system have a greater number of patients experiencing heparin-induced thrombocytopenia (HIT). HIT is excessive bleeding after being given a blood thinner containing heparin. Literature was reviewed to find what puts someone at higher risk for HIT. Then the information of all the patients with HIT in the six hospitals was compiled and organized in five categories: patient age/race/gender, primary diagnosis, secondary diagnosis, procedure, and which anticoagulant was used (heparin or enoxaparin). No significant correlation was found between age, gender, or race and susceptibility to contracting HIT except that nonwhite females were more at risk in our patient population. Among the patients, eight out of thirty had septicemia, and nine had renal failure. In research, neither condition has been mentioned as influencing the onset of HIT. However, we speculate that patients with septicemia and kidney disease are at high risk for HIT.

P24

The Effect of Therapeutic Hypothermia on Mitochondrial Akt Phosphorylation and Pim-1 Expression in Murine Hemorrhagic Shock

Presenter(s) Gina Qin, Northwestern University

Advisor(s)

Terry Vanden Hoek, University of Chicago

Current treatments for hemorrhagic shock (HS) are often ineffective. Therapeutic hypothermia (TH), an effective treatment in other similar diseases, has not been used in clinically treating HS due to the lack of understanding of its mechanisms. Akt phosphorylation (p-Akt), increased Pim-1 expression, and improved mitochondria function have been shown to mediate cardioprotection. Using an established murine HS model, we studied the role of Akt and Pim-1 in TH-induced cardioprotection. TH (33 ± 0.5 °C) was induced at 30 minute HS via surface cooling. Heart tissue was collected at 30 minute resuscitation and fractionated to measure p-Akt and Pim-1 expression in the cytosolic and mitochondrial fractions. Compared to sham, 30-minute resuscitation normothermia (R30NT) increased Akt phosphorylation at both the Threonine308 and Serine473 sites but 30-minute resuscitation hypothermia (R30TH) did not further increase it in the cytosolic fraction. In the mitochondrial fraction, R30TH showed a trend of decrease in p-Akt compared to R30NT. Interestingly, R30NT decreased Pim-1 expression compared to sham (0.33 ± 0.13 vs. 3.08 ± 0.22) and R30TH preserved Pim-1 expression in the mitochondrial fraction. Taken together, TH-mediated cardioprotection may not be associated with increased p-Akt and targeting mitochondrial Pim-1 expression may be a potential pharmacological treatment in HS.

P25 The Effect of Transgenic A20 on Inflammation of the Intestinal Epithelium

Presenter(s)

Nishith Reddy, Illinois Mathematics and Science Academy

Advisor(s)

David Boone, University of Chicago

A20, a cellular factor, has been shown to regulate inflammation of the epithelium during inflammatory bowel disease. The objective of this study was to characterize the interactions of A20 that result in the maintenance of the epithelial structure of the intestines and determine whether the expression of transgenic A20 could improve the condition of the epithelium during homeostatic inflammation. Intestinal sections of A20 wildtype and villin transgenic A20 mice with inflammatory bowel disease were characterized for NF- κ B activation, A20 expression, grade of inflammation, tight junction architecture, and cell proliferation. These sections showed preserved epithelial architecture in villin transgenic A20 mice with inflammatory bowel disease when compared to A20 wildtype mice. Non-colocalization of activated, proinflammatory NF- κ B with A20 suggests an inflammatory suppressant effect of A20. Degradation of tight junction proteins served as another indicator of the suppressed homeostatic inflammation in villin transgenic A20. As an inflammatory regulator, A20 has potential for therapeutic implementation in clinical treatment of inflammatory bowel disease.

P26 Computerized Quantification of Pleural Effusion

Presenter(s)

Ashley Ro, Illinois Mathematics and Science Academy Nikita Veera, Illinois Mathematics and Science Academy

Advisor(s)

Samuel Armato, University of Chicago

Pleural effusion is the abnormal buildup of fluid within the pleural cavity of the lungs, often caused by congestive heart failure, mesothelioma, lung cancer, and other lung diseases. MATLAB was used to run a program that can segment pleural effusion and lungs in thoracic computerized tomography (CT) scans. An in-house program, Abras, was then used to calculate the volumes of these segmented regions. Initially, preliminary segmentations were run on CT scans without pleural effusion and lung volumes were calculated from them. Later, the segmentation method was used to find pleural effusion volume as well as lung volumes in the scans of fifty patients with pleural effusion. Analyses were then completed, comparing the lung volume and pleural effusion volume, as they should have been inversely proportional. Knowing that this correlation exists can be used for future studies examining pleural effusion volume.

P27 Do Widened Pulse Pressures in Premature Infants Signify a Patent Ductus Arteriosus?

Presenter(s)

Yasmeni Sandridge, Illinois Mathematics and Science Academy

Advisor(s)

Jonathan Muraskas, Loyola University Cristina Vega, Loyola University

Patent ductus arteriosus (PDA) is a heart condition from which many premature infants may suffer. In this retrospective study conducted at Loyola University Medical Center we will determine if having a widened pulse pressure is a significant sign of PDA. A widened pulse pressure is defined as the difference of systolic blood pressure and diastolic blood pressure greater than twenty. Historically, the difference between widened pulse pressure has been taught to be a classical sign of PDA. In some studies, it has been shown that having a widened pulse pressure is not a significant sign. In this study data collected included blood pressures, pulse pressures, and echocardiogram results, and these will be analyzed in collaboration with a statistician. Currently, the data is under collection and not ready for analysis. If our results support our hypothesis, this may result in an earlier diagnosis and treatment of PDA.

P28

Characterization of Methicillin-Resistant *Staphylococcus aureus* Clinical Isolates in Infants Within the First Thirty Days of Life

Presenter(s)

Mehal Shah, Illinois Mathematics and Science Academy Divya Tankasala, Illinois Mathematics and Science Academy

Advisor(s)

Bill Kabat, Children's Memorial Research Center

Methicillin-resistant *staphylococcus aureus* (MRSA) is a bacterium which causes infections in various parts of the body. Two major types of MRSA, community-acquired (CA) and hospital-acquired (HA), are both resistant to antibiotics, but differ in their transmission method and prognosis. The purpose of this investigation was to determine the origin of certain clinically-isolated strains of MRSA through characterizations of all the strains as either CA-MRSA or HA-MRSA using various methods of identification and analysis. Initially, we isolated a cohort of MRSA isolates from newborn infants. The isolates were grown and colonized on blood agar plates. A Kirby-Bauer susceptibility assey was performed using eight antibiotics, and zones of inhibition were measured. Afterwards, pulsed-field gel electrophoresis (PFGE) was used to separate large DNA molecules. In addition, DNA was extracted from the isolates. Our preliminary results show that PCR was more efficient than PFGE analysis in collecting data. In addition, there are possible demographics that show that specific subtypes may differ. We are still are in the process of analyzing all the PCR results with all the required primers tested on the isolates. There may be significant differences in some of the strains analyzed.

P29 Randomized, Prospective Comparison of Performance Using Standard Laparoscopy, Single-Incision Laparoscopy, and a Novel Bimanual Triangulating Platform

Presenter(s)

Kevin Shi, Illinois Mathematics and Science Academy

Advisor(s)

Eric Hungness, Northwestern University B. Fernando Santos, Northwestern University

Single-incision laparoscopy (SIL) is a novel surgical approach that may be less invasive than the current gold standard laparoscopy (LAP). However, SIL introduces additional ergonomic challenges and has previously shown to result in decreased performance on standardized tasks in a simulated setting. This study was conducted to determine whether a novel bimanual triangulating platform, SPIDER, for SIL could improve performance compared to the use of existing SIL instruments. Novice test subjects were randomized to either LAP, SIL (existing technique), or SIL with SPIDER and they performed standardized tasks on a surgical simulator using their assigned technique. Subjects were tested at baseline and after completing four training sessions. Task scores will be analyzed according to time (baseline versus post-training) and instrument type (LAP, SIL, or SPIDER). Learning curves for each technique will also be quantified and compared. The results will be used to determine whether use of the SPIDER is associated with improved performance or a shorter learning curve compared to the existing SIL technique.

P30

The Influence of Body Mass Index on the Outcome of Patients with Acute Myelocytic Leukemia Following Chemotherapy

Presenter(s)

Steven Suh, Illinois Mathematics and Science Academy

Advisor(s)

Parameswaran Venugopal, Rush University Medical Center

Although the field of oncology is rapidly expanding with deeper insight into the biology, and utilizing novel diagnostic and therapeutic strategies, very little research has been done on the influence of the physiological characteristics of the patients, such as height and weight, on the outcome of therapy. To investigate this further, we analyzed the rates of cancer survival in relation to weight according to body mass index (BMI), calculated by dividing the weight in kilograms by the height in meters squared. We used data from fifty-three patients with acute myelocytic leukemia (AML) from Rush University Medical Center, gathering height, weight, response to treatment, and survival duration using a program called EPIC. Our preliminary review of the data suggests that patients with higher body mass index have worse outcomes following induction chemotherapy for AML compared to patients with normal BMI. We intend to continue this study and complete this analysis in the near future.

Q01 The Effects of Cell Demographics on Amyloid-Beta Derived Diffusible Ligand Binding and Toxicity

Presenter(s)

Ruchi Aggarwal, Illinois Mathematics and Science Academy Shruthi Subramanian, Illinois Mathematics and Science Academy

Advisor(s)

Gina Boylan, Northwestern University William Klein, Northwestern University

Amyloid beta-derived diffusible ligands (ADDLs) negatively affect neurons in Alzheimer disease (AD). The interaction of ADDLs and astrocytes is not well known. This investigation will determine how ADDL binding and induced toxicity is affected by the astrocytes to neurons ratio, *in vitro*. The experiment design will manipulate cell culture conditions to create neuron-enriched cultures, mixed cultures, and astrocyte-enriched cultures, and will then perform ADDL treatments to measure binding and toxicity. Response to ADDLs by cell type can then be analyzed. Although the experiment is in development, we hypothesize that ADDL binding and toxicity will be influenced by the presence of astrocytes. At this time, the type of affect is unknown. Astrocytes offer structural and nutritional support to neurons, but also release inflammatory factors that are injurious to neurons and they are activated in an injured AD brain. The neuron-astrocyte interaction is very complex, and little is known about the role of astrocytes in the ADDL-induced pathology of AD. Further experimentation needs to be conducted before we have conclusive results. Thus, we hope to optimize cultures to study the effects of ADDLs on different cell types. Our preliminary findings will lead to more studies on the role of astrocytes in AD.

Q02 Apolipoprotein E Effects on Synapse Volume *in vivo*

Presenter(s) Upashruti Agrawal, Illinois Mathematics and Science Academy

Advisor(s)

MaryJo LaDu, University of Illinois at Chicago Kevin Laxton, University of Illinois at Chicago Leon Tai, University of Illinois at Chicago

The genetics of Alzheimer disease (AD) includes causal factors, specifically autosomal dominant mutations that increase the 42 amino acid form of amyloid- β (A β 42) peptide and apolipoprotein E4 (apoE), the primary risk factor compared to apoE3, with apoE2 reducing risk. However, the mechanism underlying apoE isoform effect on AD susceptibility is unknown. Neuronal synapse degeneration is a key pathological hallmark of AD, particularly in the hippocampus, an area important for learning and memory. To determine the effect of apoE on A β mediated synapse degeneration, the density and volume of hippocampal synapses were assessed using state of the art array tomography (AT) microscopy, in EFAD mice. EFAD mice significantly over-produce A β 42 and one of the human apoE isoforms (apoE2, E3, or E4). This is one of the few AD transgenic mouse models where A β 42 pathology recapitulates the regional development in humans. AT uses 200 nm tissue slices, which circumvents the limits imposed by standard immunohistochemistry (>1 µm), and allows for high-resolution synapse identification. The preliminary results of this study demonstrate that synapse volume is increased in apoE2 compared with apoE3 or apoE4, while synapse density is similar across isoforms. Further studies will aid in our understanding of apoE dependent differences in synapse degeneration.

Q03 Isolation of Cholinesterases from Plaques and Tangles in Alzheimer Disease

Presenter(s)

Christina Cheng, Illinois Mathematics and Science Academy

Advisor(s)

Katherine Gasho, Northwestern University Changiz Geula, Northwestern University

Alzheimer disease is a neurodegenerative disorder that is identified pathologically by the presence of plaques and tangles in brain tissue which contain acetylcholinesterase and butyrylcholinesterase activities. The purpose of this investigation was to induce the release of cholinesterases from plaques and tangles. Alzheimer brain sections were incubated in heparin, chondroitin sulphate, trypsin, or buffer alone to interfere with the extracellular matrix that may attach cholinesterases to tissue in order to release the cholinesterases. We then performed assays on the buffer to determine how the different chemicals and concentrations affected the release of cholinesterases. We used cholinesterase histochemistry to determine if the cholinesterases were released from plaques and tangles. In biochemical assays we observed that trypsin was the most effective in releasing cholinesterases from the tissue. A significant difference in activity was seen with trypsin present compared to samples with only buffer. The amount of cholinesterase released was dose-dependent. We are currently working on analyzing the histochemical tests. These results indicate that cholinesterases are released from Alzheimer's brains and may be specifically released from plaques and tangles.

Q04

Using Hippocampal Morphometry to Detect Alzheimer Disease Pathology in Primary Progressive Aphasia Patients

Presenter(s)

Ashley Chong, Illinois Mathematics and Science Academy

Advisor(s)

Emily Rogalski, Northwestern University Lei Wang, Northwestern University

Patients with primary progressive aphasia (PPA) are limited daily by their progressively deteriorating deficit of language. My research question is: Do PPA patients undergo severe atrophy in the hippocampus, the memory center of the brain? Magnetic resonance images of seventy-two PPA patients and thirty-eight healthy control participants were processed with the FreeSurfer software package to produce left hippocampal volume. The hippocampus' volumes were analyzed with the statistical analysis program SPSS, in order to see if PPA patients had significantly smaller hippocampal volumes than that of healthy controls. Thirty-eight controls' left hippocampal volumes were compared with that of seventy-two PPA patients, and a significant difference was found through an independent t-test (p=0.000). A second analysis with an independent t-test of sixteen patients of the agrammatic variant (PPA-G) and twenty-three of the logopenic variant (PPA-L) concluded there was no significant difference between the left hippocampal volumes (p=0.074). There are currently no biomarkers for PPA, so this investigation would be one of the small important steps toward finding a biomarker for the underlying pathology.

