IMSAloquium

STUDENT INVESTIGATION SHOWCASE

April 17, 2014
www.imsa.edu

IMSAloquium
STUDENT INVESTIGATION SHOWCASE

April 2014

Dear IMSA Friends:

The Student Inquiry and Research Program (SIR) at IMSA is evidence in action of the Academy's mission "to ignite and nurture creative, ethical, scientific minds that advance the human condition." By engaging in the rich opportunities provided by the SIR experience, IMSA students pursue compelling questions of interest, conduct investigations, communicate findings, and ultimately impact society and the 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 a life-changing experience for our students. Working with world-class scholars and advisors, students have contributed to advances in a variety of fields from science, technology, engineering and mathematics, to the performing arts and history. This work is shared through presentations, publications, and collaborations with other students, scholars, artists, and inventors throughout the world.

Evidence of our students' excellence in all fields is found within this proceedings book of the twenty-sixth year of SIR. In this abstract book you will learn of our students' inquiries into their unique passions, their pursuit of new interests, and their ability to both ask and answer deep questions. Working with extraordinary advisors, they conduct high-level research fitting a world-class institution. In fact, a number of our students have already published and presented their work at state, national, and international conferences.

We are tremendously indebted to our students' advisors and their institutions. The strength of our SIR program lies with these collaborative partnerships. We thank all the experts and leaders who nurture IMSA students' talents in innovative ways and guide them as they attain exceptional levels of achievement.

These students exemplify a tradition of excellence. We have high expectations for our students, and many far exceed these expectations for accomplishments and contributions to society. They are well-prepared to confront and solve present and future challenges that impact our local and global communities. Thank you for celebrating our students' successes with us!

Sincerely,

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

Catherine C. Veal
President

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

Twenty-sixth Annual IMSAloquium
April 17, 2014

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Inside Back Cover - IMSA Map with Room Locations Highlighted

IMSAloquium cover designer is Lael Costa (IMSA Class of 2014). The image was drawn by hand on a computer; Silk was used to embellish the design and create a symmetrical version. It was completed using Adobe PhotoShop CC.

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

Twenty-Six Years of 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, includes nearly three hundred participants each year, and participation by each graduating class has grown to about 90%. Credit is now offered for participation in SIR in the summer, and Summer SIR continues to grow.

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! Representative publications, presentations, and accomplishments are listed below.

Authorship or Co-authorship in Publications (partial listing)

- *Biophysical Journal*
- *Journal of Vacuum Science and Technology B*
- *Nature*
- *The Open Virology Journal*
- *Young Scientist Journal*

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

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

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

Presentations (brief listing)

- American Physical Society
- American Society of Microbiology
- Associated Professional Sleep Societies
- 10th Annual Dabrowski Conference
- IEEE Ninth Workshop on Spatial Stochastic Models for Wireless Networks
- Junior Academy of Science at AAAS

Competitions (brief listing)

- Intel International Science and Engineering Fair
  - 26 finalists since 2008
  - 3 fourth place (individual) category awards, 1 (team) third place category award
- Intel Science Talent Search
  - 47 semi-finalists and 13 finalists since 1989
  - Finalists have placed first (1993), fifth (1998), third (1999), and second and sixth (2005)
- Siemens Westinghouse (established 1998-99)
  - 56 regional semi-finalists; 7 regional finalists, resulting in 1 national semi-finalist

2013-2014 Student Recognition

Please join us at 12:30 in the Academic Pit to celebrate the accomplishments of our students.

Prachi Aggarwal: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisors: Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff; Northwestern University
Presentation at the American Junior Academy of Science at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Charlene Angeles: The Impact of Narcolepsy on Self-Image and Quality of Life in Young Adults
Advisor: Mary Kapella; University of Illinois at Chicago
Co-presenter at 7th Annual Meeting of the Associated Professional Sleep Societies, June 1-5, 2013

Ashok Arjunakani: The Effect of Various Concentrations of Lipids on Phase Changes in the Cell Membrane
Advisor: Adam Hammond; University of Chicago
Presentation at the 9th International Student Science Fair, July 11-15, 2013, in Cornwall, England

Ashok Arjunakani: The Effect of Nitric Oxide on Cellular Adhesion in Various Cancer Cell Lines
Advisors: Madeeha Agil, Kim Elseth, and James Radosevich; University of Illinois at Chicago
Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State Finalist[1]; Intel ISEF Finalist[2]

Ryan Chiu: Uncovering the Role of PTEN in Mediating the Decrease of Pancreatic Inflammation Signals by Omega-3 Fatty Acids
Advisor: Paul Grippo; Northwestern University
Presentation at the 9th International Student Science Fair, July 11-15, 2013, in Cornwall, England

Lael Costa: Understanding the Dimensions of String Theory: The Betti Numbers of Calabi-Yau Manifolds
Advisor: Nir Avani, Northwestern University
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Lael Costa: Benefits of High School Student Research Opportunities
Student panelist at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Matthew Deng: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
*Presented and published in the Singapore International Science Challenge Proceeding, 2013, July 1-5, pages 80-94 (**Kent Gang, Siva Gangavarapu**, **Matthew Deng**, Max McGee, Ron Hurlbut, Michael Lee Dao Kang, Sean Ng Peng Nam, Harman Johll, and Tok Eng Soon; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois*

Jennifer Du: Molecular Cloning of Cellulolytic Enzymes From *Acidothermus cellulolyticus*
Advisor: Aldwin Anterola; Southern Illinois University at Carbondale
Illinois Junior Academy of Science Region V Project Exposition Finalist

Grace Duan: Identification of Active Brain Regions During Sleep
Advisors: Jennie Yufen Chen and Todd Parrish; Northwestern University
Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State Finalist[1]; Intel ISEF Finalist[2]

