IMSAloquium

STUDENT INVESTIGATION SHOWCASE

April 28, 2010

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IMSA

Intel Schools of Distinction

2009 Star Innovator

Top in Nation for Science Excellence

IMSAloquium
STUDENT INVESTIGATION SHOWCASE

April 2010

Dear IMSA Friends:

This has been an extraordinary academic year for IMSA and its Student Inquiry and Research (SIR) Program. At this time last year, during IMSAloquium, we were engaged in a site visit by Intel. Having been named one of eighteen semi-finalists in the Intel Schools of Distinction Program, from a nation-wide applicant pool of more than 700, we were being evaluated to see if we actually "walked the talk" of delivering innovative science education for our students. We met the challenge. IMSA was named Intel's top high school for science excellence in May, and then in September of 2009, at an awards celebration in Washington DC, IMSA was named the 2009 Star Innovator School of Distinction, Intel's top honor awarded to only one educational institution in the nation.

Receiving this honor, however, is about more than just SIR and our Science Program. IMSA's mission, "to ignite and nurture creative ethical minds that advance the human condition," requires that all staff and students at IMSA, in all areas and disciplines - English, Fine Arts, History/Social Science, Leadership, Mathematics, Student Life, Wellness, and World Languages – be exceptional. And they are. Evidence of our students' excellence, in all fields is found within this proceedings book of our twenty-third IMSAloquium. IMSA students engage in investigations in nanotechnology, particle physics, law, neonatal medicine, literature, transplantation biology, water purity, the educational achievement gap, neurobiology and memory, ethics, theatre, discrete mathematics, economics, and more.

Through the Student Inquiry and Research Program, IMSA provides a mechanism that enables students to pursue personalized learning and 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. You'll find evidence of this in the students who have already, in high school, published and presented at local, national, and international venues.

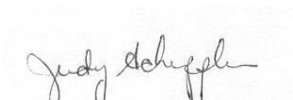
In just over two decades, the Illinois Mathematics and Science Academy® (IMSA) has become one of the premier institutions of its kind in our state, our nation, and the world. With receipt of Intel's Star Innovator Award, we also feel responsibility to continue sharing our expertise with others. Toward this end, we aggressively deliver services through innovative programs, such as SIR and our Field Services Offices, as we strive to become "the world's leading teaching and learning laboratory for imagination and inquiry."

We set high expectations for ourselves and for our students. We believe that you will find that IMSA students far exceed traditional expectations for high school student accomplishments and contributions to society. IMSA students are well-prepared to continue solving challenges and to take on global issues that we will face in the future. We are living into our mission to nurture the next generation of talent and leadership.

Thank you for your participation in and celebration of our students' successes in Student Inquiry and Research!

Sincerely,

Glenn W. "Max" McGee, Ph.D.
President



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

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

Twenty-second Annual IMSAloquium
April 28, 2010

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Inside Back Cover – IMSA Map with Room Locations Highlighted

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

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

Student Inquiry and Research

The Student Inquiry and Research (SIR) program has been an integral part of student personalized learning at IMSA since the 1989 academic year. Since its inception with seven students, SIR has grown into a program that encompasses all disciplines and participation by over 88% of the class of 2010. 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*
- *Biographies of the Citizens of Lee County Illinois: Through the Years*
- *Learning and Leading with Technology*
- *Nature*
- *NCSSSMST Journal*
- *The Science Teacher*

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

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

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

Presentations (partial list)

- American Physical Society
- American Society of Cell Biology
- American Society of Microbiology
- Illinois Association for Gifted Children
- Illinois Council of Teachers of Mathematics Conference
- International Water Forum
- 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
- Intel Science Talent Search
  - 33 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)
  - 36 regional semi-finalists resulting in 5 regional finalists and 1 national semi-finalist

2009-2010 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: 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 Project Exposition Finalist[1], Intel International Science and Engineering Fair Finalist[2]

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 Finalist[1], Illinois Junior Academy of Sciences Project Exposition Finalist[1]; Chicago Region Junior Science and Humanities Symposium Finalist; *Intel International Science and Engineering Fair Finalist[2]*

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, 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

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 Project Exposition Finalist[1]

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 Project Exposition Finalist[1]

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

Eric Huang: Proteasome Inhibition of Lithocholic Acid Derivatives
Advisor: Chin Ho Chen; Duke University
Illinois Junior Academy of Sciences Project Exposition Finalist[1]

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

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 sanofi-aventis 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*[1]*; 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

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

Janani Mandayam Comar: Development of Motor Neurons
Advisor: Donald Dosch; Illinois Mathematics and Science Academy
Illinois Junior Academy of Sciences Paper Exposition Finalist[1]

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 Project Exposition Finalist[1]

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. Hardin**[3]**,** D. Kubik, **K. Lawhorn**[3]**,** H. Lin, **L. Nicklaus,** D. Nelson, Dylan; R.R.Reis, H-J. Seo, M. Soares-Santos, A. Stebbins, **T. Yunker**[3]**)**

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 Project Exposition Regional Finalist[1], Intel International Science and Engineering Fair Finalist[2]

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 Paper Exposition Regional Finalist[1]

Shyam Saladi: Post-Myocardial Infartion Repair and Angiogenesis
Advisors: David Simpson, Samuel Dudley; University of Illinois at Chicago
Illinois Junior Academy of Sciences Project Exposition Regional Finalist[1]

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 Project Exposition Finalist[1], Intel International Science and Engineering Fair Finalist[2]

Caroline Shin: Post-Myocardial Infartion Repair and Angiogenesis
Advisors: David Simpson, Samuel Dudley; University of Illinois at Chicago
Illinois Junior Academy of Sciences Project Exposition Finalist[1]

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 Project Exposition Finalist[1]

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

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 Project Exposition Finalist[1]

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) The Illinois Junior Academy of Sciences (IJAS) State Paper and Project Expositions are May 7-8, 2010 in Urbana, Illinois
2) Intel International Science and Engineering Fair is May 9-14, 2010 in San Jose, California
3) IMSA Class of 2009

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

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Student Investigation Showcase
April 28, 2010

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	Time	Room
A01	Susan Chen	Targeting Acetyl-CoA Carboxylase in a Yeast-Based Screening System to Identify Compounds for Antiparasitic Drugs	11:15	B-108
A02	Allan Dong	Determination of Ufc1 Modification Site by Ufm1	11:15	A-149
A03	Leti Nunez	Characterizing the Phenotype of a SCAM Mouse Model for Melanoma	09:35	A-147
A04	Irina Pushel	Investigation of the Transport of Proline and Glycine Betaine by ProP in *Escherichia coli*	2:10	B-133
A05	Vamika Venkatesan	A Mouse Model for Lymphangioleiomyomatosis	09:10	A-147

Bioengineering

		Title	Time	Room
B01	Kevin Chen	sP-Selectin as a Diagnostic Biomarker for Stroke Using Integrated Sensing Nanolayers	1:45	A-149
B02	Wesley Herron Elizabeth Richardson	Use of Laser Speckle Contrast Analysis to Detect Changes in Tympanic Membrane Vibrations	1:20	A-151
B03	Nicole Howard	Development of an O-GlcNAc Transferase-Based Therapeutic for Glioblastomas	10:50	D-110
B04	Jennifer Hu	Creating a Virtual Fly Through of the Human Brain's Ventricular System	12:55	E-115
B05	Eric Huang	Direct-to-Consumer Genetic Testing Patents: A 2010 Update	2:10	A-147
B06	Mahir Khan	Designing a Robotic Stroke Therapy System Suitable for Patient Use in Residential Settings	10:25	A-149
B07	Matthew Brian McDermott	Improving Auscultation Methods in the Human Body	08:45	B-110
B08	James Parkin	Characterization of Membranes Used in Micropumps	1:45	B-116
B09	Tiffany Sinclair	The Binding Kinetics of sLE^x for P-/E-Selectins	10:00	A-131
B10	Mao Yamakawa	Left Ventricular Assist Device Development in the United States and Japan	12:55	A-149

Biology

		Title	Time	Room
C01	Lisa Akintilo Megan Wu	Spontaneous Calcium Release at the Sub-Cellular Level	08:45	D-110
C02	Morenibayo Bankole	Exploring the Cause of acd6-1 Phenotypes Expression in *Arabidopsis*	1:45	B-108
C03	Aryssa Burton	Optimization of a DNA Sequencer	10:25	B-116
C04	Cecilia Chang Harika Nalluri	A Study on the Possible Correlations between Patients with Cardiac Sarcoidosis	10:25	B-110
C05	Wen Chen Wen Li Chen	Transition Rates of Oak Trees After Death Due to *Armillaria*	12:30	B-133

Biology

		Title	Time	Room
C06	Nitin Chilukuri Jongmin Lee	Cleaners and Their Effects on Bacteria	10:25	LectHall B-206
C07	Imran Choudhry	A Genome Wide Association Study of Carotid Artery Plaque	1:45	A-131
C08	Andrew Go	Evi1 Cooperation with a Haploinsufficient Egr1 to Develop Myeloid Neoplasms	09:10	B-108
C09	Linna Guan	Investigation of the Mechanisms of Cholesterol Modulation of Inward Rectifier Potassium Channel Function	08:45	B-108
C10	Alexandra Hizel Nicholas Virgl	Validation Lactate Dehydrogenase2 in the Parasite *Toxoplasma gondii* with Respect to Its Effect on the Growth, Survival, or Persistence of the Parasite in Tissue Culture and in vivo	10:50	A-131
C11	Ingrid Hsiung	Molecular Mechanisms of Bone Marrow Stem Cell Maintenance and Mobilization	10:25	D-110
C12	Anusha Kumar	Evidence for Evolutionary Reductions in the ß-adrenergic System of the Texas Toad, *Bufo speciosus*	10:00	A-147
C13	Anusha Kumar Viral Patel	Search for Lipid and Enzymatic Markers of Chronic Alcoholism	09:10	A-149
C14	Lydia Matthews	The Role of Pigment Epithelium Derived Factor in the Expression of p21 and p27 in Pancreatic Cancer	12:55	A-113
C15	Jonathan Munoz	Alterations in Hsp27	08:45	A-149
C16	Elizabeth Murphy	Effect of Interleukin-6 Deficiency on Obesity-Induced Inflammation in Adipose Tissue in Mice	12:55	A-147
C17	Luke Nayak	Role of Interleukin 1-β in Modulating Immune Responses	10:25	A-147
C18	Cassie Parks	A Novel Approach to Erythroid Kruppel-Like Transcription Factor: Its Role in Megakaryopoiesis	10:00	A-155
C19	Lisa Patel Lokamitra Veeramasuneni	Pathogenic Entry of Herpes Simplex Virus: Syndecan Coreceptor Expression	1:20	B-116
C20	Varun Pilla	The Prevalence of CTX-M, SHV, and TEM-Producing *E. coli* Recovered from Urine Cultures	2:10	A-135
C21	James Quigley	Role of a Conserved Acidic Patch on the Protein Interactions of the Mixed Lineage Leukemia Gene	11:15	A-155
C22	Rital Shah	The Effects of Wnt on Active Transforming Growth Factor β Levels	12:30	A-113
C23	Kevin Shi Vivek Thakkar	Long Term Human Pancreatic Islet Cell Viability with PMCG Capsule in CMRL 1066 Culture Media	10:25	D-107
C24	Mahi Singh	Effect of *Dnmt3b* Deficiency on Mediastinal Lymphoma Frequency and the DNA Methylation Status of the *Thrap1*, *Bri3bp*, and *Mum1* Genes	08:45	B-116
C25	Aditya Suresh	The Role of Macrophage Phenotype in Breast Cancer Progression	09:10	D-103
C26	Michael Teng	The Astrocytic Response to Interleukin-17, a Proinflammatory Cytokine Important in Mediating Experimental Autoimmune Encephalomyelitis.	12:55	B-133
C27	Sumana Vardhan	Biology of Bone Development in Leukemia Patients	2:10	B-110
C28	Candice Yi	Identification of the Iron Acquisition Pathways of the Human Commensal Species in the Genus *Neisseria*	11:15	A-131
C29	Candice Yi	Investigation of Effective Peptides for Vaccine Against *Toxoplasmosis*	10:25	A-131

Business

		Title	Time	Room
D01	Bo Chen Sarah Vo	Recipe for the Perfect Intervention	08:45	B-133
D02	Benjamin Diaz Nikolay Glavanakov	A Statistical Analysis of Fiscal and Performance Data from English Premiership and Major League Soccer Teams and Players	1:20	A-155
D03	Jennifer Hu Weili Zheng	Defining the Current Status of Healthcare Options in India and Evaluating the Role of Private Health Insurance Within it	08:45	A-117

Chemistry

		Title	Time	Room
E01	Dane Christianson	Thermal Process Optimization for Improved Machinability of Ferrium M54	2:10	D-103
E02	William Erwin Andrew Jung	Comparison of Computational Chemistry Software and Spectrometer Data	10:50	A-135
E03	Amber Farrell	Advanced Technologies for the Removal of Dissolved Organic Nitrogen from Wastewater Treatment Plant Effluents	09:10	B-133
E04	Andrew Gray Richard Smith	Accuracy of Computational Chemistry with Ethanol and Methanol	11:15	A-135
E05	Bonny Jain	Chemically Active Colloidal Graphene with Tunable Carbon-Oxygen Ratios	1:45	A-147
E06	Pan Luo	Study of the Hydrophobicity of Polystyrene, Poly(methyl methacrylate), and Poly(styrene-block-methyl methacrylate) and Its Photomodified Form	10:50	B-108
E07	Samir Mishra	Quantitative Measurement of the Oxidation of Nonanoic Acid with Manganese Complexes	10:50	B-110
E08	Daniel Pak	Specific Cellular Uptake of Targeted Liposomes in Cancer Cells	10:25	A-119
E09	Sai Parepally	Spectroscopic Analysis of Metal Borohydrides	08:45	A-151
E10	Yiru Tao	Stable Explicit Water rRNA and tRNA Simulation Using Visual Molecular Dynamics and Nanoscale Molecular Dynamics	10:50	A-113
E11	Johannes Zhou	Anticancer Active Ingredients from *Fagerlindia depauperata*	11:15	E-115

Computer Science

		Title	Time	Room
F01	Quadis Evans Eric Shinn	The Societal Aspects of Technological Advancement	10:50	A-149
F02	Naomi Liu Si Si	Computer-Aided Microcalcification Detection for Tomosynthesis Images	09:35	A-151
F03	Marat Purnyn	Developing Smartphone Applications	11:15	LectHall B-206
F04	Benjamin Taylor	Impact and Feasibility of Cloud Computing in an IMSA Environment	2:10	A-119
F05	Gary Wang	An Exploration of the Process of Designing and Implementing a Multi-Dimensional Database	09:10	A-135

Economics		Title	Time	Room
G01	Ramtej Atluri Minjae Lee Reichert Joshua Zalameda	Analyzing Current and Past Recessions to Identify Problems and Solutions	11:15	A-119
G02	Robert Cheung Sharada Dharmasankar	The Boys Versus the Girls: Gender Specific Determinants of Success	1:45	D-107
G03	Govind Govind-Thomas	The Effect of Tort Litigation on the Market for Pharmaceuticals	1:45	A-113
G04	Joseph Hecker	The Role of Futures Contracts in the Commodities Markets	10:50	D-103
G05	Jialin Huang	Keynesian Economics and Their Relevance to Asian Economics	10:00	A-119
G06	Michael Kobiela	The Causes of the 2008 Economic Crisis and its Impact on Colleges	2:10	A-113
G07	Michael Mirski John Wang	School Structure and Academic Achievement: How the Middle School Model Affects Blacks and Whites	10:00	D-107
G08	Dharti Shah	What Motivates the Consumer? The Effects of Advertisement on Banking and Beauty Aids in the Twenty-First Century	10:50	A-117
G09	Saurin Shah	Stopping the Flow of Terrorist Funding	09:10	B-116
G10	Samuel Simon	Model of Economic Effects of the Climate Change on Different Economic Classes in the United States, the United Kingdom, and Other Countries Throughout the World	08:45	A-135
G11	Courtney Alexa Smith	The Effect of Competition Between Self-Regulators	1:45	B-133
G12	Zehua Sun	To Steal or Not to Steal: Considering the Motivations for Stealing	09:10	E-115

Education		Title	Time	Room
H01	Kirthi Banothu Yoo (Jenny) Kim Morgan Rehberg Brendan Wesp	Conventional Versus Inquiry-Based Teaching Methods: Which is More Effective?	1:20	D-110
H02	Cevdet Dogan Jonathan Loucks Sidanth Sapru	Identifying the Key Constructs of School Improvement: A Comprehensive Examination of Academic Progress and the No Child Left Behind Act	1:20	A-147
H03	Meena Iyer Victoria Lo	IMSA: Chicago Admissions Process	2:10	D-107
H04	Daniela Lefticariu	Investigation for the Illinois Law Enforcement Alarm Sysytem: Website Hosting Survey	09:35	B-133
H05	Nidhi Narielwala	High School Students Perceptions' on Business Ethics	1:20	AcPit A-138
H06	Cai O'Connell Alexandra Smick	Inspiring Youth to Lead	2:10	AcPit A-138

Engineering

		Title	Time	Room
I01	Natasha Arvanitis	The Visualization of Stresses in Solids and Fluids via Matlab	1:45	A-133
I02	Dane Christianson Michael Gleeson Yiru Tao Weili Zheng	Engineering a Water Filter for Developing Countries: Varying Lateral Thickness in Ceramic Filters to Optimize Flow Rates	1:45	D-110
I03	Samuel Contreras Audel Gutierrez	Geothermal Energy	09:35	LectHall B-206
I04	Justin Glasper	The Effect of $[Rh(NH_3)5Cl]^+$ Adsorption and Particle Size on Anatase TiO_2 as a Function of Support Treatment Procedures for the Production of C^{2+} Oxygenates	10:00	B-110
I05	Alexander Goins Brian Page	Creation of a Home Automation System: Variable Environment Simple Task Automator	12:55	D-103
I06	Shawon Jackson	Nanocapacitors Made of Bismuth Ferrite: Effect on Film Thickness and Nanocapacitor Diameter	09:35	D-110
I07	Adam Jung Faith Quist	Thermodynamic and Physical Properties of Ni_2TiSn and Ni_2NbSn	12:30	A-131
I08	Lawrence Kim Eric Kwan	Predicting the Performance of a Clean Air Device for Medical and Consumer Applications Using Computational Fluid Dynamics	1:45	B-110
I09	Zack Maril	Introduction to the Theory and Practice of Tribology	09:10	B-110
I10	Ian McInerney	Reducing Polymer Vaporization in an Educational Nanotechnology Laboratory Activity	12:30	A-147
I11	Jacob Miller Kenneth Wang	Metal Ion Doping in Metal Organic Frameworks	11:15	A-147
I12	Peter Nebres	A New Approach to Drug Delivery System Based on Magnetic Nanoparticles	2:10	A-149
I13	Brenton Noesges	Vertical Takeoff and Landing Aircraft	09:10	LectHall B-206
I14	Jonathan Park	Characterization of Electron Beam-Induced Silver Deposition from Liquid Precursor	1:45	A-151
I15	Hannah Schmitt	City House, Country House: An Architectural Investigation of Mies Van Der Rohe's Lafayette Park and Farnsworth House	10:00	D-103
I16	Navdeep Singh	Investigation into the Feasibility of Microclasp Devices for Complex Manipulation Tasks	08:45	LectHall B-206
I17	Oscar To	The Atomic Layer Deposition of Erbium Oxide Thin Films on Silicon (100)	1:20	B-133
I18	Faythe Wu	S. R. Crown Hall: A Case Study	09:35	E-115
I19	Baihan Yang	Autosacker: Designing and Developing a Novel Football to Enforce a Quick Release by the Quarterback	1:20	E-115

English

		Title	Time	Room
J01	Katherine Funderburg	Researching and Writing Historical Fiction for the Modern Reader	10:25	B-133
J02	Miguel Garcia	A Comparison on the Development of the English and Spanish Language	10:50	B-133
J03	Amogh Kambalyal Richard Song Karna Warrior	Writing, Producing, and Market Testing an Original Film Designed to Appeal to Teens	1:45	E-115
J04	Emily Weiland	Post-Apocalyptic Literature and its Relationship with the Evolving Cultural Consciousness, 1839 to Present	1:45	LectHall B-206

Environmental Science

		Title	Time	Room
K01	Vashti Aguilar	Radium Contamination in Drinking Water and the Growing Demand for Lake Michigan	08:45	A-147
K02	Sharada Dharmasankar Eric Lin Hassan Qureshi Kenneth Wang	Nanoparticle Silver-Applied Filters as Water Filtration Solutions	09:10	A-113
K03	Denise Mol	Determining the Distribution of Ozone Through Ballooning and Ultraviolet Radiation	12:55	A-131
K04	Gary Sheng	Viability and Sustainability of Biofuels in the Present and Future	1:45	AcPit A-138
K05	William Zhou	The Bioavailability of Mercury in Aqueous Solutions in the Presence of Complexing Agents	1:20	LectHall B-206

Fine Arts

		Title	Time	Room
L01	Nicholos Reid	Putting it Together: The Development of Theatrical Stage Productions	09:35	D-107

History

		Title	Time	Room
M01	Paul Angelillo Ryan Jordan	Theoretical and Pragmatic Medicine in Ancient Greece	09:10	A-117
M02	Cindy Angpraseuth	The Rise and Fall of Chivalric War	10:50	A-119
M03	Elsa Costa	Romanticism and Classicism in Nineteenth Century British Literature	09:35	A-131
M04	Diliana Dimitrova	Strengths and Weaknesses of the Copenhagen Accord	10:00	A-133
M05	Joseph Donahue	Alternate History: King Edward VIII and the Abolition of the British Monarchy	12:30	A-119
M06	Ana Dumitrescu	The Rise of Japan after World War II and its Potential Implications for Romania	12:55	A-119

History

		Title	Time	Room
M07	Brittney Hanson	Making the Right Choices: Rockford's Dilemma	09:10	A-119
M08	Lauraleigh Heffner	The History of Piracy and its Modern Applications	2:10	E-115
M09	Andrew Heuser Liana Nicklaus Thomas Oberhardt	A Simulation of Early Modern Europe	10:25	A-133
M10	Molly Pachay Kavita Patel	An Impartial View on U.S. Relations with Israel	09:10	D-110
M11	Kelly Wallin	The Consequences of Modern Agriculture	2:10	D-110
M12	Sarah Weitekamp	America's Agricultural Transition: Changes and Social Consequences in American Agriculture from Post-Civil War to Today	1:20	D-103
M13	Lisa Wendel	Future of Flight: A Comparative Look at Unmanned Aerial Vehicles Versus Piloted Aircraft	10:25	A-117

Law

		Title	Time	Room
N01	Stephanie Bernardo Leslie Martin	Comparative Analysis of Court Experience and Outcome (Results and Process) Through Pro Se and Legal Representation	10:50	E-115
N02	Abigail Flynn Jade Martin	An Examination of the Death Penalty in Countries Throughout the World	1:20	D-107
N03	Satoe Sakuma	The Insanity Defense and the Difference in States' Perspectives	10:25	A-155

Mathematics

		Title	Time	Room
O01	Kevin Baker	Investigating Quords of Quadrilaterals	09:10	A-133
O02	Shiladitya Bhattacharyya Andrew Lee Nathan Yan	Explorations of 3-Free Sequences	2:10	A-117
O03	Victor Duan	How Powers of Various Statistical Tests Vary as the Distributions they are Applied to Change	10:00	B-108
O04	Derek Hardin	Sufficient Conditions for Degree Sequence Embedding on the Projective Plane	12:30	A-133
O05	Jason Hempstead Elizabeth Ott	Quadrilateral Investigations	09:35	A-133
O06	Sara Johnson	The Mathematics Behind Geodesic Models	12:55	A-133
O07	Jisoo Kim Lucy Li Sheng-Ting Lin	Designing Origami Models	11:15	A-133
O08	Alina Kononov	Adic Expansions	1:45	A-117
O09	Eric Lin Siddharth Narayanan	Square Tilings of the Half- and Quarter-Planes.	10:00	A-113

	Mathematics	Title	Time	Room
O10	Corinne Madsen	An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Zn	1:45	A-119
O11	Michael Wong	Up the River Without a Paddle: The Expectation of Domination in Poker	1:20	A-119

	Medicine	Title	Time	Room
P01	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	9:35	A-149
P02	Amishi Bajaj	Mapping Genes of Chronic Sinusitis	10:00	A-149
P03	Sonia Bajaj	The Effects of Curcumin on Cisplatin-Resistant Ovarian Cancer	10:00	B-116
P04	Shelly Bhanot Shilpa Topudurti	Trends Observed with Mean Gestational Age, Outcome, Main Diagnosis, and Necessity for Extracorporeal Membrane Oxygenation in Patients with Persistent Pulmonary Hypertension of the Newborns from Between the Years 2000 and 2007.	10:25	A-135
P05	Madeline Booton	MRSA Prevalence in the Community as a Result of Medical Practices in the United States and Europe	12:55	D-110
P06	Andrea Castaldo Ashley Czaplicki	Evaluation of a Standardized Checklist Used During Surgical Procedures	12:55	D-107
P07	Kevin Chen	Characterization of Biomarkers at the Borderzones of Ischemic Lesions in Experimental Stroke	1:20	A-149
P08	Bernice Fokum	Prolonged Use of Pegylated Liposomal Doxorubricin in an HIV-Infected Population with Kaposi's Sarcoma	9:10	A-151
P09	Lakshmi Girijala Vaisak Nair	The Correlation Between Interferon and Tumor Necrosis Factor Levels in African American and Caucasian Sarcoidosis Patients	12:55	LectHall B-206
P10	Ankita Khandai	Novel Use of HIV-1 Rapid Tests in Determining Infection Status of Babies	12:30	A-117
P11	Ankita Khandai	Knowledge of Neonatal Healthcare in Rural Versus Urban Centers in Orissa, India	2:10	A-131
P12	Jiwon Kim Aubrey Sumaydeng Joly Wu	Analyzing the Development of Cancer Through Patient Behavior, Environment, and Genetics	1:20	A-117
P13	Pruthvi Kothari	Post-Natal Weight Gain as an Indicator for Earlier and More Precise Retinopathy of Prematurity Screening	10:00	A-135
P14	Justine Ly Katherine Shi	The Development of a Method of Early Diagnosis for Parkinson's Disease	11:15	B-110
P15	Pujan Patel	Classification of Intersectin Interacting Proteins	10:00	B-133
P16	Aldo Rossi Isolina Rossi	Genotyping Nitric Oxide Synthase Single Nucleotide Polymorphisms in Sprague-Dawley Rats from Charles River Versus Harlan	10:50	A-155
P17	Shyam Saladi Caroline Shin	Post-Myocardial Infarction Repair and Angiogenesis	10:50	A-151
P18	Rital Shah	The Role of Syndecans in Breast Cancer Metastasis to the Brain	1:20	A-113

Medicine

		Title	Time	Room
P19	Divya Tankasala	Determining Response of Cytogenetically Differing Acute Myeloid Leukemia Cell Lines to Chemotherapy	08:45	D-103
P20	Amy Zhou	Validation of HIV-1 Viral Load Determination Using Dried Blood Spot Primary Samples Tested on the Abbott RealTime PCR Assay	11:15	A-117

Neurobiology

		Title	Time	Room
Q01	Ruchi Aggarwal Mehal Shah	How does the Trafficking Motif Affect the Rate of BACE 1 Endocytosis?	09:10	A-155
Q02	Dawna Bagherian	Sex Effects on the Speech-Evoked Auditory Brainstem Response	11:15	D-103
Q03	Omotayo Balogun Kari Tyler	Effects of Antenatal Corticosteroids on the Development of Intraventricular Hemorrhage and Periventricular Leukomalacia in Premature Multiple Births	09:35	B-116
Q04	Ayse Cetinkaya	Investigation of Corticospinal Motor Neurons in Health and Integrity in Mouse Models of Amytrophic Lateral Sclerosis	1:20	B-108
Q05	Janani Mandayam Comar	Quantification of Anastrozole Consumption Administration Using a Novel Delivery System in Mice	2:10	A-151
Q06	Cecilia Countryman Pranusha Pinna	hTDP-43 Proteinopathy in *Drosophila*	10:25	B-108
Q07	Justin Feng Yanchen Shi	Exploring Resting State Connectivity with Physiologic Intervention	11:15	D-110
Q08	Brielle James Paul Yuan	Mapping Verbal Memory Areas in Epileptic Patients Through Electrocorticographic Readings of Subdural Electrodes	10:00	A-117
Q09	Monica Kozbial	Brainwave Technologies	10:25	A-113
Q10	Samuel Kwak	How Can You Train to be as Fast as The Flash?: Immediate Effects of a Two-Minute Bout of Speed-Walking Training Versus Resistance-Walking Training in a Young, Nonimpaired Group of Subjects	09:35	D-103
Q11	Ashley Ro Nikita Veera	Blood Versus Brains: A Look at Telomere Length in Mice Over Time	10:00	LectHall B-206
Q12	Priya Roy	Dopamine Neuron Loss and Tyrosine Hydroxylase-Immunoreactive Neuron Incidence of the Substantia Nigra in Parksinson's Disease	12:30	B-116
Q13	Nicole Runkle	Paracingulate Morphometry and Temperament, Character, and Cognition in Schizophrenia	11:15	A-151
Q14	Shivam Vedak	Modeling Thermal Pain Perception	08:45	E-115
Q15	Jing Wang	The Role of N-Cadherin-Mediated Cell-Cell Adhesion in Regulating Canonical Wnt/ß-Catenin Signaling	2:10	LectHall B-206
Q16	Weili Zheng	What Makes Your Memory Click?: Identifying Differential Neural Activity Relating to Memory Through Intracranial Electroencephalography	09:35	A-113

Physics

		Title	Time	Room
R01	Alexander Abbinante Wesley Bradley	At What Mass Does a Standard Model Higgs Boson Exist?	09:35	A-155
R02	Sara Akgul	Analysis of B-Tagging Algorithm Efficiencies at the Collider Detector at Fermilab	11:15	B-116
R03	Sara Akgul Kevin Zhao	Asymmetric Dice	10:50	B-116
R04	Amy Allen	Effect of Neutrons on Plastic Scintillating Material in the Mu2e Cosmic Ray Veto Shield	2:10	B-108
R05	Mohammed Hayat	Neutrino Oscillations and the NOvA Experiment	12:55	A-135
R06	Vladislav Kontsevoi	Enhancement of Thermoelectric Properties of Lead Telluride by Doping	1:20	A-131
R07	Zhengzheng Liu	Search for Sudden Stratospheric Warmings in Soudan 2's Muon Data	1:20	A-135
R08	Alexander Munoz	Visual Scanning of MINOS Neutrino Event Data	12:30	A-135
R09	Liana Nicklaus	The Mass Versus Richness Relationship for MaxBCG Galaxy Clusters	10:50	A-133
R10	James Pan	Development of a Likelihood Variable for Differentiating Between Hadronic Jets and Photons	2:10	B-116
R11	Jay Patel	Building a Scanning Probe Microscope Interface Using LabVIEW	11:15	D-107
R12	Shobhit Roy	The RRR Measurement by AC Lock-in Amplifier	1:45	A-155
R13	Anderson West	Search For Strong Gravitational Lens Systems Within the Blanco Cosmology Survey	10:25	A-151

Psychology

		Title	Time	Room
S01	Kaijia Chen	Westerners and East Asianers: Why Do We Clique?	09:10	AcPit A-138
S02	Gabriella Heller	Decontextualized Language Use in the Early Home Environment of Children with Early Unilateral Brain Injury: Relations to Vocabulary and Narrative Development	2:10	A-155
S03	Jayanshu Jain Kaitlyn Kunstman Michelle Rudolph	Learning to Forget: Post-Traumatic Stress Disorder Treatments	1:45	D-103
S04	Jasmine Joda	Genetic Implications of Schizophrenia	08:45	A-131
S05	Matthew Kleinjan	The Relationship Between Response to Stress and Alcohol Consumption	10:00	E-115
S06	Elizabeth Knowlton William Lindemann	The Quest to be the Best: A Modern Exploration of Perfectionism	10:00	AcPit A-138
S07	Jeselle Santiago Nirali Shah	Increasing Motivation in Schools	09:10	D-107

Psychology

		Title	Time	Room
S08	Ashley Smith	Assessing the Attitudes and Behaviors of Incoming Sophomores at IMSA	10:50	AcPit A-138
S09	Christopher Wallis	The Effect of the Classroom on Field Random Event Generators	1:45	A-135
S10	Claire Zhang	How I Read Your Mind: A Study of Microexpressions	09:35	AcPit A-138

Social Science

		Title	Time	Room
T01	Grace Chan Nancy Yu	China and the World	11:15	A-113
T02	Nicacio Corral Rhett Partida Isiah Ramos Alejandro Rojas	The Demographics of Latinos in the Professional Workforce Throughout the Urban Cities of the United States	11:15	AcPit A-138
T03	Jessica Hunter	Needs Assessment of Illinois Mathematics and Science Academy Students from Downstate and Rural Areas: The Invisible Minority	10:25	AcPit A-138
T04	Melissa O'Brien Kimberly Sherwin	Ethical Legislation: The Search for the Basis of Ethics	09:35	A-135
T05	Joan Steffen	Afghanistan Unveiled: the Struggle for Afghan Women's Rights	09:35	A-117

Space Science

		Title	Time	Room
U01	Natasha Arvanitis	Comparing the Unique Almahata Sitta Meteorites to Other Ureilites	2:10	A-133
U02	Amber Betzold	Search for Ultracool White Dwarfs Using the Sloan Digital Sky Survey	10:00	A-151
U03	Stephanie Cheng	Stellar Nursery: The Relationship Between a Spiral Galaxy's Bar and its Star Formation	1:20	A-133
U04	Vijay Jayaram Thomas Reith	Graphical Simulation of Dark Matter Halo Formation	09:35	B-110

Poster Map

Cafeteria

A01
A02
A03
A04
A05
B01

B02	B08
B03	B09
B04	B10
B05	C01
B06	C02
B07	C03

C04	C10
C05	C11
C06	C12
C07	C13
C08	C14
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C16
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C22	C23	C24	C25	C26	C27	C28	C29	D01	D02	D03	E01	E02	E03
E04	E05	E06	E07	E08	E09	E10	E11	F01	F02	F03	F04	F05	G01

G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G12	H01	H02	H03	H04	H05	H06	I01
I02	I03	I04	I05	I06	I07	I08	I09	I10	I11	I12	I13	I14	I15	I16	I17	I18	I19

J01
J02
J03
J04

K01	K02	K03	K04	K05	L01	M01	M02	M03	M04	M05	M06	M07	M08	M09	M10

M11	M12

M13
N01

Old Cafeteria/Commons

Diagram Not to Scale

* Biochemistry: A01-A05
* Bioengineering: B01-B10
* Biology: C01-C29
* Business: D01-D03
* Chemistry: E01-E11
* Computer Science: F01-F05
* Economics: G01-G12
* Education: H01-H06
* Engineering: I01-I19
* English: J01-J04
* Environmental Science: K01-K05
* Fine Arts: L01
* History: M01-M13
* Law: N01

continued

Old Cafeteria/Commons

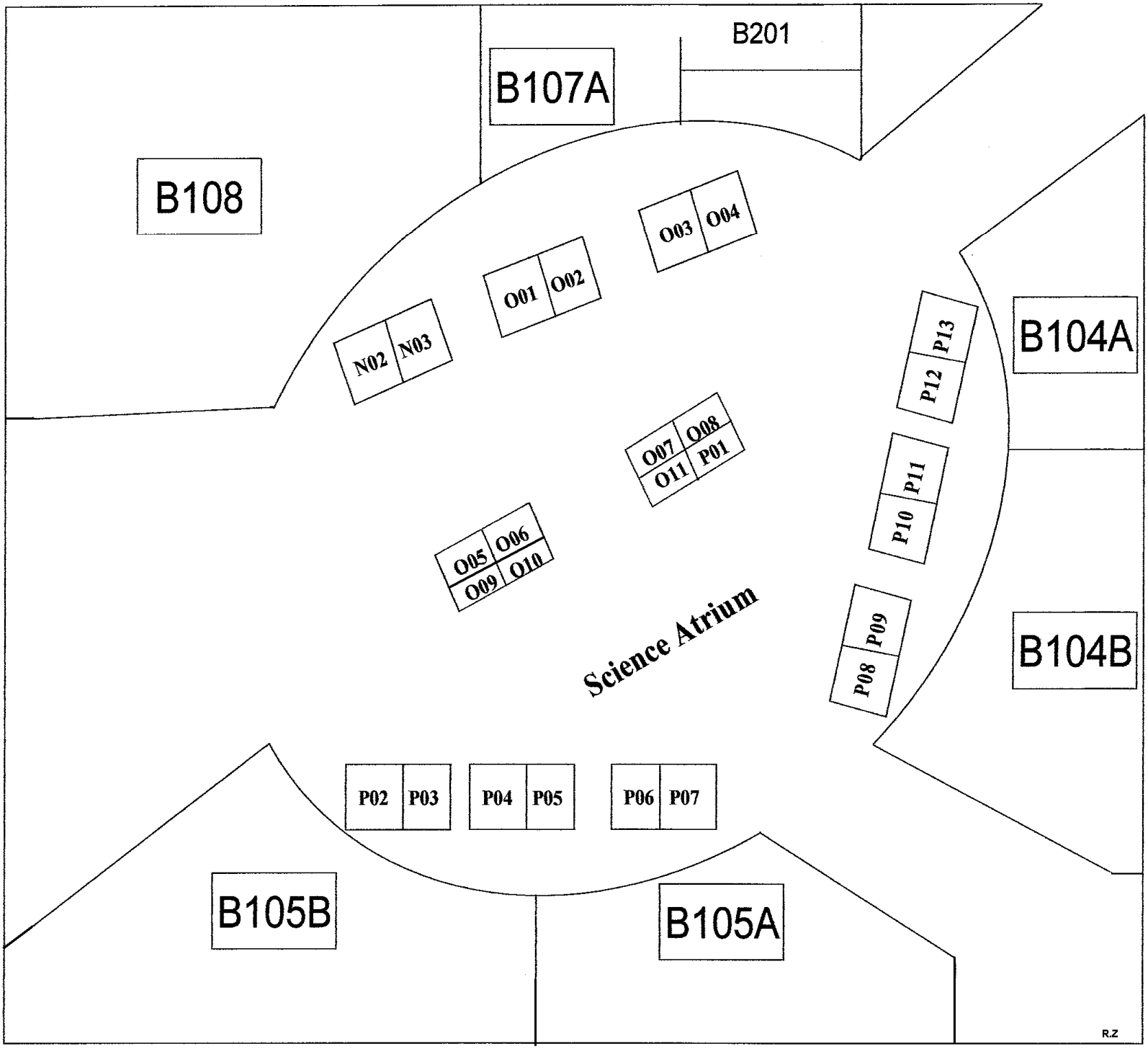
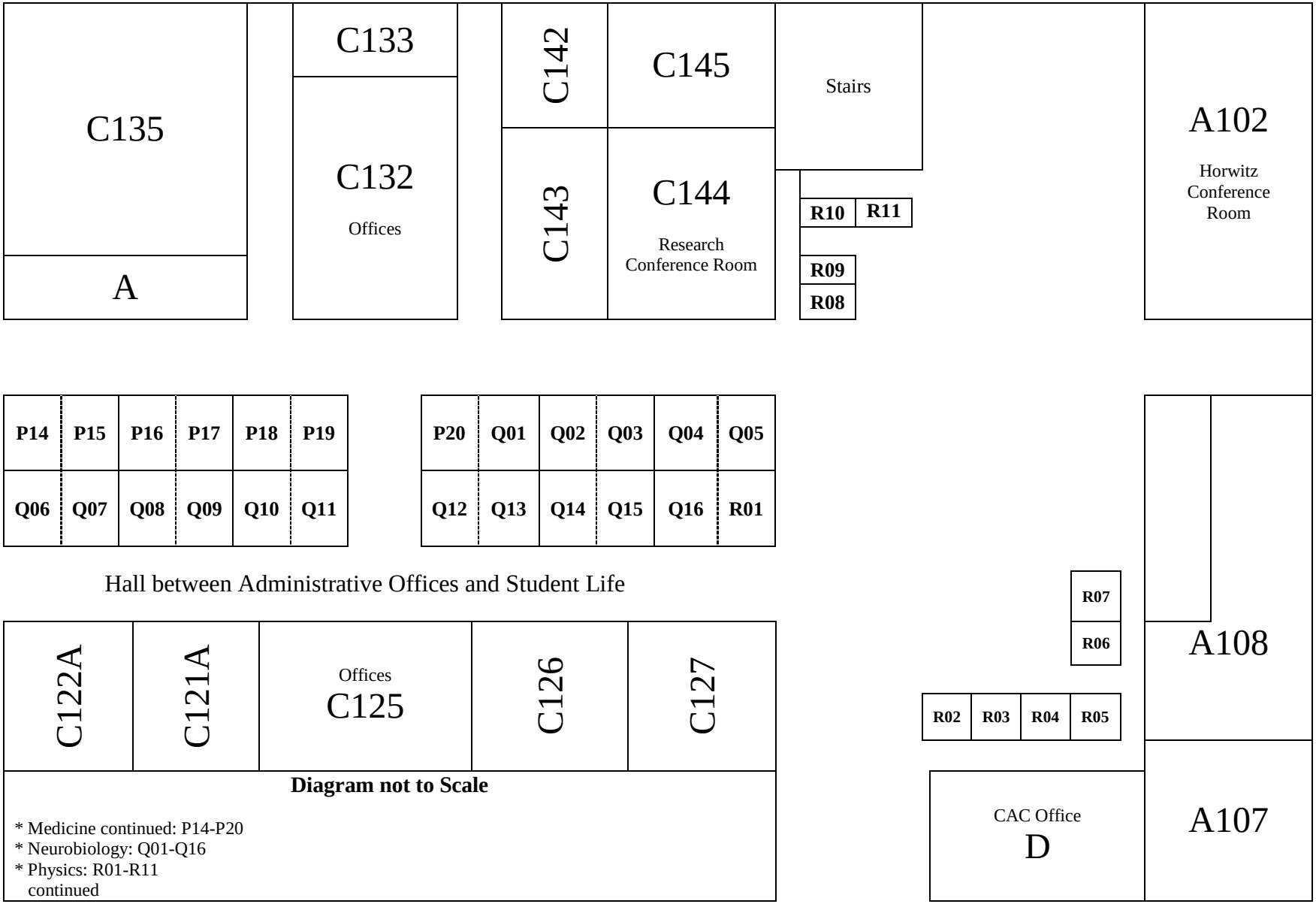