Q05 Effects of Caffeine on Motor Excitability of Skeletal Muscles in the Hand and Arm as Measured by Navigated Transcranial Magnetic Stimulation

Presenter(s)

Sanggyu (Raymond) Chong, Illinois Mathematics and Science Academy Tonu Pius, Illinois Mathematics and Science Academy

Advisor(s)

Todd Parrish, Northwestern University Xue Wang, Northwestern University

Caffeine is one of the most commonly used drugs worldwide, and it is thought to help one focus mentally and physically. To further understand the physical consequences of caffeine intake, we measured the effect of caffeine on motor excitability of a muscle in the hand called abductor policis brevis. Transcranial magnetic stimulation (TMS) was used to provoke an involuntary muscle reaction in the abductor policis brevis, and the magnitude and latency of the reaction was measured through the use of electromyography. Subjects were injected with caffeine upon first visit and saline, a control fluid, upon second visit, and the TMS data was collected before, during, and after both injections. We hypothesized that caffeine as a drug will cause a stronger and/or faster reaction than saline. The motor threshold varied between the caffeine and the saline data, so normalization by the baseline of threshold was done to compare the two. The analysis of the normalized data showed that caffeine always produced responses greater than the baseline data, and compared to saline, caffeine caused steeper changes. The data from the analysis confirmed that the injection of caffeine produced an effect on the motor excitability of the skeletal muscles in the hand.

Q06

The Effects of Menstrual Cycle Phase on Memory in Naturally Cycling Women

Presenter(s)

Julianne Crawford, Illinois Mathematics and Science Academy

Advisor(s)

Pauline Maki, University of Illinois at Chicago Antonia Savarese, University of Illinois at Chicago Mary Winters, University of Illinois at Chicago

Estrogen has been shown to impact various aspects of cognition. A prior study, utilizing a within-subjects design, reported that menstrual cycle phase does not have an impact on verbal memory in naturally cycling women, as measured by the California Verbal Learning Test (CVLT). The CVLT is a sixteenitem word list, and is a commonly used measure of immediate and long-term memory. To remove the confound of practice effects between sessions, the present study measured CVLT performance in a between-subjects design with fifty-two naturally cycling women, ages 18-40, either during the follicular phase (low estrogen levels, n = 27) or midluteal phase (n = 25) of the menstrual cycle. There was a significant difference in hormone levels between groups, with significantly higher levels of estrogen in the midluteal group. Inconsistent with the work of Mordecai, et al., the midluteal group performed better than the follicular group on measures of immediate learning, CVLT Trial 1 (p=.05) and Trial B (p=.04). No significant difference between groups was observed on CVLT delayed or cued recall trials. Thus, the present study indicates that naturally cycling women in the midluteal phase may have an advantage for tasks specifically related to immediate learning.

Q07 Using Resting State Functional Connectivity as a Biomarker to Access the Treatment Effects in Chronic Stroke Patients

Presenter(s)

Justin Feng, Illinois Mathematics and Science Academy

Advisor(s)

Todd Parrish, Northwestern University Xue Wang, Northwestern University

Chronic stroke patients suffer from brain damage caused by the cranial disturbance of blood. In my experiment, I determined the effects of therapy by analyzing resting-state connectivity of the brain of stroke patients. The structural and functional magnetic resonance imaging (MRI) of forty-seven chronic stroke patients were taken twice at Northwestern University, before and after physical therapy. During each imaging session, the patients were to perform a simple motor task for two sessions (280 seconds/session) with a block design of 30 seconds of task and 30 seconds of rest. The rest periods were extracted and concatenated for further analysis. Functional MRI images were motion corrected, smoothed, and normalized to a standard template. Twenty-seven regions of interest, including motor, premotor cortex, caudate, and so forth, were selected and correlated with the rest of the brain. Intrinsic correlated functional circuitry in stroke patient has been discovered. From there, we analyzed the regions of interest, specifically the precentral and postcentral cortexes, as well as other major areas, and performed various statistical tests on them, including paired t-tests and correlation analysis. After these steps were completed, behavioral measures were correlated with the network measures to predict who would recover. Further analysis will be performed to investigate the treatment effect.

Q08 Effect of 1-methyl-4-phenylpyridnium on Dopamine Neuron Loss in LPS Mouse Model of Parkinson's Disease

Presenter(s)

Brinda Gupta, Illinois Mathematics and Science Academy

Advisor(s)

Paul Carvey, Rush University Medical Center Bill Hendey, Rush University Medical Center

Parkinson's disease (PD) is the second most common neurological disorder, characterized by degeneration of dopamine (DA) neurons within the substantia nigra (SN). 1-methyl-4-phenyl-1,2,3,6tetrahydropyridine (MPTP) is nontoxic, passes through blood-brain barrier (BBB), and produces murine PD models. The purpose of this experiment was to analyze effects of the MPTP toxic metabolite 1methyl-4-phenylpyridnium (MPP+) on DA neurons in mice with prenatally injected lipopolysaccharide (LPS). LPS was hypothesized to compromise BBB, allowing tail-vein injected MPP+ to be taken up via the dopamine transporter, going into the neuronal synapses. Twenty-one C57/BL6 male mice were given saline or LPS prenatally (5 mg/kg). At eleven months, mice had MPP+ or LPS injected via the tail vein (120 μ g/mL). All mice were perfused with 4% paraformaldehyde, fixed for 24 hours, and sliced into series of 40 μ m sections. After, they were tyrosine hydroxylase-immunoreactive (TH-ir) stained, and examined using StereoInvestigator to evaluate TH-ir neurons within the SN. Average DA count for saline/saline and saline/MPP+ mice was significantly higher than LPS/saline and LPS/MPP+. saline/saline, saline/MPP+, LPS/saline, and LPS/MPP+ mice had 10362.41, 10834.19, 8813.42 and 8387.11 DA neurons respectively. LPS plays a role in DA degeneration. Toxins destroy DA neurons because they pass through compromised BBB, allowing for new PD pathogenesis.

Q09

The Relationship Between Effect-Site Concentration of Propofol and Burst Suppression of the Electroencephalogram in Patients Undergoing Cerebrovascular Procedures

Presenter(s)

Janell Herrera, Illinois Mathematics and Science Academy Jessica Ventenilla, Illinois Mathematics and Science Academy

Advisor(s)

Mehmet Ozcan, University of Illinois at Chicago Guy Weinberg, University of Illinois at Chicago

In a brain aneurysm surgery, brain protection is provided by propofol. The degree of brain protection is measured by burst suppression ratio (BSR) on electroencephalogram (EEG). The propofol effect-site concentration (Ce) to achieve a specific BSR is unknown. We determined the BSR in a range of propofol Ce. Forty-two patients having brain aneurysm surgery between the ages of 18-80 were recruited. Patients were divided into three groups depending on their remifentanil dosing. Propofol Ce was increased step wise until the BSR of greater than 90% was achieved. BSR was recorded continuously with an EEG monitor. In a sample patient, BSR was first observed at propofol Ce of 6 μ g/ml and BSR was greater than 90% at propofol Ce of 8 μ g/ml. The study is open until 2012 and recruitment of patients is ongoing. We expect to determine the propofol Ce range that can achieve a clinically needed level of brain protection. In addition, we expect to determine the potential synergistic or additive effects between remifentanil and propofol in achieving brain protection.

Q10 The Effects of Late Life Depression on Executive Function in the Clock Drawing Test

Presenter(s)

Irene Jiang, Illinois Mathematics and Science Academy

Advisor(s)

Melissa Lamar, University of Illinois at Chicago

The Clock Drawing Test (CDT) is a well-known, widely used neuropsychological test that measures aspects of executive function, visuospatial abilities, and graphomotor processing. Executive function is impaired in subjects with late-life depression (LLD), and we can look to the CDT as an assessment of executive dysfunction. Sixty-three subjects were taken from two studies being conducted within the University of Illinois at Chicago Department of Psychiatry; thirty-two healthy controls (HC) of age = 65.50 ± 3.95 years and thirty-one LLD of age = 65.39 ± 6.94 years. During the CDT, subjects drew a command clock setting the time to ten minutes after eleven, and copied a clock set to the same time. Both were drawn using a digitizing pen that photographed output at a rate of 80 times/second. Data was uploaded onto a computer and scored for executive function measures of planning ('hooklet' from the end of one stroke and 'hooking' toward the next) and mental manipulation (time setting). There was a significant difference between HC and LLD groups in the number of hooklets in command and copy (p ≤ 0.05), but no differences in mental manipulation as measured by time setting. These results indicate impaired planning and executive function in LLD making it possible to use the CDT as a quick and accurate test for LLD.

Q11

Continuous Positive Airway Pressure: A Study in the Change of Body Mass Index in Obstructive Sleep Apnea Syndrome Patients

Presenter(s)

Harsha Jujjavarapu, Illinois Mathematics and Science Academy

Advisor(s)

Sarah Zallek, St.Francis Medical Center

The risk for obstructive sleep apnea syndrome (OSAS) goes up as one's weight goes up. Weight loss is an effective treatment for OSAS; OSAS can contribute to weight gain. One mechanism of weight gain is by disabling leptin, a hormone that signals satiety. Treatment of OSAS with continuous positive airway pressure (CPAP) can improve leptin function and may contribute to weight loss. The purpose of this study was to find whether or not OSAS patients lost weight after regular CPAP usage over a span of ten years, and if those who did not regularly adhere to CPAP would lose less weight than those who adhered to it regularly. Subjects who used CPAP for an average of greater than seven hours per night for at least 85% of the nights were considered treatment subjects. Control subjects were patients who used CPAP for an average of less than four hours per night. The change in body mass index (BMI) between treatment and control subjects was not significantly different after one year of CPAP treatment (P=0.966). However, BMI did significantly increase in both groups (P=.024). In this study, both the treatment and control subjects gained a significant amount of weight. Other factors may affect weight in CPAP patients. Another experiment with more patients may produce different results.

Q12

Effect of Neurotoxin MPP+ on Additional Nigral Dopaminergic Neuron Loss in the MPTP Mouse Model of Parkinson's Disease

Presenter(s)

Harsha Jujjavarapu, Illinois Mathematics and Science Academy

Advisor(s)

Paul Carvey, Rush University Medical Center

Parkinson's disease (PD) is a neurodegenerative disorder that progressively impairs motor skills. Symptoms are mainly caused by a selective loss of dopamine neurons in the substantia nigra. Current thought hypothesizes that a compromised blood brain barrier (BBB) may allow peripheral immunological or neurotoxic invasion into the brain resulting in additional dopamine neuron loss. The 1-methyl-4-phenyl-1,2,3,6,-tetrahydropyridine (MPTP) mouse model is a well-established acute model for parkinsonism. MPTP metabolizes into 1-methyl-4-phenylpyridinium (MPP+), a neurodegenerative molecule which causes selective dopaminergic neuron death. The ionic MPP+ does not cross the BBB. Twenty-four retired male C57/BL6 mice were treated with MPTP (9 mg/kg) or saline. Saline or MPP+ (120 mg/120 ml) was injected intravenously on day five. Mice were sacrificed at day ten and brains were fixed, sliced, immunohistochemically stained for tyrosine hydroxylase (TH), and examined stereologically. MPP+ is expected to cross the BBB and further progress dopaminergic neuronal damage. Bilateral TH immunoreactivity count for the saline/saline and saline/MPP+ mice was significantly higher than the MPTP/saline and MPTP/MPP+ groups (12032, 12176, 8762, 6769), including a statistically significant difference between saline/saline and MPTP/saline (p= .016). No statistical difference was found between MPTP/MPP+ and MPTP/salinel despite an additional 16.5% dopamine neuron loss.

Q13 The Role of MAN2A2 Expression in Glioma Proliferation and Invasivity

Presenter(s)

Timothy Klincewicz, Community High School District 117 Areen Pitaktong, Illinois Mathematics and Science Academy

Advisor(s)

Roger Kroes, Northwestern University

The surfaces of cells are strewn with myriads of glycoconjugates - carbohydrate structures bound to cells' external lipids and proteins. These glycoconjugates dominate interactions between cells, including cell:cell communication and adhesion. Altering these structures has been shown to affect the invasiveness and proliferation of cancer cells. A previous microarray analysis of glyco-gene expression demonstrated that, among several other genes, levels of MAN2A2 expression in normal brain cells was significantly higher than that in gliomas. Towards the development of potential therapeutics, we initially cloned the protein coding region of the human MAN2A2 gene from normal human brain by standard reverse transcriptase-polymerase chain reaction. Because this region is relatively large, we amplified two overlapping amplicons and, following ligation of the complementary regions, reamplified the single, contiguous large cDNA by polymerase chain reaction. Following direct sequence validation, we ligated the insert into the pcDNA3 mammalian expression vector and stably transfected the resulting MAN2A2expressing construct into the human U373MG glioma cell line. We then demonstrated successful transfection into five of the resulting cell lines, in which each expressed higher levels of MAN2A2 mRNA (normalized to GAPDH, a control gene) relative to controls. An in vitro comparison of invasive behavior between these cell lines will demonstrate the potential relationship between MAN2A2 gene expression and resulting cell invasiveness and proliferation.

Q14 Progression of Performance Obtained During a Revolutionary Balance Exercise Regimen That Challenges Post-Stroke Survivors Beyond Their Limits of Stability

Presenter(s)

Alekya Kothamasu, Illinois Mathematics and Science Academy Alexandra Roman, Illinois Mathematics and Science Academy

Advisor(s)

David Brown, Northwestern University Nicole Korda, Northwestern University

Hemiplegia, resulting from stroke, is a condition in which the limbs on one side of the body become impaired, worsening balance. This investigation uses the KineAssist® (KA), a robotic assistive device that allows physical therapists to push patients past their limits of stability, while keeping them safe, in contrast to the conservative approach usually taken in the clinic. Participants were placed in one of three condition groups where they worked on a set of nine balance exercises over six weeks. In group 1, they completed the exercises while using the KA and worked at their maximum level of difficulty (MLD). In group 2, the participants worked with a physical therapist and worked at their MLD. In group 3, they used the KA to complete exercises at levels above their MLD. Progressive performance variables for each exercise consisted of level changes and success percentage (SP) measured per week. Analyses found significant improvement in MLD for each training group, and SP increases in group 2 over the six week period while SP decreased for group 3. These results demonstrate that stroke survivors succeeded in improving balance performance with challenging exercises, and support the idea that the regimen can be tolerated and beneficial.