Cassandra Erwin: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge Finalist[4]

Ryan Franks: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge Finalist[4]

Kent Gang: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
*Presented and published in the Singapore International Science Challenge Proceeding, 2013, July 1-5, pages 80-94 (**Kent Gang, Siva Gangavarapu, Matthew Deng**, Max McGee, Ron Hurlbut, Michael Lee Dao Kang, Sean Ng Peng Nam, Harman Johll, and Tok Eng Soon; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois*

Siva Gangavarapu: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
*Presented and published in the Singapore International Science Challenge Proceeding, 2013, July 1-5, pages 80-94 (**Kent Gang, Siva Gangavarapu, Matthew Deng,** Max McGee, Ron Hurlbut, Michael Lee Dao Kang, Sean Ng Peng Nam, Harman Johll, and Tok Eng Soon; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois*

Al-Jalil Gault: The Experience of Homelessness and Stress and its Effect on Memory Functioning in Homeless Youth
Advisor: Scott J. Hunter; University of Chicago
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Anna Gupta: Building an Efficient Egg-Based Antibacterial Water Filter
Advisor: Mark Carlson; Illinois Mathematics and Science Academy
Poster presentation at the U.S. Stockholm Junior Water Prize National Competition, June 14-16, 2013, Portland, Oregon; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois; Poster presentation and award at the Illinois Water Environment Association WATERCON banquet, March 17, 2014, Springfield, Illinois; Presentation at the Illinois section of the American Water Works Association conference March 19, 2014 Springfield, Illinois

Claire Hensley: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge finalist[4]

Michael Hrcek: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge finalist[4]

Shreya Jain: Achieving Hippocampus Activation Through fMRI Tests
Advisor: Todd Parrish; Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Omkar Kelkar: An Analysis of Regulated and Disrupted E4BP4 Circadian Waveforms in Siberian Hamsters
Advisor: Brian Prendergast; University of Chicago
Presentation at the American Junior Academy of Science at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Omair Khan: Burns Alter the Intestinal Microbiota and Increases Inflammation and Sepsis
Advisors: Mashkoor Choudhry and Zasckary Earley; Loyola University
Illinois Junior Academy of Science Region V Project Exposition Finalist: Special award from the Society for In Vitro Biology; IJAS State finalist[1]

Srisha Kotlo: Analysis of Critcal PKC-delta Sites on Sarcomeric Protein Phosphorylation and Function
Advisor: Marcus Henze; University of Illinois at Chicago
Siemens Competition Regional Semi-Finalist; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois; Illinois Junior Academy of Science Region V Project Exposition Finalist

Sanjay Kottapali: Evaluating Molecular Function
Advisors: Debabrata Chakravarti and J. Brandon Parker; Northwestern University
Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State finalist[1]

Anna Kryczka: Achieving Hippocampus Activation Through fMRI Tests
Advisor: Todd Parrish; Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago. Illinois

Maria Kuznetsov: Effects of Gestational Hormones on Free Fatty Acid Receptor 2 Expression During Pregnancy
Advisor: Brian Layden; Northwestern University
Presentation at Japan Super Science Fair (JSSF) Kyoto, Japan, November 6-13, 2013

Lakhena Leang: Creating an Isogenic Inducible Model for ALS-related FUS R521G Aggregation in Neuro2A cells
Advisor: Richard Morimoto; Northwestern University
Siemens Competition Regional Semi-Finalist

Mack Lee: Analysis of Rate Outage with Fractional Frequency Reuse and Interference Cancellation
Advisors: Randall Berry and Vijay Subramanian, Northwestern University
*Co-presenter at the IEEE Ninth Workshop on Spatial Stochastic Models for Wireless Networks, May 13, 2013, Tsukuba Science City, Japan (Lan Xing, **Mack Lee**, Rajeev Agrawal, Randall Berry, Vijay Subramanian)*

Judy Li: Analysis of Glial Activation in R6/2-YFP Mice: A Novel Mouse Model for the Analysis of Axonal Degeneration in Huntington's Disease
Advisors: Rudolfo Gatto and Gerardo Morfini; University of Illinois at Chicago
Presentation at Japan Super Science Fair (JSSF) Kyoto, Japan, November 6-13, 2013

David Lisk: Building an Efficient Egg-Based Antibacterial Water Filter
Advisor: Mark Carlson; Illinois Mathematics and Science Academy
Poster presentation at the U.S. Stockholm Junior Water Prize National Competition, June 14-16, 2013, Portland, Oregon; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois; Poster presentation and award at the Illinois Water Environment Association WATERCON banquet, March 17, 2014, Springfield, Illinois; Presentation at the Illinois section of the American Water Works Association conference March 19, 2014, Springfield, Illinois

Vivian Liu: Structural Studies of Llama Antibodies in Complex with HIV-1 gp120
Advisor: Lei Chen; National Institutes of Health
Sigma Xi: Student Research Showcase, third place, high school division, Cellular and Molecular Biology

Sameeksha Malhotra: Identification of Active Brain Regions During Sleep
Advisors: Jennie Yufen Chen and Todd Parrish; Northwestern University
Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State finalist[1]; Intel ISEF finalist[2]

Alec Mangan: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge finalist[4]

Alonzo Marsh: Team Titan Shielding Systems
Advisor: Eric Hawker; Illinois Mathematics and Science Academy
NASA Exploration Design Challenge finalist[4]