Diagram not to Scale

* Law continued: N02-N03
* Mathematics: O01-O11
* Medicine: P01-P13
  continued

Poster Map


C135
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C144
Research
Conference Room
Stairs
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R11
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R08
A102
Horwitz
Conference
Room
P14
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Q13
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Q16
R01
Hall between Administrative Offices and Student Life
R07
R06
A108
R02
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A107
Diagram not to Scale
* Medicine continued: P14-P20
* Neurobiology: Q01-Q16
* Physics: R01-R11
continued

Poster Map
Math Study Area

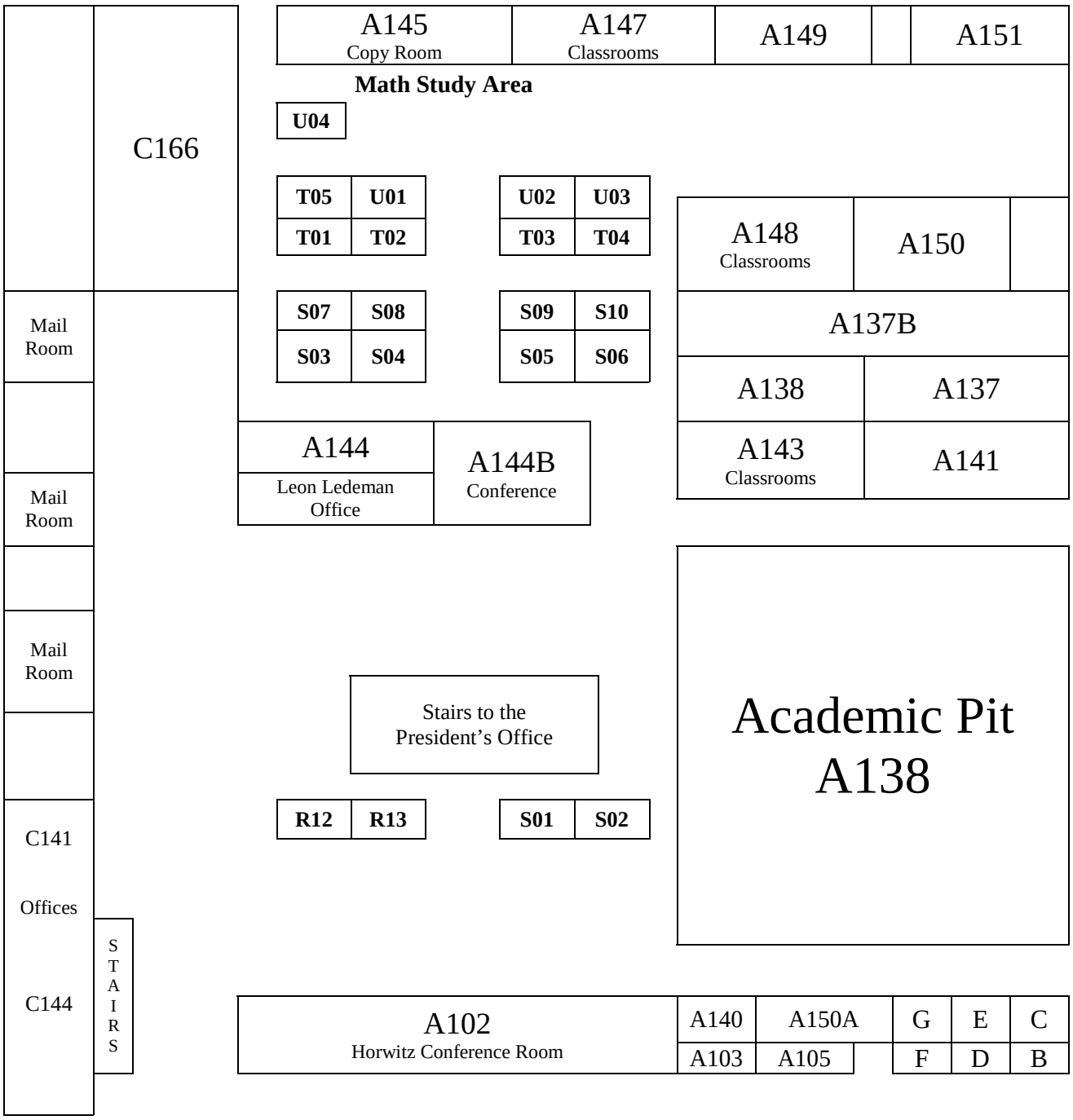

Diagram not to Scale

* Physics continued: R12-R13
* Psychology: S01-S10
* Social Science: T01-T05
* Space Science: U01-U04

IMSAloquium Schedule

08:45 - 09:00

Room	Poster ID	
A-117	D03	**Defining the Current Status of Healthcare Options in India and Evaluating the Role of Private Health Insurance Within it** Jennifer Hu, Weili Zheng, Mary Carter, Annette Marek
A-131	S04	**Genetic Implications of Schizophrenia** Jasmine Joda, David Evenson
A-135	G10	**Model of Economic Effects of the Climate Change on Different Economic Classes in the United States, the United Kingdom, and Other Countries Throughout the World** Samuel Simon, Joshua Elliott
A-147	K01	**Radium Contamination in Drinking Water and the Growing Demand for Lake Michigan** Vashti Aguilar, Peter Clancy
A-149	C15	**Alterations in Hsp27** Jonathan Munoz, Jody Martin
A-151	E09	**Spectroscopic Analysis of Metal Borohydrides** Sai Parepally, Michael Trenary
B-108	C09	**Investigation of the Mechanisms of Cholesterol Modulation of Inward Rectifier Potassium Channel Function** Linna Guan, Yulia Epshtein, Irena Levitan, Avia Rosenhouse-Dantsker, Dev Singh
B-110	B07	**Improving Auscultation Methods in the Human Body** Matthew Brian McDermott, Thomas Royston
B-116	C24	**Effect of *Dnmt3b* Deficiency on Mediastinal Lymphoma Frequency and the DNA Methylation Status of the *Thrap1, Bri3bp,* and *Mum1* Genes** Mahi Singh, Lucy Godley, Janet Lepore, Aparna Vasanthakumar
B-133	D01	**Recipe for the Perfect Intervention** Bo Chen, Sarah Vo, Pradeep Chintagunta
D-103	P19	**Determining Response of Cytogenetically Differing Acute Myeloid Leukemia Cell Lines to Chemotherapy** Divya Tankasala, Kenan Onel, Sapana Vora
D-110	C01	**Spontaneous Calcium Release at the Sub-Cellular Level** Lisa Akintilo, Megan Wu, J. Andrew Wasserstrom
E-115	Q14	**Modeling Thermal Pain Perception** Shivam Vedak, A. Vania Apkarian
LectHall B-206	I16	**Investigation into the Feasibility of Microclasp Devices for Complex Manipulation Tasks** Navdeep Singh, Laxman Saggere

09:10 - 09:25

Room	Poster ID	
A-113	K02	**Nanoparticle Silver-Applied Filters as Water Filtration Solutions** Sharada Dharmasankar, Eric Lin, Hassan Qureshi, Kenneth Wang, Mark Carlson
A-117	M01	**Theoretical and Pragmatic Medicine in Ancient Greece** Paul Angelillo, Ryan Jordan, Robert Kiely
A-119	M07	**Making the Right Choices: Rockford's Dilemma** Brittney Hanson, Jim Victory
A-133	O01	**Investigating Quords of Quadrilaterals** Kevin Baker, Michael Keyton
A-135	F05	**An Exploration of the Process of Designing and Implementing a Multi-Dimensional Database** Gary Wang, Joshua Elliott
A-147	A05	**A Mouse Model for Lymphangioleiomyomatosis** Vamika Venkatesan, Jared Klarquist, I. Caroline Le Poole
A-149	C13	**Search for Lipid and Enzymatic Markers of Chronic Alcoholism** Anusha Kumar, Viral Patel, Glyn Dawson, Sylvia Dawson, John Kilkus, Jingdong Qin
A-151	P08	**Prolonged Use of Pegylated Liposomal Doxorubricin in an HIV-Infected Population with Kaposi's Sarcoma** Bernice Fokum, Margaret Telfer
A-155	Q01	**How does the Trafficking Motif Affect the Rate of BACE 1 Endocytosis?** Ruchi Aggarwal, Mehal Shah, Virginie Buggia-Prevot, Gopal Thinakaran
AcPit A-138	S01	**Westerners and East Asianers: Why Do We Clique?** Kaijia Chen, Joan Y. Chiao
B-108	C08	**Evi1 Cooperation with a Haploinsufficient Egr1 to Develop Myeloid Neoplasms** Andrew Go, Michelle LeBeau, Angela Stoddart
B-110	I09	**Introduction to the Theory and Practice of Tribology** Zack Maril, Robert Erck
B-116	G09	**Stopping the Flow of Terrorist Funding** Saurin Shah, Eric Smith
B-133	E03	**Advanced Technologies for the Removal of Dissolved Organic Nitrogen from Wastewater Treatment Plant Effluents** Amber Farrell, Marina Arvaldos, Krishna Pagilla
D-103	C25	**The Role of Macrophage Phenotype in Breast Cancer Progression** Aditya Suresh, Galina Khramtsova, Rita Nanda
D-107	S07	**Increasing Motivation in Schools** Jeselle Santiago, Nirali Shah, Deborah McGrath
D-110	M10	**An Impartial View on U.S. Relations with Israel** Molly Pachay, Kavita Patel, Jennifer Bing-Canar
E-115	G12	**To Steal or Not to Steal: Considering the Motivations for Stealing** Zehua Sun, David Herberich, John List
LectHall B-206	I13	**Vertical Takeoff and Landing Aircraft** Brenton Noesges, Francisco Ruiz

09:35 - 09:50

Room	Poster ID	
A-113	Q16	**What Makes Your Memory Click?: Identifying Differential Neural Activity Relating to Memory Through Intracranial Electroencephalography** Weili Zheng, Vernon Leo Towle
A-117	T05	**Afghanistan Unveiled: the Struggle for Afghan Women's Rights** Joan Steffen, Robert Kiely
A-131	M03	**Romanticism and Classicism in Nineteenth Century British Literature** Elsa Costa, Christian Nokkentved
A-133	O05	**Quadrilateral Investigations** Jason Hempstead, Elizabeth Ott, Michael Keyton
A-135	T04	**Ethical Legislation: The Search for the Basis of Ethics** Melissa O'Brien, Kimberly Sherwin, Lee Eysturlid
A-147	A03	**Characterizing the Phenotype of a SCAM Mouse Model for Melanoma** Leti Nunez, Vidhya Hariharan, Jared Klarquist, I. Caroline Le Poole
A-149	P01	**Delayed Use of Calcineurin Inhibitors and High Dose Mycophenolate Mofetil as Initial Immunosuppressive Therapy for Liver Transplant Recipients with Pre-Transplant Renal Dysfunction** Amishi Bajaj, Josh Levitsky
A-151	F02	**Computer-Aided Microcalcification Detection for Tomosynthesis Images** Naomi Liu, Si Si, Robert Nishikawa, Ingrid Reiser
A-155	R01	**At What Mass Does a Standard Model Higgs Boson Exist?** Alexander Abbinante, Wesley Bradley, Ryuji Yamada
AcPit A-138	S10	**How I Read Your Mind: A Study of Microexpressions** Claire Zhang, David Evenson
B-110	U04	**Graphical Simulation of Dark Matter Halo Formation** Vijay Jayaram, Thomas Reith, Dan Hooper
B-116	Q03	**Effects of Antenatal Corticosteroids on the Development of Intraventricular Hemorrhage and Periventricular Leukomalacia in Premature Multiple Births** Omotayo Balogun, Kari Tyler, Maliha Shareef, Tricia Thomson
B-133	H04	**Investigation for the Illinois Law Enforcement Alarm Sysytem: Website Hosting Survey** Daniela Lefticariu, James Bondi, Christopher Kolar, James Page, Ken Swails
D-103	Q10	**How Can You Train to be as Fast as The Flash?: Immediate Effects of a Two-Minute Bout of Speed-Walking Training Versus Resistance-Walking Training in a Young, Nonimpaired Group of Subjects** Samuel Kwak, David Brown
D-107	L01	**Putting it Together: The Development of Theatrical Stage Productions** Nicholos Reid, Steve Scott
D-110	I06	**Nanocapacitors Made of Bismuth Ferrite: Effect on Film Thickness and Nanocapacitor Diameter** Shawon Jackson, Leonidas Ocola
E-115	I18	**S. R. Crown Hall: A Case Study** Faythe Wu, Mark Sexton
LectHall B-206	I03	**Geothermal Energy** Samuel Contreras, Audel Gutierrez, Eric Hawker

10:00 - 10:15

Room	Poster ID	
A-113	O09	**Square Tilings of the Half- and Quarter-Planes** Eric Lin, Siddharth Narayanan, Steven Condie
A-117	Q08	**Mapping Verbal Memory Areas in Epileptic Patients Through Electrocorticographic Readings of Subdural Electrodes** Brielle James, Paul Yuan, Vernon Leo Towle
A-119	G05	**Keynesian Economics and Their Relevance to Asian Economics** Jialin Huang, Richard Stalmack
A-131	B09	**The Binding Kinetics of sLE^x for P-/E-Selectins** Tiffany Sinclair, Seungpyo Hong, Ja Hye Myung
A-133	M04	**Strengths and Weaknesses of the Copenhagen Accord** Diliana Dimitrova, William Mock, Christian Nokkentved
A-135	P13	**Post-Natal Weight Gain as an Indicator for Earlier and More Precise Retinopathy of Prematurity Screening** Pruthvi Kothari, Jonathon Muraskas
A-147	C12	**Evidence for Evolutionary Reductions in the ß-adrenergic System of the Texas Toad, *Bufo speciosus*** Anusha Kumar, James Carr
A-149	P02	**Mapping Genes of Chronic Sinusitis** Amishi Bajaj, Jayant Pinto
A-151	U02	**Search for Ultracool White Dwarfs Using the Sloan Digital Sky Survey** Amber Betzold, Evalyn Gates
A-155	C18	**A Novel Approach to Erythroid Kruppel-Like Transcription Factor: Its Role in Megakaryopoiesis** Cassie Parks, John Cunningham
AcPit A-138	S06	**The Quest to be the Best: A Modern Exploration of Perfectionism** Elizabeth Knowlton, William Lindemann, David Evenson
B-108	O03	**How Powers of Various Statistical Tests Vary as the Distributions they are Applied to Change** Victor Duan, Barbara Engelhardt, Matthew Stephens
B-110	I04	**The Effect of $[Rh(NH_3)5Cl]^+$ Adsorption and Particle Size on Anatase TiO_2 as a Function of Support Treatment Procedures for the Production of C^{2+} Oxygenates** Justin Glasper, Randall Meyer
B-116	P03	**The Effects of Curcumin on Cisplatin-Resistant Ovarian Cancer** Sonia Bajaj, Donald Dosch, Judith Scheppler
B-133	P15	**Classification of Intersectin Interacting Proteins** Pujan Patel, John O'Bryan
D-103	I15	**City House, Country House: An Architectural Investigation of Mies Van Der Rohe's Lafayette Park and Farnsworth House** Hannah Schmitt, Joy Meek
D-107	G07	**School Structure and Academic Achievement: How the Middle School Model Affects Blacks and Whites** Michael Mirski, John Wang, Kerwin Charles

10:00 - 10:15

Room	Poster ID	
E-115	S05	**The Relationship Between Response to Stress and Alcohol Consumption** Matthew Kleinjan, Harriet de Wit, Margaret Wardle
LectHall B-206	Q11	**Blood Versus Brains: A Look at Telomere Length in Mice Over Time** Ashley Ro, Nikita Veera, Chunyu Liu

10:25 - 10:40

Room	Poster ID	
A-113	Q09	**Brainwave Technologies** Monica Kozbial, Mark Carlson
A-117	M13	**Future of Flight: A Comparative Look at Unmanned Aerial Vehicles Versus Piloted Aircraft** Lisa Wendel, Jim Victory
A-119	E08	**Specific Cellular Uptake of Targeted Liposomes in Cancer Cells** Daniel Pak, Seungpyo Hong, Su Eon Jin
A-131	C29	**Investigation of Effective Peptides for Vaccine Against *Toxoplasmosis*** Candice Yi, Rima McLeod
A-133	M09	**A Simulation of Early Modern Europe** Andrew Heuser, Liana Nicklaus, Thomas Oberhardt, Lee Eysturlid
A-135	P04	**Trends Observed with Mean Gestational Age, Outcome, Main Diagnosis, and Necessity for Extracorporeal Membrane Oxygenation in Patients with Persistent Pulmonary Hypertension of the Newborns from Between the Years 2000 and 2007.** Shelly Bhanot, Shilpa Topudurti, Christine Sajous
A-147	C17	**Role of Interleukin 1-β in Modulating Immune Responses** Luke Nayak, Balaji Ganesh, Bellur Prabhakar
A-149	B06	**Designing a Robotic Stroke Therapy System Suitable for Patient Use in Residential Settings** Mahir Khan, Patrick Rousche
A-151	R13	**Search For Strong Gravitational Lens Systems Within the Blanco Cosmology Survey** Anderson West, Tom Diehl
A-155	N03	**The Insanity Defense and the Difference in States' Perspectives** Satoe Sakuma, Mark Heyrman
AcPit A-138	T03	**Needs Assessment of Illinois Mathematics and Science Academy Students from Downstate and Rural Areas: The Invisible Minority** Jessica Hunter, David Evenson
B-108	Q06	**hTDP-43 Proteinopathy in *Drosophila*** Cecilia Countryman, Pranusha Pinna, Jane Wu
B-110	C04	**A Study on the Possible Correlations between Patients with Cardiac Sarcoidosis** Cecilia Chang, Harika Nalluri, John Beshai

10:25 – 10:40

Room	Poster ID	
B-116	C03	**Optimization of a DNA Sequencer** Aryssa Burton, Jamie Tweedle
B-133	J01	**Researching and Writing Historical Fiction for the Modern Reader** Katherine Funderburg, Tracy Townsend
D-107	C23	**Long Term Human Pancreatic Islet Cell Viability with PMCG Capsule in CMRL 1066 Culture Media** Kevin Shi, Vivek Thakkar, Jose Oberholzer, Meirigeng Qi, Yong Wang
D-110	C11	**Molecular Mechanisms of Bone Marrow Stem Cell Maintenance and Mobilization** Ingrid Hsiung, Min Cheng, Qin Gangjian
LectHall B-206	C06	**Cleaners and Their Effects on Bacteria** Nitin Chilukuri, Jongmin Lee, Julie Polz

10:50 - 11:05

Room	Poster ID	
A-113	E10	**Stable Explicit Water rRNA and tRNA Simulation Using Visual Molecular Dynamics and Nanoscale Molecular Dynamics** Yiru Tao, Karl Freed
A-117	G08	**What Motivates the Consumer? The Effects of Advertisement on Banking and Beauty Aids in the Twenty-First Century** Dharti Shah, Robert Kiely, Jim Victory
A-119	M02	**The Rise and Fall of Chivalric War** Cindy Angpraseuth, Claiborne Skinner
A-131	C10	**Validation Lactate Dehydrogenase2 in the Parasite *Toxoplasma gondii* with Respect to Its Effect on the Growth, Survival, or Persistence of the Parasite in Tissue Culture and in vivo** Alexandra Hizel, Nicholas Virgl, Rima McLeod
A-133	R09	**The Mass Versus Richness Relationship for MaxBCG Galaxy Clusters** Liana Nicklaus, James Annis, Huan Lin
A-135	E02	**Comparison of Computational Chemistry Software and Spectrometer Data** William Erwin, Andrew Jung, Dave DeVol
A-149	F01	**The Societal Aspects of Technological Advancement** Quadis Evans, Eric Shinn, Mike Ososky
A-151	P17	**Post-Myocardial Infarction Repair and Angiogenesis** Shyam Saladi, Caroline Shin, Samuel Dudley, David Simpson
A-155	P16	**Genotyping Nitric Oxide Synthase Single Nucleotide Polymorphisms in Sprague-Dawley Rats from Charles River Versus Harlan** Aldo Rossi, Isolina Rossi, Melina Kibbe, William Pearce, Vera Shively
AcPit A-138	S08	**Assessing the Attitudes and Behaviors of Incoming Sophomores at IMSA** Ashley Smith, Adrienne Coleman, Barbara Miller
B-108	E06	**Study of the Hydrophobicity of Polystyrene, Poly(methyl methacrylate), and Poly(styrene-block-methyl methacrylate) and Its Photomodified Form** Pan Luo, Steve Sibener

10:50 - 11:05

Room	Poster ID	
B-110	E07	**Quantitative Measurement of the Oxidation of Nonanoic Acid with Manganese Complexes** Samir Mishra, Justin Notestein
B-116	R03	**Asymmetric Dice** Sara Akgul, Kevin Zhao, Mark Fischler
B-133	J02	**A Comparison on the Development of the English and Spanish Language** Miguel Garcia, Margaret Cain
D-103	G04	**The Role of Futures Contracts in the Commodities Markets** Joseph Hecker, Doug Adams
D-110	B03	**Development of an O-GlcNAc Transferase-Based Therapeutic for Glioblastomas** Nicole Howard, Roger Kroes, Joseph Moskal
E-115	N01	**Comparative Analysis of Court Experience and Outcome (Results and Process) Through Pro Se and Legal Representation** Stephanie Bernardo, Leslie Martin, David Yanoff

11:15 - 11:30

Room	Poster ID	
A-113	T01	**China and the World** Grace Chan, Nancy Yu, Robert Kiely
A-117	P20	**Validation of HIV-1 Viral Load Determination Using Dried Blood Spot Primary Samples Tested on the Abbott RealTime PCR Assay** Amy Zhou, Bill Kabat
A-119	G01	**Analyzing Current and Past Recessions to Identify Problems and Solutions** Ramtej Atluri, Minjae Lee, Reichert Joshua Zalameda, Eric Smith
A-131	C28	**Identification of the Iron Acquisition Pathways of the Human Commensal Species in the Genus *Neisseria*** Candice Yi, Cynthia Cornelissen
A-133	O07	**Designing Origami Models** Jisoo Kim, Lucy Li, Sheng-Ting Lin, Vincent Matsko
A-135	E04	**Accuracy of Computational Chemistry with Ethanol and Methanol** Andrew Gray, Richard Smith, Dave DeVol
A-147	I11	**Metal Ion Doping in Metal Organic Frameworks** Jacob Miller, Kenneth Wang, Rachel Getman, Randall Snurr
A-149	A02	**Determination of Ufc1 Modification Site by Ufm1** Allan Dong, Guohua Lei, Honglin Li, Mei Mei, Jianchun Wu
A-151	Q13	**Paracingulate Morphometry and Temperament, Character, and Cognition in Schizophrenia** Nicole Runkle, Matthew Smith, Lei Wang
A-155	C21	**Role of a Conserved Acidic Patch on the Protein Interactions of the Mixed Lineage Leukemia Gene** James Quigley, Manuel Diaz, Ute Osmers

11:15 - 11:30

Room	Poster ID	
AcPit A-138	T02	**The Demographics of Latinos in the Professional Workforce Throughout the Urban Cities of the United States** Nicacio Corral, Rhett Partida, Isiah Ramos, Alejandro Rojas, Isabel Reyes
B-108	A01	**Targeting Acetyl-CoA Carboxylase in a Yeast-Based Screening System to Identify Compounds for Antiparasitic Drugs** Susan Chen, Piotr Gornicki, Robert Haselkorn
B-110	P14	**The Development of a Method of Early Diagnosis for Parkinson's Disease** Justine Ly, Katherine Shi, Chien-Min Kao
B-116	R02	**Analysis of B-Tagging Algorithm Efficiencies at the Collider Detector at Fermilab** Sara Akgul, Enrique Palencia
D-103	Q02	**Sex Effects on the Speech-Evoked Auditory Brainstem Response** Dawna Bagherian, Nina Kraus, Jen Krizman, Erika Skoe
D-107	R11	**Building a Scanning Probe Microscope Interface Using LabVIEW** Jay Patel, Venkat Chandrasekhar
D-110	Q07	**Exploring Resting State Connectivity with Physiologic Intervention** Justin Feng, Yanchen Shi, Todd Parrish
E-115	E11	**Anticancer Active Ingredients from *Fagerlindia depauperata*** Johannes Zhou, Hong Jie Zhang
LectHall B-206	F03	**Developing Smartphone Applications** Marat Purnyn, Namrata Pandya, Phadmakar Patankar

12:30 - 12:45

Room	Poster ID	
A-113	C22	**The Effects of Wnt on Active Transforming Growth Factor β Levels** Rital Shah, Fang Feng, John Varga, Jun Wei
A-117	P10	**Novel Use of HIV-1 Rapid Tests in Determining Infection Status of Babies** Ankita Khandai, Bill Kabat
A-119	M05	**Alternate History: King Edward VIII and the Abolition of the British Monarchy** Joseph Donahue, Eric Smith
A-131	I07	**Thermodynamic and Physical Properties of Ni_2TiSn and Ni_2NbSn** Adam Jung, Faith Quist, Philip Nash
A-133	O04	**Sufficient Conditions for Degree Sequence Embedding on the Projective Plane** Derek Hardin, Noah Prince
A-135	R08	**Visual Scanning of MINOS Neutrino Event Data** Alexander Munoz, Maury Goodman
A-147	I10	**Reducing Polymer Vaporization in an Educational Nanotechnology Laboratory Activity** Ian McInerney, James Gerry, Joseph Muskin
B-116	Q12	**Dopamine Neuron Loss and Tyrosine Hydroxylase-Immunoreactive Neuron Incidence of the Substantia Nigra in Parksinson's Disease** Priya Roy, Paul Carvey

12:30 – 12:45

Room	Poster ID	
B-133	C05	**Transition Rates of Oak Trees After Death Due to *Armillaria*** Wen Chen, Wen Li Chen, Dennis Nyberg

12:55 - 1:10

Room	Poster ID	
A-113	C14	**The Role of Pigment Epithelium Derived Factor in the Expression of p21 and p27 in Pancreatic Cancer** Lydia Matthews, Paul Grippo
A-119	M06	**The Rise of Japan after World War II and its Potential Implications for Romania** Ana Dumitrescu, Karen Alter, Eric Smith
A-131	K03	**Determining the Distribution of Ozone Through Ballooning and Ultraviolet Radiation** Denise Mol, Geza Gyuk, Mark Hammergren
A-133	O06	**The Mathematics Behind Geodesic Models** Sara Johnson, Vincent Matsko
A-135	R05	**Neutrino Oscillations and the NOvA Experiment** Mohammed Hayat, Maury Goodman
A-147	C16	**Effect of Interleukin-6 Deficiency on Obesity-Induced Inflammation in Adipose Tissue in Mice** Elizabeth Murphy, Giamila Fantuzzi, Maria Pini, Davina Rhodes
A-149	B10	**Left Ventricular Assist Device Development in the United States and Japan** Mao Yamakawa, Kyo Shunei
B-133	C26	**The Astrocytic Response to Interleukin-17, a Proinflammatory Cytokine Important in Mediating Experimental Autoimmune Encephalomyelitis.** Michael Teng, Stephen Miller
D-103	I05	**Creation of a Home Automation System: Variable Environment Simple Task Automator** Alexander Goins, Brian Page, James Gerry
D-107	P06	**Evaluation of a Standardized Checklist Used During Surgical Procedures** Andrea Castaldo, Ashley Czaplicki, Timothy McDonald
D-110	P05	**MRSA Prevalence in the Community as a Result of Medical Practices in the United States and Europe** Madeline Booton, Donald Dosch
E-115	B04	**Creating a Virtual Fly Through of the Human Brain's Ventricular System** Jennifer Hu, Andreas Linninger
LectHall B-206	P09	**The Correlation Between Interferon and Tumor Necrosis Factor Levels in African American and Caucasian Sarcoidosis Patients** Lakshmi Girijala, Vaisak Nair, Timothy Niewold, Nadera Sweiss

1:20 - 1:35

Room	Poster ID	
A-113	P18	**The Role of Syndecans in Breast Cancer Metastasis to the Brain** Rital Shah, Jennifer Koblinski
A-117	P12	**Analyzing the Development of Cancer Through Patient Behavior, Environment, and Genetics** Jiwon Kim, Aubrey Sumaydeng, Joly Wu, Donald Dosch, Richard Stalmack
A-119	O11	**Up the River Without a Paddle: The Expectation of Domination in Poker** Michael Wong, Noah Prince
A-131	R06	**Enhancement of Thermoelectric Properties of Lead Telluride by Doping** Vladislav Kontsevoi, Arthur Freeman, Jung-Hwan Song
A-133	U03	**Stellar Nursery: The Relationship Between a Spiral Galaxy's Bar and its Star Formation** Stephanie Cheng, Lucy Fortson, Geza Gyuk, Mark Subbarao
A-135	R07	**Search for Sudden Stratospheric Warmings in Soudan 2's Muon Data** Zhengzheng Liu, Maury Goodman
A-147	H02	**Identifying the Key Constructs of School Improvement: A Comprehensive Examination of Academic Progress and the No Child Left Behind Act** Cevdet Dogan, Jonathan Loucks, Sidanth Sapru, Glenn "Max" McGee
A-149	P07	**Characterization of Biomarkers at the Borderzones of Ischemic Lesions in Experimental Stroke** Kevin Chen, Agnieszka Ardelt
A-151	B02	**Use of Laser Speckle Contrast Analysis to Detect Changes in Tympanic Membrane Vibrations** Wesley Herron, Elizabeth Richardson, Claus-Peter Richter
A-155	D02	**A Statistical Analysis of Fiscal and Performance Data from English Premiership and Major League Soccer Teams and Players** Benjamin Diaz, Nikolay Glavanakov, Mathias Drton
AcPit A-138	H05	**High School Students Perceptions' on Business Ethics** Nidhi Narielwala, Gary Ernst, Barbara Miller
B-108	Q04	**Investigation of Corticospinal Motor Neurons in Health and Integrity in Mouse Models of Amytrophic Lateral Sclerosis** Ayse Cetinkaya, Pembe Hande Ozdinler
B-116	C19	**Pathogenic Entry of Herpes Simplex Virus: Syndecan Coreceptor Expression** Lisa Patel, Lokamitra Veeramasuneni, Ghadah Karasneh, Deepak Shukla
B-133	I17	**The Atomic Layer Deposition of Erbium Oxide Thin Films on Silicon (100)** Oscar To, Christos Takoudis
D-103	M12	**America's Agricultural Transition: Changes and Social Consequences in American Agriculture from Post-Civil War to Today** Sarah Weitekamp, Kathryn Kadel
D-107	N02	**An Examination of the Death Penalty in Countries Throughout the World** Abigail Flynn, Jade Martin, Sandra Babcock
D-110	H01	**Conventional Versus Inquiry-Based Teaching Methods: Which is More Effective?** Kirthi Banothu, Yoo (Jenny) Kim, Morgan Rehberg, Brendan Wesp, Julie Dowling

1:20 - 1:35

Room	Poster ID	
E-115	I19	**Autosacker: Designing and Developing a Novel Football to Enforce a Quick Release by the Quarterback** Baihan Yang, Matthew Spenko
LectHall B-206	K05	**The Bioavailability of Mercury in Aqueous Solutions in the Presence of Complexing Agents** William Zhou, Jean-Francois Gaillard

1:45 – 2:00

Room	Poster ID	
A-113	G03	**The Effect of Tort Litigation on the Market for Pharmaceuticals** Govind Govind-Thomas, Sloane Frost, Anup Malani
A-117	O08	**Adic Expansions** Alina Kononov, Micah Fogel
A-119	O10	**An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Zn** Corinne Madsen, Noah Prince
A-131	C07	**A Genome Wide Association Study of Carotid Artery Plaque** Imran Choudhry, Habibal Ahsan, Brandon Pierce
A-133	I01	**The Visualization of Stresses in Solids and Fluids via Matlab** Natasha Arvanitis, Craig Foster
A-135	S09	**The Effect of the Classroom on Field Random Event Generators** Christopher Wallis, Peter Clancy, Brenda Dunne
A-147	E05	**Chemically Active Colloidal Graphene with Tunable Carbon-Oxygen Ratios** Bonny Jain, Owen Compton, SonBinh Nguyen
A-149	B01	**sP-Selectin as a Diagnostic Biomarker for Stroke Using Integrated Sensing Nanolayers** Kevin Chen, Dimitra Georganopoulou
A-151	I14	**Characterization of Electron Beam-Induced Silver Deposition from Liquid Precursor** Jonathan Park, Ralu Divan, Alexandra Joshi-Imre
A-155	R12	**The RRR Measurement by AC Lock-in Amplifier** Shobhit Roy, C. Shekhar Mishra, Arun Saini, Genfa Wu
AcPit A-138	K04	**Viability and Sustainability of Biofuels in the Present and Future** Gary Sheng, Branson Lawrence
B-108	C02	**Exploring the Cause of acd6-1 Phenotypes Expression in *Arabidopsis*** Morenibayo Bankole, Joanna Jelenska
B-110	I08	**Predicting the Performance of a Clean Air Device for Medical and Consumer Applications Using Computational Fluid Dynamics** Lawrence Kim, Eric Kwan, Michael Corbat, Lawrence Ost, Philip Winters
B-116	B08	**Characterization of Membranes Used in Micropumps** James Parkin, Farid Amirouche
B-133	G11	**The Effect of Competition Between Self-Regulators** Courtney Alexa Smith, Jiro Kondo

1:45 – 2:00

Room	Poster ID	
D-103	S03	**Learning to Forget: Post-Traumatic Stress Disorder Treatments** Jayanshu Jain, Kaitlyn Kunstman, Michelle Rudolph, David Evenson
D-107	G02	**The Boys Versus the Girls: Gender Specific Determinants of Success** Robert Cheung,, Sharada Dharmasankar, James Heckman, John Humpries, Nick Mader
D-110	I02	**Engineering a Water Filter for Developing Countries: Varying Lateral Thickness in Ceramic Filters to Optimize Flow Rates** Dane Christianson, Michael Gleeson, Yiru Tao, Weili Zheng, Mark Carlson, Sarah OLeary
E-115	J03	**Writing, Producing, and Market Testing an Original Film Designed to Appeal to Teens** Amogh Kambalyal, Richard Song, Karna Warrior, Audrey Wells
LectHall B-206	J04	**Post-Apocalyptic Literature and its Relationship with the Evolving Cultural Consciousness, 1839 to Present** Emily Weiland, Daniel Gleason

2:10 - 2:25

Room	Poster ID	
A-113	G06	**The Causes of the 2008 Economic Crisis and its Impact on Colleges** Michael Kobiela, Jim Victory
A-117	O02	**Explorations of 3-Free Sequences** Shiladitya Bhattacharyya, Andrew Lee, Nathan Yan, Micah Fogel
A-119	F04	**Impact and Feasibility of Cloud Computing in an IMSA Environment** Benjamin Taylor, Noah Prince
A-131	P11	**Knowledge of Neonatal Healthcare in Rural Versus Urban Centers in Orissa, India** Ankita Khandai, Donald Dosch
A-133	U01	**Comparing the Unique Almahata Sitta Meteorites to Other Ureilites** Natasha Arvanitis, Mark Hammergren
A-135	C20	**The Prevalence of CTX-M, SHV, and TEM-Producing *E. coli* Recovered from Urine Cultures** Varun Pilla, Chao Qi
A-147	B05	**Direct-to-Consumer Genetic Testing Patents: A 2010 Update** Eric Huang, Simon Lin
A-149	I12	**A New Approach to Drug Delivery System Based on Magnetic Nanoparticles** Peter Nebres, Vitali Metlushko, Josh Sautner
A-151	Q05	**Quantification of Anastrozole Consumption Administration Using a Novel Delivery System in Mice** Janani Mandayam Comar, Elliott Mufson, Cassia Overk
A-155	S02	**Decontextualized Language Use in the Early Home Environment of Children with Early Unilateral Brain Injury: Relations to Vocabulary and Narrative Development** Gabriella Heller, Ozlem Ece Demir, Susan Goldin-Meadow, Susan Levine

2:10 – 2:25

Room	Poster ID	
AcPit A-138	H06	**Inspiring Youth to Lead** Cai O'Connell, Alexandra Smick, Linsey Crowninshield
B-108	R04	**Effect of Neutrons on Plastic Scintillating Material in the Mu2e Cosmic Ray Veto Shield** Amy Allen, Douglas Glenzinski, Craig Group
B-110	C27	**Biology of Bone Development in Leukemia Patients** Sumana Vardhan, Kimberley Dilley
B-116	R10	**Development of a Likelihood Variable for Differentiating Between Hadronic Jets and Photons** James Pan, Sasha Pronko
B-133	A04	**Investigation of the Transport of Proline and Glycine Betaine by ProP in *Escherichia coli*** Irina Pushel, Jeong Choe-Hwang
D-103	E01	**Thermal Process Optimization for Improved Machinability of Ferrium M54** Dane Christianson, Christopher Kern, Charles Keuhmann
D-107	H03	**IMSA: Chicago Admissions Process** Meena Iyer, Victoria Lo, Michelle Kolar, Glenn "Max" McGee
D-110	M11	**The Consequences of Modern Agriculture** Kelly Wallin, Kathryn Kadel
E-115	M08	**The History of Piracy and its Modern Applications** Lauraleigh Heffner, Claiborne Skinner
LectHall B-206	Q15	**The Role of N-Cadherin-Mediated Cell-Cell Adhesion in Regulating Canonical Wnt/ß-Catenin Signaling** Jing Wang, Anjen Chenn

A01
Targeting Acetyl-CoA Carboxylase in a Yeast-Based Screening System to Identify Compounds for Antiparasitic Drugs

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

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

Protozoan parasites cause enormous health problems to people worldwide. Vaccines are ineffective and some parasites are becoming drug-resistant. Acetyl-CoA carboxylase (ACC) is an enzyme essential to fatty acid metabolism in parasites and is a potential target for drugs. Drug screening using live parasites is impractical so a surrogate system was needed. In our strategy, introducing parasite ACC genes into wild type yeast to replace its native ACC created recombinant yeast strains whose growth depends on the parasite ACC and specific inhibitors. The yeast are in a 96-well plate set up compatible with screenings of chemical libraries. Herbicides targeting ACC of grasses, which is similar in structure and function to parasitic ACC, were tested for their ability to inhibit the growth of yeast containing the ACC of the parasite *Leishmania braziliensis*. The growth of the yeast cells in the wells was monitored for several days with a spectrometer/plate reader. When the results were analyzed, two herbicides, tepraloxydim and tralkoxydim, inhibited the growth of the yeast. A toxicity test was run on human cell lines and the results showed that there is no toxicity of these two herbicides on the cells. With this, large steps are taken to fight parasitic infections.