Q15

Characterization of HuR Overexpression in a Post-Ischemic Penumbra

Presenter(s)

Vignessh Kumar, Illinois Mathematics and Science Academy

Advisor(s)

Agnieszka Ardelt, University of Chicago Randall Carpenter, University of Chicago

Stroke is the third leading cause of death and the leading cause of disability in the United States. Currently, there are limited therapies that help patients regain lost muscle control. This investigation examines the transgenic expression of an mRNA binding protein, HuR, in astrocytes and assesses whether it can aid in functional recovery after stroke, and determines whether ischemia and estrogen treatment regulate the expression of a HuR-FLAG transgene in mice. Immunofluorescent imaging was conducted using antibodies targeting a FLAG epitope bound to overexpressed HuR. This project used immunofluorescent staining protocols to stain coronal mouse brain sections in order to determine the FLAG response to ischemic stroke in three subpopulations of transgenic mice: males, hormonally intact females, and ovariectomized (OVX) females with placebo or estrogen treatment. Initial observations detailed an increase in FLAG expression in the ischemic hemisphere 24 hours after reperfusion. A higher increase in FLAG was observed in hormonally intact females compared to males. However, OVX females treated with estrogen did not have a significant difference in FLAG expression compared to the placebo group. This led to the conclusion that another hormone present in females, such as progesterone, may cause the regulation of the transgene due to ischemia.

Q16 Dopamine Regulation of Phosphorylation of Cone-Cone Gap Junctions in Ground Squirrel Retina

Presenter(s)

Xiaoyu Li, Illinois Mathematics and Science Academy

Advisor(s)

Steven DeVries, Northwestern University

Cone photoreceptors are electrically coupled such that when the electrical potential in one cell changes, it also changes in adjacent, coupled cells. Phosphorylation of the cone gap junction protein, connexin 36 (Cx36), determines whether a coupling channel is open or closed. Cx36-containing gap junctions are phosphorylated in the open state and dephosphorylated in the closed state. Cone-cone gap junction modulation has not been extensively studied, however, the presence of rod-cone gap junction modulation raises the possibility that the same is true for cone pairs. Pieces (2 x 2 mm) of thirteen-lined ground squirrel retina were removed from the eye and incubated for 2 hrs at room temperature in a solution that contained either dopamine (100 μ M) or dopamine antagonist (spiperone and SCH23390, 10 μ M each). After incubation, the tissue was cut into 100 μ m thick slices, fixed, and labeled with separate antibodies to Cx36 and phosphorylated Cx36. Cone-cone gap junctions were then imaged in the tissue slices using a Zeiss LSM 510 confocal microscope. The colocalization of the antibody labels under the two conditions was quantified using MetaMorph software. Preliminary analysis suggests that the ratio of dephosphorylated to phosphorylated gap junctions is higher in dopamine versus the dopamine antagonist treated tissue. The results are consistent with the idea that dopamine, which is released during the daytime, induces dephosphorylation and thus closes gap junctions.

Q17

Mapping Verbal Memory Through Electrocorticographic Readings of Subdural Electrodes

Presenter(s)

Egle Malinauskaite, Illinois Mathematics and Science Academy Paul Yuan, Illinois Mathematics and Science Academy

Advisor(s)

Vernon Leo Towle, University of Chicago

Epilepsy is a neurological disorder that causes individuals to experience recurrent and potentially disabling seizures. When pharmacological treatment is ineffective, some patients must choose surgery in order to have the epileptic focus removed. Unfortunately, many patients experience a post-surgical decline in verbal memory. The electrocorticographic patterns of twelve patients with surgically implanted subdural electrodes were studied. During a forty-minute testing period, patients underwent various tasks involving long- and short-term memory, mathematical calculations, conversational questions, and word repetition. The tracking of language processing and verbal memory was hypothesized to be done through high frequency power and low frequency coherence. Localized increases in high gamma band power (70-100 Hz) were observed in response to warning tones, presented words, and the patient's verbal response. Increases in high gamma band power were observed during language processing but were absent during verbal memory. Analysis of inter-electrode theta band (4-8 Hz) coherence dynamics suggested communication between the temporal and frontal lobes during memory scanning. Future studies will utilize Granger causality as an alternate form of analysis. Locating and understanding areas important to verbal memory may improve surgical outcomes and alleviate cognitive decline for epilepsy patients.

Q18 Degradation and TRIP8b Maintenance of HCN1 and HCN2 Channels

Presenter(s)

Pujan Patel, Illinois Mathematics and Science Academy

Advisor(s)

Dane Chetkovich, Northwestern University

Deficiencies, mutations, and mislocalizations of hyperpolarization-activated cyclic nucleotide-regulated (HCN) channels, nervous ion channels responsible for maintaining membrane polarization for signaling on dendrites, have been noted in epilepsy, hippocampal seizures, and several electrocardial disorders. The adapter protein tetratricopeptide-repeat containing Rab8b interacting protein (TRIP8b) has been looked to as a potential drug therapy for these HCN channel disorders. In this study, we test for the underlying relationship between TRIP8b and HCN channels. We do so through the hypothesis that HCN channels are fated to degrade within the cell and that TRIP8b prevents this degradation, and localizes HCN channels, by binding to HCN channels specifically on only the dendrites. We are testing the use of HaloTagTM fusion protein technology and a pulse-chase analysis. HaloTagTM fusion proteins were fused with HCN1 and HCN2 through cloning, and then tested for proper expression in human embryonic kidney cells, so as to measure them with pulse-chase analysis. Knowing the relationship of TRIP8b and HCN channels and showing how it can maintain these channels may lead to the development of drug therapies for these fatal diseases.

Q19

Identification of Clathrin and Adapter Protein Interacting TRIP8b Splices

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

Advisor(s)

Dane Chetkovich, Northwestern University Ye Han, Northwestern University

The adapter protein tetratricopeptide-repeat containing Rab8b interacting protein (TRIP8b) has been identified in the regulation of hyperpolarization-activated cyclic nucleotide-regulated (HCN) ion channels via cellular membrane trafficking. TRIP8b occurs in nine isoforms that interact with the endocytosis protein clathrin and adapter proteins 1 and 2 (AP1 and AP2). This study wishes to identify which isoforms of TRIP8b interact with the clathrin and adapter proteins to the indentify those that are specifically involved in the downregulation and upregulation of HCN channels. Interactions were tested with yeast two-hybrid screens and GST-pulldown assays. All interactions were tested first with the yeast two-hybrid screening protocol, and did get data suggesting interactions between TRIP8b and clathrin and AP1 and AP2, however they were inconclusive due to the interactions in our positive controls. The main finding has been that the yeast two-hybrid method is difficult to perform on the specific constructs we developed to test the interactions. Testing was continued with GST pulldown assays, which are currently in progress. Identifying which isoforms of TRIP8b downregulate and upregulate HCN channels is critical in developing possible drug therapies for epilepsy and hippocampal seizures, which observe a pathophysiology that includes the loss of HCN channels.

Q20 Gender Differences of Neural Correlates Supporting Empathy in Schizophrenia

Presenter(s)

Nicole Runkle, Illinois Mathematics and Science Academy

Advisor(s)

Matthew Smith, Northwestern University

Research shows that schizophrenia patients (SCZ) have empathy deficits. Regions of brain activation while performing empathy-based tasks include the anterior insula (AI), temporoparietal junction (TPJ), and anterior cingulate cortex (ACC). Prior studies show that when compared to controls (CON), SCZ have reduced activation in these regions while performing empathy-based tasks. Research also shows that when compared to males, females show stronger activation in the AI and ACC regions, while males show stronger activation than females in the TPJ. Few studies have examined gender differences in empathy neural networks in SCZ. We assessed neural correlates of empathy using functional magnetic resonance imaging (fMRI) techniques. Analysis of functional neuroimages (AFNI) was used to preprocess and analyze fMRI data. Analysis-of-variance was used to examine between-group differences in the blood-oxygen-level-dependent (BOLD) response across the brain. This whole-brain analysis showed that female SCZ had a stronger BOLD response in the right TPJ, while male SCZ had a stronger BOLD response in the ACC. These findings suggest that gender differences previously found in CON were not consistent in SCZ. This also suggests that although SCZ have empathy deficits, males and females have a reduced BOLD response in distinct regions.

Q21 Mouse Models in the Genomic Age

Presenter(s)

Shannon Tai, Illinois Mathematics and Science Academy Kelly Yom, Illinois Mathematics and Science Academy

Advisor(s)

Kay Grennan, University of Chicago Chun-Yu Liu, University of Chicago

Telomeres are DNA-protein complexes that can be found at the end of each chromosome and are important for protecting genes. Here, we tested the correlation between age and telomere length in laboratory mice. DNA from the left cerebellum and blood was extracted from groups of laboratory mice of different ages. This DNA was then analyzed with quantitative polymerase chain reaction to determine the relative telomere lengths of the various groups. No significant difference was observed between the telomere lengths of the different age groups. This means that aging is unlikely to be related to telomere length in laboratory mice. Furthermore, a significant difference was found between the telomere lengths in the left cerebellum and those of the blood, which may mean that the telomere lengths in the brain are not able to accurately represent the telomere lengths in the blood, and vice versa. These results are important because these mice models may be able to be used to predict the behavior of telomere lengths in humans or other mammals. In the future, this data can facilitate investigations in microarray gene expression to observe the changes that occur in the brains of laboratory mice after the addition of a stressor.

R01 Searching for a High Mass Standard Model Higgs Boson in 6.3 fb⁻¹ of Data at the D0 Detector

Presenter(s)

Alexander Abbinante, Illinois Mathematics and Science Academy Wesley Bradley, Illinois Mathematics and Science Academy

Advisor(s)

Ryuji Yamada, Fermi National Accelerator Laboratory

In the Standard Model of particle physics, two problems that are left unaccounted for are electroweak symmetry breaking and the large masses of the W and Z bosons. The predominant theory to explain these is the Higgs mechanism, which predicts the existence of a massive scalar boson now known as the Higgs boson. The particle has never been directly observed, and doing so is the main goal of the collider experiments at Fermilab's Tevatron. This analysis describes a search for a high mass Standard Model Higgs boson by the D0 detector at the Tevatron collider. Proton-antiproton collisions with a center-of-mass energy of 1.96 TeV totaling 6.3 fb⁻¹ of data are examined. Our work is centered on the decay mode WH \rightarrow W(WW) \rightarrow lv(jj·jj), where H is the Higgs boson, W is a W boson, lv is a lepton-neutrino pair, and jj·jj represents four jets, with a specific focus on Higgs masses in the range of 175-185 GeV. Covered extensively is the development of an analysis framework written in the ROOT programming language and used to model and compare simulations to data. The result is a program which can be used to search for evidence of the Higgs across multiple channels.

R02

Detecting Cosmic Muons: Calibrating an Efficient Straw Chamber

Presenter(s)

Natasha Arvanitis, Illinois Mathematics and Science Academy Laura Napierkowski, Illinois Mathematics and Science Academy

Advisor(s)

Brendan Casey, Fermi National Accelerator Laboratory Mandy Rominski, Fermi National Accelerator Laboratory Geoffrey Savage, Fermi National Accelerator Laboratory

We worked on detector research and development for a tracking detector as a part of the muon g-2 experiment. The 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 of particle physics. Our objective was to maximize the efficiency of a straw chamber. A straw consists of a long metallic cylinder with a sense wire in the middle. When a particle passes through the straw, it ionizes the gas inside and allows the sense wire to send a signal to electronics, which do preliminary data filtration and output the data to a text file. Hardware and software were both used to filter out as much noise as possible. The optimal settings were found to be 1700 and 1680 V for the triggering photomultiplier tubes, 1600 V for the straws, one microsecond delay, and low vacuum pressure. It was found that filtering out any events with more than fifty hits eliminated the majority of the obvious noise events. The methods we developed and the programs we created will be used by the muon g-2 collaboration as they create and test new tracking detectors.

R03

Modeling the Strong Gravitational Lensing System, Clone, Using Data from the Hubble Space Telescope

Presenter(s)

Amber Betzold, Illinois Mathematics and Science Academy

Advisor(s)

Huan Lin, Fermi National Accelerator Laboratory

The strong gravitational lensing system nick-named the clone was originally discovered as SDSS J120602.09 514229.5 in the Sloan Bright Arcs Survey. The system consists of a luminous red galaxy and its smaller neighbors (z = 0.422) lensing a bright background galaxy (z = 2.001). A small luminous satellite galaxy present near the Einstein radius splits the arc. We modeled the system based on several different exposures from the Hubble Space Telescope at wavelengths 450, 606, and 814 nm, using two previously existing programs, galfit and lensview. Using the outputs from these programs, we were able to generate information about the surface mass density, luminosity, and dark matter content of the system. Using a singular isothermal ellipsoid model for the lens yields an Einstein radius of 3.8 inches and a mass within that radius of 2.87 x 10¹² solar masses. We calculated a total mass to light ratio of about 19 solar masses per solar luminosity. Our results are comparable with those obtained in previous studies of the system, but we have made new measurements of the dark matter fraction in the system. Our results support the growing evidence of high ratios of dark matter to luminous matter present in these systems.