Sruthi Mothkur: Non-Linear Relationship Between T-Tubule Remodeling and Sr Calcium Release in Failing Rat Ventricle
Advisor: J. Andrew Wasserstrom; Northwestern University
*Co-author of abstract published in Biophysical Journal, 2014, Volume 106, Issue 2, and co-presenter at the 58th annual meeting of the Biophysical Society Feb 15-19, 2014, San Francisco, CA (Jasleen Singh, Nikhil Bassi, **Shannon Tai[3], Shruthi Mothkur**, William Marszalec, Neha Singh, Gary L. Aistrup, J. Andrew Wasserstrom)*

Philip Nebres: The Effect of Varying Concentration Levels of Lipids on Phase Separation
Advisor: Adam Hammond, University of Chicago
Presentation at the 9th International Student Science Fair, July 11-15, 2013, in Cornwall, England; Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Philip Nebres: The Effect of Nitric Oxide on Cellular Adhesion in Various Cancer Cell Lines
Advisors: Madeeha Agil, Kim Elseth, and James Radosevich; University of Illinois at Chicago
Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State Finalist[1]; Intel ISEF Finalist[2]

Michelle Park: The pH of Drinks and Their Effect on Teeth
Advisor: Don Dosch; Illinois Mathematics and Science Academy
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Jenson Phung: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisors; Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff; Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Cristal Quinones: The pH of Drinks and Their Effect on Teeth
Advisor: Don Dosch, Illinois Mathematics and Science Academy
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Aishwarya Raj: Analysis of Metabolic Pathways and the Relationship to KDM5A and the Retinoblastoma 1 Gene
Advisor: Elizaveta Benevolenskaya; University of Illinois at Chicago
Sigma Xi Student Research Showcase

Xueyang Ren: Creating an Isogenic Inducible Model for ALS-Related FUS R521G Aggregation in Neuro2A cells
Advisor: Richard Morimoto; Northwestern University
Siemens Competition Regional Semi-Finalist

Daniel Rosenthal: Metal-Assisted Etching of Silicon Molds for Electroforming
Advisors: Ralu Divan and Leonidas Ocola; Argonne National Laboratory
Co-author of paper in Journal of Vacuum Science and Technology B 31(6), 2013; http://dx.doi.org/10.1116/1.4821651 *(Ralu Divan, **Dan Rosenthal**, Karim Ogando, Leonidas E. Ocola, Daniel Rosenmann and Nicolaie Moldovan)*

Daniel Rosenthal: Fabrication of Semiconductor Nanostructures by Metal-Assisted Chemical Etching
Advisors: Ralu Divan and Leonidas Ocola; Argonne National Laboratory
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School; Participated in YouTube video "A Look Inside Argonne's Center for Nanoscale Materials" Published on Jan 29, 2014, https://www.youtube.com/watch?v=E6Krh7tozGY

Shreya Santhanam: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisors; Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff; Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago. Illinois

Sreyesh Satpathy: Magnetic Resonance Probe Optimization for Early Detection of Alzheimer's Disease
Advisors: William Klein and Kirsten Viola; Northwestern University
Siemens Competition Regional Semi-Finalist; Illinois Junior Academy of Science Paper Exposition; Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State finalist[1]

Janani Sivakumar: Identification of Gravitationally Lensed Quasars: A Morphological Approach
Advisor: Sivakumar Muthuswamy; Motorola Solutions
Siemens Competition Regional Semi-Finalist

Simona Stancov: The Role of Gut Microbes in Regulating Dietary Fat-Mediated Alterations of Nuclear Hormone Receptor Expression and Metabolism
Advisor: Kristina Martinez; University of Chicago
Presentation at Japan Super Science Fair (JSSF) Kyoto, Japan, November 6-13, 2013; 39th Annual Chicago Region Junior Science and Humanities Symposium Finalist

Ranjani Sundar: Phthalates and Phthalate Alternatives: Effects on Proliferative and Estrogenic Target Genes in Ishikawa Cells
Advisors: Serdar Bulun and Ping Yin; Northwestern University
*Co-author of paper to be published in Young Scientist Journal, Vol. 4, May 2014 (**Ranjani Sundar**, Ping Yin, Serdar E. Bulun); 39th Annual Chicago Region Junior Science and Humanities Symposium Alternate; Illinois Junior Academy of Science Region V Project Exposition Finalist: IJAS State finalist[1], Intel ISEF finalist[2]; Sigma Xi: Student Research Showcase*

Poornima Sundaravelu: Allelic Variation in Catechol-o-Methyltransferase and Interpersonal Stressors on Adolescent Well-Being
Advisor: Eva Telzer; University of Illinois at Urbana- Champaign
Poster presented at STEM Summit 2014: Engage Your Brain, February 28, 2014 at Hinsdale Central High School

Sai Talluru: The Experience of *GATA6* Mutations oof All Subjects in the Monogenic Diabetes Registry
Advisors: Graeme Bell, David Carmody, and Siri Atma Greeley; University of Chicago
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Rashmi Thimmapuram: Novel Method to Find the Language Region Using Electrocorticography During Natural Conversion
Advisor: Vernon Leo Towle; University of Chicago
39th Annual Chicago Region Junior Science and Humanities Symposium Finalist; Illinois Junior Academy of Science Region V Project Exposition Finalist: Special Award from the Navy

Lynette To: Developing an Efficient Immunization Method to Elicit CD8+ T cells in Response to Qa-1-restricted Mtb-Specific Peptides
Advisors: Yao Bian and Chung-Ru Wang; Northwestern University
Presentation at Japan Super Science Fair (JSSF) Kyoto, Japan, November 6-13, 2013

Shruti R. Topudurti: The Effect of Small Molecule 390 on CXCR4 Receptors
Advisors: Richard J. Miller and Andrew Shum; Northwestern University
*Co-author of paper to be published in Young Scientist Journal, Vol. 4, May 2014 (**Selam B. Zenebe-Gete**, **Shruti R. Topudurti**, Andrew Shum, Richard J. Miller)*