A02
Determination of Ufc1 Modification Site by Ufm1

Presenter(s)
Allan Dong, Illinois Mathematics and Science Academy

Advisor(s)
Guohua Lei, Children's Memorial Research Center
Honglin Li, Children's Memorial Research Center
Mei Mei, Children's Memorial Research Center
Jianchun Wu, Children's Memorial Research Center

Ubiquitin-fold modifier 1 (Ufm1) is a recently identified ubiquitin-like protein that modifies other protein targets. Very recent genetic studies suggest that the Ufm1 conjugation system is essential for animal development. Like other ubiquitin-like systems, Ufm1 modification is accomplished with the help of its E1, E2, and E3 enzymes. Ubiquitin-fold modifier conjugating enzyme 1 (Ufc1) is the E2 enzyme for Ufm1 conjugation. Preliminary data suggests that Ufc1 can be covalently modified by Ufm1; however, the exact location has yet to be determined. PCR mutagenesis was used to mutate individual Ufc1 lysine residues to arginine. Wild-type Ufm1 was then over expressed with each Ufc1 mutant to determine whether or not the Ufc1 mutants were capable of being modified by Ufm1. By using wild-type Ufm1 and Ufc1 mutants tagged with Myc and Flag proteins respectively, a Western blot will be able to show whether or not the Ufc1 mutants can be modified by the wild-type Ufm1, thus allowing us to determine a possible modification site for this interaction. These results may increase the understanding of the functionality of Ufm1 and provide a foundation for the search for Ufm1's target proteins and biological functions.

A03
Characterizing the Phenotype of a SCAM Mouse Model for Melanoma

Presenter(s)
Leti Nunez, Illinois Mathematics and Science Academy

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

The purpose of this study is to characterize a mouse model for melanoma. We hypothesized that offspring generated from a crossbreed of tumor bearing Ink4a-/Y-Tyr RAS mice and epidermally pigmented K14-SCF mice will develop pigmented, epidermal melanomas. We characterized the mouse model by testing tumor cells for expression of melanoma-associated proteins by techniques that included: Western blot, polymerase chain reaction (PCR), immunofluorescence, immunohistochemistry, and fluorescence activated cell sorting (FACS). We tested frozen optimal cutting temperature-embedded tissue as well as cultured cells from tumor digests. Results from Western blot, using a combination of antibodies against TRP-1, TRP-2, tyrosinase, and MART-1, showed that there were no melanoma markers in the SCAM mice. Assays involving immunofluorescence and immunohistochemistry were inconclusive due to the antibodies nonspecific binding; the secondary antibodies bound to tissue even in the no primary controls. FACS staining showed minimal positive staining as compared to no primary controls, though this was also observed in our cervical cancer control cells. There were also positive PCR results, but the water control had positive results as well. The unexpected phenotype, unpigmented crossbreed tumors and data which show no melanoma-associated proteins present in these tumors, indicates that the genotype needs to be reexamined.

A04
Investigation of the Transport of Proline and Glycine Betaine by ProP in *Escherichia coli*

Presenter(s)
Irina Pushel, Illinois Mathematics and Science Academy

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

ProP is a proton-symport transmembrane protein responsible for osmoregulation and transport of compatible solutes into the cytoplasm of a cell when undergoing sufficient osmotic stress. The relative simplicity of *E. coli* and its dependence on ProP to maintain function made it an ideal subject for the examination of the protein's osmoregulatory properties. The focus of this investigation was to analyze the structure of ProP and its relation to the functional transport of proline and glycine betaine into the cell. Using AutoDock Vina and a previously proposed model of ProP, we were able to predict the binding site of both substrates to be located in a hydrophobic pocket between periplasmic loops 1 and 2. The predicted binding affinities for proline and glycine betaine (3.8 kcal/mol and 3.6 kcal/mol, respectively) are in conjunction with previous studies on substrate transport and the role of the anti-parallel coiled-coil orientation of the C-terminus in osmoregulation. Further analysis and experimentation is necessary to more thoroughly elucidate the transport mechanism as far as conformational changes and osmosensing capabilities of the C-terminus are concerned, the results of which could lead to a clearer understanding of the metabolism and adaptations of *E. coli*.

A05
A Mouse Model for Lymphangioleiomyomatosis

Presenter(s)
Vamika Venkatesan, Illinois Mathematics and Science Academy

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

Lymphangioleiomyomatosis (LAM) is a rare lung disease in women of child-bearing age. Slow-growing, but deadly tumors in LAM can be identified by expression of melanoma-associated proteins. LAM is sometimes associated with the disease tuberous sclerosis (TS), another tumor-causing disease. We hypothesized that tumors found in mice prone to TS also express melanocyte proteins, similar to LAM. If these proteins are found, these mice can serve as a model for LAM. Tuberous sclerosis complex tumors from these mice were tested for specific melanocyte proteins gp100, TRP-1, TRP-2, and MART-1. Relevant tissues were tested through Western blotting, reverse transcriptase-polymerase chain reactions, and immunohistochemistry, which did not show any melanocyte proteins. Full length gp100 cDNA was generated from mouse tissue mRNA, cloned into an expression vector, and amplified in bacteria for transfection into mouse smooth muscle cell line MOVAS. Since LAM tumor cells have smooth muscle cell characteristics, stable, gp100-transfected MOVAS cells were generated to mimic LAM cells. Transfected cells will be assessed for smooth muscle actin and gp100 expression before injection into C57B/6 mice. Lungs of injected mice will be dissected to look for melanocyte proteins. If successful, a new model for LAM will be created for use in therapeutic studies.

B01
sP-Selectin as a Diagnostic Biomarker for Stroke Using Integrated Sensing Nanolayers

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

Advisor(s)
Dimitra Georganopoulou, Ohmx Corporation

Social and industrial factors are pushing the field of disease diagnostics away from the costly, time-consuming immunoanalyzers of the past and toward the inexpensive, efficient devices of the future. Ohmx Corporation, a pioneer in developing handheld devices operating biochips modified with self-assembled nanolayers for the detection of various diseases, is researching the use of its technology in diagnosing stroke in emergency settings. This project investigates the implementation of the inflammatory protein sP-selectin, a proposed biomarker for stroke, with Ohmx Corporation's innovative technologies. By comparing sP-selectin concentrations estimated by enzyme-linked immunosorbent assays (ELISAs), the current industry standard for diagnostics, with concentrations estimated by Ohmx Corporation's biochips, I have attempted to assess the applicability of sP-selectin and Ohmx Corporation's technology as a handheld *in situ* diagnostic tool in the clinical arena. My research demonstrated that the biochips estimate sP-selectin concentration with a significant correlation to actual concentration. There is evidence that future development of Ohmx Corporation's proprietary device will be able to replicate ELISA results closely. Overall, this project suggests that with continued research, sP-selectin holds great potential as a biomarker for stroke on Ohmx Corporation's novel handheld platform for immediate stroke diagnosis.

B02
Use of Laser Speckle Contrast Analysis to Detect Changes in Tympanic Membrane Vibrations

Presenter(s)
Wesley Herron, Illinois Mathematics and Science Academy
Elizabeth Richardson, Illinois Mathematics and Science Academy

Advisor(s)
Claus-Peter Richter, Northwestern University

A laser shined on a surface creates a speckled pattern. As the surface moves, the speckles blur together. The blurring can be used to determine the amplitude of the movement. Magnified images taken of a vibrating piezo were analyzed using a technique called laser speckle contrast analysis. The blurred pattern of speckles caused by the vibration and speckle intensities were both analyzed and velocity maps were created using code developed in MATLAB. After creating velocity maps of a piezo vibrating at various speeds, mean contrasts were computed and plotted to form a calibration curve. A similar procedure was then used on a tympanic membrane (TM) of a guinea pig. Images of the membrane vibrating at various sound levels and frequencies and with different volumes of fluid in the middle ear (simulating a middle ear effusion) were taken. After analyzing the images, new contrast calibration curves were plotted and used to compare the changes in vibration pattern(s) between healthy and effused ears. The results show how the TM vibrates differently with the presence of fluid in the middle ear. The aim is that this technique can be used to aid in early diagnosis and treatment of otitis media.

B03
Development of an O-GlcNAc Transferase-Based Therapeutic for Glioblastomas

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

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

A common type of primary brain tumor, glioblastoma multiforme (GBM) is also the most deadly and invasive. As oligosaccharide structures are critical to tumor cell proliferation and invasivity, changing the expression of glycogenes involved in the biosynthesis of these cell surface structures may have therapeutic potential for treating GBM. The o-GlcNAc transferase (OGT) mRNA, a gene that synthesizes these structures, is down-regulated in clinical GBM specimens and malignant glioma cell lines. My research focused on the creation of GBM cell lines with different levels of expression of OGT mRNA transcript variants 1 and 2, and using these modified cell lines to study the effect of increased expression on cellular proliferation, adhesion to the extracellular matrix, and altered signal transduction. Human U373MG glioma cell lines with increased expression of both OGT variants were created through liposomal-mediated transfection. The level of OGT mRNA expression for each of the resultant fifty clones was determined by qRT-PCR. A low, medium, and high expresser for each variant was selected, and altered cellular adhesion to human fibronectin matrix was demonstrated in each clone. Signal transduction assays are underway to determine if altered adhesion-mediated protein tyrosine phosphorylation plays a role in this altered adhesion. These results set the stage for experiments to determine if forced expression of OGT alters *in vivo* tumorigenicity in preclinical mouse models.

B04
Creating a Virtual Fly Through of the Human Brain's Ventricular System

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

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

The ventricular system in the human brain is extremely difficult to visualize using traditional MRI or CT scans. However, it has recently become possible to piece together three dimensional digital reconstructions of the brain's ventricles. Our goal was to create a video animation that simulated flying through these structures. The reconstruction of the ventricles (created previously) was imported into a program which could export the model as well as the coordinates of cerebrospinal fluid particle path lines into an animation program. Then, using the coordinates, we created path lines for the particles and a virtual camera. Time coordinates were entered for all moving objects, resulting in a video that yielded a smooth journey with accurate velocities based off of cerebrospinal fluid flow. In the final editing program, not only were captions added but also a video insert which showed where the camera was traveling by viewing the ventricles from the outside. In all, two videos were created: one that mimicked flying through solely the ventricles and another that flew through the ventricles and subarachnoid space. It is hoped that this video is informative and offers students and educators of all ages another perspective of the human brain's ventricular system.

B05
Direct-to-Consumer Genetic Testing Patents: A 2010 Update

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

Advisor(s)
Simon Lin, Northwestern University

With the rise of sequencing technologies that allow scientists to rapidly test a section of DNA, the business of direct-to-consumer genetic testing has grown tremendously since 2008. New methods to improve genetic testing are being developed that will benefit the consumer. In this investigation, six recent patents concerning the field of consumer genetic testing were researched. Then, a summary of each patent was written along with an analysis of how the patent created a novel product or process and how it would affect the field of genetic testing. Three of the patents concerned the entire process of direct-to-consumer genetic testing. These three patents dealt with issues such as anonymity of the consumer, efficiency of the genetic testing process, and continued research about genes of interest being delivered to the consumer. Two of the other patents created processes for comparing the genetic information of individuals and how to develop user-friendly ways to display the comparison results. The final patent was related to providing information to the internet securely. These patents demonstrate that the field of genetic testing is moving towards creating a process that is more accessible to the consumer by increasing security, privacy, understandability, and efficiency.

B06
Designing a Robotic Stroke Therapy System Suitable for Patient Use in Residential Settings

Presenter(s)
Mahir Khan, Illinois Mathematics and Science Academy

Advisor(s)
Patrick Rousche, University of Illinois at Chicago

Stroke is one of the leading causes of death worldwide, and it is known to result in paralysis and loss of mobility. Stroke therapy is necessary for several patients; however, a lack of clinical therapy is available. Robotic therapy is currently available, but exclusively in university clinics. This engineering design project attempted to produce a model that is feasible for stroke victims to utilize in a residential setting for therapy. Literature was reviewed in order to learn about stroke and rehabilitation. Google SketchUp software was used to create designs for the model. The model needed to be portable, robot-enabled, electrically powered, and connected to the Internet for optimal efficiency. Design was based on the necessity of patients, and a prototype has been constructed using ordinary office materials. We hope to use metal or wood to create a more practical model soon. The current prototype's dimensions are thirty-six inches by twenty-four inches by twelve inches. The results of this investigation are an attempt to progress the current state of therapy to better utilize technology. This type of model can hopefully impact the future of bioengineering so that stroke patients have their own therapy systems to take home in the near future.

B07
Improving Auscultation Methods in the Human Body

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

Advisor(s)
Thomas Royston, University of Illinois at Chicago

Auscultation, the practice of listening to sounds produced by and transmitted through the body, is a skill many physicians lack. According to a study by the Mayo Clinic, very few physicians can accurately diagnose based on auscultation. Determining a computational way to quantify and interpret results from acoustic data would significantly advance research, education, and clinical practices. Through literature review, mathematical modeling, physical modeling, and human testing, several new means of gathering acoustic data have been developed. These new ways have shown, through testing, to be capable of producing reliable data. More conclusive testing of the devices is underway to more thoroughly verify that they can perform as intended. What's more, preliminary sample data about the acoustic response of the lung parenchyma has also been gathered. These results will change the way scientists use auscultation and view the acoustic response of the human body in general.

B08
Characterization of Membranes Used in Micropumps

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

Advisor(s)
Farid Amirouche, University of Illinois at Chicago

With the rise of unhealthy diets, diabetes has become epidemic in America. To help in treatment of diabetics, micropumps, which are safer, less expensive, and less obtrusive than conventional treatment methods, have been developed. Micropumps can be categorized into two groups: dynamic and displacement. Dynamic pumps use physical properties of the target fluid to induce movement while displacement pumps exert a force on the fluid with a movable barrier to cause motion. Insulin pumps often employ displacement pumps with diaphragms. The flow rates, volume displacement accuracy, and failure criteria for these pumps are determined by the properties of the diaphragm. For this research project, a Nanoindenter™ XP manufactured by MTS was going to be used to determine the relationship between thickness and elasticity of common diaphragms used in insulin micropumps. Nanoindentation devices such as the Nanoindenter™ XP press diamond tips into thin membranes to determine, among other physical quantities, their elasticity. However, the only available Nanoindenter™ XP was in need of a new diamond tip and fixation. Therefore, the experimental part of the research was halted and focus turned to a literature review summarizing the subjects of nanoindentation and micropumps and also providing a rationale for the experimental procedure.

B09
The Binding Kinetics of sLE^x for P-/E-selectins

Presenter(s)
Tiffany Sinclair, Illinois Mathematics and Science Academy

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

It is known that circulating tumor cells (CTCs) interact with endothelial cells in blood vessels during metastasis. Cell rolling plays a key role in the initial step of cancer metastasis, that is, extravasation of CTCs. To identify the interaction of cancer cells with endothelial cells, it is crucial to know which ligand has binding affinities with receptors on vascular endothelial cells, for example E- and P-selectin. sLE^x, one of many covering glycoproteins on cancer cell membrane, was known as a ligand against E- and P-selectins. To compare the strength of their interactions in overcoming shear stress against flow stress, binding kinetics and affinity of sLE^x against each selectin were measured by a BIAcore instrument based on surface plasmon resonance. After evaluating binding kinetics for obtained binding curves of sLE^x, we found that sLE^x has a binding affinity for both P- and E-selectin, though affinity for E-selectin (KD = 78.3 nM) was roughly three-fold higher than that of P-Selectin (KD = 210 nM). This suggests that the decoration of sLE^x on glycoproteins may enhance cell interaction with E-selectin-expressed endothelial cells against shear stress. Using adhesive proteins such as selectin and their known ligands, the adhesive protein-immobilized surface can induce cancer cell rolling.

B10
Left Ventricular Assist Device Development in the United States and Japan

Presenter(s)
Mao Yamakawa, Illinois Mathematics and Science Academy

Advisor(s)
Kyo Shunei, University of Tokyo

The usage of left ventricular assist devices (LVADs) as a bridge to transplantation (BTT) and destination therapy (DT) has been a critical issue addressed by the medical community, as an alerting number of cases of end stage heart failure has been affecting patients. This inquiry focuses on the difference of waiting periods of donor hearts, legality issues, and ultimately the rationale behind modern LVAD inventions in the United States and Japan, in order to examine the trends of LVAD improvements and modifications. The evidence behind the research largely corroborates the predictions and observed approach of device production in Japan, due to the fact that this project was conducted at the University of Tokyo. This study narrows possible predictions that could be made towards the future technological innovations of LVADs in Japan and the United States, and discusses what role each country will play in international LVAD production. From my research it could be observed that due to the difference in waiting period for donor hearts, the rationalization of enhancements and the enhancements themselves are altered between both countries.

C01
Spontaneous Calcium Release at the Sub-Cellular Level

Presenter(s)
Lisa Akintilo, Illinois Mathematics and Science Academy
Megan Wu, Illinois Mathematics and Science Academy

Advisor(s)
J. Andrew Wasserstrom, Northwestern University

Spontaneous calcium release (SCR) during intracellular calcium overload triggers extra heart beats and arrhythmias. However, we do not know how this occurs. The goal of this study was to investigate how SCR synchronization occurs between cells and how this causes a depolarization and an increase in the likelihood of spontaneous beats. We extracted a rat heart and kept it alive by immersing it in an artificial blood solution. We loaded the heart cells with various concentrations of calcium in the external solution and altered the heart rate to record images of spontaneous calcium release. After obtaining this data we analyzed the images to determine the correlation between concentration of calcium and pacing of the heart to the likelihood of SCR. Results showed that during calcium overload, spontaneous calcium release occurs earlier and becomes progressively more coordinated between myocytes. The greater the coordination of the calcium release, the greater the depolarization of that tissue, increasing the likelihood of a spontaneous heart beat. When we use experimental means to produce calcium overload in the myocyte, SCR between cells becomes more synchronized. Greater synchronization causes depolarization, which leads to a greater likelihood of spontaneous beats and arrhythmias.

C02
Exploring the Cause of acd6-1 Phenotypes Expression in *Arabidopsis*

Presenter(s)
Morenibayo Bankole, Illinois Mathematics and Science Academy

Advisor(s)
Joanna Jelenska, University of Chicago

The presence of the *acd6-1* gene mutation in *Arabidopsis* is reflected by improved plant defenses, dwarfism, and accelerated cell death among other traits. However, these phenotypes are not expressed when the plants are grown in higher temperatures. Wild type and *acd6-1* plants were grown in different temperatures and they were observed in order to document phenotype changes. Our hypothesis pointed to salicylic acid as the reason for the difference in expression of the *acd6-1* phenotype. Production of salicylic acid is regulated by the ICS1 (isochromate synthase 1) protein. Protein extracts were put through gel electrophoresis and Western blot in order to observe protein expression. Through the Western blot, we discovered that the cause of the phenotype expression at certain temperatures was not directly related to the production of ICS1. Some mutants grown did exhibit the *acds6-1* phenotype at higher temperatures; however they have not been studied in close detail yet. The expression of *acd6-1* is linked to temperature, however it is not yet known how. The experiments carried out have shed some light on the nature of the mutation and the proteins it acts through and made easier further studies to investigate the nature of this mutation.

C03
Optimization of a DNA Sequencer

Presenter(s)
Aryssa Burton, Illinois Mathematics and Science Academy

Advisor(s)
Jamie Tweedle, Illinois Mathematics and Science Academy

Students often learn how polymerase chain reactions (PCR) can be used for DNA sequencing but are usually not given the chance to determine specific sequences of DNA themselves. Besides medical and research purposes, DNA sequencing is also a valuable educational tool. This experiment investigated ways of optimizing procedures for DNA sequencing to be used in high school and undergraduate classes. To produce the most efficient methods possible, several PCR reactions and trials of DNA sequencing were run with varied conditions and reagents. Differing amounts of ExoSAP-IT (a PCR clean up protocol), DNA template, buffers, DNA Taq polymerase, dNTPs and ddNTPs were tried in order to find the optimal amount of each. Trials were run with varying DNA templates and primers. The annealing time, elongation time and temperatures in the PCR reactions were varied to create optimal results. The DNA sequencer will be run multiple times to correct errors in procedure and to produce clear results .The outcome of this experiment may help students learn about DNA sequencing with greater ease. Teachers may also use these procedures to implement lab activities with minimal time preparation and at a smaller cost.

C04
A Study on the Possible Correlations between Patients with Cardiac Sarcoidosis

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

Advisor(s)
John Beshai, University of Chicago

Sarcoidosis is a multi-organ disease, of unknown etiology, in which there is an infiltration of granulomas within soft tissue. Cardiac sarcoidosis is a major concern because it accounts for sixty-five percent of sudden deaths in patients with sarcoidosis. Though the cause is unspecified, some studies show a predisposition within families, monozygotic twins, African Americans, and females. We hypothesized that the blood work parameters and the pulmonary function parameters would show a high correlation within the patients that had cardiac sarcoidosis versus the patients with other forms of sarcoidosis. We analyzed data collected from multiple patients with sarcoidosis (cardiac and noncardiac). We conducted two-tailed t-tests on twenty-three parameters, assuming equal or unequal variance based on individual f-tests. We found a statistical difference in the means of the two groups (patients with cardiac versus non-cardiac sarcoidosis) within four of the parameters: septal late diastolic mitral annular velocity ($p=0.0158$), forced vital capacity ($p=0.0099$), forced vital capacity percent ($p=0.0276$), atrial peak filling ($p=0.0287$). These statistical differences found in the two groups show a correlation between the four parameters and patients with cardiac sarcoidosis. This can help predict future cases of cardiac sarcoidosis.

C05
Transition Rates of Oak Trees After Death Due to *Armillaria*

Presenter(s)
Wen Chen, Illinois Mathematics and Science Academy
Wen Li Chen, Illinois Mathematics and Science Academy

Advisor(s)
Dennis Nyberg, University of Illinois at Chicago

Trees capture CO_2 from the air and turn it into decay-resistant compounds. Tree death causes captured carbon to be eventually returned to the atmosphere, but the length of time and transitional stages that the tree undergoes during that return are little studied. An oak woodland site of 1267 m^2 with trees dying due to fungal disease was inventoried several times from 1993 to our 2010 study. Disease converts living trees into snags which fall down and become logs which eventually disappear. In 1993 the plot contained forty-four trees and fifty-eight trunks, thirty-one of which were alive. Between 1993 and 2000, sixteen trees died. The fourteen trees still alive in 2010 have a growth rate calculated to average 0.8 cm of diameter/year. Trees that were snags in 2000 have all fallen down by 2010, but only two of the twenty-two logs that existed in 2000 have disappeared by 2010. Almost all trees and snags mapped in 1993 are still present as down logs in 2010, despite four fires. While part of the carbon of the log is returned to CO_2 before the log is gone, transition rates we measured suggest that oak trees store carbon for many years after death.

C06
Cleaners and Their Effects on Bacteria

Presenter(s)
Nitin Chilukuri, Illinois Mathematics and Science Academy
Jongmin Lee, Illinois Mathematics and Science Academy

Advisor(s)
Julie Polz, Illinois Mathematics and Science Academy

Many students miss school due to illness, which can be avoided with better sanitation practices. In this project, different brands of cleaning solutions are used on bacteria to compare their effects. Five different brands were used: Windex, 409, Clorox Green Works, Greased Lightning, and the cleaner most used at IMSA. The common bacteria used in this experiment were *Staphylococcus epidermis*, *Escherichia coli*, and *Bacillus cereus*. Paper discs were soaked in a specific cleaning solution for ten seconds and placed in nutrient agar plates that were smeared with five-hundred microliters of a specific bacterium. The averages of the radii of the area of inhibition were compared. Data is still being collected, but from the information we have, it can be understood that Greased Lightning works best against *Escherichia coli* and *Bacillus cereus*; overall *Escherichia coli* is more resistant than *Bacillus cereus*. The information from this experiment can be used to help protect students from some illnesses.

C07
A Genome Wide Association Study of Carotid Artery Plaque

Presenter(s)
Imran Choudhry, Illinois Mathematics and Science Academy

Advisor(s)
Habibal Ahsan, University of Chicago
Brandon Pierce, University of Chicago

The buildup of carotid artery plaque can have deadly consequences, which can be avoided by early detection and treatment. One pathway to prevention could be uncovering genomic factors that are associated with increased susceptibility to this disease. A genome-wide association study facilitates such discovery, allowing us to search for correlations between observable disease and germline genetic variants, using large samples of individuals typed for >200,000 genetic variants. To ensure the validity of any associations found, many quality control procedures were carried out, including identifying (and excluding) individuals with (a) incorrectly reported gender, (b) genetic relatedness to other participants, (c) elevated heterozygosity, (d) high levels of missing data or (e) ancestry that differs from the other participants. In addition, genetic variants with high levels of missing data or deviations from Hardy-Weinberg equilibrium must be excluded. Using statistical programs such as R and PLINK, both of which utilize command line-based interfaces, we tested ~250,000 genetic variants for association with a clinical measure of carotid artery plaque within three ethnic groups: whites (n=160), blacks (n=230), and Hispanics (n=530). We have identified several candidate genes that should be investigated in future studies.

C08
Evi1 Cooperation with a Haploinsufficient Egr1 to Develop Myeloid Neoplasms

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

Advisor(s)
Michelle LeBeau, University of Chicago
Angela Stoddart, University of Chicago

Therapy-related myelodysplastic syndrome and acute myeloid leukemia (t-MDS/t-AML) are late complications of cytotoxic therapy used for treating cancers, and are usually characterized by the deletion of chromosomes 5 and/or 7 [-5/del(5q), -7/del(7q)] and a poor prognosis. Early growth response 1 (*EGR1)*, a candidate tumor suppressor gene within the commonly deleted segment of 5q that encodes a zinc finger transcription factor, was determined to act by haploinsufficiency and to cooperate with second hit mutations induced by alkylating agents to cause myeloid leukemias. To identify the mutations that cooperate with this haploinsufficiency, we used retroviral insertional mutagenesis. We have injected cohorts of *Egr /*, *Egr1 /-*, and *Egr1-/-* neonate nice with the MOL4070LTR retrovirus. The *Egr1 /-* mice injected with MOL4070LTR developed myeloproliferative disease (MPD) or AML with a shorter latency and at a higher overall frequency than the controls (*Egr1 /* mice). An initial analysis of the retroviral integrations has identified a common insertion site upstream of the *Evi1* locus. Moreover, the *Evi1* transcription factor gene was over-expressed (7-1671 fold) in *Egr1 /-* mice that developed MPD or AML compared to the controls. In humans, transcriptional activation of *EVI1* is often associated with AML. Since many t-MDS/t-AML patients have abnormalities of chromosome 5, chromosome 7, or both, our data may suggest that Evi1 cooperates with haploinsufficient levels of Egr1 to develop myeloid neoplasms.

C09
Investigation of the Mechanisms of Cholesterol Modulation of Inward Rectifier Potassium Channel Function

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

Advisor(s)
Yulia Epshtein, University of Illinois at Chicago
Irena Levitan, University of Illinois in Chicago
Avia Rosenhouse-Dantsker, University of Illinois at Chicago
Dev Singh, University of Illinois at Chicago

Today over 42 million Americans are diagnosed with hypercholesterolemia, or high levels of cholesterol, and 63 million more have borderline hypercholesterolemia. However, many do not fully understand the risks of having high cholesterol. On the molecular level hypercholesterolemia causes much more damage than what is visible on the outside including modulating the function of inward rectifier potassium (Kir) channels possibly by binding to them. The dysfunction of these channels can eventually lead to heart failure. However, the exact mechanism by which cholesterol affects Kir channel function is unknown. Our goal is to gain insight into the mechanism by which cholesterol affects channel function by investigating the effect of mutations in the channel on cholesterol sensitivity. As a first step to achieve our goal, we have designed and made several mutants whose effect on cholesterol modulation on Kir channels will be tested in future. We hope that through our research we can shed some light on ways to prevent cholesterol effect on Kir channels and reduce some of the negative ailments caused by hypercholesterolemia.

C10
Validation Lactate Dehydrogenase2 in the Parasite *Toxoplasma gondii* with Respect to Its Effect on the Growth, Survival, or Persistence of the Parasite in Tissue Culture and *in vivo*

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

Advisor(s)
Rima McLeod, University of Chicago

Toxoplasma gondii, a parasite that infects over one-third of the world's population, damages eyes and brain. The bradyzoite stage persists in all infected people and no medicines can eradicate it. In this stage, the gene lactose dehydrogenase 2 (LDH2) catalyzes the reaction of lactate to pyruvate, providing energy to the parasite. The purpose of the investigation is to determine whether this gene is essential for the parasite to persist. If so this protein would be validated as a molecular target against which medicines can be directed to eliminate latent infections. A conditional knock-down was created and inserted into the parasite DNA. This was completed by mapping out the promoter region to find the ideal place to insert the tetracycline response elements. Four tetracycline operons (tet-o) were successfully added to this region of the promoter by site directed mutagenesis. The plasmid was amplified in *E. coli*, purified via maxi-prep, and transfected into the parasite. The parasite is currently being observed in both fibroblasts and mice brain to see possible changes in cyst formation. These results have will contribute to validation of LDH2 as a molecular target and thus to improved medicines.

C11
Molecular Mechanisms of Bone Marrow Stem Cell Maintenance and Mobilization

Presenter(s)
Ingrid Hsiung, Illinois Mathematics and Science Academy

Advisor(s)
Min Cheng, Northwestern University
Qin Gangjian, Northwestern University

The new concept of cell-based therapies can eliminate prior heart-disease therapy limitations of restenosis through stimulating stem cells to grow into new vessels and cardiomyocytes to repair ischemic heart tissue. Since proteins CXCR4 and c-kit play major roles in bone marrow-derived endothelial progenitor cell mobilization, CXCR4 relations with c-kit were discerned through counting mobilized endothelial progenitor cells and treating c-kit deficient (c-kit W/W-V) and wild type (WT) mice with CXCR4 antagonist AMD3100 and agonist SDF-1. Through using procedures including DNA isolation, PCR, Western blot, co-immunoprecipitation, colony assay, proliferation assay, and bone marrow isolation, it was learned that CXCR4 and c-kit are related. In both *in vitro* and *in vivo* studies, CXCR4 regulated c-kit activity. In c-kit knockout mice, fewer cells were mobilized, confirming that CXCR4 needs c-kit to mobilize cells; while in the wild type mice, cells were mobilized. In the *ex vivo* adhesion assay, AMD3100 attenuated c-kit phosphorylation. Activating CXCR4 upregulates c-kit activity and blocking CXCR4 downregulates c-kit activity. This research is expected to contribute to eventually developing a low-risk, successful cure for ischemic heart disease.

C12
Evidence for Evolutionary Reductions in the ß-adrenergic System of the Texas Toad, *Bufo speciosus*

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

Advisor(s)
James Carr, Texas Tech University

Background adaptation refers to a predator avoidance mechanism present in certain animals, such as the frog *Xenopus laevis* and the toad *Bufo speciosus*. Proportionate to the level of external lighting, melanophore stimulating hormone (MSH) is released to trigger melanin dispersion within melanocytes, resulting in temporarily darkened skin. Epinephrine binding to β-adrenoceptors underlies the initiation of background adaptation in *X. laevis*, causing immediate skin darkening before the MSH system activates. *B. speciosus*, however, lacks this stress-response mediated accelerated coloration. This study, through radioligand binding assays and high performance liquid chromatography quantification of integumentary catecholamines, shows significantly lower [^{3}H] DHA binding and epinephrine and dopamine levels associated with *B. speciosus*, implicating both reduced β-adrenergic binding sites and diminished ligand concentration as responsible for *B. speciosus'* inability to rapidly background adapt. Given the nocturnal and fossorial behavioral characteristics of *B. speciosus*, this investigation reveals a coevolutionary loss of both the receptor and signal within a stress-response system deprived of a stressor. Such a finding suggests similar stress mechanism variation may exist among human populations with divergent life histories. Such evolved differences may influence group-specific disease rates, an important consideration in personalized medical treatment.

C13
Search for Lipid and Enzymatic Markers of Chronic Alcoholism

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

Advisor(s)
Glyn Dawson, University of Chicago
Sylvia Dawson, University of Chicago
John Kilkus, University of Chicago
Jingdong Qin, University of Chicago

Chronic alcoholism, a major health concern throughout much of the world, has promoted research on the diverse molecular effects of alcohol on the brain. Our own investigation sought to understand the differential membrane lipid composition and associated enzyme activity in tissue damaged by alcohol abuse. We conducted thin layer chromatography to identify and measure unique lipids, such as phosphatidylethanol, within the membranes of ethanol treated cells. Numerous hydrolase assays were also run to quantify enzymatic activity within and surrounding human oligodendrocyte (HOG) cells subjected to varying ethanol doses. Activity was measured through the processing of fluorescent-tagged substrates by their corresponding enzyme, graphed as fluorescence per unit of protein or volume. Our study found that several enzymes, including β-hexosaminidase A and β-glucuronidase, show inhibited activity with increasing ethanol dose treatments. Interestingly, other enzymes, in particular α-mannosidase, display significantly higher levels of activity in the cellular media following ethanol treatment. These findings may help identify a biochemical marker for chronic alcoholism, which can be used to diagnose the disorder. In addition, our results may aid the development of drug-based therapies for alcoholism by identifying potential enzymatic targets for such treatments.

C14
The Role of Pigment Epithelium-Derived Factor in the Expression of p21 and p27 in Pancreatic Cancer

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

Advisor(s)
Paul Grippo, Northwestern University

Pancreatic cancer, a disease with high mortality rate, is known for its rapid growth and metastasis, due, in part to an unregulated cell cycle. Pigment epithelium-derived factor (PEDF) is an anti-angiogenic protein, observed at decreased levels in cancerous cells. The expression of p21 and p27, cyclin dependent kinase (CDK) inhibitors, may be correlated with the expression of PEDF. Some studies suggest that p21 and p27 undergo random genetic mutations resulting in reduced or no expression in cancer cells. Thus, we hypothesize that in mutant Kras mice with complete loss of PEDF, there will be a decrease in p21 and p27 protein expression. Through Western blotting, p21 and p27 are being probed with mouse-monoclonal antibodies in both wild-type and knock-out mice. Although all the results have not been analyzed, there appears to be a significant correlation with PEDF; reduced PEDF leads to an astonishing increase in p21 and p27. DNA sequencing will help identify if these CDK inhibitors have been mutated, which can lead to altered cell cycle function. PEDF administration to these cells may reestablish proper expression levels and function of p21 and p27, restoring normal cell cycle and reversing cancer development, thus serving as a potential therapeutic.

C15
Alterations in Hsp27

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

Advisor(s)
Jody Martin, Loyola University

Heat shock proteins (HSP) are widely recognized as a necessity for protecting the cells against stresses such as extreme temperature, ultra violet light, or oxidants which interfere with normal cell functions and often result in necrosis. In response to environmental strains, stress activated pathways phosphorylate HSPs which oligomerize and chaperone processes essential to survival. One HSP mutation, C137A, was investigated because scientists theorize the reactive properties of cytosine are responsible for the protective nature and localization of HSPs within the cell. H9c2 myoblast cells transduced with green fluorescent protein, Hsp27, Hsp27 tagged with cyan fluorescent protein (CFP), Hsp27 with a C137A amino acid mutation fused with CFP, a blank virus, or nothing were treated with four dilutions of a H_20_2, nothing (control), or heat shocked. After being incubated for 4.5 hours, the cell cultures were tested for survivability and protein content. As expected, a general trend of increased survivability was shown in the H9 cells overexpressing Hsp27, but, surprisingly, the fusion proteins showed a decrease in survivability and the C137A mutation showed no significant difference. Similarly, time lapse microscopy showed no difference in localization between the C137A alteration and the controls. The data confirms the protective nature of Hsp27, and it also cautions about the use of fluorescent fusions and other proteins because of their detriment to the function of HSPs.

C16
Effect of Interleukin-6 Deficiency on Obesity-Induced Inflammation in Adipose Tissue in Mice

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

Advisor(s)
Giamila Fantuzzi, University of Illinois at Chicago
Maria Pini, University of Illinois at Chicago
Davina Rhodes, University of Illinois at Chicago

If the molecular root of problems that occur in overweight people was found, many would lead healthier and happier lives. The implications of studying the effect of interleukin-6 (IL-6) deficiency on obesity-induced inflammation in mice encompass possibly preventing or stopping inflammation from happening in adipose tissue. Ten lean wild type (WT) mice, ten lean IL-6 KO mice, fifteen high-fat diet-fed (HFD) WT mice, and fifteen HFD IL-6 KO mice all started out at the same age and at similar weight. After three months, the HFD mice weighed an average of 14.57 grams more than the lean mice. To analyze the frequency of genes present in the adipose tissue, I used the trizol method for RNA isolation, RT-PCR, qPCR, and ELISA testing. I also analyzed the results of a glucose tolerance test performed on the mice. I found that the HFD mice and the lean mice had significantly different weights and glucose tolerance test levels. However, the HFD IL-6 KO mice and the HFD WT mice did not have significantly different weights or glucose tolerance test levels, nor did the lean IL-6 KO and lean WT mice. HFD IL-6 KO mice had significantly higher MCP-1 levels than any other mouse, but otherwise HFD IL-6 KO mice showed similar inflammation patterns as HFD WT mice; however, more research needs to be done to test other genes involved in inflammation.