R04

The Accuracy of Galaxy Cluster Mass Estimates Based on Weak Gravitational Lensing Techniques

Presenter(s)

Stephanie Cheng, Illinois Mathematics and Science Academy

Advisor(s)

James Annis, Fermi National Accelerator Laboratory

Weak gravitational lensing is the bending of light due to the pull of large bodies such as galaxy clusters. In analyzing these distortions, mass estimates of the cluster can be made. However, because weak lensing affects all galaxies in the same part of the sky, estimates might erroneously include objects outside of the cluster. The purpose of this study is to determine how accurately one can recover the true mass of a cluster using weak lensing techniques. To do this, I calculated estimates for high mass (M200 > $5x10^{13}$), low redshift (z < 0.25) clusters simulated by the Dark Energy Survey project. By using simulated clusters, I could then compare my estimates to the true masses. Current results show estimates to differ by +/- 20-30% from the true masses. This indicates that neighboring objects may be a significant source of error in weak lensing techniques. Unlike other techniques, mass estimates from weak lensing account for the dark matter in a galaxy cluster. By gaining accurate mass estimates, one can determine the amount of dark matter in a cluster. With improved lensing techniques, astrophysicists can better understand dark matter and its role in the Universe.

R05 Differentiating Neutrino Events

Presenter(s)

Mohammed Hayat, Illinois Mathematics and Science Academy

Advisor(s)

Maury Goodman, Argonne National Laboratory

A significant fact about neutrinos is that they have non-zero masses. Neutrinos are detected through experiments in which detectors full of scintillator display particle paths. Each neutrino has a characteristically unique way of being identified through detectors; muon neutrinos through distinguishable linear regression of muons, electron neutrinos through scattered linear regressions of electrons, and pions, though similar to electrons, through two electromagnetic streaks, which are the plots of gammas formed from a single decaying pion. Identifying neutrinos through visual algorithms may prove to be difficult graphically due to similarities between particles, but creating patterns and algorithms increase the probability of identifying a particle correctly. This study investigates the creation of visual and computer algorithms to assist in differentiating these particles from one another. At Argonne National Laboratory, visual algorithms were created; results include calculated figure of merits, efficiency of algorithms, and compared and contrasted differentiating algorithms. These results conclude that muon neutrinos are the easiest to detect, whereas electron neutrinos in combination with pions are the hardest to differentiate. These results will allow scientists to differentiate neutrinos efficiently.

R06

Energy Calibration of Electron Antineutrino Using Boron-12 Beta Decays

Presenter(s)

Holly Hernandez, Illinois Mathematics and Science Academy

Advisor(s)

Michelangelo D'Agostino, Argonne National Laboratory Maury Goodman, Argonne National Laboratory

Seventy years ago, Enrico Fermi hypothesized the existence of a massless, chargeless particle, called the neutrino. Neutrinos come in three different flavors: electron, muon, and tau. In the 1990's, physicists found that neutrinos oscillate, or change into other flavors, and so they must have mass. This contradiction of the Standard Model of particle physics inspired dozens of new neutrino experiments. One of those experiments is Double Chooz, where electron antineutrinos from a nuclear reactor are detected in two identical detectors. As scientists try to distinguish how many antineutrinos disappear between the two detectors, they measure the amount of scintillation light created when neutrinos interact in each reaction containment vessel. However, the light output is not as important the amount of energy that was initially possessed by the neutrino. To determine the relationship between observed light and energy, this study measured beta decays of Boron 12, which has a well known energy spectrum. The objective is to determine which formula most accurately calculates the amount of energy released and how precisely we can calibrate the energy with this method. Using data from Monte Carlo simulations, histograms were generated and analyzed the information with the help of the ROOT programming language.

R07

Transfer Line Design from the Recycler Ring to the P150 Line for the Mu2e- Project at Fermi National Accelerator Laboratory

Presenter(s)

Shantanu Jain, Illinois Mathematics and Science Academy

Advisor(s)

Meiqin Xiao, Fermi National Accelerator Laboratory

With the opening of the Large Hadron Collider at CERN, Fermilab's Tevatron will be shut down, freeing three storage rings. Under the proposed Mu2e- project, this infrastructure will be reused to convert muons to electrons. This project requires that 8-GeV protons be transferred from the Booster to the Antiproton source (Pbar). Dr. Meiqin Xiao's original design offered insufficient room between the new line and the recycler ring and P150 line. Mathematically, the transfer line is represented by a matrix of lattice functions, which represent various parameters of the transfer line, such as the Twiss functions, β_x , β_y , α_x , and α_y , dispersion functions D_x , D_p_x , D_y , and D_{py} , and phase advances μ_x , and μ_y . Since the design requires that the transfer line inject the beam with predetermined parameters, the Methodical Accelerator Design program was used to match the extraction point's matrix to the injection point's matrix, while holding the strength of the magnets constant. This resulted in reduced distances between the magnetic elements of the FODO-cell, allowing for sufficient space between the magnets and other nearby hardware. Once implemented, the line will enable Pbar to become a set of proton storage rings as part of the Mu2e- project, a setup that would create original research opportunities.

R08

Modeling Quench Propagation in a System of Interconnected Superconducting Coils

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

Advisor(s)

Iouri Terechkine, Fermi National Accelerator Laboratory

Superconducting magnets yield a wide scope of useful applications, but they must account for the development of quenches, a phenomenon through which the energy stored in the magnetic field dissipates in a concentrated location. This process not only causes the loss of superconductivity, but can also severely damage the magnet and its surroundings. Computer modeling of quench propagation allows for the analysis of protection techniques that limit the negative effects of quenches. In this research, several variations of a program based on the MATLAB computing language were created to model quench propagation in a system of superconducting focusing solenoids planned for future use at Fermilab. The investigation yielded results regarding the effects of dump resistor placement and resistance on quench propagation. Data such as maximum temperature, voltage to ground, energy dissipation, and current decay was acquired through the computer programs. Currently, modeling and data collection has been completed for two quench protection schemes, with both models taking into account the location of the quench's origin. Further analysis has determined which of these techniques should be implemented for most effective protection. The results of this work may influence the design of future devices using superconducting solenoids, such as particle accelerators.

R09 Optimization of Event Selection for the Higgs Boson Sensitivity at the Collider Detector at Fermilab

Presenter(s)

Benjamin Kuo, Illinois Mathematics and Science Academy

Advisor(s)

Eric James, Fermi National Accelerator Laboratory Sergo Jindariani, Fermi National Accelerator Laboratory

The Standard Model (SM) of particle physics, proposed in the 1960s, is a quantum field theory which describes the world of elementary particles and laws of their interactions, and most of its predictions have been tested and confirmed experimentally. The only unobserved particle in the SM today is the Higgs boson which facilitates the interaction in the Higgs Field that creates mass. The search for this particle is difficult due to large backgrounds - other particles producing signatures similar to that of the Higgs boson in the detectors. In this Monte Carlo simulation-based study we aimed to demonstrate that the signal to background ratio can be significantly improved by the use of a program to compare and contrast information from two independent subsystems of the Collider Detector at Fermilab - the tracker and calorimeter. We applied many cuts to calorimeter data such as muon correction, lepton selection, and invariant mass limits. With these cuts, we hope to find true discrepancies that facilitate with Higgs identification with the tracker. Currently, running this program on testing sets, background noise is reduced. Ideally, after some revision, it can be run over other real data sets to filter through data needed to be analyzed, making the search easier.

R10

Tracking the Construction and Performance of the NOvA Detector

Presenter(s)

John Lee, Illinois Mathematics and Science Academy

Advisor(s)

Jonathan Paley, Argonne National Laboratory

The NOvA detector is a particle physics detector that is used to observe neutrinos and measure neutrino oscillations. The main focus of this investigation is to track the construction and performance of the NOvA detector. As the NOvA detector is part of a \$270 million project, it is critical to track its construction and performance. To do so, we have written a computer program using the computer language Python to extract data from several databases to generate progress reports and plots for quality control of detector components and overall performance of the operations of the detectors in the experiment. These progress reports and plots are critical to optimizing detector performance.

R11 Optimizing Nanometer-Scale Features

Presenter(s)

Kiwook Lee, Illinois Mathematics and Science Academy

Advisor(s)

David Czaplewski, Argonne National Laboratory

Electron beam lithography is a key technology to create precise nanometer structures as designed. Through e-beam lithography, electrons are focused into a resist layer to create the design. However, some electrons are scattered back to the resist causing changes in the original pattern. In order to create precise patterns, the pattern must account for the additional dose of the backscattered electrons. A silicon-on-insulator wafer was coated by negative resist, patterned by e-beam lithography, and developed by chemicals to keep only the exposed parts. The pattern consisted of a large annulus with a small pillar at the center. A pillar height, influenced by the radius of the annulus and the amount of electron dose, was measured by atomic force microscope. Pillar heights with the 350 μ C/cm² electron dose stayed to full height until 14.5 μ m radius and dropped rapidly after. Without the proximity effect, the first pillar was formed at 893 μ C/cm² electron dose with a height of 125 nm and its height increased as the electron dose increased. The data points from these patterns were then inserted into a Gaussian equation to calculate the constant beta. This beta constant will be used to optimize features of 100 nm or larger.

R12 Dynamics of Two-Dimensional Granular Gases

Presenter(s)

Peter Lu, Illinois Mathematics and Science Academy

Advisor(s)

Justin Burton, University of Chicago Sidney Nagel, University of Chicago

Granular gases are composed of nearly identical particles that are large enough for inter-molecular forces to be negligible, for example, sand. In these gases, particles undergo inelastic collisions and lose kinetic energy upon impact. Thus, the total kinetic energy of the gas decreases with time. However, a large-scale laboratory model of a granular gas has yet to be realized. We have constructed such an experiment using a very flat, smooth, aluminum plate with sloped boundaries. The 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. Computer simulations of granular gases reveal striking clustering patterns where particles bunch together in dense regions. Preliminary results show that clustering depends on the initial positions and velocities of the particles and tends to occur near the boundaries of the plate, but can sometimes occur in the center. To accompany the experiment, we compare our results to computer simulations of a two-dimensional granular gas with reflecting boundaries, which qualitatively shows the same behavior as the experiment. This clustering may have implications for phenomena such as structure and planet formation in large dust clouds.
R13 An Automated Algorithm for Closed Orbit Correction

Presenter(s)

Erik Luo, Illinois Mathematics and Science Academy

Advisor(s)

Charles Thangaraj, Fermi National Accelerator Laboratory

In modern accelerators, beam steering deals with particles as they travel down a beamline along a specific path, and how beam position monitors and dipole corrector magnets are used to change their path. Due to the machine's environment, particle drift, and external influences, the orbit is often not where it is desired, so correctors must apply a "kick" in order to steer the orbit into position. Reviewing articles and papers on this topic, I studied how matrix techniques including singular value decomposition (SVD) use beamline data to calculate the precise corrector values needed to correct the global orbit. Using the Octave programming language, I created programs that calculate these values and identify where they need to be applied. I discovered the details to generate successful SVD results and improve their accuracy, as well as how to interpret the results. This technique was compared to local orbit correction, in which particles are bumped out of orbit along a small section of the beamline. I am investigating other techniques to increase the efficiency of these programs using selected data. By testing and comparing different algorithms, I can provide physicists a model for automatic closed orbit correction.

R14

Determining the Optimal Silicon Photomultiplier Device to Measure High Energy Particle Collisions

Presenter(s)

Tuopu Ma, Illinois Mathematics and Science Academy

Advisor(s)

Jacob Anderson, Fermi National Accelerator Laboratory Juliana Whitmore, Fermi National Accelerator Laboratory

Silicon photomultipliers (SiPM) are analog devices that measure light intensity. Currently, the Compact Muon Solenoid (CMS) is in need of a replacement device. The purpose of this investigation has been to evaluate various models of existing and theoretical SiPM devices and to determine the most effective one that can be used to measure the energy of particle collisions at CMS. Fifteen types of SiPMs, including eight existing and seven non-existent models, with various capabilities were tested using a computer program that simulated particle collisions. In the analysis of the mean and RMS values, results revealed that four theoretical devices met the optimal conditions, but only two existing ones satisfied requirements. These six devices also all used an optical detector unit (ODU) rather than an electrical detector unit (EDU). However, it should be noted that ODUs have the disadvantage that they are more difficult to construct. As a result, it is difficult to definitively choose either an ODU or EDU for SiPMs. With respect to the devices, though, the main factors that affect viability are the response times and the total number of pixels. These results will greatly assist CMS in determining the SiPM device that meets its specifications.

R15 Measuring Time Calibrations in Waveform Digitizing for Practical Positron Emission Tomography Applications

Presenter(s)

Eric Ordonez, Illinois Mathematics and Science Academy

Advisor(s)

Chien Kao, University of Chicago

This Student Inquiry and Research investigation is a research endeavor in positron emission tomography (PET). PET is a medical imaging technique that uses gamma ray detection to reconstruct images of the human body. Specifically, efforts were focused on learning the specifications and capabilities of the DRS4 waveform digitizing chip and its applications to PET. Utilizing waveform digitizing in PET detectors is an innovative design. Because of experimental limitations, this investigation featured extensive research and analysis of other studies and publications to discuss the possibility of using the said chip and the future implications of such a design. This research project yielded a fundamental understanding of PET and the physics and mechanisms associated with the process. Because of their relevance to the DRS4, time was dedicated to learning the physical phenomena involved in PET detection as well as the workings of circuits and analog-to-digital conversion. Based on the current progress of the research, the initial conclusion has been made that waveform digitizing could drastically reduce PET detector size and costs in addition to greatly increasing timing accuracies and reconstructed image resolutions. The next step would be to test the chip in a detector to confirm its compatibility in such a design.

R16

Calibration of Dark Energy Camera Charge-Coupled Device Images in the Dark Energy Survey Filter System Using Astronomical Standard Stars

Presenter(s)

Deokgeun Park, Illinois Mathematics and Science Academy

Advisor(s)

Tom Diehl, Fermi National Accelerator Laboratory Douglas Tucker, Fermi National Accelerator Laboratory

Astronomical images taken from a telescope must go through image processing to remove instrumental signatures. The Dark Energy Survey (DES), which will start operations in 2012, will use a 570 megapixel dark energy camera (DECam) to study the mystery of the acceleration of the expanding universe. The DECam will use DES filters, and 74 of a new type of astronomical CCD that is particularly efficient in detecting near-infrared light. Together, the DES filters and DECam CCDs are optimized for the measurement of redshifts of distant galaxies. In preparation for the DES, data were collected from the 1m telescope, at Cerro Tololo Inter-American Observatory (CTIO) in Chile, using a DES filter set and a DECam CCD as a test set for the initial analysis of data. Here, these CTIO-1m data were used to determine the relationship between the apparent brightness of star's of known brightness (standard stars) and the amount of air the telescope looks through (angular distance from the zenith or airmass). This relationship was used to calibrate the brightness of stars that were also observed in the CTIO 1 m data set.