Lia Vallina: An OPERA-3d Model of Muon Injection in the Muon g-2 Storage Ring
Advisor: Brendan Kiburg; Fermi National Accelerator Laboratory
Presentation at the American Physical Society Conference, Savannah, Georgia, April 4-7, 2014

Stephanie Wang: A Novel Design Verifying Field Programmable Gate Arrays' Radiation-Tolerance
Advisor: Jinyuan Wu; Fermi National Accelerator Laboratory
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

Stephanie Wang: The CAKE Clocking and the Trapezoidal Clocking Schemes: Principles and Demo Tests
Advisor: Jinyuan Wu; Fermi National Accelerator Laboratory
*Co-presenter at the IEEE Nuclear Science Symposium and Medical Imaging Conference and Workshop on Room-Temperature Semiconductor X-ray and Gamma Ray Detectors, 2013 Seoul Korea Oct 27-Nov 2, 2013 (J. Wu, **S. Wang,** K. Zhang)*

Selam B. Zenebe-Gete: The Effect of Small Molecule 390 on CXCR4 Receptors
Advisors: Richard J. Miller and Andrew Shum; Northwestern University
*Co-author of paper to be published in Young Scientist Journal, Vol. 4, May 2014 (**Selam B. Zenebe-Gete**, **Shruti R. Topudurti**, Andrew Shum, Richard J. Miller)*

Luke Zhan: Regulation of Type II NKT Cell Cytokine Production by SLAM-Associated Protein
Advisors: Chyung-Ru Wang and Xiufang Weng; Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 12-16, 2014, in Chicago, Illinois

1) The Illinois Junior Academy of Sciences State Project Expositions is May 2 and 3, 2014 at Northern Illinois University, DeKalb, Illinois.
2) The Intel International Science and Engineering Fair (ISEF) is May 11-16, 2014 in Los Angeles, California.
3) Alumnus, class of 2012.
4) The winning team of the NASA Exploration Design Challenge will be announced in April; winners will build and have their design launched and tested on Orion's first test flight, Exploration Flight Test-1.

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

IMSAloquium:
Student Investigation Showcase
April 17, 2014

Schedule of Sessions

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

IMSAloquium Poster List and Presentation by Topic

Biochemistry

ID	Presenter	Title	Time	Room
A01	Kaia Ball	Functional Characterization of the HopZ Family of Type III Effectors	9:10	A-147
A02	Ryan Franks	The Effect of pH and Nitrogen, Phosphorous, and Potassium Concentration on Two-Chambered Microbial Fuel Cells	10:00	A-121
A03	Deborah Park Ruchi Patel	Determining the Optimal Conditions for Inducing Apoptosis in MCF-7 Cells With Aspirin Treatment	10:25	B-133
A04	Archit Potharazu Zachary Yager	Optimizing Light Absorption in Cyanobacteria	11:15	B-206 Lect Hall
A05	Aishwarya Raj	Analysis of Metabolic Pathways and the Relationship to Lysine (K)-Specific Demethylase 5A and the Retinoblastoma 1 Gene	2:10	B-108
A06	Ranjani Sundar	Phthalates and Phthalate Alternatives: Effects on Proliferative and Estrogenic Target Genes	1:20	A-155
A07	Sai Talluru Amy Zhu	Elucidating Proteins Involved in Mitochondrial Division and Tethering Using the Yeast Two-Hybrid System	2:10	A-155

Bioengineering

ID	Presenter	Title	Time	Room
B01	Ashok Arjunakani Philip Nebres	Investigating Methylation Patterns in Cancer Suppressor Genes Through Gene Sequencing	1:45	A-138 Acad. Pit
B02	Jennifer Du	Molecular Cloning of Cellulolytic Enzymes From *Acidothermus cellulolyticus*	10:25	A-149
B03	Ashley Kim	Confirmation of Protein Immobilization on Carbon Nanofibers Through Imaging Labeled With Glucose Oxidase-Coupled Gold Nanoparticles	10:00	A-113
B04	Danielle Madsen	Centrosome and Spectrosome Orientation in *Drosophila* APC2-mut Stem Cell Asymmetric Division	10:00	A-115
B05	Rajiv Patel-O'Connor	An Investigation of a Novel Peptide Amphiphile for Diagnosing Atherosclerosis *in vivo*	12:55	A-117
B06	Sean Potempa	Engineering Vascularized Bone	11:15	A-121
B07	Sagar Punhani Kyle Thomas	Ocular Vestibular Evoked Myogenic Potentials in Chronic Stroke Subjects	9:35	A-131
B08	Susie Shin	Construction of a Human Gene Regulatory Network	9:35	A-113
B09	Tera Sparks	Capture of Circulating Tumor Cells Using Functionalized Capture Surfaces	2:10	A-117
B10	Rajiv Trehan	Highlighting Cancerous Tissue During Brain Tumor Resection Surgery	11:15	A-147
B11	Vivek Vermani	Development of a Simulation Visual Prosthetic Device	9:10	A-119
B12	Elizabeth Weiss	The Effects of the Overexpression of *MAN1A1* and *MGAT2* in Glioblastoma Multiforme	1:45	A-131