C17
Role of Interleukin-1-β in Modulating Immune Responses

Presenter(s)
Luke Nayak, Illinois Mathematics and Science Academy

Advisor(s)
Balaji Ganesh, University of Illinois at Chicago
Bellur Prabhakar, University of Illinois at Chicago

Common autoimmune disease such as Hashimoto's thyroiditis, type 1 diabetes, and rheumatoid arthritis affect over eight and a half million Americans. Autoimmunity is caused by a perturbation of the immune system, particularly T cells. Cytokines including IL-1-β have a crucial role in determining the fate of immune response and the maintenance of immune homeostasis. Earlier studies in the lab had established the pro-inflammatory cytokines including IL-1-β secreted by inflammatory dendritic cells (DCs) may cause autoimmunity. In this investigation, I have tried to study the role of IL-1-β on DCs and their subsequent effects on T cells. This problem was approached by characterizing DCs for their phenotype upon treatment with IL-1-β. Methodologies used included RNA isolation, RT-PCR, and DC and CD4 T cell separation. Preliminary results showed that there was an issue with a primer, resulting in false positives. After changing primers, subsequent experiments showed that IL-1-β had no direct effect on DCs. Instead, it affected T cells and in an unexpected manner. This result is interesting because past scientific literature suggests that IL-1-β drives effector T cell response. Our results contradict these previous observations and interestingly show a significant increase in the regulatory T cell population.

C18
A Novel Approach to Erythroid Kruppel-Like Transcription Factor: Its Role in Megakaryopoiesis

Presenter(s)
Cassie Parks, Illinois Mathematics and Science Academy

Advisor(s)
John Cunningham, University of Chicago

Erythroid Kruppel-like transcription factor (EKLF) plays a key role in the differentiation of the megakaryocyte–erythrocyte progenitor (MEP), a hematopoietic bipotential progenitor. Initially believed to be involved solely in erythropoiesis, more recent studies suggest an additional essential role in megakaryocytic differentiation. Here, I examine the effect EKLF has upon specific megakaryocytic gene expression during the latter stages of this process. I used the Real-Time Polymerase Chain Reaction (RTPCR), an assay which measures specified genes, replicating gene sequences exponentially, and measuring the mass of the resultant DNA. One gene we targeted was *Tubulin β-1*, whose protein product is present on the surface of proplatelets, the progeny of megakaryocytes . Quantitative RTPCR showed that *Tubulin β-1* Chain expression was diminished in day 8 knockout (KO) megakaryocytes as compared to day 8 wild type (WT) megakaryocytes. Conversely, Tubulin expression was up-regulated in day 4 KO megakaryocytes as compared to day 4 WT megakaryocytes. These results, consistent with a lack of proplatelet production, suggest that EKLF is necessary for the formation of proplatelets in the latter stages of megakaryopoiesis.

C19
Pathogenic Entry of Herpes Simplex Virus: Syndecan Coreceptor Expression

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

Advisor(s)
Ghadah Karasneh, University of Illinois at Chicago
Deepak Shukla, University of Illinois at Chicago

The herpes simplex virus (HSV) is one of the most prevalent sexually transmitted diseases that infects nearly thirty to ninety percent of the adult population. An essential stage of HSV pathogenic entry is the binding of viral glycoproteins to heparan sulfate proteoglycans (HSPG) on the host cell surface. HSPGs are complex molecules composed of core proteins covalently attached to glycosaminoglycan chains. Syndecans are a family of four HSPGs that serve as coreceptors in herpes simplex viral entry and are the focus of our study. We investigated varied syndecan expression in different cell lines and looked to determine a correlation between the expression and infectivity of the virus into these cells. Syndecan fluorescence was measured across four different lines: human cervical cancer cells (HeLa), human corneal epithelial cells (HCE), retinal pigment epithelial cells (RPE), and vaginal keratinocyte cells (VK2) using flow cytometry. Each line was also tested with a plaque assay in order to quantify virus infectivity and compare the results with syndecan expression. Data analysis is currently ongoing and a correlation is yet to be found.

C20
The Prevalence of CTX-M, SHV, and TEM-Producing *E. coli* Recovered from Urine Cultures

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

Advisor(s)
Chao Qi, Northwestern University

This study investigates the prevalence of different populations of extended-spectrum beta-lactamase (ESBL) *E. coli* in the community and the hospital. Two-hundred and four inpatient and one-hundred and fifty-one outpatient *E. coli* isolates collected from outpatient/inpatient urine samples from 2003 to 2009 have been tested for the presence of the genes *blaCTX-M*, *blaSHV*, and *blaTEM*. Having the specific conditions of the PCR protocol determined by previous literature, gel electrophoresis established the genotypes of the isolates. Kirby-Bauer agar dilution will be used to develop antibiograms for the three strains. Currently, testing for CTX-M has been completed for all isolates. This project will broaden the scope of our understanding of the epidemiology of ESBL *E. coli* and the antibiotic sensitivity tests will reveal to us a more efficient empiric therapy.

C21
Role of a Conserved Acidic Patch on the Protein Interactions of the Mixed Lineage Leukemia Gene

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

Advisor(s)
Manuel Diaz, Loyola University
Ute Osmers, Loyola University

Myeloid lymphoid leukemia (MLL) is a multi-domain protein involved in the regulation of genes important during embryogenesis and hematopoiesis. When breakage of the MLL gene occurs, it can be translocated to over fifty fusion partners, producing a chimeric gene which can lead to leukemia. The goal of this project was to investigate the purpose of a conserved acidic patch of amino acids in a domain of MLL called PHDf3 by mutating the DNA sequence encoding the acidic patch to test the function of MLL. Since Cyp33 and trimethylated histone H3K4 interact with the PHDf3 domain of MLL, we first wanted to test whether the mutation of the acidic patch affected binding of Cyp33 or trimethylated histone H3K4 to PHDf3. The interaction was tested by a co-immunoprecipitation using hemagglutinin-tagged PHDf3 with flag-tagged Cyp33 and glutathione-S-transferase-tagged PHDf3 with synthetic H3 peptides. After having established that the interaction is not affected, the wild type and mutated MLL protein can be tested with other functional assays.

C22
The Effects of Wnt on Active Transforming Growth Factor β Levels

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

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

Scleroderma is an autoimmune disease with unidentified causes and no cure due to an incomplete understanding of the relationship between scleroderma and the proteins promoting the disease. Transforming growth factor beta (TGF-β) plays an important role in cell function and is known to stimulate fibroblasts which synthesize collagen. When there is an over production of fibroblasts, the excess collagen created leads to fibrosis and ultimately forms scleroderma. TGF-β is known to have a connection with a complex network of proteins, called wnt, which are also essential in cell function and have a role in tissue repair and fibrosis. Other studies found a correlation that wnt increases levels of TGF-β. To address this relationship, cells were treated with wnt for a period of three or five days. Then an enzyme-linked immunosorbant assay was employed to calculate the levels of activated TGF-β in the cells. According to the data collected, there was an increase of activated TGF-β levels in wnt treated cells, which confirmed previous studies. These results substantiate that TGF-β levels are amplified due to wnt, providing a better understanding of scleroderma etiology.

C23

Long Term Human Pancreatic Islet Cell Viability with PMCG Capsule in CMRL 1066 Culture Media

Presenter(s)
Kevin Shi, Illinois Mathematics and Science Academy
Vivek Thakkar, Illinois Mathematics and Science Academy

Advisor(s)
Jose Oberholzer, University of Illinois at Chicago
Meirigeng Qi, University of Illinois at Chicago
Yong Wang, University of Illinois at Chicago

Within pancreatic islets are insulin-producing beta cells (β-cells) that function to breakdown glucose in the body. Type I diabetes is characterized by the dysfunction of β-cells; the resulting insulin deficiency can lead to hyperglycemia (high blood glucose levels). To prevent hyperglycemia islets can be isolated from a donated pancreas and transplanted to a diabetes patient. Synthetic, gel-like membranes (capsules) composed of sodium alginate encapsulate and prevent islets from being degraded by immune rejection within the diabetic host. Assurance of the long term viability of encapsulated islets is necessary to optimize human islet transplantation. Our experiment focused on viability outside the body using islets encapsulated by a PMCG alginate capsule in CMRL 1066 culture media made up of various salts to mimic environment within the body. Specifically, the islet viability test, glucose static incubation test, ditizone test, and capsule size observation were applied to determining islet viability over six weeks. Although no significant difference has been observed between the encapsulated and free islets (control group) in terms of viability, we expect that the encapsulated cells will eventually have a significantly greater viability. If the desired results are achieved, researchers can speculate about the efficiency of islet-protecting PMCG capsules within the human body.

C24
Effect of *Dnmt3b* Deficiency on Mediastinal Lymphoma Frequency and the DNA Methylation Status of the *Thrap1*, *Bri3bp*, and *Mum1* Genes

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, or the attachment of a methyl group to specific cytosines in the genome, is altered in cancer cells. Previous studies have shown that aberrant transcription of the *DNMT3B* gene is common in human cancers. When one of these aberrant forms, *DNMT3B7*, was introduced into *Eμ-Myc* transgenic mice, the mice developed mediastinal lymphomas (cancer) at a frequency of approximately fifty-five percent, whereas the single transgenic *Eμ-Myc* mice developed mediastinal lymphomas at a frequency of only fifteen percent. This result suggested tumors that develop in *Eμ-Myc* transgenic mice are very dependent on DNA methylation. In this study, we look at what happens when we remove one copy of *Dnmt3b* from the mouse genome (*Eμ-Myc/Dnmt3b+/-*). We discovered that this type of mouse developed mediastinal lymphomas at an alarming frequency of almost 100%. We looked at the DNA methylation the genes *Thrap2, Bri3bp,* and *Mum1* in these *Eμ-Myc/Dnmt3b+/-* tumors. Our preliminary studies show that in comparison to *Eμ-Myc* and the *Eμ-Myc/DNMT3B7* tumors, *Mum1* and *Thrap2* are hypomethylated. Taken together, these data suggest that alteration of *DNMT3B* function, either by *3B7* or by *3b* inactivation, accelerate *Myc*-induced tumorigenisis.

C25
The Role of Macrophage Phenotype in Breast Cancer Progression

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

Advisor(s)
Galina Khramtsova, University of Chicago
Rita Nanda, University of Chicago

Within tumors, stromal cells assist with tumor growth. Studies have shown that tumor-associated macrophages are essential for promoting this growth. There are two types of macrophages: M1 macrophages, which kill microorganisms and tumor cells, and M2 macrophages, which promote tumor growth and angiogenesis. We sought to determine the role macrophage subtypes play in breast cancer progression. Ductal carcinoma *in situ* (DCIS) specimens were obtained from the breast cancer tissue bank under institutional review board approved protocols. Tissue microarrays (TMAs) were constructed and macrophage phenotype was determined using double immunostaining with CD68/CD163 (M2) and CD68/CD80 (M1). The percent of M1 and M2 macrophages were calculated for DCIS alone and DCIS associated with invasive cancer. Preliminary results suggest that DCIS alone has a lower percent of M1, M2, and total macrophages than DCIS which is associated with invasive cancer. If we observe that there is a difference in the percentage of M1 and M2 macrophages in DCIS alone versus DCIS with cancer, we may be able to identify which cases are most likely to progress to cancer. Understanding the role of macrophages in this setting will allow us to develop better ways to prevent breast cancer.

C26
The Astrocytic Response to Interleukin-17, a Proinflammatory Cytokine Important in Mediating Experimental Autoimmune Encephalomyelitis

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

Advisor(s)
Stephen Miller, Northwestern University

Multiple sclerosis (MS) is an autoimmune disorder in humans, resulting in the demyelineation of neurons in the central nervous system (CNS). MS is mediated by CNS-infiltrating myelin-specific Th-17 cells that produce a proinflmmatory cytokine, interleukin-17 (IL-17). Astrocytes are brain resident cells capable of responding to inflammation, however it is unknown how they respond to IL-17. It is hypothesized that astrocytes respond to IL-17 stimulation with the upregulation of proinflammatory cytokines. IL-17 and a control proinflammatory cytokine, tumor necrosis factor alpha (TNF-α) were tested to examine whether or not they trigger a change in the production of cytokines in primary astrocytes *in vitro*. After stimulation of the culture plates, mRNA was extracted and cytokine responses were analyzed by quantative real time polymerase chain reaction (qRT-PCR). IL-6, IL-23, and actin mRNA samples isolated from stimulated cells were compared against unstimulated cells to determine if there was an upregulation or downreulgation of the genes. Data analysis is currently in progress.

C27
Biology of Bone Development in Leukemia Patients

Presenter(s)
Sumana Vardhan, Illinois Mathematics and Science Academy

Advisor(s)
Kimberley Dilley, Northwestern University

Children who survive acute lymphoblastic leukemia (ALL) tend to have a higher likelihood of sustaining a bone fracture before and during treatment and have reduced bone mineral density (BMD) long-term in comparison with children who did not suffer from ALL. Recent data show that up to sixteen percent of newly diagnosed ALL patients will have asymptomatic vertebral compression fractures associated with lower bone mineral density. We believe that the process of mesenchymal stem cell (MSC) development into osteoblasts and adipocytes may be disrupted in patients suffering from ALL, and will use the following *in vitro* methods to study the possible disruption. MSC development into osteoblasts *in vitro* will be examined and compared between ALL patients and normal conditions using quantitative calcium deposition assays as well as measurement of osx, msx2, and runx2, three important molecules in osteoblast signaling pathways. If we are able to demonstrate a measurable difference in osteoblast biology, that difference might give clues to why BMD is clinically affected in these patients. In conclusion, a better understanding of MSC behavior in the leukemic bone marrow microenvironment could possibly lead to a way to identify those who are at risk for reduced BMD early on.

C28
Identification of the Iron Acquisition Pathways of the Human Commensal Species in the Genus *Neisseria*

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

Advisor(s)
Cynthia Cornelissen, Virginia Commenwealth University

In this study, the iron acquisition pathways of the human commensal species of the genus *Neisseria* were investigated. The pathways were investigated to determine the possible scope of antigenic variation *Neisseria gonorrhoeae* could possibly undergo. These pathways were investigated using polymerase chain reaction (PCR) to amplify the transferrin-binding protein A (TbpA) plug domain, Western blot analyses to determine which commensals expressed TbpA or transferrin-binding protein B (TbpB), and plate assays to determine which commensals bound human transferrin (hTf) or human lactoferrin (hLf). Through these experiments, I have determined which commensals bind hTf or hLf, which posses the tbpA plug domain, and which express the Tbp proteins. The results show that most commensals are very different genetically and obtain iron differently than *N. gonorrhoeae*. This could provide further studies to determine exactly how the commensal species obtain iron, as well as narrow down a vaccine for *N. gonorrhoeae* specific to the pathogen.

C29
Investigation of Effective Peptides for Vaccine Against *Toxoplasmosis*

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

Advisor(s)
Rima McLeod, University of Chicago

Toxoplasma gondii can cause loss of sight and brain function if a fetus contracts this during gestation when the mother is not immune. An immune mother does not transmit infection. The purpose of this investigation is to define parasite peptides that elicit the production of protective interferon gamma (IFNγ). A bioinformatics algorithm was applied to predicted proteins that might induce a protective immune response. Peptides identified were tested with human and mouse immune cells to determine whether they elicited IFNγ production using an IFNγ ELISPOT assay. This was done with pools of peptides predicted to bind to a specific HLA supertype. Individual peptides of pools that elicited a response were tested to see which peptides elicited responses. Peptides that produced a response can now be tested in vaccines. We tested peptides that bind to specific HLA haplotypes A2, A3, and B7 and found eighteen of fifty-five peptides to be potentially effective. Currently, we are testing peptides predicted to bind to HLA supertypes A01, A24, and B44 to determine effective peptides that can be incorporated into the future vaccine. These results help determine which peptides may elicit protective IFNγ in a vaccine, and bring us closer to development of a vaccine.

D01
Recipe for the Perfect Intervention

Presenter(s)
Bo Chen, Illinois Mathematics and Science Academy
Sarah Vo, Illinois Mathematics and Science Academy

Advisor(s)
Pradeep Chintagunta, University of Chicago

Adolescent substance abuse has been long instilled in our culture and is currently on the rise. Many foundations have launched campaigns in an effort to curb these mounting numbers. Over the course of this year, we have looked into the marketing techniques of several different campaigns including The Montana Meth Project, Above the Influence, and MTV Truth. We examined each campaign closely, pin-pointing which techniques were most effective and which were not based on both statistics from previously conducted surveys and personal judgment. Each campaign exercised techniques such as social marketing and direct-to-consumer advertising. However, they also varied in methodology; some utilized satire, others employed fear, and a number were thought-provoking. We believe that combining the strategies our research has deemed effective would produce a very successful campaign.

D02
A Statistical Analysis of Fiscal and Performance Data from English Premiership and Major League Soccer Teams and Players

Presenter(s)
Benjamin Diaz, Illinois Mathematics and Science Academy
Nikolay Glavanakov, Illinois Mathematics and Science Academy

Advisor(s)
Mathias Drton, University of Chicago

Our study analyzed associations between performance and pay based statistics of professional soccer teams and players in the English Premier League (EPL) and Major League Soccer (MLS), as well as the relationship between pay and performance in National Football League (NFL) teams. We analyzed this relationship primarily by performing linear regressions. We found that the correlation between pay and performance was strong in the EPL in contrast to a lack of correlation in the MLS and the NFL, which could possibly be explained by the American Leagues' use of salary caps. We also assessed the effects of individual, on-pitch performance upon a team's overall success, as well as upon individual players´ salaries, with mixed results. Finally, we investigated the impact designated players have in the MLS, and found no statistical evidence to support the popular notion that designated players improve their team's performance, nor that these highly compensated players affect attendance in either home or away matches. We did, however, find that designated players draw a significantly larger number of fouls than their lower earning teammates, possibly implying that either there is tactical incentive to foul designated players, or that referees more readily call fouls committed against superstars.

D03
Defining the Current Status of Healthcare Options in India and Evaluating the Role of Private Health Insurance Within it

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

Advisor(s)
Mary Carter, Blue Cross and Blue Shield Association
Annette Marek, Blue Cross and Blue Shield Association

We examined the progression of the healthcare industry in India over the past decade in order to evaluate the feasibility of expanding the role of private health insurance. After thorough examination and interviews, we came to four main conclusions. First, the middle class in India is increasing in both population and economic power, which has resulted in a larger disposable income for a larger segment of the population. Second, this group will seek to improve its healthcare from the underfunded, inefficient, and often inferior care provided through the public healthcare infrastructure to private care which, though expensive, is more effective and well-equipped. Third, private health insurance may help shoulder the rising cost of treatment from out of pocket payments to affordable premiums. Finally, private insurance gives the middle class a means to afford care that is otherwise unavailable to them, therefore it is becoming increasingly desirable. Based on these assertions, we have concluded that the market for private health insurance in India is growing but there are several considerations on entry, such as the efficiency of third party administrators, prevalence of employer based insurance, and favorable political changes in foreign direct investment regulation. Above all, private health insurance must be tailored to the Indian healthcare infrastructure as well as to Indian culture.

E01
Thermal Process Optimization for Improved Machinability of Ferrium M54

Presenter(s)
Dane Christianson, Illinois Mathematics and Science Academy

Advisor(s)
Christopher Kern, QuesTek Innovations LLC
Charles Keuhmann, QuesTek Innovations LLC

Ferrium M54 is an ultra high strength structural steel that was computationally designed and developed by QuesTek Innovations LLC for use in applications, such as landing gear for aircraft. A key hurdle for its implementation is the increased difficulty machining compared to current Fe-C steels, due to the increased alloy content. This study aims to optimize the thermal processing of M54 prior to machining by evaluating different solution treatment and annealing temperatures to achieve the optimal microstructure. A full factorial design of experiments was developed to analyze the effect of different temperatures on martensitic content and hardness. Temperatures for the solution treatment and annealing phases were chosen to precipitate specific carbides to pull carbon out of the matrix to promote additional martensitic transformation. The test matrix was later refined by performing preliminary analyses on particular temperatures to eliminate unnecessary experiments. Results indicate that the incomplete solution treatment and double anneal steps may affect the overall hardness of the material. The strength of M54 was reduced by about five to ten percent in this study. This indicates that there may be potential for further reduction of the hardness of M54 with further thermal process optimization.

E02
Comparison of Computational Chemistry Software and Spectrometer Data

Presenter(s)
William Erwin, Illinois Mathematics and Science Academy
Andrew Jung, Illinois Mathematics and Science Academy

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

Computational chemistry is an area of chemistry that uses software on servers based on complex mathematical equations to model molecules and run tests on them. The goal of our experiment is to compare the data from the computational chemistry servers with physical data and examine the accuracy of the computational chemistry servers. Our experiment involves modeling two molecules, water and 1-propanol, running computational and lab-based tests on them, including infrared and ultraviolet spectroscopies, and comparing the results. We are also examining different ways of modeling the molecules, such as the optimization of the molecular geometries. We have currently run infrared spectroscopy tests on both of these molecules using the Gaussian and GAMESS online servers and using an infrared spectrometer. We assumed that the spectra given from the spectrometer was correct, so when we compared the computational data to it, our results showed that the Gaussian program was more accurate, with approximately one-third of the error of the GAMESS program. If our results show that the computational chemistry programs model molecules and run tests with accuracy, then computational chemistry can become a viable alternative to actual experimentation. This could potentially be a very useful alternative to running expensive experiments with large molecules.

E03
Advanced Technologies for the Removal of Dissolved Organic Nitrogen from Wastewater Treatment Plant Effluents

Presenter(s)
Amber Farrell, Illinois Mathematics and Science Academy

Advisor(s)
Marina Arvaldos, Illinois Institute of Technology
Krishna Pagilla, Illinois Institute of Technology

After water from wastewater treatment plants (WWTP) has been discharged into the environment, dissolved organic nitrogen (DON) is a dangerous chemical that can still be present. It is very hazardous to humans and to the bodies of water into which it is released. DON can act as a nutrient for algae which, if exposed to large amounts, can grow into algae blooms and cause hypoxia. DON can also react with chlorine, which is added to WWTP effluents in order to eliminate disease causing bacteria. When DON reacts with chlorine, substances that do not kill these bacteria are produced. The purpose of this investigation is to determine the most effective method for removing DON from wastewater treatment plant effluents. Two advanced technologies for wastewater filtration, carbon adsorption and enhanced coagulation and flocculation, were chosen because they are commonly used as tertiary treatment in WWTP. After running WWTP effluents through each of these treatments, the amount of DON is measured in each sample. This will determine the most effective method for DON removal in WWTP effluents. The implications of these results will determine the wastewater tertiary treatment method that is safest of the three for the environment and for society.

E04
Accuracy of Computational Chemistry with Ethanol and Methanol

Presenter(s)
Andrew Gray, Illinois Mathematics and Science Academy
Richard Smith, Illinois Mathematics and Science Academy

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

Computational chemistry is a form of chemistry used for modeling atoms and compounds electronically. We have spent these past two semesters determining the accuracy of two North Carolina computational chemistry server programs, GAMESS and Gaussian. We modeled ethanol and methanol molecules with the GAMESS program. We ran an infrared spectrum test on these molecules and compared the data with experimental data from the laboratory. We ran tests on an infrared spectrophotometer machine with ethanol and methanol. After analyzing our results, we have discovered that the GAMESS program is not nearly as accurate as Gaussian, and that while these modeling programs portray a generally correct infrared spectrum, there are many differences between the computer data and the spectrophotometer data. These findings will be perceived as detrimental to the computational chemistry field, due to the fact that they are not nearly one hundred percent accurate. However, these results might provide valuable insight to where the dissimilarities between the software data and the laboratory data, potentially improving the computational chemistry field as a whole.

E05
Chemically Active Colloidal Graphene with Tunable Carbon-Oxygen Ratios

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

Advisor(s)
Owen Compton, Northwestern University
SonBinh Nguyen, Northwestern University

Synthesis of colloidal graphene from dispersions of graphene oxide is typically performed via reduction with hydrazine derivatives, increasing the carbon-oxygen ratio of the graphene nanosheets to approximately 10:1 from around 2:1. However, few avenues have been described thus far in the literature for the synthesis of graphene-based materials with carbon-oxygen ratios in between those of graphene and graphene oxide. In this work, we report a method to yield partially reduced graphene oxide through thermal reduction of graphene oxide in a number of solvents. Specifically, we report that refluxing graphene oxide for 1 hour in dimethylformamide (DMF) at 160°C, dimethyl sulfoxide (DMSO) at 200°C, and methylpyrrolidone (NMP) at 210°C raises carbon-oxygen ratios from 1.6 to 2.67 in DMF, 1.79 to 3.98 in DMSO, and 1.77 to 4.36 in NMP. Furthermore, we demonstrate that paper-like materials produced by vacuum-assisted self-assembly from dispersions of thermally-reduced graphene exhibit both electrical conductivity chemical activity, properties that are mutually exclusive for most graphene-based materials.

E06

Study of the Hydrophobicity of Polystyrene, Poly(methyl methacrylate), and Poly(styrene-block-methyl methacrylate) and Its Photomodified Form

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

Advisor(s)
Steve Sibener, University of Chicago

Controlling interfacial interactions has found a wide range of applications in areas such as surface-responsive materials in biological systems, coating technologies, adhesives and self-cleaning surfaces. Polystyrene (PS), poly(methyl methacrylate) (PMMA), and poly(styrene-block-methyl methacrylate) (PS-b-PMMA), along with its photomodified counterpart, were used in this study because of their unique microstructures, hydrophobicity, and important application in nanoscale lithography, electronics and magnetic memory. In this experiment, PS, PMMA and PS-b-PMMA films were used to investigate how surface morphology affects interfacial properties and thus influences macroscopic properties such as wetting. Samples of PS-b-PMMA were photomodified to obtain greater surface corrugation. Upon exposure to UV radiation, PMMA was removed from the diblock polymer, leaving behind fingerprint PS domains. Atomic force microscopy (AFM) was used to investigate the surface morphology of those substances at a nanoscopic level. The contact angles formed between those surfaces and water droplets were measured. PS and PMMA polymers yielded contact angles around ninety degrees, while PS-b-PMMA gave higher angles around one hundred degrees because of its mild intrinsic corrugation of one nanometer. Irradiated PS-b-PMMA produced the highest contact angles, greater than one hundred degrees, due to its enhanced roughness, ten nanometers, from the photomodification. Interfacial energies can be extracted from these contact angle measurements through Young's relation.

E07

Quantitative Measurement of the Oxidation of Nonanoic Acid with Manganese Complexes

Presenter(s)
Samir Mishra, Illinois Mathematics and Science Academy

Advisor(s)
Justin Notestein, Northwestern University

Hydrocarbon fuels are a conventional natural resource, but modern catalysts are being developed to create hydrocarbons from biomass. This project focuses on using catalyzed oxidative decarboxylation reactions to convert fatty acids to hydrocarbons. The normally slow reaction is catalyzed by a manganese compound. Nonanoic acid was used as a model fatty acid, which is converted to octane and octene if the reaction is successful. Mixtures containing known concentrations of nonanoic acid, dichlorobenzene, hydrogen peroxide and manganese catalyst were allowed to react at different temperatures and for different times. Samples were extracted every two hours and analyzed using gas chromatography / mass spectrometry (GC/MS), to quantify the amount of product and rate of reaction. GC/MS separates chemical mixtures and outputs a chromatogram that has peaks whose different retention times, peak areas, and mass spectra help identify compounds. Using known concentrations, a calibration curve was created to correlate concentration and peak area. The calibration curves will then be used to quantify the concentrations of samples from catalyst runs. The results of these analyses will be used to evaluate the efficiency of different reaction conditions. With this information, optimal reaction conditions will be determined which then can be used in alternative energy technologies.

E08
Specific Cellular Uptake of Targeted Liposomes in Cancer Cells

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

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

Folic acid receptor (FAR) is generally overexpressed in cancer cells. For this reason, folic acid (FA) has been widely used as a targeting ligand in cancer. In this study, stabilized liposomes with folic acid (FA-liposomes) were prepared for specific cancer targeting and liposomes without FA were used as a control. The physical properties of liposomes were characterized by the measurement of size and zeta potential (surface charge) of liposomes. To control FAR expression by KB cells, cells were incubated in FA-deficient (FAR KB cells) and FA-containing (FAR- KB cells) medium, respectively. The fluorescence-labeled liposomes with and without FA were used to visualize the cellular uptake of liposomes into the two different cancer cells (FAR and FAR-) by fluorescence microscopy. The results showed that FA-attached liposomes directly enhanced the specific cellular uptake by FAR KB cells compared to FAR- KB cells. In conclusion, this system can be effective in enhancing the specific cellular uptake of anticancer therapeutics encapsulated in FA-liposomes.

E09
Spectroscopic Analysis of Metal Borohydrides

Presenter(s)
Sai Parepally, Illinois Mathematics and Science Academy

Advisor(s)
Michael Trenary, University of Illinois at Chicago

Metal borohydrides show a great deal of potential as hydrogen storage materials because they can reversibly absorb and desorb hydrogen. Although the desorption reactions of many metal borohydrides have been reported, the reaction mechanisms and intermediates are not yet fully understood for most compounds. In this investigation, we aim to utilize infrared spectroscopy to better understand the hydrogen desorption and absorption of metal borohydrides. Spectra of $Ca(BH_4)_2$, $LiBH_4$, and KBH_4 with KBr background were taken at varying temperatures in high vacuum (pressures of 9×10^{-2} torr). Samples were pressed onto a tungsten grid which was cleaned thoroughly in order to ensure that the sample was not contaminated. Additionally, we are investigating the optimal conditions for sample preparation. We have started collecting spectra from the background (KBr) and we are waiting to acquire spectra on the metal borohydrides.

E10
Stable Explicit Water rRNA and tRNA Simulation Using Visual Molecular Dynamics and Nanoscale Molecular Dynamics

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

Advisor(s)
Karl Freed, University of Chicago

Visual simulations are often performed to help gain knowledge about the mechanism of biological molecules. These simulations mimic somewhat of the reality that could not be achieved using experimental tools. There are many types of RNA; two that will be analyzed in this study are tRNA and rRNA. In order to better understand RNA, molecular dynamics simulations were performed in explicit water as the solvent on these two types of RNA. Simulations were created through stages of preparation, minimization, heating up, equilibration, and production. The results are then compared with implicit simulations performed by other members within our group. The explicit rRNA simulation reached a stable average confirmation with root mean square deviation (RMSD) of 2.5 Å from the initial structure which compared to the implicit RMSD is lower. Explicit tRNA simulation reached a stable RMSD of 2.75 Å. Overall, the explicit simulations were more stable compared to the implicit ones. Also when the implicit model is aligned with its initial structure, the center is aligned while the ends deviated. These explicit results will thus help to modify the implicit models, in the hopes of creating the first working, stable implicit RNA simulations.

E11
Anticancer Active Ingredients from *Fagerlindia depauperata*

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

Advisor(s)
Hong Jie Zhang, University of Illinois at Chicago

A perfected treatment for cancer patients has remained frustratingly elusive to modern society. Naturally, there is a considerable scientific and commercial interest in the continuous discovery of new anticancer agents from all sources, including natural plant-derived agents. This study examines the plant *Fagerlindia depauperata*, a woody vine native to eastern regions of the world. After screening of thousands of plants, the methanol extracts of this vine has shown potent inhibition effects against several cancer cell lines. Such effects can be traced to the biologically active compounds within the plant, which can be isolated for further bioassay study. The current investigation uses thin layer chromatography and column flash chromatography to separate compounds within plant extracts, and high performance liquid chromatography may be used to further purify compounds from separated fractions. Spectrometers such as 1H and 13C nuclear magnetic resonance are powerful tools used to determine the chemical structures of the isolated compounds. Studies continue on evaluation of the anticancer activity of these compounds, and isolation of additional anticancer active compounds from the plant.

F01
The Societal Aspects of Technological Advancement

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

Advisor(s)
Mike Ososky, Applied Computer Technology

Our investigation is directly concerned with the societal implications of the Law of Accelerating returns proposed by Kurzweil, in his book, *The Age of Spiritual Machines*. We used a survey, historical research, and science fiction books to analyze how society will respond to the effects of Kurzweils Law. Applying his law to life and technology, Kurzweil asserts that the time interval between significant advances made in this evolutionary system is exponentially decreasing. Our civilization lies on the knee of this exponential curve – the transition between sluggish technological advancement and unimaginable progress. According to Kurzweil, significant technological advancements will occur by the week, and then by the day until they occur almost instantaneously. How will this come about? Who is to say we are prepared for another information shock? How will society respond to this rapid forthcoming of technology, ideas, and artificial intelligence? Will people respond as the Luddites did in England 1812 or like they did to Darwin in 1859? Our investigation aims to answer these questions. The results of this investigation are anthropological, simply to study the reactions of society in terms of technology.

F02
Computer-Aided Microcalcification Detection for Tomosynthesis Images

Presenter(s)
Naomi Liu, Illinois Mathematics and Science Academy
Si Si, Illinois Mathematics and Science Academy

Advisor(s)
Robert Nishikawa, University of Chicago
Ingrid Reiser, University of Chicago

In computer-aided detection (CAD), a computer algorithm attempts to detect microcalcifications, tiny calcium deposits in breasts that can be indicative of cancer, with a high sensitivity. After all suspect calcifications are found, a feature analysis phase occurs where features of the detected signals are used to remove false detections. In our project, we analyzed the effectiveness of Initial Detect, an algorithm for stage one of CAD on two types of images, TV and EM, which were produced using different reconstruction algorithms. We aimed to determine which reconstruction algorithm more effectively produced a tomosynthesis volume that allowed for efficient detection of microcalcifications. After running images through Initial Detect, plotting free-response receiver operating characteristic (FROC) curves, and creating scatter plots, we find that using TV images detect more microcalcifications with less false positives. Graphs of FROC curves showed a steeper rise in accuracy for TV images, along with a starting accuracy of sixty-seven percent of true positives, whereas EM images had forty-six percent accuracy. Thus, we conclude that Initial Detect is more effective on TV images. In the future, tomosynthesis images should be reconstructed as TV images to improve microcalcification detection efficiency in CAD. CAD can then be used as an aid for radiologists.

F03
Developing Smartphone Applications

Presenter(s)
Marat Purnyn, Illinois Mathematics and Science Academy

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

With the advent of smartphones, phones are able to replace a laptop in many situations. My goal in this investigation was to expand my knowledge of the Java programming language and write an application for Google's Android operating system (OS). By using books and websites on the topic, I researched the Android application programming interface (API). I was able to learn how to develop an application for the Android OS with proficiency, learning about many of its differences with standard Java programs. I learned how to utilize, manipulate and override methods in the Android API, use many different layouts and modify them with (Extensible Markup Language) XML or code during the execution of the program, as well as how to write the program so that it is efficient and requires the least amount of resources to run. I have become proficient with both Java and the Android API and have created a Blackjack game that runs without problems on an Android phone. Although I have accomplished my goals in this investigation I hope to further my knowledge of the subject by continuing to write Android applications.

F04
Impact and Feasibility of Cloud Computing in an IMSA Environment

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

Advisor(s)
Noah Prince, Illinois Mathematics and Science Academy

A cloud computing paradigm is one in which data and applications are stored remotely while users access them from a thin client. The goal of this investigation was to determine the feasibility, potential benefits, and potential detriments of a cloud computing infrastructure in a higher education environment similar to IMSA. It was concluded that a cloud model is not at this time feasible in such environments for a variety of reasons including maturity and availability of software, various concerns with hardware such as power consumption and cost, as well as issues with the legality of data storage and application licensing. The model does, however, present the potential for a number of benefits such as greater collaboration between institutions, consistent and equal availability of resources, and reduced cost. Cloud computing also has some flaws associated with it, such as increased security risks, increased power consumption, and greater initial cost to the institution. As the cloud paradigm matures and becomes more clearly defined, while being combined with different and more mature software and the accompanying licensing and laws, many of the issues will likely be resolved and a cloud could provide great benefit to both students and the institution.

F05
An Exploration of the Process of Designing and Implementing a Multi-Dimensional Database

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

Advisor(s)
Joshua Elliott, University of Chicago

Scientific models produce large amounts of data that need to be processed and accessed by tools that are versatile because users want to change variables and parameters. One solution to effectively handle such large amounts of data generated by such models is the utilization of a database. However, such a database requires much time to design and implement, especially when the model is large. A Community Integrated Model of Economic and Resource Trajectories for Humankind (CIM-EARTH) is an example of such a model. I aimed to design and implement a multi-dimensional database to handle data generated by the CIM-EARTH model. A prototype was built using Microsoft SQL Server 2008. The prototype was successful in handling a small sample of processed data and demonstrated the efficiency of databases. The prototype was then expanded to include a large amount of raw data and to run simple statistical analyses on it. Although these prototypes will not be implemented directly into the data flow generated by CIM-EARTH, the process of designing and implementing the prototype provided valuable experience for future endeavors. Future databases may be based off the prototypes I built, but scaled to a larger size and adjusted to accommodate different variables of the model.

G01
Analyzing Current and Past Recessions to Identify Problems and Solutions

Presenter(s)
Ramtej Atluri, Illinois Mathematics and Science Academy
Minjae Lee, Illinois Mathematics and Science Academy
Reichert Joshua Zalameda, Illinois Mathematics and Science Academy

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

In 2007, the economy fell into a recession. In reality, the economy goes through a business cycle that is highlighted by periods of growth and contraction. Although, the recent state of the economy was just a product of this cycle, economists still had trouble predicting that the stock market and the economy would crash. We believe that economists failed to predict the recession because each group of economists would only look at a specific area of economy that pertained to their field. However, we can find trends in the United States economy to predict and resolve future conflicts by analyzing employment and unemployment rates as well as variety of data that provide consumers with information on the job market. This resolves the problem of the economist by looking at a variety of data, and it allows us to construct a better idea of the events that happened during the recession and to offer some possible resolutions.

G02
The Boys Versus the Girls: Gender Specific Determinants of Success

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

Advisor(s)
James Heckman, University of Chicago
John Humpries, University of Chicago
Nick Mader, University of Chicago

According to 1979 longitudinal data, males have an average wage that is thirty-eight percent higher than females. We examine both cognitive and non-cognitive skills to find potential explanations for this difference. Non-cognitive skill is measured by the Rotter Locus of Control scores and the Rosenberg Self-Esteem Scale while cognitive skill is measured by the Armed Forces Qualification Test. Conditional on the amount of schooling received, we find that the gap decreases by five percentage points. When controlling for non-cognitive skills, we find that of the wage differential among males and females increases by forty-seven percentage points. Interestingly, we find that when controlling for cognitive skill, the gender gap in wage is enlarged by one percentage point.

G03
The Effect of Tort Litigation on the Market for Pharmaceuticals

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

Advisor(s)
Sloane Frost, University of Chicago
Anup Malani, University of Chicago

This investigation questions whether state tort litigation against pharmaceutical companies makes the market for pharmaceuticals more efficient. The Food and Drug Administration (FDA) heavily regulates the market for pharmaceuticals. On the path to being approved, a drug must go through a wide variety of tests and trials, and must face severe scrutiny by the FDA. Pharmaceutical companies face not only a stringent regulatory process, but also they assume the risk for consumer tort litigation. Thus, the cost of innovation in the market for pharmaceuticals is very high. The purpose of tort litigation is to provide compensation for consumers who were harmed by the use of drugs. Yet the benefit of the increased consumer compensation may be outweighed by the cost of the additional burden that pharmaceutical companies must maintain. This investigation questions whether tort litigation could lead to increased efficiency in the market, by analyzing the effect of tort litigation on FDA-mandated labeling changes. Our findings have interesting implications for the role of tort litigation in the market for pharmaceuticals and for many competitive markets.