R17 Operating Voltage of the Silicon Detectors in the Collider Detector at Fermilab

Presenter(s)

Jorge Quero, Illinois Mathematics and Science Academy

Advisor(s)

John Freeman, Fermi National Accelerator Laboratory Michelle Stancari, Fermi National Accelerator Laboratory

Out of the several sub-detectors in the Collider Detector at Fermilab (CDF), the silicon detectors, are the most exposed to radiation damage from collided particles. As radiation damage increases, the operating voltage across the sensors must be raised to accommodate it. In order to know what operating voltage is necessary for each individual sensor, many sets of previously measured depletion voltages were extrapolated to gain a reasonable estimate. The first task was to predict the required operating voltages for the next year, and raise them accordingly; the other task was to find when the sensors will reach 170 volts, the maximum safe operating voltage. The results reveal that all of the sensors in the first layer of the silicon detector will require above-maximum operating voltage at approximately 18 inverse femtobarns. In addition, half of them will be at about 14 inverse femtobarns. The silicon detectors play a vital role in taking data for the CDF, especially as the closest detectors to the particle collision point. This project is necessary for optimizing the efficiency of the silicon detectors so that they can take the most accurate data possible and how long they can run efficiently without breaking.

R18

Investigation of Radiation Cool-Down Curves and Development of Tools for Their Analysis

Presenter(s)

Amir Safavi, Illinois Mathematics and Science Academy

Advisor(s)

Bruce Brown, Fermi National Accelerator Laboratory

Since the 1930's, physicists have built accelerators which can produce radiation for scientific study. As a byproduct, accelerator facilities can have locations where ionizing radiation poses a hazard to workers. Not only do Fermilab accelerators produce radioactivity at the target area, but also at where the beam is lost. In this study, radiation cool down curves were analyzed to determine the ratio of different isotopes that make up the radioactive material created. From one radiation curve, we calculated that the percentage of isotopes was 63 % manganese⁵⁶, 27 % manganese⁵⁴, and 10 % manganese⁵². To automate this process, computer software was created using Microsoft Visual Basic and Excel. In addition, a Geiger counter was built to learn practical techniques such as soldering. Furthermore, it will be used to collect data. The results of an analysis on the Main Injector C307 Collimator, the methods used, and software created were published so that people could perform analyses on other sources of radiation. During the investigation, I learned the theory behind particle showers, gamma radiation, and creation of isotopes. The study and outcomes will help people at Fermilab to keep radiation exposure low by predicting levels of radiation in the areas where work is planned.

R19 The Comparison of the Different Radiotherapy Neutron Sources in Various Facilities for the Optimal Result in Neutron Therapy

Presenter(s)

Michelle Suh, Illinois Mathematics and Science Academy

Advisor(s)

Thomas Kroc, Fermi National Accelerator Laboratory

This study strived to understand to what extent neutron spectra from various neutron therapy facilities influence the clinical results of neutron therapy for treating cancer. Measuring the effectiveness of a certain radiotherapy treatment method is difficult due to numerous factors that influence the results. Thus, this investigation aimed to solely compare the difference in energy spectra of four neutron therapy facilities: in Seattle and Detroit, at the University of California at Los Angeles (UCLA), and at Fermilab. MCNPX, a Monte Carlo computer program, was used to emulate the interaction of the incident proton or deuteron beam with the target of each neutron source. As expected, higher energy incident beam produced higher energy neutrons. Fermilab, which uses the highest energy incident beam, generated a higher energy neutrons, but the quantity was insignificant. For now, we are uncertain of what kind of result leads to the best radiotherapy treatment. These results can be further pursued to identify whether there is a correlation between the energy spectra and the clinical results of neutron therapy. The discovery of a correlation can become a basis to finding the most efficient neutron source for the best treatment result and for the improvement of neutron therapy overall.

R20

Using GALFIT and Lenstool to Analyze Gravitational Lenses

Presenter(s)

Gary Wang, Illinois Mathematics and Science Academy

Advisor(s)

Sahar Allam, Fermi National Accelerator Laboratory Huan Lin, Fermi National Accelerator Laboratory

Outer space remains as a mysterious new frontier for mankind, so we turn to unique methods to obtain information on distant galaxies and stars, such as gravitational lensing. This investigation looked at analyzing the Clone lensing system and determined the best model as well as the distribution of dark matter in the system. GALFIT, animage analysis software, was used to model the individual galaxies within the system and an image of the background galaxy of the lensing system. The system was then analyzed with Lenstool, which modeled the mass distribution of the galaxy. The results obtained from GALFIT and Lenstool have had chi squared values close to one, meaning that they were relatively good fits. Chi squared values from the GALFIT analyses were $\chi^2 = 1.029$, $\chi^2 = 1.116$, and $\chi^2 = 1.162$. The best model obtained from Lenstool so far was the elliptical singular isothermal sphere model for all four galaxies in the system. The results from this investigation provide some insight into the distribution of dark matter throughout our Universe. Although only one system was analyzed in this investigation, future work could involve other lensing systems and the comparisons of the models of each respective system.

S01 Correlation of Print Advertisements, Self-Concept, and Body Image in Adolescent Girls

Presenter(s)

Uchenna Agwuncha, Illinois Mathematics and Science Academy

Advisor(s)

Deborah McGrath, Illinois Mathematics and Science Academy

The average American woman is 5' 4" tall and weighs 140 pounds, whereas the average American model featured in advertisement campaigns is a mere 115 pounds and 5' 11" tall. A study by the American Psychological Association found that after three minutes spent looking at a fashion magazine including such models, 70% of women of all ages feel depressed, guilty, and unpleased. This study seeks to correlate women's physical appearance as presented in print magazines advertisements with poor self-image and body image in adolescent girls. Information has been gathered from female students at IMSA through an electronic survey with topics based on previous research and studies. Extensive research and critical documentary reviews have allowed for the creation of the questionnaire. The primary purpose of the survey is to gain understanding of what IMSA female students believe about the role that the media through advertisements plays in one's self concept and decisions made regarding our body.

S02

Examining Differences in Cognitive and Executive Functioning Scores in Patients with Autism Spectrum Disorders, ADHD, and Co-Occurring Autism and ADHD

Presenter(s)

Jennifer Bailey, Illinois Mathematics and Science Academy

Advisor(s)

Scott Hunter, University of Chicago

Autism spectrum disorders are becoming more and more commonplace in our country. These disorders are also being diagnosed along with other disorders quite frequently. This investigation focused on one of those disorders, attention defici hyperactivity disoreder (ADHD), and its relationship to autism spectrum disorders in neuropsychological testing. Patient data from the University of Chicago Comer Children's Hospital Pediatric Neuropsychology Service was used to run a correlation analysis between three neuropsychological tests that are important in diagnosing both disorders. The three tests, WISC-IV, BASC 2, and BRIEF, use a combination of parental feedback and examinations to assess a child's executive functioning and intelligence quotient. Through analysis, a positive correlation between WISC-IV verbal comprehension and BRIEF metacognitive index was found for patients with only an autism spectrum disorder. For patients with only ADHD, a negative correlation was found between WISC-IV verbal comprehension and the BRIEF global executive composite score. This suggests that in patients with autism spectrum disorders, executive functioning improves as language skills improve. However, in patients with ADHD, their level of executive functioning decreases as their language skills increase, suggesting that autism spectrum disorders are more affected by a child's language skills.

S03 An In-Depth Analysis in Decision Making Based Upon the Decision Making Index Scale

Presenter(s)

Kirthi Banothu, Illinois Mathematics and Science Academy Brendan Wesp, Illinois Mathematics and Science Academy

Advisor(s)

Rebecca White, University of Chicago

This study compares the effectiveness of different styles of decision making and the implications it has for an individual's future decisions. The three different styles that will be analyzed are analytical, intuitive, and regret. The authors will administer the decision making index assessment (DMI) to all the participants as a means to gauge their style of decision making. After completing the DMI, the participants will take part in a complex decision task, namely a horse-race betting simulation. Participants are presented with different pieces of information about horses (for example, the name of the horse) and are asked to choose which information to view in order to choose which horse they think will be most likely to win a race. The participants bet on multiple rounds in order to collect information in regards to how a decision will change. They are currently no results because the experiment is still in progress. The implications of this are that there is a possible ability to determine what style of decision making is most effective in the world and leads to the most success and least amount of regret.

S04

Predicting the Mind of a Serial Murderer: The Success of Criminal Profiling in the Case of the Green River Killer

Presenter(s)

Jessica Grady, Illinois Mathematics and Science Academy Michelle Jardine, Illinois Mathematics and Science Academy

Advisor(s)

James Bondi, Illinois Mathematics and Science Academy Steven Bongardt, Federal Bureau of Investigation

Criminal profiling is a procedure that determines possible personality traits, demographics, geographic locations, and behavioral characteristics of an unidentified offender or offenders based on features of a crime scene. It is a tool frequently used by detectives and the Federal Bureau of Investigation to aide in creating or narrowing down a list of suspects after all other methods have proven unsuccessful. However, criminal profiling is met with much controversy. In order to determine if profiling is a useful tool, a literature review-based case study on Gary Ridgway, a prolific serial murderer more commonly known as the Green River Killer, was conducted. By looking at how and why he killed as well as the contents of the profile and how it was used in the investigation, we determined that criminal profiling was moderately successful. While the profile helped narrow down a list of suspects that included Ridgway and aspects of the profile correctly modeled him, the profile hindered the investigation. The way this case developed suggests that as long as the profile is correctly created and used, criminal profiling can be an asset to investigators.

S05 Awareness of Being Stared at: Investigations into the Possibility of a Sixth Sense

Presenter(s)

Carly Houdek, Illinois Mathematics and Science Academy Elaina Zintl, Illinois Mathematics and Science Academy

Advisor(s)

David Evenson, Illinois Mathematics and Science Academy

There is that nudge of awareness, something slight that pokes at the senses and serves as a sign of recognition that someone is staring at you. We explored the extent to which the sense of being stared at is part of a psychological sixth sense. There are differing views of extra senses, ranging from anecdotal accounts to more serious research studies. Using that research, we separated the differing views and then used unobtrusive observation to measure human perception of a stare. We stared at students, recorded response times, and then created an experimental design using slight deception to measure the phenomenon and link our findings to a psychological sixth sense. At this point, the experiment is underway. Through unobtrusive observation of subjects we have collected data that seems to be significant, supporting the presence of the sense, and showing differences in response time due to gender and environment. We look forward to seeing the outcome of the controlled study and whether it will confirm our initial observations. If so, then further research in this area of human perception is warranted.

S06

The Effect of Parental Input on the Language and Reading Development of Children During Preschool

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

Advisor(s)

Ozlem Ece Demir, University of Chicago

During the years of preschool, children engage in different activities with their parents that might prepare them later for emerging academic challenges in the school environment. General measures of parental language input are often used as a later predictor of children's language performance. However, not much is known about the early parental predictors of children's literacy-related skills, such as decoding or reading comprehension. In the current investigation, through the study of naturalistic parent-child interactions, we examined the links between early parent utterances about literacy and children's later reading skills. Parents and children were videotaped at child age thirty and fifty months in 90-minute organic sessions in their homes, and sessions were transcribed. The transcripts were then coded for pertinent utterances about literacy, including book-reading episodes, the pairing of letter sounds, corresponding letter forms, and so forth. Changes in parental input over time were analyzed using an ANOVA statistical test. Children's decoding and reading comprehension skills were then assessed at kindergarten and first grade using Woodcock-Johnson Tests of Achievement. Relations between early parental literacy input and later child outcomes were examined using regression analysis.

S07 Features of Effective Support Programs for Pediatric Multiple Sclerosis

Presenter(s)

Brittany Kwamin, Illinois Mathematics and Science Academy Whitney Kwamin, Illinois Mathematics and Science Academy

Advisor(s)

Christopher Kolar, Illinois Mathematics and Science Academy

Multiple sclerosis (MS) is an autoimmune disease that attacks the central nervous system that typically affects people between their twenties and forties. About 5 percent of multiple sclerosis patients are diagnosed before the age of eighteen. Although there are many support programs available, pediatric MS is rare and demands a different type of attention. Our goal is to create an outline resource that will alter the current support systems to meet the needs of pediatric MS patients. We released a survey that was available for ten days on a website called patientslikeme.com. Our results showed that people want to see more clubs or accessible websites strictly for men and women with adolescent onset of multiple sclerosis. We hope to use our research to advocate for this rare community, and show society what programs are effective for the entire MS community.

S08 d-Amphetamine: Effects on Mood and Speech

Presenter(s)

Paloma Ocola, Illinois Mathematics and Science Academy

Advisor(s)

Harriet de Wit, University of Chicago Margaret Wardle, University of Chicago

The psychostimulant drug, d-amphetamine, is associated with increased focus and feelings of euphoria. Increased sociability and talkativeness could be factors that cause people to use amphetamine recreationally. In our study, we observed how amphetamine affected speech and word use, as well as evaluating potential moderators of these effects like gender and personality. Thirty participants attended a double blind study, comprised of four sessions at which they received placebo, 5 mg, 10 mg or 20 mg of amphetamine. At each session, participants talked about an important person in their life for five minutes to female experimenters. These speeches were transcribed and then coded using the Linguistic Inquiry and Word Count program, which counted words in different categories such as positive words, pronouns, and so forth. Even though amphetamine increased feelings of elation, it did not increase word count overall, or the number of positive words, negative words, or first person singular pronouns used. However, amphetamine's effects depended on the gender of the participant. While word counts remained the same across placebo and amphetamine conditions in women, men talked significantly more on amphetamine than placebo. Thus, there was a modest, gender-dependent effect of amphetamine on talking. This could indicate amphetamine's effects depend on social conditions such as opposite-sex versus same-sex situations.