Biology

ID	Presenter	Title	Time	Room
C01	Joshua-Paul Ajayi	Effects of Kallikrien Gene Polymorphisms on Prostate Cancer Risk and Prostate Specific Antigen	1:45	A-113
C02	Waleed Ali	Utilizing Nuclear Morphometry to Differentiate Between Salivary Gland Cancers	1:45	A-121
C03	Ashok Arjunakani Philip Nebres	The Effect of Nitric Oxide on Cellular Adhesion in Various Cancer Cell Lines	2:10	A-138 Acad. Pit
C04	Xindi Chen	Regulation of Interleukin 17 Receptor D by MicroRNA193a-3p in Colon Cancers and Associated Diseases	9:35	A-115
C05	Mary Cody	The Effect of Different Meat Types and Chemicals on Carrion Insect Attraction	10:50	A-133
C06	John Deng	Effects of Dietary Fat on Secreted Frizzled-Related Protein 1 in Normal Mouse Colon	12:30	A-119
C07	Vishrut Dixit	New Regulators of Lysosome Motility	1:20	A-147
C08	Natalie Dong Atene Poskute Saigopal Somasundaram	Optimizing DNA Sequencing Using DNA Isolation, Polymerase Chain Reaction, and Gel Electrophoresis	10:50	B-206 Lect. Hall
C09	Nisa Faheem Somie Park Lajvanthi Sudhakar	The Effect of microRNA on the Proliferation of Non-Small Cell Lung and Breast Adenocarcinoma	12:30	B-206 Lect. Hall
C10	Kristy Fang Nahee Park	Physical Interactions of Regulatory Sequences Within Schizophrenia-Associated MIR137 Locus	12:30	A-121
C11	Yan Lin Feng	Deoxycholic Acid Alters Expression of Cancer and Epigenetic Genes in Mouse Intestinal Epithelium	1:45	B-116
C12	Natasha Freund	Using Golden Helix to Analyze Data From Whole Genome Sequences of Polycystic Ovarian Syndrome	1:20	A-131
C13	Geronimo Garcia Priya Trivedi	Examining Cell-Cell Communication in Filamentous Cyanobacteria Using Electron Tomography	8:45	A-149
C14	Cammille Go	Patterns Behind Degeneration of Retinal Ganglion Cells in Glaucoma on Oscillatory Potential Waves	1:20	A-115
C15	Annika Gomez	Engineering a Luminescent Reporter Protein to Track Influenza A Virus Infection *in vivo*	10:25	A-113
C16	Alyda Huerta	CRISPR/Cas9 RNA-Guided Upregulation of Utrophin as a Therapy for Duchenne Muscular Dystrophy	10:00	A-147
C17	Shreya Jain	Effect of High Nitric Oxide Microenvironment on Cancer Cell Migration	1:20	A-138 Acad. Pit
C18	Elijah Jimenez	Phenotypic Characterization of OX40L-Expressing Dendritic Cells Expanding T-Regulatory T-Cells	8:45	A-131
C19	Vivian Jin Shuchi Patel	Error Correction Approach of Next Generation Sequencing Data for Analysis of HIV-1 Variability	10:25	A-133
C20	Omkar Kelkar	The Effect of Photoperiod and Thyroid Hormone on Innate Immune Response in *Phodopus sungorus*	10:25	A-135

C21	Nicholas Kiene	Effects of Environmental Factors, Immune Evasion, and Reservoir Population on the Prevalence of Lyme Disease	10:00	B-133
C22	Srisha Kotlo	The Role of E2F1 in Regulating Bone Marrow Cell Oxidative Metabolism and Ischemic Cardiac Repair		
C23	Sanjay Kottapalli	Evaluating Molecular Function of Proteins Through Integrase-Mediated Cassette Exchange	1:45	A-135
C24	Kathryn Kuna	Analysis of Retinoblastoma I and Lysine (K)-Specific Demethylase 5A on Metabolic Pathways	12:55	B-108
C25	Quinn Lewis	Effects of a Nuclear Receptor Agonist on Gene Expression of Hepatocyte Organoids	2:10	B-116
C26	Gina Liu	Identification of Fate Regulators in Human Embryonic Stem Cells	8:45	A-151
C27	Gina Liu	Creating an Efficient Code Pipeline to Analyze *Caenorhabditis elegans* Drug Sensitivity	9:10	A-151
C28	Shruthi Mothkur	Correlation Between Intracellular Calcium Release and T-Tubule Organization in Failing Rat Myocytes	1:20	B-108
C29	Shruthi Mothkur	Characterization of *EZH2*, *KDM5A*, and *KDM5B* Alterations in Human Breast Cancer	1:45	B-108
C30	Emily Mu	Functions of Transcriptional Corepressor Groucho on Neuronal Differentiation	9:10	A-115
C31	Julian Pacheco	Association Between Diabetes-Related Single Nucleotide Polymorphisms and Various Cancer Types	12:30	A-135
C32	Breanna Pederson	Homozygous Genotypes Long Adenine and Short Variant of Serotonin Transporter Gene and Link to Autism	10:25	A-155
C33	Michael Pradaxay	Toll-Like Receptor 4 and Amyloid Precursor Protein Gene Roles in the Onset of Alzheimer's Disease	1:20	A-113
C34	Maureen Reiser	The Relationship Between Enrichment Type and Daily Activity in a Mountain Lion	12:55	B-206 Lect. Hall
C35	Nicole Schubert	Factors Influencing the Effectiveness of Enrichment for Captive Gray Wolves (*Canis lupus*)	1:45	B-206 Lect. Hall
C36	Christopher Shin	The Role of Viral Protein 1/2 in Herpes Simplex Virus 1 Replication	1:45	A-155
C37	Sachi Singh	Effect of Apolipoprotein E4 Allele on Deterioration of Brains in Patients With Alzheimer's Disease	1:20	A-133
C38	Shelly Teng	The Effects of A4V Superoxide Dismutase 1 Mutant Protein Incorporation on Calcium Ion Membrane Conductance	2:10	A-121
C39	Yash Thacker	Designing an Algorithm to Analyze Images of Moving Mitochondria	12:30	E-115 Kids Inst.
C40	Lynette To	Developing an Efficient Immunization Method to Elicit CD8+ T Cells	1:20	A-149
C41	Brian Vien	The Effects of the Microflora on Corneal Epithelial Cell Migration *in vitro*	2:10	A-133
C42	Amanda Walsh	Determining Gene Recruitment Sequences for Targeting ACT1 Gene to the Nuclear Periphery in Yeast	8:45	A-121
C43	William Widjaja	The Role of ER71 in Blood Vessel Development	11:15	A-133
C44	Mayuri Yasuda	The Absence of Gut Microbes Alters Hepatic Nuclear Receptor Expression	1:20	B-116