G04
The Role of Futures Contracts in the Commodities Markets

Presenter(s)
Joseph Hecker, Illinois Mathematics and Science Academy

Advisor(s)
Doug Adams, Aardvark Trading

Futures contracts for agricultural commodities have been traded in the U.S. for over one hundred years, and serve various purposes in the markets today. The purpose of this investigation was to discover the ways in which they are traded, and why. I started reading a few books, entitled *Trading and Exchanges*, *The Art of Grain Merchandising*, and *Options, Futures, and Other Derivatives*. These books described how trading worked, and the ways in which futures are traded. I saw them electronically being traded, along with bonds and currencies. This opened up many different questions, and I applied my knowledge to discussions and examples with my advisor. Futures derive their value from an underlying asset, otherwise making them a derivative contract. There are many different players that participate in this trading, and they move a good from one time to another. This creates opportunities to profit, enabled by differences between prices in the current time and what they might be in the future. Through this, I discovered that the contracts are not usually delivered, but are traded before expiration. Since the futures market has increased trader participation in the commodities market, the greater amount of liquidity means larger potential profits for different producers.

G05
Keynesian Economics and Their Relevance to Asian Economics

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

Advisor(s)
Richard Stalmack, Illinois Mathematics and Science Academy

The purpose of my experiment is to determine the role that Keynesian economics plays in the economic growth of Asian countries. On a more general term, my purpose is to find the role that government policy and involvement plays in Asian economies. In order to decipher any sort of conclusion, we tracked the economic growth of three select Asian nations known for their economic growth in spite of their authoritarian histories, namely China, Japan, and Korea. We tracked the historical state of politics in each country and searched for any correlation between these changes and the economic development of these respective nations. Our investigation has yielded the impression that government policies that work cooperatively with their respective economies facilitate economic growth, as opposed to governments that try to suppress and control their economies. It seems that while some government involvement is necessary to set boundaries for the freedoms of the market, a policy that is too overbearing is extremely counterproductive. This investigation examines current economics policies in current Asian governments. Stemming from the recent economic recession, governments have taken a more direct approach to mitigating the economic crisis. Hence, this experiment will help determine the validity of such actions.

G06
The Causes of the 2008 Economic Crisis and its Impact on Colleges

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

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

The 2009 economic crisis has led to the worst recession in U.S. history since the Great Depression. This project strives to answer two questions: What caused the crisis, and how does it affect colleges and college-bound students? A review of the literature suggests that irresponsible risk-taking within the financial and banking sectors was the root cause of the crisis. A rise in defaults of subprime borrowers and the collapse of many derivative securities (both areas in which risk was not well-understood) caused over-leveraged banks to collapse. Government intervention slowed the crisis, yet the damage was done. Many colleges lost upwards of thirty percent of their endowments, but most private colleges had only single-digit tuition increases. Even public schools, which face severe budget cuts nationwide, rarely had hikes above the ten to fifteen percent range. Anecdotal evidence suggests that institutions are responding with other, less drastic measures such as class sizes increases and reduced hiring. While the quality will suffer, higher education has not fallen out of reach due to the crisis. I am in the process of conducting a survey of IMSA seniors to gauge their college cost perceptions, which will be used to design an online resource about colleges and the economy for future students.

G07
School Structure and Academic Achievement: How the Middle School Model Affects Blacks and Whites

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

Advisor(s)
Kerwin Charles, University of Chicago

The black-white achievement gap is an inexplicable and damaging aspect of the school system. Previous research has suggested that differences in school structure between elementary and middle school play a role in determining motivation and academic success for black students. We utilize regression analysis on survey data previously collected through the Tennessee Student Teacher Achievement Ratio project and the Common Core of Data, a database of all elementary and secondary schools in the United States. Using grade point average and on time high school graduation rates as measures of academic success, we determine the impact of school structure on achievement across both races. We confirm that graduating from elementary to middle school in the fifth grade has a differential negative impact on blacks, while graduating in the fourth grade has the opposite effect. These results are robust to numerous specifications. Adoption of the middle school structure by school districts seems to be linked with decreasing academic performance in general and affects the achievement gap acutely. More distressing is that education has been defined by a shift to a middle school model over the past few decades. Policy implications of our research include a reversion to the elementary school model, which would potentially have a positive effect in narrowing the black-white achievement gap.

G08
What Motivates the Consumer? The Effects of Advertisement on Banking and Beauty Aids in the Twenty-First Century

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

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

What motivates the consumer? After September 11, 2001, the economy faced a stand still. The chairman of the Federal Reserve, Alan Greenspan, feared that the shock of the terrorist attacks would cause the economy to cease functioning because people were no longer interacting with one another. Still, despite the devastating conditions of the economy, people desired barely affordable houses, and were left paying off overwhelming mortgages for years on end. One may question why people are purchasing items or products that are beyond their financial limits. The answer is simple: persuasion and social status. Advertisement plays a crucial role in creating a need for a product in the mind of the consumer, and ultimately, advertisement creates the demand for a given product. We use the small scale example of mascara purchases, to address the large scale issues on mortgages. People buy mascara, a pricey cosmetic, because they are envious, or because they want to be beautiful or popular. People buy expensive houses to be seen in a higher class and to live the luxurious American Dream of owning a home. This investigation addresses business ethics and the effects of advertising on the consumer and the economy in the twenty-first century.

G09
Stopping the Flow of Terrorist Funding

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

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

Terrorist organizations have become large and complex networks able to plan operations around the globe. In order to support their infrastructure which allows the planning of attacks, terrorist organizations rely on a diverse spread of funding including state sponsorship, organized crime such as the drug trade and smuggling, charities, informal money systems, and personal donations. This study analyzes terrorist funding as well as information on the organization of terrorist organizations and the laws and other legislation of national governments and international organizations to mitigate it. What is clear about national responses is that, while they emphasize the importance of interdepartmental cooperation in tracking and arresting terrorist funding, they are often mired in political interests. International responses meanwhile often lack the power and support to give meaningful results. Since terrorists are no longer only regional or national, cooperation between nations afflicted by terrorism and world powers able to block terrorist financing is imperative. International cooperation between law enforcement and financial departments of nations as well as private entities is necessary to suspend terrorist financing in the future.

G10
Model of Economic Effects of the Climate Change on Different Economic Classes in the United States, the United Kingdom, and Other Countries Throughout the World

Presenter(s)
Samuel Simon, Illinois Mathematics and Science Academy

Advisor(s)
Joshua Elliott, University of Chicago

We are studying the distributional impacts of recent economic changes such as carbon taxing by looking at the different income groups in expenditure surveys of multiple countries. We are using the Consumer Expenditure Survey from the United States, the Family Expenditure Survey from the United Kingdom, the Expenditure Survey for Brazil, and the Family Income and Expenditure Survey for Japan. First we found the data for the respective countries and formatted it to fit the grouping in the U.S. Consumer Expenditure Survey. This involved looking at the definitions of each category to see what it included and to group the data accordingly. We also documented which countries have easy accessibility to their expenditure surveys for future expansion. By comparing and understanding the data, we can draw a connection between the changes we see and the expenditure of different income classes throughout the world. Currently we have just documented the available data but we are hoping to format and make a model out of the data.

G11
The Effect of Competition Between Self-Regulators

Presenter(s)
Courtney Alexa Smith, Illinois Mathematics and Science Academy

Advisor(s)
Jiro Kondo, Northwestern University

The 2007 merger of two major self-regulatory organizations (SROs), the New York Stock Exchange and National Association of Securities Dealers, brought into question the effects of competition between SROs on the aggressiveness of enforcement of misbehavior by industry participants. In this investigation, I analyzed investor-broker arbitrations from both before and after the merger, as well as reviewed media about the merger, noting the incentives of those making comments. Preliminary results show that investment firms that were members of only one SRO before the merger (and therefore were not influenced by competition) were punished more after the merger while investment firms that were members of both SROs (and therefore were influenced by competition) were punished slightly less after the merger. The outcomes of this study could lead to a greater understanding of the implications of competition with respect to regulation of financial markets.

G12
To Steal or Not to Steal: Considering the Motivations for Stealing

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

Advisor(s)
David Herberich, University of Chicago
John List, University of Chicago

Have you ever considered stealing something before? Whether you managed to execute, successfully or not, such a stunt, the economic motive for doing so remains the same: the utility of stealing a good (accounting for the probability and consequences of getting caught) outweighs the utility from buying the same good. Our study examines the effect on the propensity of a customer to steal a good by changing its nominal value, thus changing the nominal benefit that the customer believes to have received from that good, while controlling for the consequences of getting caught. At a family-owned store called AiNi, fake jade bracelets were displayed in a location out of the view of the cashier, and three different prices ($99.99, $49.99, and $9.99, respectively) were interchanged periodically. At each price level, the number of bracelets stolen per day was recorded, and a t-test that compared the number of bracelets stolen per day for the $99.99 and $9.99 price levels was calculated. Although results suggested that there was no statistically significant difference between the number of bracelets stolen at $99.99 and $9.99 (p->0.288), the total number of bracelets stolen at the price level $99.99 did exceed that of $9.99.

H01
Conventional Versus Inquiry-Based Teaching Methods: Which is More Effective?

Presenter(s)
Kirthi Banothu, Illinois Mathematics and Science Academy
Yoo (Jenny) Kim, Illinois Mathematics and Science Academy
Morgan Rehberg, Illinois Mathematics and Science Academy
Brendan Wesp, Illinois Mathematics and Science Academy

Advisor(s)
Julie Dowling, Illinois Mathematics and Science Academy

This study compares the effectiveness of conventional (lecture-based) and inquiry-based teaching methods. The four IMSA student authors taught six diverse sixth grade classes at a local middle school. Over the course of two units and four class sessions, the authors taught science classes about waves and erosion. During the units, the IMSA students brought hands-on activities that correlated with the material in the students' textbooks. The IMSA students gave short assessments at the end of every class period to gather data to compare lecture-style teaching by the regular teacher and the inquiry-based hands-on teaching by IMSA students. The assessments were created based on the textbooks and not on the student-written lessons. The results will help teachers make more informed decisions about what teaching methods to use in their classes. This study compares the students' assessment scores after the inquiry-based classes taught by IMSA students and after the lecture-based classes taught by the students' science teacher. After three of the four class sessions, preliminary data shows higher assessment scores from the inquiry-based classes.

H02

Identifying the Key Constructs of School Improvement: A Comprehensive Examination of Academic Progress and the No Child Left Behind Act

Presenter(s)
Cevdet Dogan, Illinois Mathematics and Science Academy
Jonathan Loucks, Illinois Mathematics and Science Academy
Sidanth Sapru, Illinois Mathematics and Science Academy

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

The Elementary and Secondary Education Act (also known as the No Child Left Behind Act) has been denounced by educators and researchers alike as ineffective and impractical, especially in its mandate that every single student nationwide meet state education standards by the year 2014. The purpose of this investigation was to create a series of recommendations for the federal reauthorization of the No Child Left Behind (NCLB) Act by identifying instructional and administrative commonalities between schools achieving significant gains in student performance. A comprehensive survey was sent out to one hundred fifty-three principals whose schools received the Academic Improvement award from the Illinois State Board of Education, with survey participants being asked to identify and explain the processes and initiatives leading to their school's success. Case studies were performed at a number of these schools, and on-site interviews were conducted with teachers and administrators. Preliminary recommendations include the introduction of a rewards-based accountability system into NCLB, as well as the creation of a single set of nationwide learning standards and an increased focus on teacher effectiveness. These recommendations – if integrated into NCLB – can help to provide the framework for an effective school accountability system that significantly improves student achievement throughout the United States.

H03
IMSA: Chicago Admissions Process

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

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

Within the city of Chicago, a plethora of studies indicate that high schools are falling short of national benchmarks. There are many contributing factors to student underperformance, however many experts have concluded that high schools themselves are not providing students with a sufficient education and are the reason for students failing to meet national benchmarks. IMSA is a state agency that runs a residential high school program for talented and gifted students from all over the state. Through state funds, IMSA provides invaluable opportunities many public and private high schools do not have the means of providing. This residential program in Aurora, Illinois is exploring the creation of a second campus in Chicago to provide more opportunities for talented inner-city students. Through interviews with Chicago Public High School personnel, we have learned that different types of high schools (selective enrollment versus charter) have different admissions processes. Some high schools only rely on one single composite score whereas others use the blind lottery method. Using IMSA's admissions process and identified key components in Chicago admissions processes, we hope to create an ideal admissions process that targets students in Chicago with demonstrated potential in math and science.

H04
Investigation for the Illinois Law Enforcement Alarm Sysytem: Website Hosting Survey

Presenter(s)
Daniela Lefticariu, Illinois Mathematics and Science Academy

Advisor(s)
James Bondi, Illinois Mathematics and Science Academy
Christopher Kolar, Illinois Mathematics and Science Academy
James Page, Illinois Law Enforcement Alarm System
Ken Swails, Illinois Law Enforcement Alarm System

My investigation focuses primarily on conducting a survey to send throughout police and investigative offices that are part of the Illinois Law Enforcement Alarm System (ILEAS) throughout Illinois. The goal is to better understand exactly what features of a website would be beneficial to ILEAS in informing the public about important issues. The issues are significant to ILEAS because their goal is to meet the needs of law enforcement throughout the state of Illinois in matters of mutual aid, emergency response, and the combining of resources for public safety. The survey questions what webpage services would be helpful for ILEAS to host so its members can spread information to the public in their respective districts, as well as amongst investigative officials throughout the state. The results from the survey will give ILEAS helpful recommendations as to what kinds of services they should offer when building this website.

H05
High School Students Perceptions' on Business Ethics

Presenter(s)
Nidhi Narielwala, Illinois Mathematics and Science Academy

Advisor(s)
Gary Ernst, North Central College
Barbara Miller, Illinois Mathematics and Science Academy

My study focuses on the ethical and unethical principles of students in the classroom. It has been shown that students whose ethical decision making is skewed in the classroom may carry these same qualities into their work ethic, which can greatly impact society. I am surveying a wide range of high school students about their perceptions of ethical situations in academics and business. This research uses a previously designed survey which was administered to college students. I will use high school students from three different high schools. Once I have surveyed the students, I will analyze the data and compare it to the original study. To analyze the data, I will be using a chi-square statistical test for independence. I will also be comparing the overall classes, for example, class of 2010 versus class of 2011, class of 2011 versus class of 2012, and class of 2010 versus 2012. Also, I will be comparing males to females and may additionally compare different school data. With this, I will be able to determine the ethical standard of high school students in society today, as well as how gender and school type affects one's ethical decision-making skills.

H06
Inspiring Youth to Lead

Presenter(s)
Cai O'Connell, Illinois Mathematics and Science Academy
Alexandra Smick, Illinois Mathematics and Science Academy

Advisor(s)
Linsey Crowninshield, Illinois Mathematics and Science Academy

Inspiring Youth to Lead (IYL) is an experiential, hands-on program that aims to develop children's confidence as leaders and students in and outside of school. It also investigates the outcome of the program to evaluate equal progression in each gender. This eight-week, five-module program focuses on leadership, self-awareness, group dynamics, and communication. These skill sets are intertwined with the seven pillars of Character Counts: character, trustworthiness, respect, responsibility, fairness, caring, and citizenship. The entire program is paired with surveys that assess participants' performance in school, participation in after-school activities, involvement in the community, and the specific topics covered in each module. Fourteen children enrolled at Gates Elementary School in Aurora, IL participated in this program. The pre-survey results showed that eight of nine females want to do better in school, versus four of five five males. Also, two of five males were confident in raising their hand in class versus two of nine females. To fundamentally improve confidence and participation in school and community children are in need of a program that offers development of skill sets in the seven pillars of Character Counts and Leadership. Further results will indicate the successfulness of IYL in doing this.

I01
The Visualization of Stresses in Solids and Fluids via Matlab

Presenter(s)
Natasha Arvanitis, Illinois Mathematics and Science Academy

Advisor(s)
Craig Foster, University of Illinois at Chicago

Visualization of various quantities in mathematical models provides a simple way to perform a reasonability check, and thus can be used to verify large programs easily. We worked on the visualization of displacement, strain, and stress in solids and of volumetric flux and pressure in fluids. We used Matlab and a program named Fred to process data and display our diagrams. Fred took input in the form of partial differential equation meshes and calculated the values listed above. Its output was in the format of several complex matrices, which we processed and graphed. We created a flexible, efficient program complete with graphical user interface to take data and plot it. The program successfully plotted multiple sets of data and was able to perform a basic reasonability check on the data, providing a visual way to verify the feasibility of the inputted data and the program as a whole. This program and others like it will be helpful in modeling stresses on major engineering endeavors and small, specialized designs under stress. Finally, the visual output of the program is an easy way to communicate engineering to the general public. This program will facilitate further engineering research.

I02
Engineering a Water Filter for Developing Countries: Varying Lateral Thickness in Ceramic Filters to Optimize Flow Rates

Presenter(s)
Dane Christianson, Illinois Mathematics and Science Academy
Michael Gleeson, Illinois Mathematics and Science Academy
Yiru Tao, Illinois Mathematics and Science Academy
Weili Zheng, Illinois Mathematics and Science Academy

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

The purpose of this experiment was to observe the effect that the lateral thickness of a conical clay filter has on its flow rate. Optimizing flow rates brings us one step closer to designing a successful, low-cost water filter. Using an even mixture of clay and sawdust, conical filters of the same approximate height (~150 mm) but different wall thicknesses (15 mm, 13 mm, 10 mm, 7 mm, and 5 mm) were made. They were then kiln fired, causing the sawdust to burn out, leaving pores behind, and then painted with silver-coated silica (for its antibacterial properties). Two hundred fifty milliliters of water were run through each filter, and the flow rate was measured. When we compared our flow rates to the filters' thicknesses, we found that there is a general negative relationship between the rate of water flow through the filters and the thickness of the filters. These results will assist us in optimizing the filter dimensions in order to balance the flow rate and the antimicrobial property in order to reach our performance goals for our filter (two liters of water filtered per hour, 99.99% killing efficiency).

I03
Geothermal Energy

Presenter(s)
Samuel Contreras, Illinois Mathematics and Science Academy
Audel Gutierrez, Illinois Mathematics and Science Academy

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

Throughout recent years, the fluctuation of cost of renewable and non-renewable energy sources has altered the demand for energy. As technology becomes more available, people take advantage of renewable alternatives as a means to lower fuel costs, such as hybrid technology and eighty-five percent ethanol fuel in cars. In homes today, most people heat and cool their homes using natural gas or electricity. However, there is an alternative to these non-renewable resources: geothermal energy. The purpose of this study was to consider the feasibility of a geothermal energy system and find out whether nonrenewable energy can be conserved in residential areas such as the Illinois Mathematics and Science Academy residence halls. Research on the components of geothermal systems, the temperature of the ground, the specific heat of the materials, the type of materials and substances used to keep the system operating, and the laws of thermodynamics, were all used to understand a realistic heating and cooling possibility. Using standard thermodynamics the conclusion was made that a geothermal system was a viable alternative. Our presentation will provide a background on geothermal energy and lead into the basics of how a geothermal energy system works.

I04
The Effect of $[Rh(NH_3)5Cl]+$ Adsorption and Particle Size on Anatase TiO_2 as a Function of Support Treatment Procedures for the Production of C^{2+} Oxygenates

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

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

Heterogeneous catalysts play a significant role in the petrochemical industry. They are used to increase productivity under mild conditions and increase selectivity and thereby reduce waste. As many catalytic materials are typically precious metals dispersed on high surface area supports, generally we desire that the metal particles are as small as possible such that exposed surface area is maximized. In this study, rhodium was supported onto an anatase titania (TiO_2) support through strong electrostatic adsorption. Rhodium catalysts can be used to convert synthesis gas (a mixture of CO and H_2) into ethanol and other alcohols. Before the catalyst can be used, the catalyst must go through a variety of treatments including calcination, reduction, and steam treatment. Several samples were subjected to each treatment in various orders. These samples were analyzed as to particle size and Rh dispersion during different phases of the treatments. Characterization of the catalysts included transmission electron microscopy, X-ray photoelectron spectroscopy and X-ray diffraction in order to analyze our samples. Although results are still being analyzed, if the results prove to be successful, using strong electrostatic adsorption we can achieve particle sizes which may beat the best current industrial formulations.

I05
Creation of a Home Automation System: Variable Environment Simple Task Automator

Presenter(s)
Alexander Goins, Illinois Mathematics and Science Academy
Brian Page, Illinois Mathematics and Science Academy

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

In this investigation we strove to create a fully functional home automation system on a small scale. Through the use of Phidget modular electronics we were able to create a simple, yet effective home automation system named VESTA. With it, users can control room climate, door position, music, lights, and other elements of their home. This setup, designed from scratch, presented us with the challenge of selecting parts that were both cost-effective and practical. Our experiment had us working with radio frequency identification, sensors, servos, and stepper motors controlled by custom software implementing languages such as C, PHP, and BASH. Through the use of our expandable automation software and custom protocols, we were able to control VESTA via multiple frontends, retrieve feedback from each module, and keep tabs on the room's environment. The automation of the door provided both the biggest challenge and the most obvious improvement of living conditions, so this was our primary focus. VESTA is designed to be simple enough to implement in virtually any home, and with improvement could provide a marketable alternative to the expensive home automation systems available today.

I06
Nanocapacitors Made of Bismuth Ferrite: Effect on Film Thickness and Nanocapacitor Diameter

Presenter(s)
Shawon Jackson, Illinois Mathematics and Science Academy

Advisor(s)
Leonidas Ocola, Argonne National Laboratory

Nonvolatile memories have critical impact in emerging computer science. To optimize such memory, nanocapacitors are used to store electric charge. A nanocapacitor contains two conducting layers with a dielectric field in between them. Nanocapacitors with a ferroelectric film in between the electrodes are unique because ferroelectric materials, such as bismuth ferrite (BFO), exhibit polarization capabilities when an external electric field is applied between the two electrode layers. This polarization provides the unit of memory. Therefore, this research project focused on studying BFO as a new ferroelectric material to create nanocapacitors. These nanocapacitors were fabricated on a strontium titenate (STO) substrate, consisting of a top and bottom layer of strontium ruthenate (SRO) with BFO in the middle of the nanocapacitor. The process of producing such nanocapacitors required us to create a design for each layer of the nanocapacitor, transfer the layout to the substrate using electron-beam lithography, and etch unnecessary material to isolate the nanocapacitor. These steps were repeated multiple times to construct each layer of the nanocapacitor. Our main objective is to use these nanocapacitors to find a correlation between the film thickness and nanocapacitor diameter on the nanocapacitor polarization characteristics. In doing so, we hope to enhance nonvolatile memory in electronic devices that contain nanocapacitors.

I07
Thermodynamic and Physical Properties of Ni_2TiSn and Ni_2NbSn

Presenter(s)
Adam Jung, Illinois Mathematics and Science Academy
Faith Quist, Illinois Mathematics and Science Academy

Advisor(s)
Philip Nash, Illinois Institute of Technology

Heusler alloys often have interesting ferromagnetic properties. These properties make them ideal for spin electronic devices such as polarized light emitters and spin injection devices. We have researched the properties of two Heusler alloys, Ni_2TiSn and Ni_2NbSn. We studied the crystallographic structure of the compounds using X-ray diffraction and electron dispersive analysis. We examined thermochemical properties using calorimetry. We used dilatometry and a variety of other techniques to study the physical properties of the alloys. In this study, we have found that the materials did not show a Curie temperature down to -200°C. The enthalpy of formation and the heat content of each alloy are unusually small compared to Neuman-Kopp calculations based on the elemental composition. This is a possible indication of half metallicity. At equilibrium, the Ni_2TiSn and Ni_2NbSn compounds synthesized contained two other phases, accounting for approximately twenty percent of each system. Both alloys are very brittle and could not be hot formed without cracking. Due to the low Curie temperature and the brittleness of the alloys, they may not find practical use in spintronics except as thin films. Neither compound exhibited any clear phase transformation on heating above room temperature so the shape memory effect is absent.

I08
Predicting the Performance of a Clean Air Device for Medical and Consumer Applications Using Computational Fluid Dynamics

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

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

Turbulent flow coming from an air filtering unit quickly becomes contaminated with particulates as it leaves the filter. To develop a larger region of clean air, a thin mesh sheet is appended to the end of the unit, creating unidirectional flow. This technology would ideally allow the air filtering unit to take the place of a clean room. Using three dimensional modeling and computational fluid dynamics software, a digital model of the filtering unit and fluid flow was replicated. Comparing these results with physical measurements such as particle counts or velocity distributions, the accuracy of the model can be validated. If the model replicates the real-world behavior of the air flow, the computational fluid dynamics software would be able to predict the effects of certain external stimuli, such as an open window or a person walking by, on the size and range of the clean air pocket. The data collected from the digital model would give a quantitative estimate for the effectiveness of the device. This would help determine the optimal settings and conditions for the air filtering unit.

I09
Introduction to the Theory and Practice of Tribology

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

Advisor(s)
Robert Erck, Argonne National Laboratory

Scuffing is a form of mechanical wear of metals, which is due to adiabatic shear instability that can cause sudden catastrophic failure in engines and machines. Applying chemical coatings to heavily-loaded parts can improve scuffing resistance, and therefore improve power density and efficiency. The long-term goal of the project is the investigation and assessment of the efficacy of such coatings to prevent scuffing. I spent the past school year upgrading a testing machine at Argonne National Laboratory that is used to assess scuffing performance, and conducted several preliminary tests. Machine improvements included replacing worn parts, installing and improving a new sample holder that prevents specimen misalignment and, improving fixturing for accuracy and ease of use. I conducted several baseline test runs, and under my operation, the test machine produced several controllable localized scuffing events. I learned to operate the computer that does the data acquisition and machine control, and became proficient at recognizing the sound of an impending scuffing event to stop the test at the correct time to produce the best data. I also graphed the results obtained from the data acquisition system, and took digital photomicrographs of tested specimens.

I10
Reducing Polymer Vaporization in an Educational Nanotechnology Laboratory Activity

Presenter(s)
Ian McInerney, Illinois Mathematics and Science Academy

Advisor(s)
James Gerry, Illinois Mathematics and Science Academy
Joseph Muskin, University of Illinois at Urbana-Champaign

Nanotechnology is a growing industry with new technologies developed everyday. In order to support this industry the current high school population must be taught about nanotechnology and its impact. One activity that does this has grown out of nanoscale research based on microstereo lithography. A three-dimensional solid is created using a polymer consisting of 1,6 hexanedial diacrylate, irgacure 819 and sudan 1. Objects are made layer by layer using a computer projector and a simple staging device. This activity can be done safely in a high school laboratory environment. We have noticed through observing the process that the polymer will sometimes vaporize if exposed to too much light at one time, causing toxic fumes. Through experimentation it was determined that by changing the pixel values of the exposed area to be a gray-scale image, the vaporization of the polymer can be reduced. From this we will be able to develop a C algorithm to relate the surface area of the object to the correct gray-scale value of the image so as to reduce the amount of vaporization of the polymer.

I11
Metal Ion Doping in Metal Organic Frameworks

Presenter(s)
Jacob Miller, Illinois Mathematics and Science Academy
Kenneth Wang, Illinois Mathematics and Science Academy

Advisor(s)
Rachel Getman, Northwestern University
Randall Snurr, Northwestern University

In the face of problems with oil and other fossil fuels, the Department of Energy has set goals for the scientific community's creation of a hydrogen fuel cell by 2015. Metal organic frameworks (MOFs) are one of the most promising methods of storing molecular substances such as hydrogen for fuel. One of the many ways to improve these structures is through metal ion doping. Through computational chemical studies using the Gaussian program, we have reevaluated the rationale behind using lithium, the most commonly doped metal, in such a role. Throughout our study, we examined hydrogen molecular physical bonds to alkali and alkaline earth metals and alkoxide benzenes of the most promising metals. Finally, we used grand canomical Monte Carlo (GCMC) classical simulations to investigate H_2 storage in magnesium alkoxide. In this way, the Department of Energy's 2015 goals for hydrogen storage can be met.

I12
A New Approach to Drug Delivery System Based on Magnetic Nanoparticles

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

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

The purpose of this project was to determine how to create an efficent system for drug delivery using nanoparticles. Nanoparticles were fabricated and tested for functionalization. This led to the focus on certain characteristics of the nanoparticles such as its biocompatibility, propagation capabilities, and cell attachment. The tests have shown these nanoparticles can be moved in a fluidic environment using a local magnetic field and that they will go onto the nanotransmitter that has been created. However, other problems still include how to precisely put the nanoparticles on the transmitter and how to make the nanoparticles not stick together and to the surface. If this technology works, this would revolutionize treatment strategies. For example, it would allow a more concentrated attack on a cancer site as opposed to a treatment that could affect the entire body.

I13
Vertical Takeoff and Landing Aircraft

Presenter(s)
Brenton Noesges, Illinois Mathematics and Science Academy

Advisor(s)
Francisco Ruiz, Illinois Institute of Technology

In my investigation, I have been working with vertical take-off and landing (VTOL) aircraft. The simplicity of this type of aircraft can potentially lead to a flying car because of the lift created, and there is no need for a complicated steering system. I work with an electric and a gas powered model. For each of these models, I have been working towards testing the lift capabilities. In order to test for lift in both models, improvements must be made to each model. On the electric model, I have been designing a gimball assembly and on the gas powered model, I look to improve its reliability. The results of my investigation are still inconclusive; I have been unable to test models at this point. Currently I am improving my gimball designs and trying to learn CAD programming in order to get these parts created in order to test them. I am also still researching ways to create molds for plastic cogs of the gas powered model in order to recreate these plastic gears into stronger materials such as bronze. The gears are too weak to hold up against the engine torque and need to be strengthened. Developing this technology can help improve transportation.

I14
Characterization of Electron Beam-Induced Silver Deposition from Liquid Precursor

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

Advisor(s)
Ralu Divan, Argonne National Laboratory
Alexandra Joshi-Imre, Argonne National Laboratory

Electron beam-induced deposition using gas phase precursor molecules is an extensively studied fabrication technique. Liquid phase metal deposition has recently been shown to achieve higher purity levels than traditional gas phase deposition, and the goal of this investigation was to characterize liquid phase silver deposition in particular. A scanning electron microscope (SEM) was used to deposit silver on polyamide membranes in Quantomix capsules containing aqueous $AgNO_3$ solution at 0.001M by means of accelerating electrons into the solution at a couple nanometers diameter spot for silver ion reduction. Atomic force microscopy and SEM were subsequently used to characterize size (height and width, respectively) to relate to electron dosage. The Monte Carlo simulation of electron trajectory in solids program was used to model electron trajectory in the solution to relate the size data with electron spread. During depositions, different electron beam energies were used to see how electron energy influences deposition. We observed granular growth of silver with sub-100 nm grain size and ~300nm aggregation size. These results could be applied in various fields, especially in photonics and biology, as results indicate that with some limitation we can fabricate granular silver structures with this novel method.

I15
City House, Country House: An Architectural Investigation of Mies Van Der Rohe's Lafayette Park and Farnsworth House

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

Advisor(s)
Joy Meek, Wheeler Kearns Architects

The buildings of architect Ludwig Mies van der Rohe possess a unique modern style. Mies not only produced a new design style, he changed the meaning of simplicity in architecture through his focus on basic materials of steel and glass. Structure, material, function, and technology are important parts of the design and construction processes of a building. This investigation compared and contrasted the role of these four elements within two of Mies' masterpieces, the multi-family residential Lafayette Park townhouses (1955-1963) in Detroit, Michigan and the single family residential Farnsworth House (1946-1951) in Plano, Illinois. Lafayette Park functioned as an affordable housing complex; Mies had to create uniform housing units that met the developer's budget and the market of the time. He emphasized the use of steel and glass in both, however with more simplicity in the Farnsworth House where he had an opportunity to create a private weekend home with few limitations. Though the buildings were constructed for different needs, the overall Miesian style and technology was similar. A visual and textual comparison of the two structures was created by reading critical reviews and bibliographies on Mies, building study and final models of both spaces, and visiting the Farnsworth House.

I16
Investigation into the Feasibility of Microclasp Devices for Complex Manipulation Tasks

Presenter(s)
Navdeep Singh, Illinois Mathematics and Science Academy

Advisor(s)
Laxman Saggere, University of Illinois at Chicago

Grasping and manipulation of microparticles suspended or floating in a fluid is important for applications such as the physical handling of biological matter. Currently there is a lack of reliable methods to accomplish such manipulations, which present challenges due to motility of the particles in the medium. Conventional methods do not fully take into account the rapid movement of particles through phenomenon such as Brownian motion and fluid flow induced forces. Adding to the difficulty are adhesion and surface tension at the liquid-air interface which make successful manipulation more difficult. This project tests the applicability of a novel microgripper, called the microclasp, for the challenging task of grasping microparticles suspended in fluid. The microclasp has a unique structure that circumvents the problem of particle motion through an enclosing multipoint grasp. In order to demonstrate in-fluid microclasping, a two-arm micropositioning system was built for high-precision positioning and actuation of the micro-clasp under a microscope. Using this system, the microclasp was introduced into a water environment in which polyethylene microspheres were suspended. We successfully accomplished stable grasps of trapped microparticles in each of the experimental runs, notwithstanding the unpredictable motion of microparticles in fluid, thereby demonstrating the effectiveness of the microclasp in accomplishing reliable and stable grasps in fluid environments.

I17
The Atomic Layer Deposition of Erbium Oxide Thin Films on Silicon (100)

Presenter(s)
Oscar To, Illinois Mathematics and Science Academy

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

As the size of transistors has been shrinking over the past few decades, alternative high dielectric constant (high-k) materials are needed to replace silicon oxide (k = 3.9) in order to meet the needs for low energy applications and future nanoelectronics. Recently, several high dielectric constant materials have been widely investigated as replacements for SiO_2. Among the potential alternative high-k materials, lanthanide oxides have attracted considerable interest due to their favorable properties, including high dielectric and thermal stability. Compared to other lanthanide oxide thin films, erbium oxide is more thermodynamically stable (~ 900°C) as a result of the small radius of erbium and erbium oxide's negligible interaction/reaction with silicon substrates. In this study, erbium oxide is being deposited using a novel atomic layer deposition (ALD) system. Preliminary optimal conditions, including system pressure, precursor/oxidizer pulse and purge time, and substrate temperature have been obtained; these show self-limiting thin film growth and saturation of the surface deposition reaction. The ALD temperature window has been founded to be between 160°C and 330°C. Thicknesses of the resulting thin films are determined by using spectroscopic ellipsometry. The ultimate goal for this investigation is to determine optimal conditions, growth rates and process – structure interrelationships in the ALD of erbium oxide thin films.

I18
S. R. Crown Hall: A Case Study

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

Advisor(s)
Mark Sexton, Krueck and Sexton, Architects

Called by some as the modern Parthenon, S. R. Crown Hall, on the campus of the Illinois Institute of Technology in Chicago, was designed by the leading modernist architect of the twentieth century, Ludwig Mies van der Rohe. Researching the life history and works of Mies allowed for an understanding of his general design ideas of universal space and simplicity which stemmed from his experiences as a German architect during World War II under Nazi political pressure during the new industrial age. Crown Hall was field dimensioned, and plans, sections, elevations, and details, which were produced using a computer drafting program, were then compared to the original drawings giving insight on Mies' appreciation for simplicity in the exposed steel and glass of the structure. The plans also show the particular heating, cooling, and lighting systems which utilize ventilation and sunlight and thus improve sustainability. Meetings with a structural engineer shed light on the main floor's unusual columnless nature by explaining the load flow of the building. First hand observations as well as weekly meetings with the architects that renovated Crown Hall in 2005 also gave unparalleled insight into the building. These months of study have given an understanding of Crown Hall and the reasons behind its continuing impact on modern architecture.

I19
Autosacker: Designing and Developing a Novel Football to Enforce a Quick Release by the 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. It does this by measuring the time between when the football is snapped by the center and released by the quarterback. This football will be used for recreational games that do not have an even number of players and competitive players who need to practice a quick release. To accomplish this, the football utilizes a PIC (programmable interface controller) microcontroller that flashes light-emitting diodes (LEDs) if the quarterback holds the ball too long. The prototype currently in development utilizes a normal football modified with a small circuit containing a button, a PIC, and LEDs. Most of the development time was spent on learning PIC programming in C and circuit building. The initial prototype will be completed by the end date.

J01
Researching and Writing Historical Fiction for the Modern Reader

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

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

Historical fiction was read for content but also to discover the process of writing historical fiction, which was accomplished in part by reading authors' extensive endnotes. Research was conducted to obtain information on the village of New Salem, Illinois, which was founded along the Sangamon River in 1828 and abandoned by 1840. A portion of each week was spent developing and then writing an original work of historical fiction set in New Salem, which included developing multiple fictional characters and placing them in a historical context. This original work was discussed with a current published historical fiction author. The writing was then discussed with a group of IMSA staff and students who had read a significant excerpt. This was beneficial in deciding what literary characteristics make historical fiction appealing or unappealing to modern readers. It was determined that the most valuable techniques for writing involved creating an accurate historical atmosphere to the written work through the incorporation of small details such as weather and descriptions of the land, rather than through relating actual historical events. The original work was revised and bettered using the readers' suggestions in an attempt to create a polished piece that would draw attention to historical fiction as a genre of literature and New Salem as a forgotten piece of Illinois history.

J02
A Comparison on the Development of the English and Spanish Languages

Presenter(s)
Miguel Garcia, Illinois Mathematics and Science Academy

Advisor(s)
Margaret Cain, Illinois Mathematics and Science Academy

The Spanish language, an amalgam of Latin, the Visigothic tongue and Arabic, has been spoken and written for almost twelve centuries. Interestingly, it has changed very little in all that time. English from 1200 years ago, on the other hand, is so different from today's version that it is almost unreadable. The purpose of this project was to research the origin and development of the Spanish language and understand why it has remained relatively unchanged. Then, we compared these findings to the development of the English language. Our research has led us to conclude that it is largely the geographical features of Spain that have shaped and maintained the language. Due to the isolation of the Iberian Peninsula, and its internal geography, the Spanish language underwent much less change than English

J03
Writing, Producing, and Market Testing an Original Film Designed to Appeal to Teens

Presenter(s)
Amogh Kambalyal, Illinois Mathematics and Science Academy
Richard Song, Illinois Mathematics and Science Academy
Karna Warrior, Illinois Mathematics and Science Academy

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

The goal of our investigation was to make a film that would appeal to both males and females between the ages of fifteen and nineteen. We analyzed film reviews and box office exit polls of various movies in order to see what appeals to each gender. We found that females appreciate relationships between characters more than males, while males focus more on action and overall plot, ignoring smaller details. We decided to use the genre of romantic comedy because it combines complex relationships, to appeal to females, with broad comedy, that appeals to males. After researching this genre, we scripted, cast, and shot an original film set on the IMSA campus. We plan to survey audiences to see if our film has equal appeal to females and males between the ages of fifteen and nineteen. The early results of our inquiry are that we learned how each decision in the film-making process can affect audience appeal. By making movies that appeal to both males and females, directors, producers and companies can market their films more effectively.

J04
Post-Apocalyptic Literature and its Relationship with the Evolving Cultural Consciousness, 1839 to Present

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

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

Post-apocalyptic literature has existed for as long as science fiction has existed, and continues to be popular in various media in the present day. The earliest example is perhaps Mary Shelley's *The Last Man*, which is often considered the first science fiction novel. This inquiry seeks to trace the development of the genre from its earliest incarnations through the present day. This includes critical readings of twelve works by eleven authors, as well as context for each and its place in the larger canon. Post-apocalyptic fiction often mirrors the common fears and concerns of the day, such as the threat of nuclear warfare in the Cold War and environmental and biological issues in recent years. The genre has also had an influence on other media, including music and film. *I am Legend* by Richard Matheson is not only an important post-apocalyptic novel, but may be considered the first modern horror novel and the progenitor of the modern zombie story. The genre is not limited to adult fiction; children's novel *The City of Ember* by Jeanne DuPrau was a bestseller and received a film adaptation. The future of post-apocalyptic fiction will be determined by the fears that define the coming decades.