S09 How Stress Affects Sleep in Elderly People with Cardiovascular Risk Factors

Presenter(s)

Patricia Walchessen, Illinois Mathematics and Science Academy

Advisor(s)

Kathryn Reid, Northwestern University

This study looks at how stress affects sleep quality in the elderly, categorized as having low cardiovascular risk factors. Stress has been reported to decrease sleep quality according to studies of people aged 4 to 40. However, very few studies have focused on the elderly population. Examining the results of a perceived stress survey with various indicators of sleep quality enables a better understanding of how stress affects sleep. Preliminary analysis indicates no association between stress and sleep quality in my sample of the elderly population. Based on sleep quality indicators such as duration of sleep, the percent mobile, fragmentation, and sleep efficiency, there appears to be no association between sleep and stress. However, my preliminary analysis does not control for gender or age. To date, my analysis suggests results that are different from previous studies of other populations and how stress affects their sleep. This study highlights the importance of further research of elderly sleep habits and how the elderly respond to stress.

S10

An Exploration into Artificial Intelligence, the Human Mind, and Systems

Presenter(s)

Andrew Wentzel, Illinois Mathematics and Science Academy

Advisor(s)

Mike Ososky, Applied Computer Tech.

There are hundreds of different theories regarding artificial intelligence. The real question that needs to be asked is what similarities an artificial intelligence system will have with the system of the human mind. This can only be explained through reading various works of contemporaries in the field of artificial intelligence, such as Douglas Hofstadter, Daniel Dennett, Ray Kurzweil, and many others. For our investigation, we decided to focus on self-organizing, adaptive systems that utilize recursion as a method of achieving intelligence. Self-organization of a system is necessary to achieve the complexity to be adaptive; this complexity is based on the use of recursion. Through this study, we have found that the similarities between the human mind and possible artificial intelligence are so great that a sufficiently powerful system would be able to pass itself off for human.

T01 Nationalism in Spain: Catalonia and the Basque Country

Presenter(s)

Paul Angelillo, Illinois Mathematics and Science Academy Ryan Jordan, Illinois Mathematics and Science Academy Rhett Partida, Illinois Mathematics and Science Academy Rafael Rodriguez, Illinois Mathematics and Science Academy Samuel Simon, Illinois Mathematics and Science Academy

Advisor(s)

Jose Palos, Illinois Mathematics and Science Academy Eric Smith, Illinois Mathematics and Science Academy

Nationalism is one's identification with a nation of peers on cultural or ethnic grounds. In Spain, the term nationalism does not always apply to the state itself, but rather to the various regions of the country. The two comunidades autónomas (autonomous communities) of Spain with the greatest expression of nationalist sentiments are Catalonia and the Basque Country. The group studied these two communities extensively, using books such as *Homage to Catalonia* and *Foundations of National Identity*, and internet articles from Spanish magazines including *Cambio*. The group also interviewed Catalonian citizens and a professor at the University of Barcelona to expand their understanding of the cultural basis of these nationalist movements. The group then determined that the source of Catalanismo and Vascuencismo (the two nationalist movements) were distinct. Catalanismo is primarily a result of the different language and history shared by the Catalonian people, whereas Vascuencismo is based mainly on the concept that race-ethnic Basques are of Celtic origins, and therefore are genetically different from other Spaniards. The most extreme form of the Basque movement after the Franco regime was associated with the terrorist activities of Euskadi Ta Askatasuna, a nationalist organization, while Catalanismo gained more autonomy for Catalonia via politics. Currently, the European Union is entertaining a policy of regionalism, which would be the fastest avenue to Catalan and Basque independence.

T02 An Analysis of the Patient Protection and Affordable Care Act and its Effect on Physician Compensation and Health Insurance Companies

Presenter(s)

Cevdet Dogan, Illinois Mathematics and Science Academy Aditya Suresh, Illinois Mathematics and Science Academy

Advisor(s)

Christian Nokkentved, Illinois Mathematics and Science Academy

On March 23, 2010, President Barack Obama's Patient Protection and Affordable Care Act became law, providing the framework for a new health care reform. The new legislation amended many aspects of the healthcare system of the United States, but was met by some criticism from insurance companies and practicing physicians. Through peer-reviewed journals and opinionated articles from both sides of the argument, researchers looked for possible consequences of the legislation and any detrimental effects it might have on insurance companies and practicing physicians. Insurance companies worried about the new obligations to cover pre-existing conditions, to accept all customers, and to continue coverage of children until age 26 on their parent's insurance. Physicians criticized the bill because of worries of getting paid less despite gaining more patients. However, it was found that in the long run, insurance companies would profit as the new influx of patients would increase the profit made from premiums. As for physician compensation, the effects of the bill will vary depending on the physician specialty. The effects of the new healthcare reform may seem harsh at first, but insurance company profits and physician compensation will remain mostly safe and might even increase from the changes.

T03

IMSA, Parents, Expectations: Illinois Massive Stress Academy... Stressing Out Over Nothing

Presenter(s)

Jonathan Henricks, Illinois Mathematics and Science Academy Thomas Lightfoot, Illinois Mathematics and Science Academy

Advisor(s)

Tracy Rogers, Northern Illinois University

Students at the Illinois Mathematics and Science Academy are faced with a unique opportunity. Totally immersed in an academic environment, the students live on-campus amongst their fellow students. The students at this institution often complain of stress and our investigation makes an attempt to identify the major sources of student pressure as determined by the student body. We gathered our information through a survey sent to the students, and our survey asked questions pertaining to academic pressures; social pressures in terms of relationships with parents, siblings, and classmates; as well as the time constraints caused by extracurricular activities and sports. Once we gathered all of the student's responses we found that ninety-six percent of students believe that their fellow classmates are stressed and that students find homework, tests, and personal motivation as their three largest sources of stress and pressure. It is our hope that from this data our residence counselors will be able to come up with better and more efficient ways to help students deal with stress.

T04 Cultivating the Gifted Minority Leader

Presenter(s)

Shawon Jackson, Illinois Mathematics and Science Academy Satoe Sakuma, Illinois Mathematics and Science Academy

Advisor(s)

Purva Rushi, Illinois Mathematics and Science Academy

Leadership, being such a complex topic, is perceived in a wide variety of ways. Despite the distinct perceptions of which characteristics define a leader, however, there still exists a set of common traits amongst all effective leaders. The purpose of this investigation is to determine whether or not gifted African-American and Hispanic students perceive leaders differently than other ethnic groups. Additionally, we aim to learn which traits and behaviors the aforementioned groups recognize as needed to be an effective leader. In order to do so, students at residential academies were surveyed, in which they answered questions about what traits they recognize in effective leaders, as well as determining which behaviors and actions an effective leader portrays. If we find that African-American and Hispanic students fail to recognize core leadership traits, then we will make recommendations that involve implementing leadership education programs for said groups, in hopes that they will develop a greater understand of how to be an effective leader in their home communities, high schools, and the workforce.

T05

Sharing Needles: The Implementation of a Syringe Exchange Program in Chicago

Presenter(s)

Rahul Maheshwari, Illinois Mathematics and Science Academy

Advisor(s)

James Victory, Illinois Mathematics and Science Academy

This study views the utility of a syringe exchange program (SEP) implementation in the Chicago area. SEPs provide a method for injecting drug users to exchange used needles for sterile ones. Numerous studies conducted by the National Institutes of Health have demonstrated that SEPs are integral in combating the spread of blood-borne diseases such as HIV and hepatitis C in urban settings in a cost-effective manner. This study conducted phone surveys involving various free clinics in the Chicago area to gauge the potential impact an implementation of an SEP may have. Additionally, quantitative and qualitative analyses of existing SEPs in other locations were performed to better understand the logistics of an SEP, as well as understand existing legislation that governs these types of programs. The outcome of this project is a model of an SEP applicable to the Chicago area.

T06 Assessing Math Performance of Multilingual IMSA Sophomores

Presenter(s)

Sarah Malik, Illinois Mathematics and Science Academy

Advisor(s)

David Evenson, Illinois Mathematics and Science Academy Christopher Kolar, Illinois Mathematics and Science Academy

This study focuses on analyzing the math performance of multilingual IMSA sophomores verses those who are only proficient in English. The idea behind this study is that mathematics is often thought of as a language, so perhaps knowledge of more than one language contributes to success in mathematical computation. While all IMSA students are above average in mathematics, this study focuses on sophomores since they are least exposed to the unique learning environment at IMSA. This study profiles sophomores from the fall semesters of 2008-2010; about 360 students are profiled. Each student's gender, ethnicity, SAT math score, and IMSA math course grades are considered. This is done in order to identify specifically how different groups of multilingual and unilingual students perform in mathematics. Minitab 14 was used to run analyses such as multivariate regression, stepwise regression, R² values to evaluate the strength of correlation, and significance between variables. The study was most concerned with multilingual students; seen as not significant with a p-value of 0.725. The variables which showed significance were Asian race and SAT math score. The study showed that in gifted students, such as IMSA sophomores, being multilingual does not affect ability in mathematics.

U01 The Dinosaurs' Demise: An Investigation into the K-T Impact

Presenter(s) David Dailey, Illinois Mathematics and Science Academy Christopher Sartain, Illinois Mathematics and Science Academy

Advisor(s)

Mark Hammergren, Adler Planetarium

Sixty-five million years ago, an asteroid impacted a location near present day Chicxulub, Mexico. It is generally agreed upon that this event caused the mass extinction of the dinosaurs and other species. During our investigation, we researched a possible mechanism of the extinction, the Firestorm Theory. This data was collected by researching the known distributions of tektite densities. Tektites are a more specific glass form of ejecta that is formed by impacts. Using the programming language IDL, a launch program was created with K-T impact data that created a global distribution. Then, using the mass and velocities from the simulation and tektite densities, the kinetic energy was calculated. A five percent luminous efficiency will be used to find the thermal radiation per area. The simulation is almost complete, and most of the data to create a K-T distribution has been found. Preliminary data and calculations indicate that the energies released by the impact are near those needed for global firestorm ignition. This data appears to support the physical underpinning of the K-T mass extinction.

U02 Gravitational Interactions in Globular Clusters

Presenter(s)

Ian Nodurft, Illinois Mathematics and Science Academy

Advisor(s)

Mark Subbarao, Adler Planetarium

My research involves study into the evolution of globular star clusters due to gravity. These clusters are some of the oldest objects in the Universe, and are very dense, containing in the order of hundreds of thousands of stars. I looked at the length of time it takes for a cluster to stabilize and also its mass loss rate. I used Processing, a language based on Java, to create an n-body simulation of stars in two dimensions. At every time step, I calculaed each particle's velocity and how the gravity of all the particles is affecting each other. I have been outputting all of the necessary data to an excel file to analyze the total kinetic energy of the cluster and mass loss rate over time. The research I am conducting will help us to better understand the dynamics of globular clusters.

V01

A Comparison of Islam and Christianity: Religion's Institutions

Presenter(s)

Kristopher Fernandez, Illinois Mathematics and Science Academy

Advisor(s)

Robert Kiely, Illinois Mathematics and Science Academy

My study has been a historical comparison of Islam and Christianity, specifically asking what differences have their respective revelations made on their institutions, leaders, and rules? To answer this question, a significant amount of reading has been done. So far, I have read the Qur'an, most of the Bible, and I've begun a study on Christian heresies. I plan to read more books and have more extensive discussions with my advisor. Thus far, the institutions appear to be different because they reflect the differences in the religion. Islam is founded on the Qur'an, which is a book that mostly contains rules. The institution has faced very few schisms because the revelation has nothing to interpret. On the other hand, Christianity maintains that orthodoxy is the most important aspect of piety. Because of that, there is always debate on what the Christian is supposed to believe. The Christian institution is composed of many different types of belief, but Islamic institution is virtually uniform, with varying degrees of extremism.

2009-2010 Student Recognition

The below accomplishments are a summary from the 2009-2010 academic year

Ruchi Aggarwal: How Does the Trafficking Motif Affect the Rate of BACE 1 Endocytosis? Advisors: Virginie Buggia-Prevot, Gopal Thinakaran; University of Chicago *Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, Intel International Science and Engineering Fair Third Place Winner*

Vashti Aguliar: Mercury Contamination in Lake Michigan and its Impact (SIR 2009) Advisor: Robert Kiely; Illinois Mathematics and Science Academy *Presented at the International Water Forum, March 17-22, 2010, Kyoto, Japan*

Sara Akgul: Validity of Gap Triggers in the CDF Detector Advisor: Ricardo Eusebi; Fermi National Accelerator Laboratory *Chicago Region Junior Science and Humanities Symposium Finalist*

Lisa Akintilo: Induction of Triggered Activity by Spontaneous Intracellular Calcium Release in Whole Heart – Experimental and Modeling Studies Advisor: J. Andrew Wasserstrom; Northwestern University

Co-author of manuscript *in preparation* (J. Andrew Wasserstrom, Yohannes Shiferaw, Satvik Ramakrishna, Heetabh Patel, James E. Kelly, Matthew J. O'Toole, Amanda Pappas, Nimi Chirayali, Nikhil Bassi, Lisa Akintilo, Meghan Wu, Rishi Arora, Gary L. Aistrup)

Amishi Bajaj: Delayed Use of Calcineurin Inhibitors and High Dose Mycophenolate Mofetil as Initial Immunosuppressive Therapy for Liver Transplant Recipients with Pre-Transplant Renal Dysfunction

Advisor: Josh Levitsky; Northwestern University 2010 sanofi-aventis International BioGENEius Challenge Illinois State Finalist, Illinois Junior Academy of Sciences Paper Exposition Finalist¹, Illinois Junior Academy of Sciences Project Exposition Finalist, Chicago Region Junior Science and Humanities Symposium Finalist, Intel International Science and Engineering Fair Finalist

Shelly Bhanot: Effects of Surfactant on the Survival Rate and Incidence of Intraventricular Hemorrhages in Infants with Birth Weight Equal or Less Than 1000 Grams During Three Different Periods in a Single Tertiary Center (SIR 2009) Advisor: Christine Sajous; Loyola University

Presentation at the Midwest Society of Pediatric Research, October 7-9, 2009, Chicago, IL

Grace Chan: The Effects of Pioglitazone on Glucose Uptake in C6 Glioma Cells Advisors: Douglas Feinstein, Anthony Sharp; University of Illinois at Chicago *Presented at the Seventh Annual Japan RITS Super Science Fair, Oct. 29- Nov. 5, 2009, Kyoto, Japan*