C45	Sung Yeo	The Effects of Adiponectin on Fibrosis	1:20	A-121

Business

ID	Presenter	Title	Time	Room
D01	Sun Kim John Satter	Possible Short Term Investment Strategy	1:45	E-115 Kids Inst.
D02	Rohit Mahankali	An Ethnographic Study of Start-Up Businesses and Their Approaches to Defining Target Markets	10:50	B-108
D03	Jonathan Peloquin	Investigation of the Implementation of Global Positioning Systems in Missiles and New Technologies	9:35	E-115 Kids Inst.

Chemistry

ID	Presenter	Title	Time	Room
E01	Kyle Chen	Characterization of Polymer Modification via Sequential Infiltration Synthesis Process	8:45	A-133
E02	Siva Gangavarapu	Atomic Layer Deposition of Hafnium Oxide on a Silicon Substrate		
E03	Arjit Jaiswal Varun Patel	Using Granular Silicon-Graphene Anodes to Boost the Capacity of Lithium-Ion Batteries	12:55	A-151
E04	Jacob Kronenberg	Engineering Self-Assembling Peptides to Tune the Coordination Environment of Metalloporphyrins	12:30	A-133
E05	Anna Kryczka	Computational Study of Propane Dehydrogenation Over Palladium Alloy Catalysts	8:45	B-116
E06	Nida Normantaite	Phase Transitions From Amorphous to Crystalline in Polyethylene Terephthalate Polymer	10:50	A-115
E07	Daniel Rosenthal	The Effects of Process Parameters on Metal-Assisted Chemical Etching		
E08	Mateusz Wojtaszek	Detecting and Quantifying Trace Amounts of Silver Nanoparticles and Ions in Solution	10:00	B-108

Computer Science

ID	Presenter	Title	Time	Room
F01	Ethan Bian Benjamin Rabe	Creating a Fast and Accurate Physics Engine Modeling Soft-Body Collisions with OpenGL and Java	12:55	E-115 Kids Inst.
F02	Remy Bubulka	Constructing and Optimizing a System to Store and Protect Corporate Records	9:10	A-121
F03	Advitheey Chelikani Saurabh Kumar	Using Markov Decision Processes to Determine Optimal Claim Policy for Automobile Accidents	1:45	A-151
F04	Advitheey Chelikani	Comparing the Rate Monotonic and Earliest Deadline First Scheduling Algorithms	1:20	A-151
F05	Diana Chen Sneha Thakkar	Showing Ego Depletion and Motivation in Video Games	11:15	A-138 Acad. Pit
F06	Eric Hennenfent	Constructing a Web Interface for the NOvA Experiment	9:10	A-155
F07	Saurabh Kumar	Measurement of Alzheimer's Disease Diagnostic Accuracy Using Machine Learning Algorithms	2:10	A-151

F08	Andrew Kuznetsov	Development of Mechanical Turk Simulations for Auction Theory Research	1:20	E-115 Kids Inst.
F09	Claire Lee Emily Rader	Transition From Biological Life to the Development of Artificial Intelligence	2:10	B-206 Lect. Hall
F10	Mack Lee	Simulating Bandwidth Reuse Methods to Maximize Speed and Coverage for Cellular Customers		
F11	Nicholas Magerko Jonathan Reynolds	Constructing High Quality Three-Dimensional Models With Economical Hardware	10:25	A-115

Economics

ID	Presenter	Title	Time	Room
G01	Timothy Gietl	Effect of Refinery Outages on Petroleum Administration for Defense District - West Coast Gasoline Prices	10:50	B-110
G02	Timothy Gietl	Development of Trading and Risk Management Strategies for Ibovespa Index Futures	11:15	B-110
G03	Yasmine Gordon	A Comparison of Accuracy and Validity of Risk Adjustment Models Used in the Health Care Industry	10:50	A-138 Acad. Pit
G04	Huajie Huang	How Rigged is the London Interbank Offered Rate?	9:35	B-110
G05	Huajie Huang	How Efficient is the Foreign Exchange Market?	10:00	B-110
G06	Derek Lubecke	Investigating Central Banking Development, Policies, and Actions Throughout the World	8:45	B-133
G07	Daniel Pechi	International Pharmaceutical Markets and Patent Law	11:15	A-117
G08	Michael Zeng	A Visually Intuitive Approach to Market Profiles	10:25	B-110

Education

ID	Presenter	Title	Time	Room
H01	Karin Han	Agent-Based Modeling and the Understanding of Causality in College Biology Students	12:30	B-110
H02	Kayla Ingram	Black and Latino Student Motivation Engaged in Science, Technology, Engineering, and Mathematics	10:25	A-119

Engineering

ID	Presenter	Title	Time	Room
I01	Michael Adams	Design of a Double Rotor Vertical Takeoff and Landing Prototype	11:15	A-113
I02	Timothy Akintilo Vimal Bellamkonda	Development of a Quantitative System for Evaluating At-Home Standing of the Mobility Disabled	10:00	B-116
I03	Tahj Alli-Balogun Thomas Wu	A Physical and Chemical Investigation of the Heusler Alloy Fe_2TiSn	9:10	A-131
I04	Daniel Atten Marissa Borchering	Separating Carbon Dioxide Gas From Lawn Mower Exhaust Gases	10:25	B-116