K01
Radium Contamination in Drinking Water and the Growing Demand for Lake Michigan

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

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

Radium contamination in well water sources and population growth has driven many outer Chicago suburbs to petition for Lake Michigan drinking water. Some suburbs have been denied this and must deal with radium contamination. Joliet is an outer Chicago suburb that has serious radium contamination in its water. Joliet has tried changing to Lake Michigan water, but it has not been possible. Removal of radium in Joliet has resulted in radium-containing sludge that is dumped in area farms. Plainfield and Naperville changed to Lake Michigan water in the last ten years due to a rapid population increase and to avoid the use of radium-contaminated well water. This investigation will address environmental and health risks due to radium-contaminated drinking water and how to deal with allocation of water with increasing populations.

K02
Nanoparticle Silver-Applied Filters as Water Filtration Solutions

Presenter(s)
Sharada Dharmasankar, Illinois Mathematics and Science Academy
Eric Lin, Illinois Mathematics and Science Academy
Hassan Qureshi, Illinois Mathematics and Science Academy
Kenneth Wang, Illinois Mathematics and Science Academy

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

There is a universal understanding that many developing countries lack the facilities needed to continuously provide fresh, clean water for everyday use, especially in nations with high populations and lack of industrial regulation. We aim to provide a robust, cost-efficient water filter capable of removing the threat from waterborne pathogens. Our goal is to create a sustainable ceramic filter that filters at least forty liters of water per day, with a 99.99% killing effectiveness, and a maximum cost of 20 U.S. dollars. Using nanoparticulate silver impregnated clay, we have made conical ceramic filters that reach those target values. Currently we are altering the cone thickness to reach an optimal tradeoff between flow rate and killing effectiveness.

K03
Determining the Distribution of Ozone Through Ballooning and Ultraviolet Radiation

Presenter(s)
Denise Mol, Illinois Mathematics and Science Academy

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

The purpose of this investigation was to research the relation between altitude and amount of ozone in our atmosphere. Ozone is a molecule that is constantly destroyed and recreated by ultraviolet radiation (UVR). We assume there is a close enough correlation between O_3 and UVR; that is, that there is nothing else significantly blocking UVR on its way down to the surface. Thus UVR makes a good proxy for measuring the distribution of ozone at different altitudes. We expect to see a rise in UVR as the balloon travels through the ozone layer, and a significant amount more at the peak of its flight. To calculate the distribution, we built a photometer to send up in a balloon launch. This instrument uses a photodiode (like a solar cell) and other simple electronics to record UVR by creating a small current as the balloon sails higher through the atmosphere. When the balloon reached extreme altitudes, the air around became so thin that the balloon burst. The data from this launch showed that ozone is confined to a particular region of the atmosphere, although the numbers were not precise enough to determine an exact amount of ozone.

K04
Viability and Sustainability of Biofuels in the Present and Future

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

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

Increased attention to food-based biofuels has spurred controversy about their impact on food prices and the environment. Debate results in skepticism about their sustainability. This paper discusses environmental and social sustainability in the context of biofuels and the factors affecting the economic viability of present and future biofuel production. Putting together this review first involved a comprehensive process of building proficiency with the concepts of biofuels and sustainability. The majority of the process involved the enlistment of a multifarious, but meaningful, selection of articles useful in answering the sustainability question. This independent study paved an understanding to the world of biofuels as alternative energy and the importance of sustainability in determining funding. Importantly, cellulosic biofuels from dedicated energy crops offer considerable promise as a main alternative energy. These energy crops show promise in reducing the competition for land and undesirable environmental impacts negatively associated with ethanol. The investigation is almost complete and all that is needed is piecing together of each piece of information in a final, argumentative paper. Furthermore, technological innovation and policy incentives are needed to develop more sustainable biofuels, guide the mix of feedstocks, their methods and locations of production.

K05
The Bioavailability of Mercury in Aqueous Solutions in the Presence of Complexing Agents

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

Advisor(s)
Jean-Francois Gaillard, Northwestern University

Mercury contamination of freshwater systems is an increasing environmental problem. The accumulation of mercury within food webs and its transformation to more toxic chemical forms, such as methyl mercury, in the aquatic environment is controlled by its bioavailability, that is, the fraction of the metal that is incorporated inside living cells. We have conducted a study on how complexing agents, or ligands, would affect the bioavailability of mercury to microorganisms. We have used a genetically engineered *E. coli* bacteria that reports on the presence of intra-cellular mercury by producing a luminescent signal. The response of this bioluminescence biosensor allows us to measure the flux of mercury that is bioavailable and assess how it is affected by the presence of different ligands. Preliminary results show that some ligands facilitate the biouptake of mercury whereas other ligands inhibit it. Control experiments are being conducted to determine whether these ligands promote or slowdown the metabolism of the microorganism used, since it would then affect the outcome of the test. The results of this study suggest that the free ion model is not a good proxy for assessing the bioavailability of mercury and that the release of anthropogenic ligands contributes to the mobility of mercury.

L01
Putting it Together: The Development of Theatrical Stage Productions

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

Advisor(s)
Steve Scott, Goodman Theatre

Theater is a unique art form that has influenced its spectators for decades. Theater serves as a way to allow audiences to think, expose themselves to new experiences, reflect on their own lives, and simply be entertained. Putting on successful theatrical stage productions involves an entire network of people from various backgrounds and departments, all working towards a common goal. This unique form of business collaboration and communication is what it takes for a theater company like the Goodman Theatre in Chicago, Illinois to be successful. In order to fully understand the creative process in developing successful theater, a study was done at the Goodman Theatre on the development of theatrical stage productions from the ground-up. Employees in various departments of the theater were interviewed about what they do and how they work with others to make the shows at the theater successful. In addition to that, many operations in the theater were observed, such as rehearsals for an upcoming play and script evaluations. My results showed that successful theater companies like the Goodman Theatre, must work as a single unit. There is no assembly line behavior when putting together a season. Every department, from lighting, to costumes, to marketing, must work in sync in order to have profitable productions. Through my investigation, I found that with the cooperation of everyone in this business, the stories that unfold in a playwright's mind may become a spectacle on stage.

M01
Theoretical and Pragmatic Medicine in Ancient Greece

Presenter(s)
Paul Angelillo, Illinois Mathematics and Science Academy
Ryan Jordan, Illinois Mathematics and Science Academy

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

While medical practice before the dawn of the scientific revolution could hardly have been called scientific, each early attempt to develop a working theory of medicine drew upon, in different amounts, mythological and theoretical beliefs as well as first-hand, practical knowledge. Such an atmosphere of medical thought existed in Ancient Greece, where the two sides both contrasted and intertwined, inspiring and forming medical thought to this day. Through personally reading and analyzing the translated works of Hippocrates, Aristotle, and Galen and comparing our thoughts with secondary sources, we developed two categories of Grecian medical thought, the theoretical and the practical. Comparing and further analyzing the contents of these two groupings brought us to the conclusion that, while theories based on mythology continually fell in and out of favor, Grecian nature ideologies (namely humorism) held constant sway in their medical practices, although often practical data disagreed with the theory.

M02
The Rise and Fall of Chivalric War

Presenter(s)
Cindy Angpraseuth, Illinois Mathematics and Science Academy

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

Chivalry, honor, bravery, glory: these are all characteristics of the knight in shining armor. How did this icon come to be? Through poetry and war, I have been researching the rise and fall of the armored horseman and their impact on history to the modern day. I have discovered how these soldiers originated and why they had to fall. I shall tell you the tale of how the common foot soldier from the fall of Rome evolved into the armored horseman of the Middle Ages and how that high and mighty figure became a foot soldier once again. Knights influenced European war and politics until the twentieth century, their impact lasting over a thousand years. Western nations have preserved the ideas of chivalry and hierarchy right up until today.

M03
Romanticism and Classicism in Nineteenth Century British Literature

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

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

The nineteenth century was a time of conflicting ideologies and aesthetics. With the rise of the Romantic movement, the competing ideals of romanticism and classicism shaped the course of an empire. This investigation is an attempt to explain the context for major works of British literature during this century in light of this dichotomy. Surprisingly, when examining the early Romantic movement, the lines between these two standards start to blur. Still more intriguing are the common origins of seemingly opposed political movements: the seeds of both early socialism and modern libertarian ideology can be found in the writings of the early Romantics. What is ultimately presented here is not only a study in distinctions: it reveals a remarkable common heritage.

M04
Strengths and Weaknesses of the Copenhagen Accord

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 the United Nations' Copenhagen Climate Change Conference and its expectations and outcomes, predominantly the Copenhagen Accord. The investigation deals with the major issue of climate control, and as with any current problem, there are many sides and opinions. The main issues facing the participant nations at the conference were those of funding, mitigation of emissions, and adaptation to new control policies, especially for developing countries. The project has dealt with the viewpoints, for dealing with these problems from the sides of developed and developing nations, and on more specific nations which have come out as powerful participants in the climate debate. Literature review from both first-hand and second-hand sources has been employed as the method of investigation in order to get the most clear idea of the various viewpoints on this conference and the resulting document. The results, although they may not be accepted by all parties involved in the current climate debate, represent a careful analysis of the actions and expectations of various major participant nations in the climate debate, and their implications for the future of climate change regulation.

M05
Alternate History: King Edward VIII and the Abolition of the British Monarchy

Presenter(s)
Joseph Donahue, Illinois Mathematics and Science Academy

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

Alternate History is a genre of literature and historical research which explores the consequences of changing the outcome of one historical event. This investigation creates an alternate history scenario in which the United Kingdom's King Edward VIII defies Prime Minister Stanley Baldwin and his cabinet by marrying the twice-divorced Wallis Simpson, and refusing to abdicate the throne, resulting in Baldwin leading Parliament in abolishing the British monarchy. While researching this scenario, books on the time period and key figures embroiled in the events were read. A timeline depicting events in the alternate history was derived from events which actually occurred. In the alternate timeline, the United Kingdom dissolves into the Republic of Great Britain and the Kingdom of Canada and New Zealand. Neville Chamberlain is elected Britain's first president, and he engages in a power struggle with the Prime Minister, Winston Churchill, over involvement in World War II. These events transform the war as we know it into a longer-lasting, nuclear struggle. At the end of the war, Russia invades Japan, and both Japan and Germany are divided. This sets the stage for a more intense Cold War. This inquiry shows how changing one historical event can affect countless other seemingly unrelated events and, in effect, can rewrite history.

M06
The Rise of Japan after World War II and its Potential Implications for Romania

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

Advisor(s)
Karen Alter, Northwestern University
Eric Smith, Illinois Mathematics and Science Academy

After World War II, Japan experienced significant growth in its economy, which became known as the Japanese Miracle. In my investigation, I have been working to determine the specific factors that contributed to Japan's economic success and whether Romania could use similar factors in order to rise to financial stability and become a regional leader. I have found three major factors that played a role in Japan's economic success. One of these factors was the allegiance between Japan and the United States. The United States helped Japan quickly recover from the destruction caused by World War II. The well-educated work force in Japan also contributed to the Japanese Miracle. The third factor that contributed to Japanese progress was that China was no longer a front runner in the global economy. The results of my investigation are still fairly inconclusive. However, I can state that the three factors that contributed to Japan's success do not seem to be present in Romania. After further research, I will be able to determine what attributes Romania does have that might help it improve its economic standing.

M07
Making the Right Choices: Rockford's Dilemma

Presenter(s)
Brittney Hanson, Illinois Mathematics and Science Academy

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

In the past Rockford has been famous for being home to the world's first women's baseball team, but unfortunately, now the city is getting more press for a very different reason. It is home to one the highest unemployment rates in the state and the country. Through my research, I worked to explore why the economic failure of the past ten years has hit the city of Rockford with such tremendous force. I used information from city directories and the United States Census Bureau to understand why industry was so important to the city. I came to discover that, because the city was built on industry and being employed was historically more important than being educated, more emphasis was placed on building up business and less on education. The city became completely dependent on the industry. When more competitive countries and companies began to grow and the industries bee to evolve to use new equipment and techniques, the Rockford workers were often left in the dust. As a result of my research, I have devised a plan to revitalize Rockford and other cities that have been affected in the same way by the economic downfall.

M08
The History of Piracy and its Modern Applications

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

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

The recent spate of piracy off the coast of Somalia has renewed international interest in this ancient profession. Though piracy consists of a good deal of swashbucklin', few pirates resembled Johnny Depp. In my investigation, I examined patterns of piracy from the Bronze Age to the modern era. I searched through books and historical documents learning that certain patterns exist which promote piracy. I began researching the Sea People, who tormented the eastern Mediterranean in the sixteenth century B.C. Piracy continued until pirates captured Julius Caesar, leading to a revolutionary extermination. Later the Vikings of northern Europe sought to pillage villages and steal goods. Several of these and Russian communities then invited these strong, fearless Norwegians to lead their people. I concluded that piracy always prevails, but increases with political and economical instability. Only a strong thalassocracy, often imperial, can eliminate these scallywags. Ironically, such thalassocracies often result from piracy. Through Francis Drake, Martin Frobisher, and Henry Morgan, the modern British Navy and the British Empire were formed, destroying their own profession. With the breakup of this empire, piracy has returned, most predominantly off the coast of Somalia.

M09
A Simulation of Early Modern Europe

Presenter(s)
Andrew Heuser, Illinois Mathematics and Science Academy
Liana Nicklaus, Illinois Mathematics and Science Academy
Thomas Oberhardt, Illinois Mathematics and Science Academy

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

As a result of research using maps and secondary sources, this independent study has created a board game to simulate the political, military, and economic climate of Europe in the sixteenth and seventeenth centuries. In particular, we have created scenarios for the reign of Charles V, the French Wars of Religion, and the Thirty Years' War. The game is loosely modeled after *Machiavelli*, a simulation of Renaissance Italy. Participants use a map that encompasses Western and Central Europe, parts of the Ottoman Empire and Northern Africa, as well as the surrounding bodies of water. The map is divided into small provinces and seas which players conquer in order to meet each scenario's objectives. Additionally, because siege warfare was integral to the military campaigns of this era, many regions contain fortresses which must be taken. To simulate finances, players collect taxes from their controlled regions and fortresses, and spend these funds to purchase armies, fleets, and other pieces. To win, players must negotiate with one another, representing the dynamic, often cutthroat political dealings of the era. We have also pursued modeling the influences of trade, religion, plague, and rebellion. In sum, we feel this simulation is an entertaining and accurate portrayal of the specific scenarios, and can be used as an effective teaching tool.

M10
An Impartial View on U.S. Relations with Israel

Presenter(s)
Molly Pachay, Illinois Mathematics and Science Academy
Kavita Patel, Illinois Mathematics and Science Academy

Advisor(s)
Jennifer Bing-Canar, American Friends Service Committee

Through media review and interviews with Israelis and Palestinians in Chicago, our investigation considers the pros and cons of the U.S. and Israel alliance. Internationally, America is associated with many of Israel's actions. American policy on Israel, stems from potent pro-Israeli (Jewish and non-Jewish) political opinion that sometimes digresses from democratic values and respect for human rights. The United States' alliance with Israel has affected international relations and the perception of the U.S. in a myriad of ways worldwide. The two nations have a strong military alliance, with the U.S. supplying weapons and aid to Israel, and Israel providing a base in the Middle East for military operations. However, Israel has continuously committed human rights violations against the Palestinians, such as during the Gaza Crisis in January 2009. America's enduring alliance with Israel is of special interest to all citizens because Israel receives $3 billion from the U.S. each year, which is more financial aid than any other country receiving aid from the U.S. The many different view points, stories and experiences from Palestinians, Israelis living in fear of attack, Christians, refugees, Zionists, and Jews across the world, makes this conflict multifaceted and creates a quagmire difficult to untangle.

M11
The Consequences of Modern Agriculture

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

Advisor(s)
Kathryn Kadel, Illinois Mathematics and Science Academy

We are, as a nation, quite literally made of corn. The New Deal contained several bills directly affecting farmers, giving them price supports, and a way to manage the market to protect the agricultural economy from collapse. Since the 1970s, these sustainable price supports have given way to subsidies, which continue to degrade the value of America’s crops, and have contributed to the invention of new pesticides, herbicides, and foods, including high fructose corn syrup. These in turn have resulted in the degradation of human and environmental health in the United States. With the rise of fast food, spurred by an overabundance of cheap beef and grains, has come obesity and the associated heart conditions and diabetes, leading to higher medical costs for citizens and the government. It is no longer profitable to raise cattle in the manner their bodies are designed to handle - a diet of mostly grasses - and so we stuff them with cheap corn, creating health problems and pain for the animals, but also allowing for a more rapid spread of mutated food-borne illnesses. America’s farmers have lost respect for their jobs, and for corn which rapidly destroys our fertile lands and pollutes our water.

M12
America's Agricultural Transition: Changes and Social Consequences in American Agriculture from Post-Civil War to Today

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

Advisor(s)
Kathryn Kadel, Illinois Mathematics and Science Academy

In the last one hundred and fifty years, industrialization and changes in policy on the part of the United States government dramatically transformed small-scale farming, making it unable to maintain long-term profitability and leading to gradual commercialization and loss of the traditional family-farm structure. Through study of literature reviews and interviews, this project examined this large-scale abandonment of farming by immense sectors of the population and the resulting shifts in the lifestyle of both non-farm and farming Americans. Due to overproduction, lack of parity in production, uneven foreign trade markets, expensive farming equipment, and governmental policies that favored large-scale, industrial farming practices, small-scale farming was no longer a feasible means of making a living. Ideologically, American agriculture has left the Jeffersonian, independent, self-sustaining mores of its past and shifted to a highly interdependent system largely controlled by a few corporations and highly reliant upon financial assistance from the American government. These changes have hugely diminished rural culture, leaving rural towns and countryside's barren as former farmers leave for suburban and urban lifestyles. Understanding these shifts and transformations in agriculture is crucial to understanding the importance of agriculture as a whole upon America and the impact the ideological shift from agrarianism to industrialism has had.

M13
Future of Flight: A Comparative Look at Unmanned Aerial Vehicles Versus Piloted Aircraft

Presenter(s)
Lisa Wendel, Illinois Mathematics and Science Academy

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

The initial push for the technological initiative of unmanned aerial vehicles (UAV) arose during the Vietnam War. Although the unmanned aerial vehicle programs in the United States Military have been successful in certain roles, it is clear that there will always be missions only manned aircraft can accomplish. These include air superiority missions and heavy bombing missions, which require the judgment of a trained and experienced pilot. Through literature review as well as data analysis, I have explored the limitations of UAVs. The key standard of my comparison has been the number of civilian deaths due to UAVs versus piloted aircraft and overall cost. To understand the nature of UAVS one must first analyze maneuverability, payload, surveillance capabilities, and amount of armor required. The results of my study show that UAVs have not been as successful in their ability to replace human pilots or decrease collateral damage, as was originally hoped.

N01
Comparative Analysis of Court Experience and Outcome (Results and Process) Through Pro Se and Legal Representation

Presenter(s)
Stephanie Bernardo, Illinois Mathematics and Science Academy
Leslie Martin, Illinois Mathematics and Science Academy

Advisor(s)
David Yanoff, David L. Yanoff Law Office

As a result of our current economic situation, it has become common for litigants to represent themselves in civil courts to cut down on expenses. This increase in self-represented litigation causes us to wonder what advantages an attorney has over a Pro Se litigant. Our inquiry investigates both attorneys and Pro Se litigants within personal injury, contracts, and the eviction courts of the Chicago Circuit Court System. Through interviews, case study research, and court observations it has become evident that Pro Se litigants are more common in courts such as evictions, but as cases become more complicated, like those in contracts and personal injury, it becomes more difficult to understand the court room procedures. Results determined that several factors contribute to how each Pro Se litigant will fare, such as their economic standing, the specifics of their particular case and how informed they are about the process but there are also numerous resources available for their assistance. In just some instances though, having legal representation is necessary.

N02
An Examination of the Death Penalty in Countries Throughout the World

Presenter(s)
Abigail Flynn, Illinois Mathematics and Science Academy
Jade Martin, Illinois Mathematics and Science Academy

Advisor(s)
Sandra Babcock, Northwestern University

Around the world, the use of the death penalty is reducing, but fifty-eight countries are still retentionist, meaning they still practice the death penalty, which many call an inhumane and unjust punishment. In addition, there are thrity-five de facto abolitionist countries, meaning they have not executed anybody in over ten years. At Northwestern Law's Center for International Human Rights, we have been conducting an investigation that is part of a large death penalty research project, with the goal of creating an online database of death penalty policies and procedures. Our research has centered on looking at the laws and practices around the world. We have conducted this research by obtaining penal codes, which are the most accurate documents available for researching punishments for crimes, and researching the policies and procedures related to death penalty as well as information such as ratification of international treaties and trends in the application of the death penalty for retentionist and de facto abolitionist countries. Although the database is not yet complete, with our work and the continued work of other researchers it is scheduled to launch by the end of 2010.

N03
The Insanity Defense and the Difference in States' Perspectives

Presenter(s)
Satoe Sakuma, Illinois Mathematics and Science Academy

Advisor(s)
Mark Heyrman, University of Chicago

Insanity is the legal term for not being able to distinguish the difference between right and wrong in the moment of the crime. At present, the legislatures of the fifty states are allowed to determine their own form of the insanity defense or determine to abolish it, which five states already have. These five states include: Idaho, Kansas, Montana, Nevada, and Utah. By analyzing the differences between the forty-five states that offer an insanity defense as a valid defense in court and the five states that do not, I found that the five states, with the exception of Nevada, are all conservative states. A reoccurring pattern can be drawn from the incarceration rates, as well as the punishment available in each of the five states which indicate the difference between the states that have abolished the insanity defense and the states that have not.

O01
Investigating Quords of Quadrilaterals

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

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

Geometry has always been a fascinating subject for mathematicians, full of incredible and surprising results and discoveries. This investigation primarily focused around quords (segments in quadrilaterals), specifically, midvexes (segments drawn from a vertex to the midpoint of an opposite side). Cabri Geometry II, a computer program, was used to enhance the exploration process. A relatively unexplored topic in geometry, groundbreaking work was both expected and found, providing insight and parallels previously unknown in the vast realm of quadrilaterals and midvexes.

O02
Explorations of 3-Free Sequences

Presenter(s)
Shiladitya Bhattacharyya, Illinois Mathematics and Science Academy
Andrew Lee, Illinois Mathematics and Science Academy
Nathan Yan, Illinois Mathematics and Science Academy

Advisor(s)
Micah Fogel, Illinois Mathematics and Science Academy

Sets with arithmetic properties are of great interest to number theorists. One particular type of set, first described by Erdos, is a 3-free set. 3-free sets are sets that do not contain an arithmetic progression of length 3; in other words, you cannot find two elements of the set x and y such that xy=2z, where z is also an element of the set. A naïve way to generate 3-free sets is by the greedy algorithm, which always takes the next available number, inductively. Although the greedy algorithm does not always generate the largest 3-free subset possible, it exhibits elegant properties. In fact, for numbers of the form $\Sigma\ 3^n$ the greedy algorithm does in fact generate the largest 3-free subset.

O03
How Powers of Various Statistical Tests Vary as the Distributions they are Applied to Change

Presenter(s)
Victor Duan, Illinois Mathematics and Science Academy

Advisor(s)
Barbara Engelhardt, University of Chicago
Matthew Stephens, University of Chicago

The power of a statistical test is a measure of how well a test determines a true difference between populations. Power is affected by a variety of variables including sample size, standard deviation, and effect size. However, this study analyzes how the powers of several widely used statistical tests change as the distributions of the populations vary. It is expected that different tests perform with varying power under different circumstances, so this study aims to see how the Students t-test, Wilcoxon rank-sum test, and normal-scores test perform under a variety of distributions, including t-distribution, normal distribution, gamma distribution, uniform distribution, and log-normal distribution. Power was computed by running simulations in the statistical program R. Two samples were created using random simulations of varying distributions. Afterwards, the tests were applied and powers were compared. Results showed that the normal-scores test often achieved the highest power. When it did not, it still performed very well compared to the other tests. Because we do not usually know the population distribution, this allows us to select a robustly powerful test to analyze data that are distributed under varying distributions, the normal-scores test.

O04
Sufficient Conditions for Degree Sequence Embedding on the Projective Plane

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

Advisor(s)
Noah Prince, Illinois Mathematics and Science Academy

A graph's degree sequence is the list of its (not necessarily distinct) vertex degrees, generally in non-increasing order, and a realization of a sequence S is a graph which possesses degree sequence S. Previous work by Prince and Wenger on determining degree sequences which possess some planar-embeddable graphic realization has raised the question of which degree sequences possess some embeddable realization on other surfaces. In this investigation, we discuss work with Prince on the projective plane, which includes an outline of a proof that graphic degree sequences with minimum degree one have some embeddable realization on the projective plane if the sum of the vertex degrees S(n) satisfies S(n)<= 2n 18. We also prove a similar characterization for the existence of a projective planar embeddable realization of arbitrary graphic sequences with minimum degree two. In addition, we also provide a proof for a lemma which simplifies inductive investigation of bounds on projective planar and planar graphs. These results indicate the existence of significant commonalities between bounding values on surfaces of differing genus, and the major lemma proven, if properly generalizable, has the potential to greatly facilitate analogous research into surfaces of greater genus.

O05
Quadrilateral Investigations

Presenter(s)
Jason Hempstead, Illinois Mathematics and Science Academy
Elizabeth Ott, Illinois Mathematics and Science Academy

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

Over the past few millennia, the Euclidean triangle has been the basic foundation for all of geometry. This basic shape has been examined to the point where little original research exists in relation to it. Due to this, our investigation focused on a figure that has been given hardly any attention: the quadrilateral. Our project was centered on organizing and classifying all possible quadrilaterals based on relationships between their sides, diagonals, and angles in a way that no other project has been. Using a computer program, Cabri Geometry II, we worked to construct these quadrilaterals. Because the nature of our project was more classification than research, the bulk of our work can be seen in an extensive list of quadrilaterals we compiled. This list includes the explanation of every one of over one hundred quadrilaterals alongside the constructions of those quadrilaterals. Our original work will aid other geometers in their exploration of yet unstudied areas of quadrilaterals.

O06
The Mathematics Behind Geodesic Models

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

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

The study of spherical geometry has made it possible for people, notably Magnus Wenninger, to design and build paper spherical models. A year-long investigation has been conducted to explore these spherical models, as well as to extend the ideas of geodesics and model building to other surfaces, such as tori and ellipsoids. Several models were made, some predesigned and others developed during this inquiry. As a result of this project, a better understanding of geodesic models, especially non-spherical models, was achieved. The resulting models and mathematical ideas will be presented in this investigation.

O07
Designing Origami Models

Presenter(s)
Jisoo Kim, Illinois Mathematics and Science Academy
Lucy Li, Illinois Mathematics and Science Academy
Sheng-Ting Lin, Illinois Mathematics and Science Academy

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

Countless origami diagrams have been published to show step-by-step instructions on how to fold paper models. However, they rarely communicate the actual designing process. In this investigation, we learned about some of the design techniques by analyzing the crease patterns of existing origami models. We then applied this knowledge to design our own models. We folded new origami models by using a technique called circle packing. Circle packing maximizes the area of circular regions representing different parts of the model within the constraints of the paper used. We arranged circles on sheets of paper in the general design of the model we wanted to create. However, we found that freely moving the circles sometimes left a large amount of unused paper. We then rearranged these circles to better utilize this space. We have also designed bases, the preliminary forms of origami models. So far, we have successfully designed two models that resemble birds from these bases. Besides its aesthetic value, origami has countless mathematical and scientific applications. By exploring the techniques of designing origami models, we could find ways to efficiently use paper in folding sophisticated models and perhaps expand the scope of origami applications in math and science.

O08
Adic Expansions

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

Advisor(s)
Micah Fogel, Illinois Mathematics and Science Academy

In a metric where two numbers are close in value if they differ by a large power of 10 (that is, 333 is closer to 433 than 33 is to 43), some numbers have representations that extend indefinitely to the left instead of to the right. For example, ...999 is a 10-adic representation of -1. I studied which numbers have such representations in which bases, which of those representations are unique, and other properties of the adic rings. In an arbitrary base, all rationals have unique expansions that terminate on the right and are periodic on the left. However, not every real has a terminating representation in every base, and not every adic number is real. Furthermore, if a real number does have a terminating representation, it is not unique. The special case when the base is prime (the p-adics) has many applications to other fields of mathematics and is essential to elliptic curve cryptography and public key cryptography. The general case has been less studied, but it is possible that it will have applications of similar caliber.

O09
Square Tilings of the Half- and Quarter-Planes

Presenter(s)
Eric Lin, Illinois Mathematics and Science Academy
Siddharth Narayanan, Illinois Mathematics and Science Academy

Advisor(s)
Steven Condie, Illinois Mathematics and Science Academy

Our project focuses on the tiling of the half- and quarter-planes using exactly one square of each positive integer side length. In 2008, Henle and Henle found a tiling of the infinite, unbounded plane using such squares. The question of squaring a square dates back to 1936 when Tutte solved certain systems of squares using a modification of the Kirchoff electric circuit laws. Henle and Henle, inspired by Tutte, approached the problem of tiling differently, using six-sided figures called ells and recursive algorithms to fill a plane with unique squares. Unfortunately, their method is inapplicable to the half- and quarter-planes. While we have made some possible algorithms for accomplishing the desired tiling, brute force computer simulations have shown that our methods are flawed because numerous iterations resulted in diverging sequences, which is not what we are looking for. Our work is important because it deals with open problems in tiling that have remained unsolved for nearly three-quarters of a century.

O10
An Extension of the Erdös-Ginzburg-Ziv Theorem: Non-Zero Sums in Zn

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 stating that any sequence of 2n-1 elements from Z_n has a subsequence of length n summing to 0. This theorem has been generalized to Z_n^2 by Reiher. Alon and Dubiner conjectured that in Z_n^d a sequence of $(n-1)*2^d$ 1 elements has a subsequence of length n summing to 0. The EGZ theorem has also been generalized to groups other than Z_n with the Ballobàs-Leader theorem, which proved a much stronger form of the EGZ theorem for all finite abelian groups. In this investigation, we looked at generalizing to non-zero sums in Z_n. Our results showed that a sequence of 2p-2 elements from Z_p has a p-length sum to x, where x is any non-zero element from Z_p. We also found that behavior of subsequences of length of n that sum to x of sequences of Z_n varied depending on whether or not n and x are coprime.

O11
Up the River Without a Paddle: The Expectation of Domination in Poker

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

Advisor(s)
Noah Prince, Illinois Mathematics and Science Academy

The legality of online poker has come under discussion in the news due to recent legislation banning certain types of online gambling. The argument stems from poker's debated status as a game of chance rather than one of skill. The purpose of this investigation is to demonstrate quantitatively that poker is not a game of pure chance. The independent chip model (ICM) predicts the equity of a player relative to the number of chips each player holds in tournament play, which effectively predicts that each hand of poker is governed by pure luck, akin to a coin flip. By evaluating the ICM in a two-player format, we were able to show through computations verified by simulations that a player having disproportionately few chips has no strategy with non-negative expectation, a marked difference from a coin flip, demonstrating the value of proper strategy, and hence, skill in poker. Preliminary results show that a dominating chip stack can manipulate decisions in their favor in order to control a commanding amount of equity. Therefore, the ICM's reliability in predicting equity does not hold, which provides basis of argument showing that luck is not the sole determining factor of outcomes in poker.

P01
Delayed Use of Calcineurin Inhibitors and High Dose Mycophenolate Mofetil as Initial Immunosuppressive Therapy for Liver Transplant Recipients with Pre-Transplant Renal Dysfunction

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

Advisor(s)
Josh Levitsky, Northwestern University

Immunosuppression following liver transplantation is essential for survival of both the allograft and the patient. Calcineurin inhibitors (CNIs) are essential to immunosuppression for organ transplantation but are associated with significant side effects such as nephrotoxicity and neurotoxicity. Therefore, an approach towards combination therapy has been advocated to achieve dose reduction or withdrawal of CNIs to decrease the incidence of side effects. Combination therapy involves delayed use of CNIs in addition to high dose mycophenolate mofetil (MMF), which is devoid of nephrotoxicity and neurotoxicity. In this investigation, a case group consisting of liver transplant patients with pre-transplant renal failure was compared to a control group of liver transplant patients on currently applied immunosuppressive regimens. Fifteen cases have been reviewed to measure the effectiveness of combination therapy on the function of the liver and the kidney in patients with pre-transplant renal failure. Results have demonstrated that combination therapy is indeed effective; it has improved organs' conditions and allowed for continual decrease in medication doses. The next step in this project involves the review of a control group and conduction of comparative analyses between the two groups.

P02
Mapping Genes of Chronic Sinusitis

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

Advisor(s)
Jayant Pinto, University of Chicago

The major objective of this project was to identify the gene(s) that confers susceptibility to chronic sinusitis, an important public health problem causing significant impact on quality of life. Our studies were initiated in the Hutterites, a religious group that practices a communal lifestyle and shares common environmental exposures. Previous studies have suggested a role for genetic variation in the chromosome 7q31 region influencing susceptibility to chronic sinusitis in the Hutterites. Our preliminary results have reflected that chronic sinusitis maintains a genetic basis, and we continued investigating this by recruiting case and control samples of outbred Caucasian subjects with chronic sinusitis at the University of Chicago as well as members of Hutterite colonies to examine differing factors between the two groups. We specifically examined a group of twenty cases of Hutterites exemplifying sinus disease with acute interest for medical history, medicines taken, allergy status, and ability to smell properly. We have concluded that genetic factors cause chronic sinusitis; as the project continues, we plan to investigate genes demonstrating significant associations in the Hutterites. Ultimately, understanding the molecular pathophysiology of chronic sinusitis may lead to improvements in the diagnosis and treatment of this burdensome disease.

P03
The Effects of Curcumin on Cisplatin-Resistant Ovarian Cancer

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

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

Ovarian cancer is the number one cause of death from a gynecologic malignancy. Of the 25,400 U.S. woman diagnosed with ovarian cancer each year, approximately 14,300 die. Chemotherapy, radiation, and surgery have been applied as methods of treatment, but none has been recognized as a cure. Curcumin, a component of the common cooking spice turmeric, was found to have anti-cancer properties when tested on neoplastic ovarian cells. This study tested curcumin for possible therapeutic effects on chemotherapy-resistant ovarian cancer cells. If capable of inducing apoptosis, the component could be incorporated into cancer-fighting drugs as a form of treatment. The apoptotic effect of curcumin on cisplatin-resistant ovarian cancer was determined by a series of steps. Two cell cultures were maintained in fresh media, and the cells were treated with varying doses of curcumin. These samples were then applied to an acrylamide gel, and a Western blot was run to test for the protein caspase-3. Preliminary results were negative.

P04
Trends Observed with Mean Gestational Age, Outcome, Main Diagnosis, and Necessity for Extracorporeal Membrane Oxygenation in Patients with Persistent Pulmonary Hypertension of the Newborns from Between the Years 2000 and 2007

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

Advisor(s)
Christine Sajous, Loyola University

We examined trends in mean gestational age, outcome, main diagnosis, and necessity for extracorporeal membrane oxygenation (ECMO) for infants who were at least thirty-five weeks with persistent pulmonary hypertension of the newborns (PPHN). A comparison between the time periods, 2000-2003 and 2004-2007 was made in order to analyze any changes in the mean gestational ages of the infants with PPHN, their outcome, and their main diagnoses. Beginning in 2000, the Loyola University Medical Center (LUMC) began to administer a nitric oxide treatment to their PPHN patients. By studying these two time periods, we determined if there was a change in the mean gestational age or in the common diagnoses among the observed patients. Additionally, we looked at how the nitric oxide may have influenced variances in the outcome of the infants, including referral of the patient for ECMO at another hospital. Our current analysis from our retrospective chart review is underway. An analysis of these factors will provide a further understanding of the effectiveness of PPHN treatments over time at the LUMC and their effects on the infants.

P05
MRSA Prevalence in the Community as a Result of Medical Practices in the United States and Europe

Presenter(s)
Madeline Booton, Illinois Mathematics and Science Academy

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

Methicillin-resistant *Staphylococcus aureus* (MRSA), antibiotic-resistant bacteria commonly found in many hospital-based infections in Europe and the United States, has recently become a contagion outside of the hospital and is becoming increasingly community-based. Due to differing medical practices, such as hand washing practices and antibiotic prescription policies, between Europe and the United States, there are fewer cases of MRSA in various European countries than in the United States. An experiment conducted to determine the percentage of Illinois Mathematics and Science Academy students with colonizing methicillin-resistant bacteria located on their hands revealed a percentage of about 6.4% of students. The differences seen in Europe and the United States suggest changes in hospital practices that might reduce the number of cases of MRSA in the United States.

P06
Evaluation of a Standardized Checklist Used During Surgical Procedures

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

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

Preventable patient harm related to surgery, such as wrong-site procedures and patient misidentification, can occur due to a lack of communication and teamwork amongst hospital staff and physicians. In order to improve patient safety, through a goal of improved communication and teamwork, the University of Illinois Medical Center adopted the World Health Organization safe surgery checklist. The checklist includes two separate processes – a *sign-in* which occurs just after the patient enters the operating room and *time-out* just before surgical incision. The sign-in is facilitated by the anesthesiologist, and covers general patient and surgery information while the time-out, overseen by the attending surgeon, covers additional checkpoints, which include risk of blood loss and operative duration. During the observation of twenty-five surgeries in which the checklist document was used, the staff rarely engaged as a team and the quality of the intended time-out conversations decreased as the study progressed. Of note, a review of nursing documentation failed to identify the inadequacy of the expected engagement of the team. Our observations show that the checklist became more of a documentation task than an effective tool to reach the goal of improved patient safety-related communication.

P07
Characterization of Biomarkers at the Borderzones of Ischemic Lesions in Experimental Stroke

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

Advisor(s)
Agnieszka Ardelt, University of Chicago

Following an ischemic stroke, cells located in the center of the lesion rapidly perish, but those located at the periphery (borderzone) may be salvaged and participate in neurorepair. It is important to investigate the mechanisms of neurorepair to optimize stroke treatment. This project aims to characterize ischemic lesion borderzones in an experimental model by studying molecular markers of injury. Through immunolabeling in tissue sections and fluorescent microscopy of biomarkers in rat brain slices, I have delineated spatial and temporal markers of the borderzone. My research indicates that by post-stroke day 3 (PSD3), nestin (an intermediate filament protein) is expressed at the borderzone, marking the region where glial scarring is predicted to form by PSD30. Microtubule-associated protein 2(Map2) is present in healthy neurons, and Map2 immunoreactivity overlaps with nestin immunoreactivity on PSD3, although no double-labeling within a single cell occurs. Iba-1 (expressed in activated microglia), which is present in both healthy and injured tissue by PSD3, is dramatically upregulated in necrotic tissue by PSD10. In conjunction with other biomarkers, nestin, Map2, and Iba-1 are indicators of the ischemic borderzone during the early post-stroke period and can be used to track the effectiveness of neuroreparative therapies in this model.