Irene Chen: Coordinate-Free Characterization of Homogeneous Polynomials with Isolated Singularities Advisor: Stephen Yau; University of Illinois at Chicago 69th Annual Intel Science Talent Search Semi-finalist

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, NJ*

Dane Christianson: Developing World Water Filter Project: Flow Rate Characteristics Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Illinois Engineering Council Achievement in Engineering Winner, IJAS State Illinois Section of the American Water Works Association Outstanding Science Fair Project Winner **David Derry**: Magnetic Quantum Dot Cellular Automata and its Applicability in Replacing Transistors Advisors: Viatli Metlusho, Josh Sautner; University of Illinois at Chicago

Presented at the Seventh Annual Japan RITS Super Science Fair, Oct. 29- Nov. 5, Kyoto, Japan, Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA

Amber Farrell: Removal of Organic Nitrogen Present in Wastewater Effluents to Prevent Drinking Water Sources Contamination

Advisors: Marina Arnaldos, Krishna Pagilla; Illinois Institute of Technology Co-presenter at National Academy of Engineering Grand Challenges Summit, April 21, 2010, Chicago, IL

Michael Gleeson: Developing World Water Filter Project: Flow Rate Characteristics Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy Presented at the International Water Forum, March 17-22, 2010, Kyoto, Japan Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Illinois Engineering Council Achievement in Engineering Winner, IJAS State Illinois Section of the American Water Works Association Outstanding Science Fair Project Winner

Shravanthy Gumidyala: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis

Advisors: Brent Parris, Vernon Leo Towle; University of Chicago Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA

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, NJ*

Eric Huang: Proteasome Inhibition of Lithocholic Acid Derivatives Advisor: Chin Ho Chen; Duke University *Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner*

Bonny Jain: Modification of Polyelectrolyte Multilayer Films to Increase Cation Selectivity Advisor: Merlin Bruening; Michigan State University 69th Annual Intel Science Talent Search Semi-finalist

Sara Johnson: The Mathematics Behind Geodesic Models Advisor: Vincent Matsko *Presented at the Illinois Section of the Mathematical Association of America Annual Conference*

Jisoo Kim: Designing Origami Models Advisor: Vincent Matsko Presented at the Illinois Section of the Mathematical Association of America Annual Conference

Vladislav Kontsevoi: Enhancement of Thermoelectric Properties of Lead Telluride by Doping Advisors: Arthur Freeman, Jung-Hwan Song; Northwestern University Siemens Competition Semi-finalist, 69th Annual Intel Science Talent Search Semi-finalist, Presented at American Physical Society annual conference, March 15-19, 2010, Portland, OR, Chicago Region Junior Science and Humanities Symposium Finalist

Anusha Kumar: Evidence for Evolutionary Reductions in the β-adrenergic System of the Texas Toad, *Bufo speciosus*

Advisor: James Carr; Texas Tech University

Siemens Competition Semi-finalist, 69th Annual Intel Science Talent Search Semi-finalist, 2010 sanofiaventis International BioGENEius Challenge Illinois State Finalist, Presented at the Society for Integrative and Comparative Biology National Conference, Jan. 3-7, 2010, Seattle, Washington, (A. Kumar, R. Larson, C. Brown, J.A. Carr), Illinois Junior Academy of Sciences Paper Exposition Finalist, Chicago Region Junior Science and Humanities Symposium Finalist Anusha Kumar: Conservation Tillage as a Carbon Wedge Advisors: Willa Shultz, Audrey Wells; Illinois Mathematics and Science Academy *Presented at the Keystone Energy Board annual meeting, Oct. 14, 2009, Washington, DC*

Anusha Kumar: The Role of PS-1 in Adult Neurogenesis Advisor: Orly Lazarov; 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. 17-21, 2010 San Diego, CA

Allison Larrabee: Building Self-Esteem and Confidence in Young Children Advisor: David Evenson; Illinois Mathematics and Science Academy Presented at the Illinois Association of Gifted Children Conference, Feb. 7-9, 2010, Chicago, IL

Lucy Li: Designing Origami Models Advisor: Vincent Matsko Presented at the Illinois Section of the Mathematical Association of America Annual Conference

Santina Lin: Designing Origami Models Advisor: Vincent Matsko Presented at the Illinois Section of the Mathematical Association of America Annual Conference

Iris Liu: Study of Neutrinos from Active Galactic Nuclei Advisor: Maury Goodman; Argonne National Laboratory *Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA*

Jonathan Loucks: An Analysis of Illinois Public Schools: An Examination of Factors that Contribute to the Narrowing of the Socioeconomic Achievement Gaps

Advisor: Glenn "Max" McGee; Illinois Mathematics and Science Academy Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA

Jonathan Loucks: Predicting Protein Secondary Structure: An Analysis of PSSP Methodologies and their Accuracies

Advisor: Sarah O'Leary, Illinois Mathematics and Science Academy Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner; IJAS State National Anti-Vivisection Society's Award for Best Advancement in the Humane or Alternative to the Use of Animals in Research Winner

Madhav Mohandas: Climate-based Predictive Modeling of Seasonal Influenza Outbreaks Advisor: Guanglin Li; Northwestern University Chicago Region Junior Science and Humanities Symposium Finalist

Peter Nebres: The Applicability of Magnetic Quantum Cellular Automata as an Alternative to Transistors Advisors: Vitali Metlushko, Josh Sautner; 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. 17-21, 2010, San Diego, CA*

Peter Nebres: The Potential of Fe/Au Nanoparticles as a Magnetic Refrigerant Advisor: Ronald P. Andres; Purdue University *Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Lyell J and Ethyl M Thomas Scholarship Winne, IJAS State Best in Category for Materials Science Winner* Liana Nicklaus: The Sloan Nearby Cluster Weak Lensing Survey
Advisors: Jeffrey Kubo, James Annis, Donna Kubik, Albert Stebbins; Fermi National Accelerator
Laboratory
Published in The Astrophysical Journal Letters, Volume 702, Issue 2, pp. L110-L113 (2009;
(J. M. Kubo, J. Annis, F.M. Hardin¹, D. Kubik, K. Lawhorn¹, H. Lin, L. Nicklaus, D. Nelson, Dylan;

R.R.Reis, H-J. Seo, M. Soares-Santos, A. Stebbins, **T. Yunker**¹)

Daniel Pak: Specific Cellular Uptake of Targeted Liposomes in Cancer Cells Advisors: Seungpyo Hong, Su-Eon Jin; University of Illinois at Chicago Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, Intel International Science and Engineering Fair Finalist

Jonathan Park: Determining the Mechanisms of Herpes Simplex Virus Type 1 Ocular Cell Infection (SIR 2009)

Advisors: Christopher O'Donnell, Deepak Shukla; University of Illinois at Chicago Siemens Competition semi-finalist; Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA

Varun Pilla: Increase in Prevalence of CTX-M-Producing *E. coli* Recovered from Outpatient Urine Cultures

Advisor: Qi Chao; Northwestern University Chicago Region Junior Science and Humanities Symposium Finalist

Shyam Saladi: Structural Examination of Na⁺ Channels Advisor: Sarah O'Leary; Illinois Mathematics and Science Academy *Illinois Junior Academy of Sciences State Paper Exposition Gold Award Winner; IJAS State Best in Category Cellular and Molecular Biology*

Shyam Saladi: Post-Myocardial Infartion Repair and Angiogenesis Advisors: David Simpson, Samuel Dudley; University of Illinois at Chicago Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner; IJAS State Best in Category Health Science Winner

Sidanth Sapru: Neurogenesis Permissive Chromatin in Neural Crest Cells as Novel Epigenetic Marks During Mouse Neural Tube Closure
Advisor: Chandra Mayanil; Northwestern University *Co-author of abstract presented at the Experimental Biology Meeting of the American Society of Biochemistry and Molecular Biology April 18-22, 2009, New Orleans, LA* (S. Ichi, Y. Shen, H. Nakazaki,
S. Sapru, B. Mania-Farnell, T. Tomita, D.G. McLone, C. S. K. Mayanil)

Mehal Shah: How Does the Trafficking Motif Affect the Rate of BACE 1 Endocytosis? Advisors: Virginie Buggia-Prevot, Gopal Thinakaran; University of Chicago *Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, Intel International Science and Engineering Fair Third Place Winner*

Caroline Shin: Post-Myocardial Infartion Repair and Angiogenesis Advisors: David Simpson, Samuel Dudley; University of Illinois at Chicago Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Best in Category Health Science Winner

Yiru Tao: Developing World Water Filter Project: Flow Rate Characteristics and Germicidal Properties Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy Presented at the International Water Forum, March 17-22, 2010, Kyoto, Japan, Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Illinois Engineering Council Achievement in Engineering Winner, IJAS State Illinois Section of the American Water Works Association Outstanding Science Fair Project Winner Shilpa Topudurti: Effects of Surfactant on the Survival Rate and Incidence of Intraventricular Hemorrhage in Infants with Birth Weight Equal or Less Than 1000 Grams During Three Different Periods in a Single Tertiary Center (SIR 2009)
 Advisor: Christine Sajous; Loyola University
 Presentation at the Midwest Society of Pediatric Research, October 7-9, 2009

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, NJ

John Wang: A Model of Semi-Rational Behavior in Asset Markets Advisor: Noah Prince Presented at the 27th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

Anderson West: The Search for Dark Matter: Using Strong Gravitational Lenses to Quantify the Dark Matter in Two Galaxy Clusters

Advisor: Thomas Diehl; Fermi National Accelerator Laboratory Presented at the Seventh Annual Japan RITS Super Science Fair, Oct. 29- Nov. 5, Kyoto, Japan

Megan Wu: Induction of Triggered Activity by Spontaneous Intracellular Calcium Release in Whole Heart – Experimental and Modeling Studies

Advisor: J. Andrew Wasserstrom; Northwestern University Co-author of manuscript *in preparation* (J. Andrew Wasserstrom, Yohannes Shiferaw, Satvik Ramakrishna, Heetabh Patel, James E. Kelly, Matthew J. O'Toole, Amanda Pappas, Nimi Chirayali, Nikhil Bassi, Lisa Akintilo, Meghan Wu, Rishi Arora, Gary L. Aistrup)

Nancy Yu: The Activation Kinetics of CD4 and CD8 T Cells in Response to *Listeria monocytogenes* Infection

Advisors: Mark Miller, Baomei Wang; Washington University in St. Louis School of Medicine Siemens Competition Semi-finalist

Weili Zheng: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis

Advisors: Brent Parris, Vernon Leo Towle; University of Chicago Presented at the American Junior Academy of Sciences conference at the American Association for the Advancement of Science annual conference, Feb. 17-21, 2010, San Diego, CA

Weili Zheng: Developing World Water Filter Project: Flow Rate Characteristics Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy Illinois Junior Academy of Sciences State Project Exposition Gold Award Winner, IJAS State Illinois Engineering Council Achievement in Engineering Winner, IJAS State Illinois Section of the American Water Works Association Outstanding Science Fair Project Winner

Amy Zhou: New Battles against Complex Infections: Synergy Studies Against Methicillin-Resistant Staphylococcus aureus

Advisor: William Kabat; Children's Memorial Hospital Chicago Region Junior Science and Humanities Symposium Finalist

1) IMSA Class of 2009

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R01	136	Alexander Abbinante	10:25	A-147
Q01	124	Ruchi Aggarwal	8:45	A-115
Q02	124	Upashruti Agrawal	1:20	A-131
S01	146	Uchenna Agwuncha	11:15	A-113
B01	42	Lisa Akintilo	9:35	A-131
I01	84	Yusuf Aktan	12:55	A-133
P01	109	Courtney Amegashie	9:10	A-115
T01	151	Paul Angelillo	12:55	A-135
A01	38	Vidya Anjur	10:50	B-148
R02	136	Natasha Arvanitis	8:45	Acad Pit A-138
K01	95	Michael Atten	10:50	Acad Pit A-138
B02	42	Ramya Babu	9:35	A-133
S02	146	Jennifer Bailey	9:35	Acad Pit A-138
H01	78	Sonia Bajaj	10:25	A-135
P02	109	Omotayo Balogun	10:25	B-116
S03	147	Kirthi Banothu	1:20	A-133
R03	137	Amber Betzold	10:25	A-119
O01	104	Shiladitya Bhattacharyya	10:00	A-149
K02	96	Mitchell Bieniek	11:15	Acad Pit A-138
C01	47	Wendy Bindeman	10:25	B-108
C02	48	Kamila Bond	10:00	A-133
102	84	Justin Booth	1:45	Kids Inst E-115
P03	110	Madeline Booton	12:30	B-108
R01	136	Wesley Bradley	10:25	A-147
P04	110	Seth Butcher	10:50	A-147
B03	43	Yiyun Cao	12:30	A-147
H02	79	Ayse Cetinkaya	1:20	A-147
P05	111	Ajay Chatrath	10:25	A-149
P06	111	James Chen	10:25	B-148
H03	79	Wen Li Chen	12:55	D-103
103	85	Wen Min Chen	10:50	A-149
Q03	125	Christina Cheng	10:00	A-135
R04	137	Stephanie Cheng	1:45	A-131
F01	71	Jason Chien	9:10	A-121
P07	112	Nitin Chilukuri	9:35	B-148
H04	80	Grace Choi	12:30	A-117
Q04	125	Ashley Chong	11:15	A-119
Q05	126	Sanggyu (Raymond) Chong	9:10	A-131
104	85	Dane Christianson	9:10	B-116
G01	75	Paul Cladek	12:30	A-151
H05	80	Francis Cocjin	10:00	A-147