I05	Eric Barrientos	Purifying Contaminated Water With Silver Nanoparticle-Infused Ceramic Filters	9:35	B-108
I06	Brendan Batliner Milan Shah	Integration of Sensors in a Wireless High Altitude Balloon Cut-Down System	2:10	A-119
I07	Evan Derse	Modifying Wind Turbine Blade Design to Reduce Noise While Retaining or Increasing Power Generation	8:45	B-110
I08	Kevin He Adit Suvarna	A Multiplexed Readout Scheme for a Large Array of Photomultiplier Tubes	11:15	A-149
I09	Vinesh Kannan	Modifying and Reinforcing Bimetallic Strips for Application in Expanding Structures	10:25	B-108
I10	Alan Yang	Improving the Efficiency of Power Amplifiers in Radio Frequency Plasma Lamps	12:55	A-131

English

ID	Presenter	Title	Time	Room
J01	Ana Curtis	Gender-Driven Perceptions of Women in Nineteenth Century British Literature	11:15	A-115

Environmental Science

ID	Presenter	Title	Time	Room
K01	Elise Douglas Gregory O'Bannon	Synthesis of Isobutanol From Lignocellulosic Biomass Inoculated With Fungus and Bacteria	1:20	A-117
K02	Anna Gupta David Lisk	Building an Efficient Egg-Based Antibacterial Water Filter	9:10	B-108
K03	Eveline Liu	The Role of Climate Change in the Biodiversity of Ant Species	8:45	A-119
K04	Bailey Simmons-Brown	Chlorella’s Effect on Ammonium and Nitrate Levels	9:10	B-116
K05	Aaron Victor Ziang Wang	Investigation of the Ecological and Economical Effects of Green Roofs	9:35	B-116

Fine Arts

ID	Presenter	Title	Time	Room
L01	Daniel Collins	Thematic Development in Beethoven’s Piano Sonatas and its Applications to Modern Composition	2:10	E-102 Aud.

History

ID	Presenter	Title	Time	Room
M01	Max Kontorovich	An Examination of the Causes of World War II and the Cold War	9:10	A-133
M02	Andrew Salij	Vikings and Monasteries: An Analysis of the Conversion of Medieval Europe	9:10	B-133
M03	Stephanie Wang	Confucius to Fake Gucci? A Historical Approach to Explaining the Development of China's Black Market	10:00	A-138 Acad. Pit

Law

ID	Presenter	Title	Time	Room
N01	Edward Jun	A Study of the Application of Death Penalty Law in Sub-Saharan Africa	1:45	A-117

Mathematics

ID	Presenter	Title	Time	Room
O01	Lael Costa	Taking the Red Pill: Degenerations of Matrix Space	11:15	A-135
O02	Luke Musgrave	Examining Influential Factors for Team Pitching Environments in Major League Baseball	12:55	B-116
O03	Suraj Sinha	Upset Definition and Prediction in Tennis	9:35	A-121
O04	James Tao	Counting Rational Space Curves Meeting Lines and Points Using the Method of Degeneration	12:30	A-155

Medicine

ID	Presenter	Title	Time	Room
P01	Max Ackerman	Assessment of the Degree of Variation of Histologic Inflammation in Ulcerative Colitis	8:45	A-135
P02	Prachi Aggarwal Jenson Phung Shreya Santhanam	An Evaluation of Chicago Public Schools' Health-Related Policies	9:10	B-206 Lect. Hall
P03	Ryan Chiu	Epidermal Growth Factor Ameliorates Transforming Growth Factor β-Induced Collagen Deposition in Pancreatic Stellate Cells	2:10	A-147
P04	Lohitha Guntupalli	Assessment of Non-Rapid Eye Movement Delta Sleep and its Correlation to Excessive Daytime Sleepiness	2:10	A-113
P05	Taylor Herr	Pain Trajectories Across Different Variables for Inpatients at the University of Illinois at Chicago Medical Center	12:30	A-113
P06	Fengling Hu	Effects of T1L Reovirus Infection on Antiviral Response of Human Lamina Propria Cell Types *in vitro*	9:35	A-147
P07	Sharon Johnson Sophia Lam	The Correlation Between Gestational Age and Independent Oral Feeding in Preterm Newborns	10:50	A-147
P08	Omair Khan	Burn Injury Alters the Intestinal Microbiota and Increases Inflammation and Risk of Sepsis	1:45	A-149
P09	Frances Seo	Effects of Transcranial Direct Current Stimulation on Reaching Distance of Impaired Arm Post Stroke	10:00	A-117
P10	Abhishek Sethi	Does Connective Tissue Growth Factor Cause Left Atrial Fibrosis in Dilated Cardiomyopathy?	2:10	A-135
P11	Vimig Socrates	Clinical Studies in Venous Leg Ulcers and Incisional Hernias	10:00	A-151
P12	Simona Stancov	The Role of Gut Microbes in Regulating Dietary Fat-Mediated Alterations of Nuclear Hormone Receptor Expression	11:15	B-116
P13	Shruti Topudurti Selam Zenebe-Gete	The Effects of the Novel Agonist 390 on the CXC Type 4 Chemokine Receptor	10:50	A-135
P14	Paul Wang	The Future of Healthcare Reform: The Quantitative and Qualitative Implications of Value-Based Care	10:25	A-138 Acad. Pit

P15	Irina Wirjan	Identifying the Melanosomal Component Responsible for Selective Sensitivity to Bleaching Phenols	8:45	A-117
P16	Luke Zhan	Effects of KBU2046 on Common Chemotherapeutics and Androgen Regulation in Breast and Prostate Cancers	11:15	B-133