P08
Prolonged Use of Pegylated Liposomal Doxorubricin in an HIV-Infected Population with Kaposi's Sarcoma

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

Advisor(s)
Margaret Telfer, John H. Stroger, Jr. Hospital of Cook County

Kaposi's sarcoma (KS) occurs in HIV-patients as a slow-growing malignancy. Chemotherapy must be given carefully to avoid increasing infection rate. KS is treated with doxorubricin, a drug linked with cardiotoxicity at doses above 500mg/m^2. Previous studies found that PL-DOX, a new form of this drug, could be given over long periods at low-doses without inducing cardiotoxicity. Later studies recommended multiple gated acquisition (MUGA) scans to monitor cardiac function. Our study is a seven-year follow-up of fifty-five male KS patients treated with 20mg/m^2 of PL-Dox every three weeks until disappearance of lesion, withdrawal of treatment, or discovery of cardiac damage by MUGA scans at six months. Patients were grouped by cumulative dose (mg/m^2). Twenty-one patients received less than 200mg/m^2, eleven received 200-399mg/m^2, seven received 400-500mg/m^2, and sixteen received greater than 500mg/m^2. Five patients died during this study. Of sixteen people receiving over 500mg, one died of cancer, one was switched to another drug, and one patient stopped taking PL-DOX after finding an abnormal MUGA which led to the diagnosis of coronary disease. The other thirteen in this group remain alive with no evidence of heart problems. Four patients receiving doses less than 500mg/m^2 died. Two of these were victims of heart trouble. MUGA scans were accomplished only yearly, showing need for improvement in hospital procedures. We find that patients can tolerate doses greater than 500mg/m^2 when closely monitored with physical examinations and MUGA scans.

P09

The Correlation Between Interferon and Tumor Necrosis Factor Levels in African American and Caucasian Sarcoidosis Patients

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

Advisor(s)
Timothy Niewold, University of Chicago
Nadera Sweiss, University of Chicago

A multi-systemic inflammatory disease of unknown etiology, sarcoidosis, is characterized by non-caesating granulomas. In the attempt to identify its cause, environmental, occupational, and genetic factors have all been implicated, but none have been statistically proven. The current assumption is that genetic factors interact with environmental stresses to increase disease susceptibility. Therefore, the study utilized retrospective data from ninety-eight sarcoidosis patients in order to collect data concerning cytokines, tumor necrosis factor-alpha (TNF-α) and interferon-alpha (IFN-α) levels, ancestry, neurological, cardiac, and pulmonary involvement; from there, Microsoft Excel was utilized to determine the correlations among that previously stated variables. The data analysis yielded two significant correlations: in African Americans, there is a correlation between TNF-α and neurological involvement in sarcoidosis, and in Caucasian Americans, there is a correlation between IFN-α and pulmonary involvement in sarcoidosis patients. Agreeing with previous clinical studies, these correlations offer insight into the pathogenesis of the disease. More importantly though is that we are now capable of targeting the disease based on ancestry, developing drugs to target certain cytokines elicited in each respective race.

P10
Novel Use of HIV-1 Rapid Tests in Determining Infection Status of Babies

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

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

Most newly infected children with HIV-1 contract the virus during birth. However, not all babies born to HIV-infected mothers become infected. Uninfected babies undergo a process called seroreversion. This occurs as maternal HIV-1 antibodies transferred during the third trimester gradually decrease, leaving the baby HIV-uninfected. In developed countries, costly and repetitive enzyme immunoassay (EIA) and Western blot tests are used for up to eighteen months to determine the final status of the baby, while many developing countries use antibody assays instead. The objective of the study was to evaluate the use of HIV-1 rapid tests in determining infection status compared to customary lab tests. In this study forty-three plasma samples from twenty-four previously tested uninfected patients were collected and tested on two different Food and Drug Adminsitration approved HIV-1 rapid tests, OraQuick and UniGold. Some samples were also tested by EIA and Western blot where original data was not available. Data was divided into two subgroups: samples taken within eight months of birth and samples taken nine months onward. The results showed that of the twenty-one samples in the nine month onward group, fifteen were negative on the OraQuick and UniGold, while only six were negative on the ELISA. Based on these results, it can be said that the OraQuick and UniGold rapid tests may be effective in accurately determining infection status in as little as nine months after the HIV exposed baby is born.

P11
Knowledge of Neonatal Healthcare in Rural Versus Urban Centers in Orissa, India

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

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

Neonatal healthcare is the preservation of health of newborn babies, and is an issue of vital importance. In countries with good healthcare infrastructure, and education, general knowledge of healthcare and medicine is much more accessible. However, developing countries like India are still in the process of improving such hospital and educational infrastructure, making the issue of keeping newborn babies alive and healthy one at the forefront of international healthcare. One of the most important factors in neonatal care is the parents. Their caretaking can only be adequate if their knowledge of their baby's needs is also sufficient. This project investigated the amount of knowledge mothers of newborn babies in the rural versus urban areas of Orissa, India had about the healthcare of their babies. Eighty-three mothers of children one year and younger were surveyed for this study: forty-two from urban centers in Bhubaneswar, Orissa and forty-one subjects from villages nearby Bhubaneswar. The survey included questions on illness and caretaking, as well as demographic information such as household income and family size for purposes of comparison. The results were not conclusive; however, the lack of knowledge across all demographics was significant in understanding the attitude towards medicine and healthcare in developing countries.

P12
Analyzing the Development of Cancer Through Patient Behavior, Environment, and Genetics

Presenter(s)
Jiwon Kim, Illinois Mathematics and Science Academy
Aubrey Sumaydeng, Illinois Mathematics and Science Academy
Joly Wu, Illinois Mathematics and Science Academy

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

Determining prognosis and outcome of cancer can be approached by looking at many different factors, including patient behavior, environment, and genetics. Analysis of databases of the varying factors of behavioral risks and geographical location and their correlations with cancer development showed unexpected and unaccountable complexities. However, with the analysis of genetics, through the field of pharmacogenetics, the individual's unique genome is examined. Now cancer patients receive novel and more effective treatment. Pharmacogenetics is the study of genetic variations between individuals in order to predict a patient's ability to metabolize and respond to medicine. New advances in microarray technology generate gene expression profiles for a patient to help analyze their individual response to drugs by identifying patterns of markers and genes. With one in seven women developing breast cancer in their lifetime, breast cancer, the most prevalent cancer threatening women, is on the frontier of pharmacogenetics research. Already, significant discoveries such as the HER2 receptor, the tumor suppressors BRCA1 and 2, and the estrogen receptor have significantly changed breast cancer treatment and classification, making pharmacogenetics a key to diagnosing and treating cancer.

P13
Post-Natal Weight Gain as an Indicator for Earlier and More Precise Retinopathy of Prematurity Screening

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

Advisor(s)
Jonathon Muraskas, Loyola University

Retinopathy of prematurity (ROP) is abnormal blood vessel development in the retina of a premature infant and is the leading cause of childhood blindness. All infants with a gestational age (GA) below thirty-three weeks and a birth weight (BW) below 1500 grams undergo multiple eye exams in order to identify who needs further treatment. The purpose of our study was to validate a study done in Sweden that showed post-natal weight gain as an indicator for earlier and more precise ROP screening with slight modifications. We retrospectively identified all infants admitted to the neonatal intensive care unit at Loyola University Medical Center (GA < thirty-three weeks, BW < 1500 grams) from 2005 to 2008. We then set up a database in order to look at the birth weight, gestational age, medical interventions, daily weight gain, discharge weight, discharge gestational age, and postnatal diagnoses of each infant. We hypothesized our results to show that premature infants with adequate weight gain developed less severe ROP compared to those infants with poor weight gain. If our hypothesis proved to be true, we would be able to predict infants who would need earlier and more frequent ROP screenings versus those who would not, therefore reducing the stress and cost of eye exams.

P14
The Development of a Method of Early Diagnosis for Parkinson's Disease

Presenter(s)
Justine Ly, Illinois Mathematics and Science Academy
Katherine Shi, Illinois Mathematics and Science Academy

Advisor(s)
Chien-Min Kao, University of Chicago

Parkinson's disease is classified as a disorder that impairs motor skills, speech, and other functions. Typically, the diagnosis of Parkinson's is based on the observations of regressing motor skills in addition to a patient's medical history. It is known that Parkinson's disease is marked by the degeneration of dopaminergic neurons. Using the tracer, TRODAT, to generate SPECT images of the brain, we normalized the SPECT images to a standard template image using a common reference coordinate. Then, a statistical analysis on the concentration of dopamine, which is indicated by the tracer, was conducted to reveal the degeneration of the dopaminergic neurons. By comparing the concentration of dopamine in healthy patients to the concentration of dopamine in Parkinson's patients, a trend can be detected. If these quantitative measurements can be made earlier, a patient can be given an earlier diagnosis. Also, because this method is more computer-based and requires less human proficiency, a more accurate diagnosis can be given. Currently, our final results are still pending. Even so, we have found a possibility for inaccuracy in this new method. Nevertheless, we hope that the technique we are working on with our advisors is ultimately an improvement upon current methods of diagnosis.

P15
Classification of Intersectin Interacting Proteins

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

Advisor(s)
John O'Bryan, University of Illinois at Chicago

This study was conducted to categorize the targets of both isoforms of intersectin (ITSN) and identify their possible involvement in cellular and biochemical pathways. As a scaffold protein, ITSN consists of multiple interacting domains that bring together various proteins with multiple other interactions and functions. A high throughput yeast-two hybrid screen was previously performed by the laboratory to identify potential ITSN targets. Using the data from that study, research via databases and literature review was done to gather information on the targets, such as interacting domains, functions, and pathways. We then collated this information into a table, and after examining the targets, we hypothesized that ITSN is involved in regulating multiple biochemical pathways. Most of the proteins that interacted with ITSN were found to be involved in cellular endocytosis; however, additional pathways were identified. One novel ITSN interaction was with mTRP53, a tumor suppressor gene, which suggests ITSN involvement in the regulation of cancer. Using the results of this study, future researchers can test for the involvement of ITSN in cellular and biochemical conditions such as cancer. Furthermore, drugs may be developed to disrupt the functions of ITSN and create possible therapies.

P16

Genotyping Nitric Oxide Synthase Single Nucleotide Polymorphisms in Sprague-Dawley Rats from Charles River Versus Harlan

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

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

Surgical interventions used to treat atherosclerosis, or hardening of the arteries, often fail due to a process called neointimal hyperplasia (NIH). One of the common animal models for NIH is the rat carotid injury model. Investigators noticed rats of the same strain, but purchased from different vendors, did not develop the same rates of NIH. We hypothesized that polymorphisms in a candidate gene for NIH, endothelial nitric oxide synthase (NOS3), were responsible for differences in response to injury seen in the rats. DNA was isolated from twenty inbred Sprague Dawley rats that were purchased from two different vendors. The rats were genotyped using polymerase chain reaction followed by restriction endonuclease digestion and electrophoresis. The primers were designed based on NOS3 sequences from the rat genome database. The New England Biolabs NEBCutter software was used to find the enzyme used for genotyping. We analyzed one NOS3 single nucleotide polymorphism, (SNP); either a guanine (G) or cytosine (C) is found at this location. Of the rats that were analyzed, all had the G-G genotype, which does not support our hypothesis. These results suggest that this NOS3 SNP may not be associated with variations of NIH formation in the rats.

P17
Post-Myocardial Infarction Repair and Angiogenesis

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

Advisor(s)
Samuel Dudley, University of Illinois at Chicago
David Simpson, University of Illinois at Chicago

Pluripotent stem cells have been shown to harbor potential for enhanced myocardial infarct repair. One potential mechanism of repair is stem cell secretion of paracrine factors. The purpose of this investigation is to determine the angiogenic potential of human mesenchymal stem cells (hMSC) and human embryonic stem cell-derived mesenchymal cells (B4 cells) cultured in three-dimensional collagen patches. A vessel formation assay was completed using conditioned media from hMSC and B4 cells exposed to hypoxia as a monolayer or within a patch. The extent of vessel formation was quantified after twenty-two hours. Additionally, mRNA was isolated from hypoxic hMSC and B4 cells cultured as monolayers or patches to determine the extent of vascular endothelial growth factor (VEGF) expression by real time RT-PCR. Results show that vessel formation properties are augmented for endothelial cells exposed to conditioned media for hMSC and B4 cells cultured in patches compared to monolayers. Additionally, VEGF mRNA abundance in increased in hMSC and B4 cell patches compared to monolayers. This suggests that the culture of stem cells in three-dimensional collagen patches show increased angiogenic potential which may be driven by increased expression of paracrine factors such as VEGF.

P18
The Role of Syndecans in Breast Cancer Metastasis to the Brain

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

Advisor(s)
Jennifer Koblinski, Northwestern University

Breast cancer patients die when the cancer metastasizes to the brain. The mechanisms of breast cancer metastasis to the brain are poorly understood. Syndecan (SD)1-4 are a family of transmembrane heparin sulfate proteoglycans that are widely expressed in developing tissues and are known to have a role in cancer. The role of SD in breast cancer metastasis is currently unknown. We hypothesize that SD2 and 4 increase breast cancer metastasis to the brain. To address this hypothesis, SD2 and 4 expressions were silenced in a breast cancer cell line, MDA-231, labeled with green fluorescent protein. Cells were injected in the left ventricle of the mouse heart; four weeks later the tumors were examined in dissected fixed brains of these mice using a fluorescent dissecting scope. The right hemisphere of the each brain was sliced. Tumors within these slices were imaged and tumor size was quantified to determine tumor burden. Quantitative PCR was also performed to confirm these results. We found that silencing of SD2 and 4 expression decreased tumor burden within the brain compared to the control. These results suggest that SD2 and 4 play important roles in the growth of breast cancer cells in the brain.

P19
Determining Response of Cytogenetically Differing Acute Myeloid Leukemia Cell Lines to Chemotherapy

Presenter(s)
Divya Tankasala, Illinois Mathematics and Science Academy

Advisor(s)
Kenan Onel, University of Chicago
Sapana Vora, University of Chicago

Acute myeloid leukemia (AML) patients with abnormalities of chromosomes five and/or seven are known to respond more poorly to chemotherapy than their cytogenetically normal counterparts. Studies have shown that some patients are more likely to have resistant forms of AML associated with poor-risk cytogenetic features and multi-drug resistant phenotypes. The purpose of this investigation was to determine how cytogenetically different acute myeloid leukemia cell lines respond to different chemotherapeutics. Following a standard cytotoxicity protocol, a total of eleven different AML cell lines were dosed with four chemotherapy drugs at various concentrations. Drug sensitivity was determined by calculating an IC_{50} (inhibitory concentration) at twenty-four hours for each drug/cell line combination. Two methods were used to measure viability; a standard MTT assay and the bench top flow cytometer. Preliminary findings indicate that, as expected, certain cell lines are more sensitive/resistant to particular chemotherapy agents than others; notably the Kasumi1 cell lines which are resistance to mitoxantrone. The UOCM1 (Del5q, monosomy 7) line shows a marked sensitivity to cisplatin which, though apparently effective against some AML cells, is not typically prescribed in the clinic. Experiments are ongoing, and when completed, informed conclusions regarding the effect of chromosome 5/7 status on chemotherapy resistance/sensitivity will be gathered.

P20
Validation of HIV-1 Viral Load Determination Using Dried Blood Spot Primary Samples Tested on the Abbott RealTime PCR Assay

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

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

The human immunodeficiency virus (HIV) affects about 0.6% of the world´s population. Testing of plasma samples in some areas of the world can be difficult due to processing and storage equipment. However, a new approach with dried blood spots (DBSs) is less difficult and time-consuming to perform, and the DBSs may be safely stored at room temperature until transported to centralized testing laboratories. The Abbott RealTime HIV RNA PCR processed and assayed on the Abbott m2000 sp System uses the integrase gene as its primary target in comparison to other platforms that target the envelope or gag gene for detection of HIV-1 proviral DNA. This project focused on finding the sensitivity and specificity of the Abbott m2000 sp System in determining the HIV-1 RNA levels in samples taken between 2009 and 2010. Results show that DBS samples are less sensitive than plasma using the system. While standard plasma real time PCR has a lower limit of detection of around 40 copies/mL, using DBS extracts from the same patients results in a preliminary lower limit of detection of 4000 copies/mL on the system. Further testing must be done to determine the value of using dried blood spots for quantitative viral load testing with the Abbott m2000sp System and the exact sensitivity and lower limit of detection for clinical evaluation in select regional settings.

Q01
How does the Trafficking Motif Affect the Rate of BACE 1 Endocytosis?

Presenter(s)
Ruchi Aggarwal, Illinois Mathematics and Science Academy
Mehal Shah, Illinois Mathematics and Science Academy

Advisor(s)
Virginie Buggia-Prevot, University of Chicago
Gopal Thinakaran, University of Chicago

Alzheimer's disease is characterized by the buildup of β-amyloid in the brain. BACE 1 is an essential enzyme for the cleavage of the amyloid precursor protein (APP), which leads to the formation of β-amyloid. Controlling BACE 1 levels will decrease the buildup of β-amyloid, which in turn will reduce the occurrence of Alzheimer's disease-associated pathological lesions in the brain. BACE 1 is thought to cleave APP when both proteins move from the cell surface into the cell. Therefore, in this investigation we studied the endocytosis of BACE 1 in African green monkey (COS) cells. Endocytosis of wildtype BACE 1 and a mutant where the dileucine motif has been mutated were studied by labeling BACE 1 and using video microscopy. The dileucine motif was used in order to provide insight of this trafficking motif on BACE 1 endocytosis. Preliminary data shows that the BACE 1 bearing the dileucine motif significantly decreases the rate of BACE 1 endocytosis compared to wildtype BACE 1. Overall, the outcome of this experiment will provide supplementary knowledge for possible ways to manipulate BACE 1 movement within the neurons and brain β-amyloid levels ultimately reducing the progression of Alzheimer's disease.

Q02
Sex Effects on the Speech-Evoked Auditory Brainstem Response

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

Advisor(s)
Nina Kraus, Northwestern University
Jen Krizman, Northwestern University
Erika Skoe, Northwestern University

The brain's response to auditory stimuli can be objectively assessed through the auditory brainstem response (ABR), a waveform showing the electrical activity of the brain in response to sound. BioMARK is a clinical technology which uses a 40 ms speech stimulus, /da/, to determine the efficacy of the auditory nervous system. The current study included the collection of the BioMARK response of seventy-six subjects (thirty-eight females) to examine the effect of a subject's sex on his or her ability to process sound and demonstrated that female responses have shorter latencies and larger amplitudes, indicating that their brains respond faster and more robustly to sound. Though previous studies have demonstrated this for peak V of the click-evoked response, the current study shows significant differences in BioMARK peaks V, A, F and O, but not in C, D and E. In addition, it has demonstrated that spectral encoding of high frequencies (700-1100 Hz) is significantly larger in females than in males. These results suggest that BioMARK is a useful clinical tool that does not display pervasive sex effects.

Q03
Effects of Antenatal Corticosteroids on the Development of Intraventricular Hemorrhage and Periventricular Leukomalacia in Premature Multiple Births

Presenter(s)
Omotayo Balogun, Illinois Mathematics and Science Academy
Kari Tyler, Illinois Mathematics and Science Academy

Advisor(s)
Maliha Shareef, Loyola University
Tricia Thomson, Loyola University

We investigated trends involving the existence of intraventricular hemorrhage (IVH) and periventricular leukomalacia (PVL) in premature multiple births as a result of antenatal corticosteroids betamethosone and dexamethosone. According to past research, betamethosone significantly decreases the risk of the appearance of IVH and PVL, even more than dexamethosone which in some studies has been found to increase occurrence of IVH in premature births. Through chart review of multiple births for 2006-2009 from the Loyola University Medical Center neonatal intensive care unit's database, we have gathered data to investigate these trends. The type of information we gathered includes but is not limited to: grade of IVH, extent of PVL, gestational age, multiple type, birth weight, and Apgar scores specific to each patient. The original intention was to analyze data from 1998-2008, but after data collection; we have had to narrow the focus to later years. We are now analyzing data from 2006-2009. We also intended to compare the trends of IVH and PVL in multiples with respect to each steroid with the trends of IVH and PVL with respect to the same steroids in singleton births. Data analysis of the data collected 2006-2009 is underway. Results from our research may be able to help the scientific community determine which antenatal corticosteroid is better to use in cases involving mothers that are at risk for delivering prematurely.

Q04
Investigation of Corticospinal Motor Neurons in Health and Integrity in Mouse Models of Amytrophic Lateral Sclerosis

Presenter(s)
Ayse Cetinkaya, Illinois Mathematics and Science Academy

Advisor(s)
Pembe Hande Ozdinler, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease which results in the progressive degeneration of corticospinal motor neurons (CSMN) and spinal motor neurons. This leads to the loss of motor function and muscular paralysis, and ultimately results in death. Point mutations on the superoxide dismutase 1 (SOD1) gene have been linked to familial ALS cases, and mouse models of ALS with the SOD1G93A mutation have been generated. In this study, CSMN integrity and health in wild-type, SOD1G93A transgenic mice, and a novel mouse model, CSMNb -/- which shows an ALS-like phenotype was investigated using structural, anatomical, and cellular analysis. Brain and spinal cord tissue were prepared for further cellular and anatomical analysis by taking coronal and sagittal sections. After a complete familiarization with the anatomical structures of the brain such as the motor cortex, striatum, and hippocampus, Nissl staining was performed to visualize the layers of the cortex and axonal projections. The initial findings upon comparison of identical sections suggest that CSMN are vulnerable in ALS mouse models, and there is a significant reduction in subcortical axon projections, especially in CSMNb -/- mice. These results build upon previously reported findings, and strongly suggest that CSMNb -/- mice mimic ALS pathogenesis.

Q05
Quantification of Anastrozole Consumption Administration Using a Novel Delivery System in Mice

Presenter(s)
Janani Mandayam Comar, Illinois Mathematics and Science Academy

Advisor(s)
Elliott Mufson, Rush University Medical Center
Cassia Overk, Rush University Medical Center

Low estrogen level is a significant risk factor for Alzheimer's disease (AD). Estrogen has been shown to regulate AD-like neuropathology in a triple transgenic mouse model of AD (3xTgAD). However, it is unknown if inhibiting estrogen production in the brain using an aromatase inhibitor, anastrozole, would also increase plaque or tangle-like deposits. Due to poor palatability of anastrozole, a novel oral hydration gel system was employed. This study evaluated the six-month consumption rate of the drug-treated versus control gel and the corresponding plasma levels of anastrozole at the time of sacrifice using liquid chromatography-mass spectrometry. There was no significant difference in gel consumption between the treated and control groups. Preliminary results also indicate that concentration of anastrozole in the plasma was, on average, 1.1 ± 0.4 ng/mL. Further analysis will show if correlation exists between plasma levels of anastrozole and the amount of drug consumed.

Q06
hTDP-43 Proteinopathy in *Drosophila*

Presenter(s)
Cecilia Countryman, Illinois Mathematics and Science Academy
Pranusha Pinna, Illinois Mathematics and Science Academy

Advisor(s)
Jane Wu, Northwestern University

The neuropathology of TAR DNA binding protein-43 (TDP-43) has been found to cause many human neurodegenerative diseases such as Parkinson's, Alzheimer's, and Huntington's, and amyotrophic lateral sclerosis (ALS). Studies have shown that in affected neuronal tissues, TDP-43 forms aggregates in the cytoplasm. In order to expand our knowledge of TDP-43 proteinopathy, we examined how the human TDP-43 (hTDP-43) gene was expressed in *Drosophila melanogaster*, a useful animal model because of its genetic similarities to humans. We studied the expression of hTDP-43 protein in transgenic flies in order to gain knowledge of the pathogenesis of TDP-43 proteinopathy. We found that the overexpression of hTDP-43 protein may cause morphological changes and function deficits caused by TDP-43 proteinopathy, which can be seen in the animal model. The expression of wildtype hTDP-43 in *Drosophila* led to age-dependent degeneration. In transgenic flies, neurodegeneration was detected through the development of mushroom bodies, ommatidia loss, and photoreceptor degeneration. The transgenic *Drosophila* served as a good model for our study because they showed pathological and clinical features of ALS as well as neuropathological, biochemical, and functional features of hTDP-43 proteinopathy.

Q07
Exploring Resting State Connectivity with Physiologic Intervention

Presenter(s)
Justin Feng, Illinois Mathematics and Science Academy
Yanchen Shi, Illinois Mathematics and Science Academy

Advisor(s)
Todd Parrish, Northwestern University

From walking to speech, our everyday body functions are controlled and coordinated by the brain. Interactions between brain regions can now be studied with the use of functional magnetic resonance imaging. With these images, effects of drugs on the brain can be studied as well. For our experiment, we set out to use functional imaging to analyze and correlate the network connections inside the brain in resting state, before and after the injection of caffeine. First we gathered both functional and structural images, on eleven test subjects before and after the injection of caffeine. We then proceeded to analyze these images. After reorienting motion correction and aligning each image, we processed the images in several steps, including smoothing, normalizing, and so forth. From there, we analyzed the regions of interest and proceeded to perform various statistical tests on them, including t-tests, paired t-tests, and correlation analysis. We have found that in general, network correlations are less substantial after the injection of caffeine at resting state than before the injection. Our average trends have shown that for the most part there is more correlated activity before caffeine injection than after, contrary to what most people feel after having a coffee. In the future, we will be able to further analyze more subtle but significant trends in the functional connectivity and also eventually figure out whether if the source of trends is physiological or neural.

Q08
Mapping Verbal Memory Areas in Epileptic Patients Through Electrocorticographic Readings of Subdural Electrodes

Presenter(s)
Brielle James, Illinois Mathematics and Science Academy
Paul Yuan, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

Affecting over one percent of the world's population, epilepsy is a condition in which patients experience recurring seizures that are potentially disabling and prevent them from leading normal lives. When pharmacological treatment is ineffective, many patients choose surgery to remove the epileptic focus. Unfortunately, some post-surgical patients experience a decline in memory while still facing the same crippling effects of their seizures. We studied the electrocorticographic (ECoG) patterns of four right-handed epileptic patients (three children, one adult) who had been surgically implanted with subdural electrodes. Each was given a memory test that included tasks involving long and short term memory, as well as mathematical calculations and word repetition. Local increases in gamma band activity (70-100 Hz) were observed in response to warning tones, presented words, and the patient's verbal response. Additionally, local activity in the temporal lobe and the posterior parietal cortex was found to increase between the presented words and the patient response, signifying either memory retrieval or volition (the act of deciding to speak). Moreover, it was discovered that during the word repetition task, words received through auditory means were processed differently from those presented visually. Locating the areas important to verbal memory may improve surgical outcomes for those suffering from epilepsy.

Q09
Brainwave Technologies

Presenter(s)
Monica Kozbial, Illinois Mathematics and Science Academy

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

The goal is to observe the extent to which the real-time display of brainwaves enables a user to manipulate them and to develop our own application. For over twenty-five years, neurofeedback has sought to help people with a variety of situations ranging from treating depression to alleviating headaches through the manipulation of brainwaves. Companies have developed game controllers based on this concept to enhance the gaming experience. I am working with a single sensor headset developed by Neurosky, called the Mindset, which scans the brain for activity at established frequencies and interprets these signals in terms of mental states, such as attention and meditation. The Mindset data stream can be accessed with different platforms. I have chosen to work with java, ActionScript and C. I chose java because of my familiarity with it and ActionScript and C because of the sample code available on the company's website. I have written a program that has successfully accessed the Mindset data stream and has retrieved values relating to brainwave activity. Currently, I am working on an application that will utilize and manipulate the brainwave data retrieved from the Mindset.

Q10
How Can You Train to be as Fast as The Flash?: Immediate Effects of a Two-Minute Bout of Speed-Walking Training Versus Resistance-Walking Training in a Young, Nonimpaired Group of Subjects

Presenter(s)
Samuel Kwak, Illinois Mathematics and Science Academy

Advisor(s)
David Brown, Northwestern University

Two training approaches for improving walking speed post-stroke are resistance training and speed training. Previous studies have shown that both speed and resistance training improves walking speed of stroke survivors in the short term. Although experiments have looked at both types of training, they have not compared the two with each other in the same patient cohort. The purpose of this study was to examine the short term effects of speed-based versus resistance-based training in non-impaired individuals to be compared with a future group of stroke survivors. Seven non-impaired individuals walked around a 16.5 meter circle circuit at various paces for six by two minute intervals (two trials of two minutes baseline, two minutes intervention, two minutes aftereffect measurement). Step rate, gait speed, heart rate, and blood pressure were measured using data recorded during the experiment. Results showed that neither speed-based nor resistance-based training had a statistically significant effect on the immediate walking speed of subjects. However, lap four of the aftereffect measurement of the speed-based training was significantly faster than the previous three laps. This experiment suggests that walking speed accelerates shortly after speed-based training. These results can now be compared with stroke survivors who, due to slower walking speeds and less ability to increase speed, may benefit more from resistance training compared with speed training.

Q11
Blood Versus Brains: A Look at Telomere Length in Mice Over Time

Presenter(s)
Ashley Ro, Illinois Mathematics and Science Academy
Nikita Veera, Illinois Mathematics and Science Academy

Advisor(s)
Chunyu Liu, University of Chicago

Gene expression and telomere length studies are currently popular in neuropsychiatric research. However, these studies are complicated by the fact that epigenetic markers, gene expression and telomere length vary during normal development and aging. Also, it is not known how similarly they change in blood versus in brain tissue. This investigation focuses on how telomere length varies over developmental time in the brain and blood of mice. To conduct the investigation, blood and brain tissue samples were collected from inbred mice strain C57BL/6J at three developmental stages: infant (postnatal day 15 (p15)), juvenile (p35), and adult (p60). DNA was extracted from mouse leukocytes and cerebellum. SYBR Green quantitative PCR was used to measure telomere length. Establishing how telomere length changes over developmental time in normal mice will assist other researchers in conducting investigations involving mouse models of neuropsychiatric disorders.

Q12
Dopamine Neuron Loss and Tyrosine Hydroxylase-Immunoreactive Neuron Incidence of the Substantia Nigra in Parksinson's Disease

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

Advisor(s)
Paul Carvey, Rush University Medical Center

Parkinson's disease (PD) is characterized by the degeneration of about 50-75% of dopamine (DA) neurons in the substantia nigra (SN) of the brain. In past studies, the degeneration of DA neurons within the SN of the brain has also been linked with the loss of tyrosine hydroxylase-immunoreactive (TH-ir) neurons in the SN. This study used the 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-treated mouse model to examine the relationship between DA neuron toxicity and TH-ir cell loss in PD. Twenty-eight, eight-month old male mice were split into two groups; each group was injected systemically four times with MPTP or saline on a two-hour injection protocol. Once sacrificed, the mice's brains were removed, sliced at a thickness of forty micrometers using a sliding microtome, stained using the avidin-biotin complex method, and examined stereologically by using the program StereoInvestigator to count TH-ir neurons within the SN. Mice are currently being sacrificed. Staining and neuron counts are pending. If decreased TH-ir neuron cell counts in the nigral region of the brain correlate with the number of DA neurons, they can thus be used to determine the amount of DA neuron degradation in PD.

Q13
Paracingulate Morphometry and Temperament, Character, and Cognition in Schizophrenia

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

Advisor(s)
Matthew Smith, Northwestern University
Lei Wang, Northwestern University

Research suggests that paracingulate gyrus (PCG) morphometry is related to temperament, and that controls (CON) have an asymmetric PCG when compared to schizophrenia subjects (SCZ). Whether PCG abnormalities are related to patterns of temperament, character, and cognition in schizophrenia is unknown. In this project, we delineated PCG from MRI scans to assess prevalence, volume, thickness, and surface area. These PCG measures were compared between SCZ and CON, and correlated with temperament, character, and cognition. In contrast to prior research, we found a greater PCG asymmetry (Left>Right) in SCZ when compared to CON. We also found that the PCG measures were unrelated to temperament and character. However, SCZ with no PCG present had lower self-directedness and cooperativeness than SCZ with the PCG. SCZ with no PCG present had higher cognitive scores than SCZ with the PCG present, while CON with no PCG had lower cognitive scores than CON with PCG present. These findings suggest that lack of PCG for SCZ is related to a more immature character profile. Our findings also suggest that there may be an interaction between schizophrenia and the presence of PCG as cognitive impairments were evident in SCZ with PCG and CON with no PCG.

Q14
Modeling Thermal Pain Perception

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

Advisor(s)
A. Vania Apkarian, Northwestern University

Previous studies have documented the pain ratings of subjects in response to noxious thermal stimuli. On the contrary, very few have attempted to model these ratings, perhaps due to the notion that thermal pain perception is a transitive process that is too complex to be modeled within a single mathematical model with a high degree of accuracy. Within the present study, we sought to show otherwise by deriving the simplest possible equations to model pain ratings of subjects in relation with corresponding temperature profiles. For this, we used the computerized continuous visual analog scale (VAS) ratings of subjects with data obtained from previous published articles. The equations were derived through the process of iteratively optimizing variables within proposed equations to minimize variance between the model and actual pain perception curves. Our findings indicate that though a first order differential equation with a single constant sufficiently satisfies VAS ratings which are linearly related to the stimuli patterns, it loses validity in more dynamic VAS ratings. In these situations, it is necessary to take into account the derivative of the temperature curve. Thus, our final results suggest that the simplest optimal model is that of a second degree differential equation with three independent constants, the physiological sources of which remain to be determined.

Q15
The Role of N-Cadherin-Mediated Cell-Cell Adhesion in Regulating Canonical Wnt/ß-Catenin Signaling

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

Advisor(s)
Anjen Chenn, Northwestern University

Wnt/β-catenin signaling controls many fundamental processes during embryonic development, and its deregulation has been linked to tumorgenesis. Wnt signals stabilize β-catenin, allowing it to accumulate within responding cells, and to cooperate with TCF DNA-binding factors in activating transcription of target genes. β-catenin is also an integral component of the adherens junctions, where it links the transmembrane protein cadherin to the intracellular actin cytoskeleton. Previous research has suggested that N-cadherin's function in cell-cell adhesion may regulate Wnt/β-catenin signaling. In order to test this, an N-cadherin mutant lacking the C-terminal β-catenin binding domain, which has been shown by its maker to impair cell-cell adhesion, was transfected into human embryonic kidney (HEK) 293T cells to test its effect on Wnt/β-catenin signaling. After co-culture with Wnt-releasing 293T cells for 24 hours, a luciferase reporter assay was conducted to quantify β-catenin signaling levels. The data from three separate trials showed that Ncad-ΔC significantly down-regulated Wnt/β-catenin signaling. These results suggest that N-cadherin-mediated cell-cell adhesion plays a role in regulating Wnt/β-catenin signaling and may be important in embryogenesis and/or tumorgenesis.

Q16
What Makes Your Memory Click?: Identifying Differential Neural Activity Relating to Memory Through Intracranial Electroencephalography

Presenter(s)
Weili Zheng, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

Studies have shown that the brain exhibits different activity when it successfully encodes a memory. Evidence of differential neural activity based on memory (Dm) has been previously found using functional magnetic resonance imaging near the medial temporal lobe, as well as the prefrontal cortex. This study is a further exploration in Dm using intracranial electroencephalography and a verbal memory paradigm. Epilepsy patients with chronically implanted subdural grids were tested with a verbal memory paradigm. Then, the EEG epochs during the successful memory encoding process, when the subject subsequently remembers the word, were compared to epochs during failure to encode, when the subject subsequently is unable to recall the word. Results showed that subsequently recalled words were associated with significantly higher levels of activity in the delta and theta power (1-7 Hz), as well as in the gamma frequency band (30 Hz). In addition, the study did not show any significant Dm activity in either the medial temporal lobe or prefrontal cortex. This study can lead to improved understanding of how the brain can successfully encode facts and words and may eventually lead to methods of improving the human memory.

R01
At What Mass Does a Standard Model Higgs Boson Exist?

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, one mystery that still remains is how each particle in the universe obtained its own distinct mass. A particle known as the Higgs boson is theorized to have given all other particles mass, and is the subject of our investigation. In preparation for the analysis of raw data, tools such as Monte Carlo simulations, the ROOT programming language, and multi-variable analysis programs are being studied and tested. Sample data sets have been collected and Monte Carlo simulations have been applied to them in order to gain experience with the simulations. Data reduction of these sets will soon begin so that an understanding of multi-variable analysis tools may be achieved. Testing and analysis scripts have been written and existing ones have been manipulated in order to also achieve a fluency in the ROOT programming language. These steps are providing a strong foundation of understanding of the real data analysis that will be performed in the future. We will be continuing our work and research through the summer and into the next school year, during which time we hope to make much more progress in the hunt for the Higgs.

R02
Analysis of B-Tagging Algorithm Efficiencies at the Collider Detector at Fermilab

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

Advisor(s)
Enrique Palencia, Fermi National Accelerator Laboratory

This investigation studies the efficiencies outputted from B-tagging algorithms used to analyze CDF Run II data at Fermilab. The ability to identify jets having originated from a b-quark or other long-lived particle is extremely important to many physics analysis at CDF. For example, search for the Higgs boson at low masses (M_H <140 GeV/c2) and studies of the top-quark rely heavily on algorithms which "tag" jets as b-jets. These algorithms rely heavily on the performance of the CDF silicon detector. One of the goals of the calibration procedure is to measure b-tagging efficiency in a data sample. The b-tag scale factor defined as the ratio of the positive b-tag rate in data and Monte Carlo, is then determined. B-tagging algorithms have had decreasing efficiencies so, in order to be useful in further scientific investigations, the source of this error has to be understood and, if possible, corrected. The analysis I performed has provided insight on the source of this decrease. Plotting detector efficiencies against time, we can see that the rate of change of the correlation is significantly negative for all periods of time analyzed. Since we know that luminosity has increased with time, we can conclude that B-tagging algorithms decrease in efficiency is partly due to changing luminosities in the detector.

R03
Asymmetric Dice

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

Advisor(s)
Mark Fischler, Fermi National Accelerator Laboratory

We investigate trends in the probability of an asymmetrical die landing on a specific side, given various degree of asymmetry of the die. Using the equations of classical physics, we present equations modeling a single bounce and collision of the die with the ground and combine bounces and collisions into a trajectory calculating algorithm that tells us the side the die lands on given any initial conditions. The model includes effect of ordinary single-corner bounces, and also cases where the die is sliding on a single side or is tilting while (nearly) resting on a corner. We show that the behavior becomes a chaotic function of the initial conditions, and thus the probabilities are independent of initial heights, velocities, and angular velocities, as long as the initial energy is large. We present probabilities for a rectangular die of slight and extreme elongations, and discuss the way the odds of landing on the small side go to zero, as the die becomes longer.

R04
Effect of Neutrons on Plastic Scintillating Material in the Mu2e Cosmic Ray Veto Shield

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

Advisor(s)
Douglas Glenzinski, Fermi National Accelerator Laboratory
Craig Group, Fermi National Accelerator Laboratory

Mu2e proposes a detector of superior sensitivity to interact with an intense beam of slow muons and actively look for neutrino-less muon (μ) to electron (e) conversion in the coulomb field of a nucleus (μ- N --> e- N). Cosmic ray interactions in the Mu2e target and detector regions constitute three percent of all expected background, as they can be mistaken for signal events. The Cosmic Ray Veto Shield (CRV) is an active shield designed to detect and identify incoming cosmic rays to eliminate this background. Neutron radiation originating from the creation and stopping of the muon beam in the Mu2e detector may interfere with the CRV, causing it to be dysfunctional. In this investigation, neutron effect on the scintillating material used in the CRV was tested using a californium 252 neutron source. Aluminum plates were stacked at varying widths between the neutron source and CRV in an effort to increase the purity of the source. Runs taken with no source and no aluminum had a trigger rate of 2.5 events/sec. Runs taken with the source and without aluminum exhibited a trigger rate of 18 events/sec, an increase of eighty-six percent. Ten centimeters of aluminum blocked seventy-five percent of the incoming particles, leaving an eleven percent increase of unknown composition. Future studies include further testing with aluminum to eliminate all gamma and beta particles and creating new trigger panels to improve selection of cosmic rays with specific properties such as position or angle of incidence.