H06	81	Katia Colin	10:50	Lect Hall B-206
G02	76	Caitlyn Collett	9:35	Lect Hall B-206
H07	81	Eleanor Cory	2:10	A-115
N01	102	Jennifer Crawford	1:20	A-117
Q06	126	Julianne Crawford	1:20	A-151
L01	99	Megan Czajka	1:20	D-103
U01	154	David Dailey	8:45	A-131
105	86	Logan Damiani	2:10	A-151
M01	99	Shelby Daniel-Wayman	12:55	D-107
J01	94	Monica Daniels	9:10	D-103
C03	48	Sonya Dave	9:10	B-110
106	86	Henry Deng	2:10	A-131
N02	103	Diliana Dimitrova	9:10	A-147
C04	49	Xin (Danny) Ding	10:00	B-110
O02	105	Marcelo Diop-Gonzalez	8:45	B-116
T02	152	Cevdet Dogan	9:35	A-147
P08	112	Samantha Donermeyer	1:20	D-107
C05	49	Sruthi Doniparthi	11:15	B-133
C06	50	Xiangyun (Johnny) Duan	10:25	A-155
B04	43	Sharon Duval	10:50	A-155
C07	50	Christine Engbretson	11:15	A-155
Q07	127	Justin Feng	12:30	A-131
A02	38	Yan-Yang Feng	12:55	A-155
V01	155	Kristopher Fernandez	10:25	A-115
C08	51	Lucija Filipac	10:50	A-119
K02	96	Garrett Flack	11:15	Acad Pit A-138
C09	51	Hana Fouladi	1:20	A-155
C10	52	Nicholas Fung	11:15	B-116
C11	52	Mukesh Gande	11:15	B-148
M02	100	Joscelyn Garcia	9:35	A-135
105	86	Nathan Geldner	2:10	A-151
H08	82	Dominic Gentile	10:00	B-108
H08	82	Matthew Gietl	10:00	B-108
C11	52	Kyle Glasper	11:15	B-148
C12	53	Andrew Go	1:45	A-155
H09	82	Carlos Gomez	10:00	Acad Pit A-138
K01	95	Rafael Gonzalez	10:50	Acad Pit A-138
S04	147	Jessica Grady	1:20	Acad Pit A-138
C03	48	Carol Gu	9:10	B-110
C13	53	Webster Guan	1:20	B-108
J02	94	Kathleen Gundry	8:45	A-135
P09	113	Annie Guo	9:10	A-113
P10	113	Annie Guo	9:35	A-113
C14	54	Eaton Guo	10:50	B-110
Q08	128	Brinda Gupta	11:15	A-131

107	87	Saarthak Gupta	2:10	A-155
G03	76	Inga Gurevich	8:45	A-155
F02	72	Samuel Haile	10:25	A-121
O03	105	Derek Hardin	1:45	A-135
108	87	Kenneth Harvey	12:55	Lect Hall B-206
R05	138	Mohammed Hayat	1:20	A-135
G04	77	Joseph Hecker	1:45	Lect Hall B-206
T03	152	Jonathan Henricks	12:30	Kids Inst E-115
P11	114	Jacob Henry	10:25	B-110
R06	138	Holly Hernandez	11:15	A-135
Q09	128	Janell Herrera	1:45	D-107
M03	100	Miranda Herzog	8:45	A-147
S05	148	Carly Houdek	10:00	A-117
109	88	Peter Howes	12:55	D-110
P12	114	Ingrid Hsiung	10:50	A-113
C15	54	Dorcas Huang	1:45	D-103
B05	44	Eric Huang	2:10	A-135
T04	153	Shawon Jackson	10:25	Acad Pit A-138
S06	148	Ethan Jacobs	2:10	B-108
R07	139	Shantanu Jain	10:25	D-103
F03	72	Shantanu Jain	10:50	D-103
C16	55	Brielle James	12:55	Kids Inst E-115
S04	147	Michelle Jardine	1:20	Acad Pit A-138
P13	115	Vijay Jayaram	1:45	B-133
G05	77	Zeno Jeong	9:10	D-107
Q10	129	Irene Jiang	12:55	A-119
T01	151	Ryan Jordan	12:55	A-135
Q11	129	Harsha Jujjavarapu	10:25	A-131
Q12	130	Harsha Jujjavarapu	10:50	A-131
O04	106	Adam Kalinich	1:20	Lect Hall B-206
I10	88	Aditya Karan	1:45	A-147
C17	55	Lakshmi Katta	10:50	B-108
B06	44	Nilesh Kavthekar	10:00	A-113
F04	73	Nilesh Kavthekar	10:25	A-113
R08	139	Emil Khabiboulline	1:45	Acad Pit A-138
P14	115	Alex Kim	12:55	B-110
O05	106	Jisoo Kim	9:35	A-149
P15	116	Jiwon Kim	9:10	A-149
C18	56	Yoo (Jenny) Kim	9:35	B-116
P16	116	Ifreke King	10:50	A-135
E01	69	Matthew Kleinjan	1:20	Kids Inst E-115
Q13	131	Timothy Klincewicz	11:15	A-121
C19	56	Hannah Koo	1:45	B-108
Q14	132	Alekya Kothamasu	8:45	A-149
108	87	Austin Kramer	12:55	Lect Hall B-206

A03	39	Krishna Kudaravalli	1:20	B-110
P17	117	Previn Kumar	1:45	B-110
Q15	132	Vignessh Kumar	10:50	B-116
K03	97	Benjamin Kuo	8:45	A-119
R09	140	Benjamin Kuo	9:10	A-119
B07	45	Samuel Kwak	2:10	A-147
S07	149	Brittany Kwamin	11:15	A-117
S07	149	Whitney Kwamin	11:15	A-117
C20	57	Jacob Lahr	2:10	A-117
R10	140	John Lee	12:30	B-116
I04	85	Jongmin Lee	9:10	B-116
C18	56	Jongmin Lee	9:35	B-116
A04	39	Justin Lee	9:10	D-110
R11	141	Kiwook Lee	2:10	Acad Pit A-138
P18	117	Samantha Levin	1:20	A-119
E02	70	Mingyang (Jennifer) Li	1:20	B-116
F04	73	Ted Li	10:25	A-113
Q16	133	Xiaoyu Li	1:45	B-116
T03	152	Thomas Lightfoot	12:30	Kids Inst E-115
P19	118	Sarah Lisk	12:30	Lect Hall B-206
D01	68	Naomi Liu	1:45	A-119
H10	83	Victoria Lo	12:55	A-115
R12	141	Peter Lu	2:10	B-116
R13	142	Erik Luo	8:45	B-133
E03	70	Pan Luo	10:50	A-133
P20	118	Justine Ly	8:45	A-117
R14	142	Тиори Ма	9:10	B-133
H09	82	Christopher Macias	10:00	Acad Pit A-138
O06	107	Corinne Madsen	1:45	A-149
T05	153	Rahul Maheshwari	11:15	D-107
T06	154	Sarah Malik	10:25	A-117
Q17	133	Egle Malinauskaite	2:10	A-149
C21	57	Nolan Maloney	1:20	A-115
C22	58	Janani Mandayam Comar	11:15	A-151
102	84	Brendan Mathias	1:45	Kids Inst E-115
P21	119	Daniel Matthews	11:15	Lect Hall B-206
C23	58	Lydia Matthews	9:35	A-117
C17	55	Rhyston Mays	10:50	B-108
H07	81	Allyson Milenkovic	2:10	A-115
F05	73	Derrick Miller	11:15	D-103
P22	119	Hannah Miller	2:10	B-110
I11	89	Samir Mishra	2:10	A-119
A05	40	Madhav Mohandas	8:45	A-133
B08	45	Madhav Mohandas	9:10	A-133
P23	120	Christina Momchev	9:35	B-133

C24	59	Thitipong Mongkolrattanothai	10:00	B-133
C25	60	Christine Mourafetis	9:35	B-110
I12	89	Byron Mui	1:20	A-149
I13	90	Jonathan Munoz	2:10	D-103
R02	136	Laura Napierkowski	8:45	Acad Pit A-138
F06	73	Angus Nelson	9:35	A-121
J03	95	Perry Nelson	8:45	D-103
U02	155	Ian Nodurft	12:55	B-133
M04	101	Melissa O'Brien	8:45	D-107
K01	95	Cai O'Connell	10:50	Acad Pit A-138
H06	81	Chibuzo Obasi	10:50	Lect Hall B-206
S08	149	Paloma Ocola	2:10	D-107
R15	143	Eric Ordonez	1:20	B-133
E04	71	Elizabeth Ott	11:15	D-110
C22	58	Sai Parepally	11:15	A-151
R16	143	Deokgeun Park	2:10	B-133
C26	60	Cassie Parks	8:45	A-151
T01	151	Rhett Partida	12:55	A-135
D02	68	Jay Patel	1:45	A-115
K04	97	Neel Patel	1:20	D-110
Q18	134	Pujan Patel	1:45	A-113
Q19	134	Pujan Patel	2:10	A-113
F07	74	Gregary Pergrossi	10:00	A-121
F07	74	Zachary Pergrossi	10:00	A-121
P12	114	Pranusha Pinna	10:50	A-113
Q13	131	Areen Pitaktong	11:15	A-121
P07	112	Ajay Pius	9:35	B-148
Q05	126	Tonu Pius	9:10	A-131
C27	61	Irina Pushel	10:00	B-148
P24	120	Gina Qin	12:55	B-148
R17	144	Jorge Quero	11:15	A-133
O01	104	James Quigley	10:00	A-149
N03	103	Haley Ramirez	1:45	A-117
O07	107	Matthew Rasmussen	9:35	A-155
C09	51	James Rea	1:20	A-155
P07	112	Abhinav Reddy	9:35	B-148
C24	59	Mahendra Reddy	10:00	B-133
K05	98	Nishith Reddy	9:35	A-115
P25	121	Nishith Reddy	10:00	A-115
P13	115	Thomas Reith	1:45	B-133
I14	90	Benjamin Richardson	2:10	D-110
D03	68	Glen Richardson	8:45	Lect Hall B-206
P26	121	Ashley Ro	10:00	Kids Inst E-115
T01	151	Rafael Rodriguez	12:55	A-135
I15	91	Madison Rogers	2:10	Kids Inst E-115

Q14	132	Alexandra Roman	8:45	A-149
I11	89	Shobhit Roy	2:10	A-119
Q20	135	Nicole Runkle	11:15	A-149
R18	144	Amir Safavi	8:45	Kids Inst E-115
T04	153	Satoe Sakuma	10:25	Acad Pit A-138
A06	40	Sarah Salameh	2:10	B-148
P27	122	Yasmeni Sandridge	12:55	A-121
U01	154	Christopher Sartain	8:45	A-131
M05	101	Jeannine Schulz	10:50	A-115
P28	122	Mehal Shah	2:10	A-133
A07	41	Samir Shah	9:35	D-103
M04	101	Kimberly Sherwin	8:45	D-107
A06	40	Urmi Sheth	2:10	B-148
P20	118	Katherine Shi	8:45	A-117
P29	123	Kevin Shi	9:35	D-107
I16	91	Yanchen Shi	10:00	D-107
H11	83	Alan Shramuk	10:25	Lect Hall B-206
D01	68	Si Si	1:45	A-119
T01	151	Samuel Simon	12:55	A-135
C28	61	Mahi Singh	10:50	A-151
B09	46	Navdeep Singh	8:45	A-121
O08	108	Rose Sloan	10:25	D-107
C29	62	Alexandra Smick	9:10	A-151
I13	90	Samuel Smith	2:10	D-103
I17	92	Hyun Jin Song	9:10	Acad Pit A-138
Q01	124	Shruthi Subramanian	8:45	A-115
R19	145	Michelle Suh	1:45	A-151
P30	123	Steven Suh	8:45	D-110
A04	39	Sung Hwan Suh	9:10	D-110
C20	57	Amanda Sul	2:10	A-117
T02	152	Aditya Suresh	9:35	A-147
C30	62	Andrew Ta	1:20	A-121
Q21	135	Shannon Tai	1:20	B-148
P28	122	Divya Tankasala	2:10	A-133
O09	108	Michael Teng	10:50	A-117
D02	68	Vivek Thakkar	1:45	A-115
O01	104	Oscar To	10:00	A-149
C31	63	Aaditya Tolappa	1:45	A-133
L01	99	Connor Tomasko	1:20	D-103
I01	84	Matthew Tsao	12:55	A-133
P02	109	Kari Tyler	10:25	B-116
C32	63	Risun Udawatta	9:35	D-110
B10	46	Sydney Valero	9:35	A-151
C33	64	Sumana Vardhan	10:50	B-133
P26	121	Nikita Veera	10:00	Kids Inst E-115

N04	104	Vamika Venkatesan	1:45	A-121
Q09	128	Jessica Ventenilla	1:45	D-107
C34	64	Sonam Vyas	10:00	A-151
S09	150	Patricia Walchessen	10:25	D-110
C35	65	Kelly Wallin	2:10	A-121
C20	57	Connie Wang	2:10	A-117
R20	145	Gary Wang	10:00	A-119
G06	78	Harley Wang	9:10	A-155
F04	73	Joseph Wang	10:25	A-113
F08	75	Kevin Wang	9:10	Lect Hall B-206
C36	65	Xun Ming (Jenny) Wang	10:50	D-110
G02	76	Samuel Weitekamp	9:35	Lect Hall B-206
M06	102	Sarah Weitekamp	8:45	B-148
S10	150	Andrew Wentzel	2:10	Lect Hall B-206
S03	147	Brendan Wesp	1:20	A-133
I18	92	Michael White	1:45	B-148
C37	66	Jordan Williams	8:45	B-110
F01	71	Konrad Wrobel	9:10	A-121
I19	93	Joly Wu	9:10	Kids Inst E-115
B01	42	Megan Wu	9:35	A-131
C38	66	Diana Xu	11:15	B-108
D02	68	Nathan Yan	1:45	A-115
I20	93	Baihan Yang	10:00	Lect Hall B-206
C39	67	Karthik Yarlagadda	9:35	Kids Inst E-115
B11	47	Candice Yi	12:55	A-113
C40	67	Candice Yi	1:20	A-113
Q21	135	Kelly Yom	1:20	B-148
K06	98	Vanya Yorgova	1:45	D-110
Q17	133	Paul Yuan	2:10	A-149
A08	41	Stanley Yuan	10:25	Kids Inst E-115
K04	97	Seth Zelman	1:20	D-110
A08	41	Vivian Zhang	10:25	Kids Inst E-115
O09	108	Kevin Zhao	10:50	A-117
I16	91	Douglas Zhu	10:00	D-107
S05	148	Elaina Zintl	10:00	A-117



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