R05
Neutrino Oscillations and the NOvA Experiment

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 masses. This has been controversial in previous years but it is concluded through neutrino oscillations that neutrinos have masses. Neutrino oscillation experiments have revealed that neutrinos change flavor after propagating a finite distance. The NOvA experiment is a particle physics experiment designed to detect neutrinos created by Fermilab's NuMI (Neutrinos at the Main Injector) beam. NOvA is intended to be the successor to MINOS. NOvA will consist of a detector at Fermilab, the near detector, and a far detector in northern Minnesota, the far detector. NOvA's main goal is to observe the oscillation of muon neutrinos to electron neutrino (νμ→ νe). This will assist particle physicists in constructing a matrix describing neutrino oscillation by finding one matrix parameter for the Θ-13 angle. My investigation examines the theory and mathematics behind the neutrino oscillations angles, specifically the Θ-13 angle, and it investigates how the NOvA experiment relates in finding Θ-13. During my time at Argonne National Laboratory, I was asked to look at databases for construction plans of the NOvA experiment to find and correct corrupted construction data. Along with looking at data and technical designs, I further observe NOvA construction plans in order to find how the detector functions and how it could potentially find Θ-13.

R06
Enhancement of Thermoelectric Properties of Lead Telluride by Doping

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

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

Thermoelectric materials have important applications including power generation and cooling. The focus of modern thermoelectric research is to increase the dimensionless thermoelectric figure of merit, $ZT = TS^2\sigma/\kappa$ where T, S, σ, and κ are the absolute temperature, Seebeck coefficient, electrical conductivity, and thermal conductivity, respectively. By means of first-principles calculations using the full-potential linearized augmented plane wave method, we used band-gap engineering to improve the so-called power factor $S^2\sigma$. The calculations were performed for 64-atom supercells corresponding to 1.56% doping, and site preferences for dopant atoms were established. To determine Seebeck coefficients and electrical conductivities, we performed calculations based on the Boltzmann transport theory in the constant relaxation time approximation. We found that doping creates electronic levels in the band gap which modify transport properties. Quantitatively, *p*-type doping with As on the Te site or Ca or Sr on the Pb site enhances the thermoelectric power factor due to increased electronic conductivity. Doping with As, Sb, Cd, or Zn on the Pb site results in an enhanced *n*-type thermoelectric power factor at low carrier densities. These results provide insight into the correspondence between the qualitative aspects of band structures and densities of states and quantitative thermoelectric properties.

R07
Search for Sudden Stratospheric Warmings in Soudan 2's Muon Data

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

Advisor(s)
Maury Goodman, Argonne National Laboratory

Far in the upper atmosphere, cosmic rays collide with the constituents of the atmosphere, interact or decay, and form muons and muon neutrinos. These particles will then traverse the atmosphere and the dense rock interior of the Earth, encountering energy losses by electromagnetic interactions. Then, the muons and muon neutrinos are detected underground at places such as the MINOS detector and the Soudan 2 detector. The atmosphere of the Earth is a gas, and as temperature increases, the gas will expand, becoming less dense. When the atmosphere is less dense, fewer particles will interact and instead decay, increasing the number of muons detected underground. Therefore, through an analysis of the previously accumulated muon detection rate data from the Soudan 2 experiment, a correlation of muon detection rate and change in temperature, αT value, was determined. At this point, the αT value was not high enough to signify a strong correlation. Thus, Soudan 2's historical database was analyzed in order to make necessary cuts and improve the αT value. Furthermore, the muon detection data was used to identify signs of a phenomenon in the upper atmosphere known as sudden stratospheric warmings. A comparison of the experimental results was made to a previously conducted and similar experiment that used the MINOS detector. The results will further the understanding of particles, their relationship to life, and the temperature changes of the stratosphere.

R08
Visual Scanning of MINOS Neutrino Event Data

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

Advisor(s)
Maury Goodman, Argonne National Laboratory

Using event, or neutrino collision, data, I have sought to accurately determine traits such as neutrino flavor and charge by looking for unique indicators in the events themselves. More specifically, this year I have been working with neutrino electron events and a special type of muon event, called rock muon events, from the MINOS experiment. For the electron neutrino events, twenty-three events were found that were thought to be electron neutrino events, and I checked whether eight of these events were possibly miscategorized. In the end, the errors I found were not significant enough to change the label of the event. As for the rock muon events, I looked at these events to determine if the magnet in the center of the detector was bending the muon's path towards or away from it. This bending is then used to determine if a positive or negative muon was knocked out by a neutrino or antineutrino. The number of muons found in the MINOS Far Detector is used to verify that current measurements of the value of ΔM^2_{32} hold true when found with neutrinos and antineutrinos. As of right now, I am still scanning through rock muon events with final results still being prepared.

R09
The Mass Versus Richness Relationship for MaxBCG Galaxy Clusters

Presenter(s)
Liana Nicklaus, Illinois Mathematics and Science Academy

Advisor(s)
James Annis, Fermi National Accelerator Laboratory
Huan Lin, Fermi National Accelerator Laboratory

Using MaxBCG galaxy cluster data from the Sloan Digital Sky Survey, we studied the relationship between the clusters' weak lensing mass estimates and richness in three richness bins. Richness is a measure of the number of galaxies in a cluster. While this relationship had been derived before using stacked clusters, we analyzed individual clusters, allowing us to estimate the scatter in the masses. However, due to the large amount of noise in the individual measurements, we grouped individual clusters into small stacks of ten to minimize noise while still being able to estimate scatter. To account for biases in our data, we had to consider contributions from both large scale structure and statistical noise. To correct for large scale structure biases, we ran analyses on random pieces of sky from the same redshift distribution as the clusters. We then subtracted the mass estimates of these fields from the cluster estimates. When estimating the scatter, we again considered both large scale structure and statistical noise, the latter found through analyzing cluster simulations. These contributions were subtracted to obtain the intrinsic mass scatter. Our mass-richness relationship closely matched results from previous studies, though our estimate of the mass scatter was larger than expected.

R10
Development of a Likelihood Variable for Differentiating Between Hadronic Jets and Photons

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

Advisor(s)
Sasha Pronko, Fermi National Accelerator Laboratory

The Collider Detector at Fermilab detects photons and hadronic jets. The hadronic jet may imitate the signature of a photon in the case where a $\pi 0$ meson is emitted. The photon is important in searches for new physics beyond the Standard Model and any hadronic jets confused as photons my skew such searches. In this inquiry, the distributions of PT, dR, and Ntrack were studied to determine the chance of each particle being formed. This probability is then transformed into a likelihood variable by multiplying these three together and then taking the negative log. Currently the likelihood variable has data from just the photons, but progress on integrating data from the hadronic jet distributions is well under way. With data from just the true photons, the separation between the hadronic jet and photon signatures is already surpassing the current identification criteria is both efficiency and rejection. Adding in the data from the hadronic jets should continue to improve the cuts.

R11
Building a Scanning Probe Microscope Interface Using LabVIEW

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

Advisor(s)
Venkat Chandrasekhar, Northwestern University

This investigation deals with revamping the programming of a scanning probe microscope (SPM). The old program written in VisualBASIC requires programming knowledge to utilize fully, so for the sake of simplicity, the new user interface is being written in LabVIEW. The SPM methods used encompass some of the most useful ways of researching and seeing nanoscale images. The piezoelectric actuator built by Attocube that the Northwestern University Mesoscopic Physics Group uses in its machine allows it to move with enough precision to get lateral resolutions of less than fifty angstroms, making this machine an important researching tool, and my work aims at making part of a simplified user interface to increase the usability. LabVIEW is created by National Instruments and has a unique method which is very user friendly and extremely easy to manipulate, as well as the increased functionality of being able to collect data directly and operate it to display an image and control the microscope all from organized, easy to use panels. Through the course of my work, I will have programmed a working front panel and the back end interfaces to operate the approach mechanism for the machine.

R12
The RRR Measurement by AC Lock-in Amplifier

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

Advisor(s)
C. Shekhar Mishra, Fermi National Accelerator Laboratory
Arun Saini, Fermi National Accelerator Laboratory
Genfa Wu, Fermi National Accelerator Laboratory

The performance of a superconductive cavity depends upon the purity of the niobium used to make the cavity. The RRR measurement is used to quantify the purity of the metal, therefore the precise measurement of the RRR is necessary for making good cavities and helps to understand the material history during manufacturing and processing. RRR measurement at Fermilab has been using DC current source, which is susceptible to many sources of noise. In order to reduce the amplification of the noise, the external signals have to be synchronized with the lock-in amplifier signal. The lock-in amplifier technique has the ability to eliminate most of the noise except the signal generator. I have learned the principles of using lock-in amplifier technique in measuring small signals. The work has demonstrated the feasibility of lock-in amplifier technique in the Fermilab materials laboratory. I have identified the most sources of noise which was the circuit, signal generator, and current source. The effort to further improve the signal noise ratio is in progress. By increasing the accuracy of the RRR measurement, it will have a positive impact in understanding the fabrication and the processing of niobium cavities.

R13
Search For Strong Gravitational Lens Systems Within the Blanco Cosmology Survey

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

Advisor(s)
Tom Diehl, Fermi National Accelerator Laboratory

Strong gravitational lensing systems (SGLs) have proven to be useful tools in quantifying the mass profiles of galaxies or galaxy clusters independently of the light emission distribution. A search for SGLs was conducted over one hundred square degrees of the Blanco Cosmology Survey. A total of one thousand and seventy-three candidates were selected from g-band black-and-white images based upon morphology alone. Color thumbnails of these systems were produced. Requiring that star-forming lensed source galaxies must have a consistent color that is typically bluer than the lensing galaxy, nine were selected for further study. We will show false color images of the selected candidates with hypothesized source images labeled.

S01
Westerners and East Asianers: Why Do We Clique?

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

Advisor(s)
Joan Y. Chiao, Northwestern University

In high schools all around the nation, the exaggerated stereotypes portrayed in movies and books are shown to have some truth to them. I am investigating the differences in social perception between Westerners and East Asianers and linking these differences to the formation and structure of high school social cliques. Through a twenty question survey in which high school students at the Illinois Math and Science Academy rank their agreement to statements regarding social cliques, we will be able to see trends on how students of different races choose their respective social groups. I have not yet been able to distribute my survey due to complications with survey development and approval, but it will be distributed and analyzed as soon as possible. Some studies have shown that Westerners and East Asianers do indeed perceive others differently: Westerners in an individualistic view and East Asianers in a group context. My prediction is that this will prove true through the data the survey harnesses. This project will lead to important conclusions about teenage minds and hopefully to better high school environments.

S02
Decontextualized Language Use in the Early Home Environment of Children with Early Unilateral Brain Injury: Relations to Vocabulary and Narrative Development

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

Advisor(s)
Ozlem Ece Demir, University of Chicago
Susan Goldin-Meadow, University of Chicago
Susan Levine, University of Chicago

Children with pre- or perinatal unilateral brain injury (PI) demonstrate remarkable brain plasticity when developing primary communicative skills (for example, gesture production, lexical skills, and syntactic comprehension). The plasticity might not extend to later-developing complex language skills, such as narrative skills. The current study examines the role of parental input on a child's later language development. Spontaneous caregiver-child interactions were studied for both typically-developing (TD) and PI children, and caregiver input (general language input and decontextualized language input) and the child decontextualized language use was measured at thirty and forty-two months of age. Child vocabulary and narrative skills were measured at six years of age as outcome variables. Results suggest that caregiver decontextualized language input at thirty months positively correlates with vocabulary outcomes of both TD and PI children. Early narrative talk of TD children positively correlates with later narrative outcomes, after controlling for parental input. However, for PI children, only parental use of narrative talk correlates with later narrative outcomes. Thus, findings suggest that decontextualized language input is particularly important for later language outcomes of children with brain injury.

S03
Learning to Forget: Post-Traumatic Stress Disorder Treatments

Presenter(s)
Jayanshu Jain, Illinois Mathematics and Science Academy
Kaitlyn Kunstman, Illinois Mathematics and Science Academy
Michelle Rudolph, Illinois Mathematics and Science Academy

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

Post-traumatic stress disorder (PTSD) is a psychological disorder precipitated by an extreme stressor. To be diagnosed with PTSD, the patient must continue to re-experience the traumatic event by feeling their original sense of fear, helplessness, and horror. While there are many treatments for PTSD, the focus of this project was on counterconditioning, a type of behavior therapy used to eliminate a negative response and replace it with a positive one. To get a complete view of the treatment and its efficacy, a literature review was completed and then compared to a personal interview with a therapist who treats clients in a PTSD clinic. The disorder is associated with over-activation of the amygdala as a result of a lack of inhibitory control by ventromedial prefrontal cortex, as well as by deficient hippocampal function. Because counterconditioning uses a similar neurological pathway to condition the patient not to elicit a fear response to a stimulus, it was considered one of the most effective treatments for the disorder. However, it is also one of the most stressful treatment options. The interview with the therapist elucidated the truth: the best way to treat PTSD is with a mixture of treatment modalities.

S04
Genetic Implications of Schizophrenia

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

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

Schizophrenia is a serious mental disorder that plagues about one to two percent of the population. The implications of schizophrenia may be split into two main categories: genetic implications and environmental implications. Although environmental factors play a large role in the disease, genetic factors are more of a base or precursor. Environmental factors determine the severity of the disease for the patient. This investigation focuses on genetic implications of schizophrenia. Through extensive research of a broad base of articles and analysis of twin and adoption studies, one may conclude that the causes of schizophrenia have multiple pathways. This psychological disorder cannot be narrowed down to just one cause, but must be looked at from several perspectives. The results of this investigation can broaden the public's eyes about such an unknown disease.

S05
The Relationship Between Response to Stress and Alcohol Consumption

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

Advisor(s)
Harriet de Wit, University of Chicago
Margaret Wardle, University of Chicago

In laboratory animals high response to stress predicts higher drug intake. This investigation examined response to stress in normal human volunteers to determine if stress-reactivity in young adults predicted progression in the habitual amount of alcohol consumed over a year. My hypothesis was that a high response to stress would predict an increase in drinking over the next year. Forty-seven light-drinking college students, aged eighteen to twenty-five, underwent the Trier Social Stress Test to determine their response to stress. Their weekly alcohol consumption was assessed at baseline, six, and twelve months after the stress procedure. Stress response was measured with self-reported anxiety, heart rate, and salivary cortisol. Linear regressions were used to examine the relationship of stress response to change in alcohol consumption with possible confounding variables included as covariates. Self-reported anxiety after stress predicted a decrease in drinking ($b = -0.300$, $p = 0.019$) between baseline and six months. However, none of the variables of interest significantly predicted changes in drinking ($p = 0.163$ to $p = 0.727$) from baseline to twelve months. This indicates that stress response can predict a change in drinking over the short term (six months). However, the direction of the change was not as predicted. A high response to stress actually predicted a decrease in drinking, suggesting that the more stressed someone is the less they will drink over time.

S06
The Quest to be the Best: A Modern Exploration of Perfectionism

Presenter(s)
Elizabeth Knowlton, Illinois Mathematics and Science Academy
William Lindemann, Illinois Mathematics and Science Academy

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

Perfectionism is the general state of mind in which a person holds themselves to unrealistically high standards of achievement or performance. Though much research exists in this area, there is no generally agreed-upon definition of what it means to be a perfectionist. It was our goal to determine the precise effect of perfectionism on aspects of a person's life, including their general health, and their academics. Towards this end, we created a working definition of perfectionism based on our relevant research. Following that, we wanted to examine trends in perfectionists, so we worked to develop a survey to conduct on students at the Illinois Mathematics and Science Academy (IMSA), especially as this relates to general health and academic performance. We then constructed a survey to search for and then analyze variables related to perfectionism in the students at IMSA. From our results, we discovered trends in several different areas including eating and sleep habits, parental influence, and grades, among other variables. We believe this research helped us to understand the exact nature of perfectionism and identify both some positive and negative aspects of this state of mind in IMSA students.

S07
Increasing Motivation in Schools

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

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

Procrastination, apathy, indolence: Many individuals indulge in these forms of indifference throughout life and are haunted by it. A formidable foe that can help one escape these tendencies is motivation. This project aims to conquer these initiative inhibitors by understanding how to approach motivation effectively. We focused on several theories that comment on the mechanics of motivation, and then used these theories to devise our own idea of how to heighten motivation and lessen apathy. As students, we felt that it would be most helpful to our community to direct what we have learned towards increasing student involvement in the classroom. With the goal-oriented, self-determinant, reward, and social approval theories in mind, we constructed a survey requesting Illinois Mathematics and Science Academy teachers of different disciplines to comment on the teaching styles they personally employ to engage students. The results of this survey will be beneficial to society by providing students, and by extrapolation, people in general, a means to use motivation effectively.

S08
Assessing the Attitudes and Behaviors of Incoming Sophomores at IMSA

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

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

This is an approach to understanding the attitudes and behaviors of incoming IMSA students and the specific changes they experience in their sophomore year. The National Research Center for the Gifted and Talent conducted a study, The Social and Emotional Development of Gifted, which explains how gifted students are used in comparative studies with other students, but they have not been sufficiently studied. Thus, educational institutions do not have a true understanding of the needs of gifted students. To better understand how the attitudes and behaviors of sophomores have changed, a pre and post survey was distributed during the first semester of sophomore year and will be issued again during the second semester. The results from the surveys will be compared and analyzed as to how sophomores have adjusted to IMSA and whether or not they have developed new outlooks. This will inform IMSA about the effectiveness of current programs, or the need to develop new programs that will foster the positive development in attitudes and behaviors of sophomore students.

S09
The Effect of the Classroom on Field Random Event Generators

Presenter(s)
Christopher Wallis, Illinois Mathematics and Science Academy

Advisor(s)
Peter Clancy, Illinois Mathematics and Science Academy
Brenda Dunne, International Consciousness Research Laboratories

There is evidence to suggest that the conscious act of focusing on changing the output of a physical random number generator (REG) or unconscious behaviors can be correlated with creating a statistically significant amount more of 1's than 0's (or vice versa) in the output of the machine. It is hypothesized that student engagement in a class can positively influence REG output. This hypothesis was tested by running an REG in many classes with a control REG running in a separate location and a pseudo-random number generator running at the same time. A list of questions was used to assess the level of student engagement and interest in the class. More engaging classes were analyzed and compared to the less engaging classes. The possible outcomes are that 1) the engaging classes have a greater effect on the REG's output than the un-engaging class, 2) the un-engaging classes have a greater effect, or 3) there is no statistical different between the outputs.

S10
How I Read Your Mind: A Study of Microexpressions

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

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

Microexpressions are universal. People of different cultures and religions express what Paul Ekman believes to be the seven basic facial microexpressions: anger, contempt, disgust, fear, joy, sadness, and surprise. This investigation has focused on a literature review of Ekman’s work and the completion of the Subtle Expression Recognition Training Program. After taking the pre-test for the training program, I discovered that it is possible for a beginner to identify most microexpressions without formal training. However, the natural ability to identify the microexpressions does not necessarily translate into applying this knowledge outside of the training program. These results suggest that more intensive training is needed to accurately identify microexpressions in real world situations. Such results would also have an impact on persons whose job depended on accurate recognition of microexpressions, such as interrogation in law enforcement or in homeland security situations.

T01
China and the World

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

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

In the past ten years, China has developed from a third-world country to one of the most economically influential nations on the globe. Because of its rapid rise to prominence, China's economic ties with the United States and its approach to various global issues have acquired increased significance. For example, the country has become the biggest buyer of U.S. treasury securities, which help fund U.S. government activities. In return, the U.S. is the single largest importer of Chinese goods and China's economic boom is inevitably tied to its market. The Sino-American relationship has been a topic of much debate, and it has been argued that China's role in America's economy contributed to the current recession. However, regardless of its causes, that recession's end will depend on China's economy. Because of China's newfound economic strength, it has wielded great influence on global issues, such as nuclear proliferation in North Korea and Iran. China uses its booming economy as leverage in international politics. Furthermore, China's industrial growth has also inflicted significant damage to the natural environment. China's carbon emissions top every other nation' emissions, and as a result, China has been a center of attention at global conferences, such as the recent one in Copenhagen. Our research has demonstrated the interrelated character of economics, politics, and diplomacy in evaluating China's relationship with the U.S. and the world as a whole.

T02
The Demographics of Latinos in the Professional Workforce Throughout the Urban Cities of the United States

Presenter(s)
Nicacio Corral, Illinois Mathematics and Science Academy
Rhett Partida, Illinois Mathematics and Science Academy
Isiah Ramos, Illinois Mathematics and Science Academy
Alejandro Rojas, Illinois Mathematics and Science Academy

Advisor(s)
Isabel Reyes, US Hispanic Leadership Institute

Every day, immigrants from foreign countries enter the United States hoping for a better lifestyle. Although the back-breaking work they are given is not exactly the America they had envisioned, they continue performing their duties in hopes that their children will have even better opportunities. In order to judge the effectiveness of programs such as The Center for the Advancement of Hispanics in Science and Engineering Education (CAHSEE) and The Hispanic Alliance for Career Enhancement (HACE), which seek to help immigrants realize this dream, we along with the United States Hispanic Leadership Institute collected workforce data in a variety of professions across a variety of cities for 2002-2008. We analyzed this data and determined trends in job growth for different ethnic groups in these different professions and locations. If a positive slope is found, our data would indicate the increase of Hispanics associated with these jobs. If a negative slope is found, the data would signify a decrease in the Hispanic workforce among certain professions over our time frame. Whether or not the number of Hispanics increases in our selected professions over time has direct implications with the CAHSEE and the HACE. An increasing Hispanic workforce would signal a need to continue funding and supplying such programs, while a decrease would call the effectiveness of such programs into question.

T03
Needs Assessment of Illinois Mathematics and Science Academy Students from Downstate and Rural Areas: The Invisible Minority

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

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

Students from outside the Chicago metropolitan area represent the second largest minority group at IMSA. Therefore, it is important to determine if these students, and rural students, have unique non-academic needs, such as religious resources, better transportation to/from IMSA, or extra social support that are unaddressed. The needs of downstate and rural students were determined through a survey of current IMSA students, developed based on a literature review. Data from this survey were analyzed using the chi-square test for independence and other statistical techniques. Responses to questions concerning IMSA's attitude toward downstate and rural students were found to vary depending on whether the respondent self-classified as a downstate student. A similar variance was found between students self-classified as rural and not rural. This suggests both rural and downstate students have unique needs IMSA should address. Additionally, 27.3% of rural respondents indicated they had been made uncomfortable about their rural background while at IMSA. While this represents only a small percentage of total IMSA students, the fact that any students have been made uncomfortable because of their hometown indicates IMSA could take more steps to address rural-urban diversity.

T04
Ethical 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

In recent years, many ethics scandals have occurred within government. As a result, the public's trust in legislators and the government has steadily declined. Throughout this study, we have expanded our general knowledge of ethics as well as studied the process of passing laws. After developing a strong background of our topic, we started creating two surveys. The first surveys the general public for their perceptions of the role of ethics in government while the second is directed towards the legislators of Illinois and their thoughts on how ethical they are. Although our study is not yet completed we plan to analyze the survey results to generate recommendations for legislators on how the government can regain trust in constituents and create a more ethical government.

T05
Afghanistan Unveiled: the Struggle for Afghan Women's Rights

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

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

When American and British forces invaded Afghanistan shortly after the September 11th terrorist attacks, one of the coalition's many political goals was the promotion of the rights of Afghan women. However, most Americans are unaware of the reasons such improvements are necessary in Afghanistan, the strategies implemented by coalition forces to achieve these advances, and the obstacles impeding such developments. This investigation explores these factors through the study of Afghan politics, gender roles, and culture over the past hundred years. The study also examines American and international aid efforts targeted at Afghan women and how these endeavors could be more successful. Thorough analysis of books, news articles, research papers, and primary source documents has revealed that the rights of Afghan women have declined over the past century in correlation with the rise of Islamic fundamentalism. Although the initial revocation of women's rights in Afghanistan may have been in the form of political decrees issued by the repressive Taliban regime, these injustices have now become a part of Afghan culture and society. American and international forces must work cautiously and, in many cases, indirectly to promote the elevation of women in a society that fears Westernization, foreign influence, and the retaliation of the Taliban.

U01
Comparing the Unique Almahata Sitta Meteorites to Other Ureilites

Presenter(s)
Natasha Arvanitis, Illinois Mathematics and Science Academy

Advisor(s)
Mark Hammergren, Adler Planetarium

Ureilites, which scientists believe are the remains of differentiated asteroids, are a rare type of meteorite that is rich in carbon. Recently, scientists observed asteroid 2008 TC3 in space and as it entered the atmosphere. Later, fragments of the meteorite, the Almahata Sitta ureilite, were recovered in the Sudanese desert. This is the first occurrence of an asteroid studied as both an asteroid and a meteorite. In the search for a difference between Almahata Sitta and other ureilites, I used Interactive Data Language to examine the spectra of ureilites, minerals, and asteroids. The examination of a 1-micron absorption feature, caused by silicate minerals and present in almost all ureilites, showed that, in general, the feature occurs at wavelengths of around 0.95 microns in all ureilites in the sample. However, there was wide variation in depth of the feature, probably caused by varying silicate to carbon ratios; the Almahata Sitta meteorite displayed an unusually shallow feature. Thus, the Almahata Sitta meteorite has a lower silicate percentage than other ureilites in the sample. This conclusion will aid future research involving the Almahata Sitta meteorites.

U02
Search for Ultracool White Dwarfs Using the Sloan Digital Sky Survey

Presenter(s)
Amber Betzold, Illinois Mathematics and Science Academy

Advisor(s)
Evalyn Gates, University of Chicago

White dwarfs are the remnants of low mass stars, and as such, the coolest of these are some of the oldest objects in the universe. Within the seventh data release of the Sloan Digital Sky Survey, one thousand two hundred objects were identified as possible ultracool white dwarf (UCWD) candidates based on color magnitudes and reduced proper motion parameters. Spectra of UCWDs are featureless and exhibit a dramatic drop-off from the black body radiation curve. We examined and classified the spectra of all SDSS targeted objects. Based on previous SDSS data, we expected to find five to ten additional UCWDs. While we found a number of DC white dwarfs, a classification of white dwarf that has a featureless spectrum but a temperature above four-thousand Kelvin, we did not discover any UCWDs. The lack of UCWDs in this targeted population may be due to the small numbers of these objects, or it may indicate a bias in the selection algorithm. Our results suggest that there is not a large population of faint UCWDs in the halo of our galaxy.

U03
Stellar Nursery: The Relationship Between a Spiral Galaxy's Bar and its Star Formation

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

Advisor(s)
Lucy Fortson, Adler Planetarium
Geza Gyuk, Adler Planetarium
Mark Subbarao, Adler Planetarium

A spiral galaxy is a galaxy with pinwheel-shaped arms spiraling out of it. In up to two-thirds of these galaxies, there is a visible bar extending across the galaxy's center. Despite their frequency, the effects of the bar on a barred spiral galaxy are still unclear. This investigation examines whether a galaxy's bar fuels star formation. Galaxies from the Sloan Digital Sky Survey were separated into barred or non-barred classes using Galaxy Zoo II, an online program which utilizes the public to classify galaxies. In order to characterize these galaxies, we constructed histograms and color versus magnitude graphs. We then used Baldwin, Phillips, and Terlevich (BPT) diagrams to indicate the presence of star formation or an active galactic nucleus (AGN) in the galaxy. As the BPT diagrams showed both star formation and AGN in barred spirals, we created histograms of the derived average star formation rate, based on the technique discussed in Brinchmann et. al (2004). By comparing the results for barred and non-barred galaxies, we found a negative correlation between a galaxy's tendency to have a bar and its star formation rate. In examining these results, we can better understand barred spirals, including our own Milky Way, and the evolution of galaxies.

U04
Graphical Simulation of Dark Matter Halo Formation

Presenter(s)
Vijay Jayaram, Illinois Mathematics and Science Academy
Thomas Reith, Illinois Mathematics and Science Academy

Advisor(s)
Dan Hooper, Fermi National Accelerator Laboratory

In recent years, there has been a general consensus amongst astrophys50ists that the matter we see makes up only a small fraction of the total mass of the universe. The rest is made up by an elusive yet pervasive entity known as dark matter, which only interacts with regular matter through the force of gravity and possibly other weak forces. Their gravitational interactions lead to the formation of the large halo shaped structures that surround each galaxy. To show the results of this interaction graphically, one must use the Laws of Gravitation to simulate the movement of individual dark matter particles over time, with the knowledge that after a sufficiently large interval, they will have formed a stable halo. The difficulty with such a large scale simulation lies in the n-body problem, which states that it is impossible to mathematically predict the motion of more than two particles in a gravitational field. Because of this complication, simulations must be done discretely through the use of a computer program. In this project, we wrote such a program that details the formation of this galactic halo.

2008-2009 Student Recognition

The below accomplishments are a summary from the 2008-09 academic year.

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

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

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

Kevin Chen: Homer Protein Mediation of Abeta-Derived Diffusible Ligand Binding in Alzheimer's Disease
Advisors: William Klein and Pascale Lacor, Northwestern University
NCSSSMST Student Research Symposium

Susan Chen: Modeling a Hydrocephalic Brain
Advisors: Sukhraaj Basati and Andreas Linninger, University of Illinois at Chicago
Fifth International Students Science Fair

Hyunjii Cho: Detecting the Difference between Normal and Cancerous Stem Cells Through Analysis of Morphology, Gene Expression, and Effects of Dichloroacetate (DCA)
Advisors: Morris Kletzel and Marie Olszewski, Children's Memorial Research Center
Siemens Competition Semi-finalist

Kevin Crews: Comparison of Substrate Mimetic Inhibitors of PKB
Advisos: Chaim Gilon and Yiftah Tal-Gan, Hebrew University of Jerusalem, Israel
Siemens Competition Semi-finalist

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

Sharada Dharmasankar: Low-cost, Durable Water Filter
Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy
EurekaFest June 24-27, 2009 Cambridge, MA

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

Abbey Flynn: Children, Special Protection Measures, and the CRC
Advisor: Sandra Babcock, Northwestern University
The Campaign for U.S. Ratification of the Convention on the Rights of the Child (CRC): 1st Place in the Special Protection Measures Category of the Campaign's 2009 Cynthia Price Cohen Essay Contest for "Children, Special Protection Measures, and the CRC"

Michael Gleeson: Low-cost, Durable Water Filter
Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy
EurekaFest June 24-27, 2009 Cambridge, MA

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

Shravanthy Gumidyala: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
Illinois Junior Academy of Sciences Finalist, Intel International Science and Engineering Fair Finalist

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

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

Bonny Jain: On the Embedding of Degree Sequences on the Projective Plane and Torus
Advisor: Noah Prince, Illinois Mathematics and Science Academy
Presentation: 26th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

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

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

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

Vlad Kontsevoi: Problem Solving in Elementary Mathematics: the IMO and Putnam Competition
Advisor: Noah Prince, Illinois Mathematics and Science Academy
Presentation: 26th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

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

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

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

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

Eric Lin: Technical Feasibility of a Novel Method for Station Keeping
Advisor: Peter Schubert, Packer Engineering
Co-author of paper presented at American Institute of Aeronautics and Astronautics Space 2009 Conference and Exhibition, September 14-17, 2009

Santina Lin: Origami Axiom 6: Solving Cubic Equations and Trisecting Angles
Advisor: Noah Prince, Illinois Mathematics and Science Academy
Presentation: 26th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

Iris Liu: Study of Neutrinos from Active Galactic Nuclei
Advisor: Maury Goodman, Argonne National Laboratory
Fifth International Students Science Fair

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

Jonathan Loucks*:* An Analysis of Illinois Public Schools: An Examination of Factors that Contribute to the Narrowing of the Socioeconomic Achievement Gaps
Advisor: Glenn "Max" McGee
Illinois Junior Academy of Sciences Finalist, Intel International Science and Engineering Fair Finalist (winner of Illinois Institute of Technology scholarship)

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

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

Peter Nebres: Lattice Geometry
Advisor: Noah Prince, Illinois Mathematics and Science Academy
Presentation: 26th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

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

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

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

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

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

Shyam Saladi: Sedimentation in Pervious Concrete
Advisor: Brian Lutey, Ozinga Brothers, Inc
American Concrete Institute's Concrete Projects Student Paper Competition Fourth Place

Jonathon Schwarzbauer: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
Illinois Junior Academy of Sciences Finalist, Intel International Science and Engineering Fair Finalist

Jenny Shao: A Comprehensive Mathematical Model of Tumor-Immune Dynamics
Advisor: Dr. Bin Shao
Intel Science Talent Search Semi-finalist, Junior Sciences and Humanities Symposium Finalist

Nathanial Simpson: Technical Feasibility of a Novel Method for Station Keeping
Advisor: Peter Schubert, Packer Engineering
Co-author of paper presented at American Institute of Aeronautics and Astronautics Space 2009 Conference and Exhibition, September 14-17, 2009

Eric Shyu: Luminescent Cadmium Cordination Polymers with Deverse Structural Morphologies
Advisor: Robert LaDuca, Michigan State University
Intel Science Talent Search National Finalist, Siemens Competition semi-finalist
Publication: Robert L. LaDuca and Eric Shyu, Divalent metal succinate/perchlorate coordination polymers incorporating a kinked hydrogen-bonding capable diimine: Chains, layers and a (5,6)-connected binodal network featuring alternating rectangular and hexagonal grids, *Polyhedron* 28(4): 825-834.
Publication: Eric Shyu, Ronald M. Supkowski, and Robert L. LaDuca, A Chiral Luminescent Coordination Polymer Featuring a Unique 4-Connected Self-Catenated Topology Built from Helical Motifs, *Inorganic Chemistry:* 48(7): 2723-2725.

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

Yiru Tao: Low-cost, Durable Water Filter
Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy
EurekaFest June 24-27, 2009 Cambridge, MA

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

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

Arika Verma: Identification of Molecular Breast Cancer Subtypes using Tissue Microarrays and Digital Microscopy
Advisors: Andrey Khramtsov and Funmi Olopade, University of Chicago
Illinois Junior Academy of Sciences Finalist, Intel International Science and Engineering Fair Finalist

Jing Wang: Differences between Wild Type and Knockout Cyclophilin B in the Mammary Gland Development of Mice in Relation to Breast Cancer
Advisors: Charles Clevenger and Y'vonne Feeney, Northwestern University
NCSSSMST Student Research Symposium

John Wang: The Educational Black-White Achievement Gap: Significant Factors in a Static-State Intergenerational Model
Advisors: Jonathan Hersh and Emily Oster, University of Chicago
Presentation: 26th Annual Rose-Hulman Institute of Technology Undergraduate Mathematics Conference

Nancy Yu: Differences between Wild Type and Knockout Cyclophilin B in the Mammary Gland Development of Mice in Relation to Breast Cancer
Advisors: Charles Clevenger and Y'vonne Feeney, Northwestern University
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Eva Yuan: Particulate Matter Causes Endothelia Cell Barrier Disruption and Induces acute Lung Damage in a Murine Model of Asthma: Physiological and Genomic Contributions
Advisors: Joe Garcia, Liliana Moreno and Ting Wang, University of Chicago
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Anthony Yunker: Weak Lensing Mass Estimates of Low Redshift Galaxy Clusters
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Weili Zheng: Determining Latencies of Event-related Potentials from Verbal Memory Tasks Using Gamma Frequency Band Analysis
Advisor: Brent Parris and Vernon Leo Towle, University of Chicago
Illinois Junior Academy of Sciences Finalist, Intel International Science and Engineering Fair Finalist

Weili Zheng: Low-cost, Durable Water Filter
Advisors: Mark Carlson, Sarah O'Leary; Illinois Mathematics and Science Academy
EurekaFest June 24-27, 2009 Cambridge, MA

Amy Zhou: New Battles against Complex Infections: Synergy Studies Against Methicillin-Resistant *Staphylococcus aureus*
Advisors: Bill Kabat and Rajeswari Pitchumani, Children's Memorial Hospital
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Johannes Zhou: Determination of Effectiveness of Leading Antacid Brands
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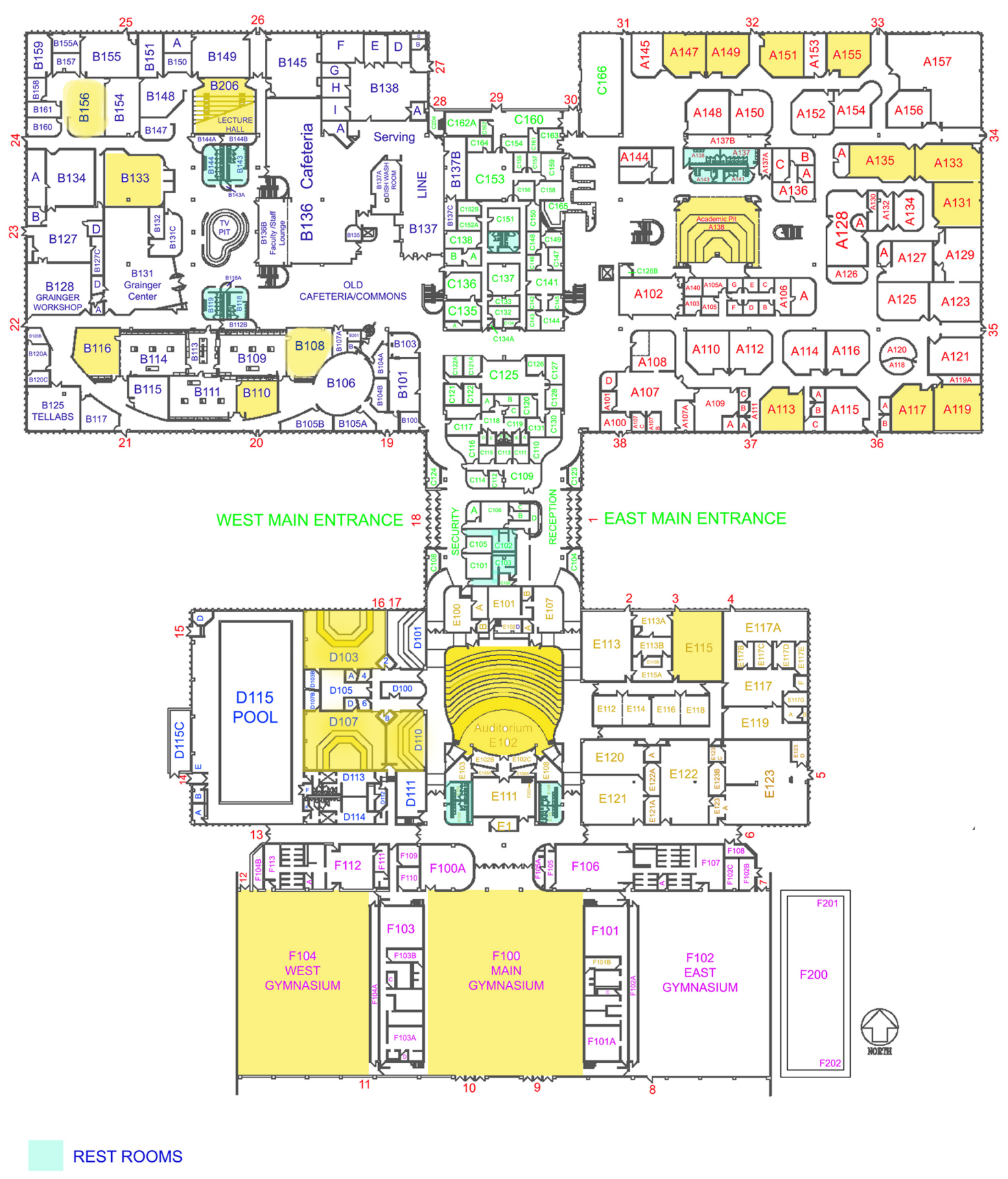

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