Neurobiology

ID	Presenter	Title	Time	Room
Q01	Kristin Carlson	Alteration of Brain Connections in Resting State Networks After Performing Simple Motor Actions	2:10	B-133
Q02	Greeshma Chilukuri Jayathi Varadheeswaran	Automatic Switching Point From Perfusion to Permeability Using a Single Full-Dose Contrast Injection	1:20	B-133
Q03	Joseph Donermeyer Dawson Patel	A Comparison of the Magnitude of Visual Simon Effect in High School Students With and Without Music	10:25	B-206 Lect. Hall
Q04	Grace Duan Sameeksha Malhotra	Active Brain Regions During Sleep Using Electroencephalography Functional Magnetic Resonance Imaging	1:45	B-133
Q05	Anastasia Fafara Brianna Pusey	Age-Related Changes in Visual Learning Strategies	8:45	E-115 Kids Inst.
Q06	Kayla Hannon	Infant Tractography of the Anterior Limb of the Internal Capsule	10:50	A-113
Q07	Rhea Harsoor Shveta Thakkar	Following Speech Through the Brain: Three Successive Parallel Networks	10:50	A-155
Q08	Mohamed Kady Harishankar Logaraj	The Effects of Neurotrophic Drugs on the Degeneration of Cochlear Hair Cells in Guinea Pigs	8:45	A-147
Q09	Vandana Karan	Effects of Vindeburnol on Alzheimer's Disease-Type Pathology	10:50	A-131
Q10	Taylor Knopf	Acute Ischemic Stroke in Pregnancy: A Nationwide Inpatient Sample	11:15	A-131
Q11	Lakhena Leang Xueyang Ren	Identifying Chaperones and Co-Chaperones Affecting Mechanisms of FUS R521G Aggregation in N2A Cells	10:50	A-149
Q12	Jessica Lee	Inhibitable Plasma Cholinesterases as Biomarkers of Alzheimer’s Disease	10:00	A-131
Q13	Judy Li	Activated c-Jun N-Terminal Kinase Contributes to the Differential Vulnerability of Neurons in Huntington’s Disease	10:00	A-135
Q14	Emily Ling	Using Microfluidic Chambers to Evaluate the Effect of MitoQ on Fused in Sarcoma-Mediated Neurotoxicity	10:25	E-115 Kids Inst.
Q15	Emily Ling Hye Jean Yoon	Screening Potential Treatments for Amyotrophic Lateral Sclerosis	10:50	E-115 Kids Inst.
Q16	Matthew Park	Extracting the Hemodynamic Response With the Finite Impulse Response Filter	12:55	B-133
Q17	Haneesha Paruchuri	Analysis Comparing Defective RNA Binding Proteins in Association With Amyotrophic Lateral Sclerosis	10:00	E-115 Kids Inst.
Q18	Vignesh Ravi	Monitoring the Time and Extent of Neurodegeneration in the Motor Cortex of a Novel Amyotrophic Lateral Sclerosis Mouse Model	9:10	A-138 Acad. Pit

Q19	Sreyesh Satpathy	Optimization of a Magnetic Resonance Probe for Early Detection of Alzheimer's Disease	1:20	B-110
Q20	Sajishnu Savya	The Relationship Between the Hippocampus and Long-Term Memory Loss in Alzheimer's Disease	1:45	A-133
Q21	Vimig Socrates	Audiotactile Interactions in Texture Perception in Humans	9:35	A-151
Q22	Rashmi Thimmapuram	Method to Find the Language Region in the Brain Using Electrocorticography From Natural Conversation	11:15	A-155
Q23	Rashmi Thimmapuram	The Role of Microglial Transient Receptor Potential Ankyrin 1 in Alzheimer's Disease	1:45	B-110
Q24	Wenhan Wang	Functional Analysis of Dopaminergic Neurons Derived From Human Embryonic Stem Cells	10:25	A-121
Q25	Hye Jean Yoon	Developing Therapeutic Approaches to TAR DNA Binding Protein 43 and Fused in Sarcoma Proteinopathies	11:15	E-115 Kids Inst.
Q26	Timothy Zhou	Quantifying the Effects of Amyotrophic Lateral Sclerosis on Axon Continuity and Larval Motility	8:45	B-206 Lect. Hall

Physics

ID	Presenter	Title	Time	Room
R01	Vikram Anjur Alexander Moreno	Performance Validation of the QIE10 Application Specific Integrated Circuits for the Phase I Upgrade of the Compact Muon Solenoid Detector at CERN's Large Hadron Collider	1:45	A-147
R02	Mason Dearborn	Cosmic Ray Background in the NOvA Neutrino Experiment	8:45	A-155
R03	Daniel Gonzalez	Measuring the Energy of Antineutrinos	9:35	A-155
R04	Ka wai Lee	Ultrasonic Thermometry for the Analysis of Thermal Protection Materials	9:35	A-133
R05	Jameson O'Reilly	Measurement of the Ratio of $\sigma(pp \rightarrow Z + bb)/\sigma(pp \rightarrow Z + jj)$ at $\sqrt{s} = 1.96$	10:25	A-117
R06	Sattvic Ray	Analyzing the X-Ray Spectra of Nova V339 Delphi and Nova KT Eridani Using Model Atmospheres	2:10	A-131
R07	Dennis Rich	Synthesis of Carbon Nanotubes Used in Thermoelectric Devices by Chemical Vapor Deposition	9:10	A-113
R08	Bhairvi Shah	Fiber Optic Interferometers as Acoustic Sensors for Bubble Chamber Dark Matter Detectors	10:50	A-117
R09	Janani Sivakumar	A Search for Strong Gravitational Lenses in the Dark Energy Survey Supernova Fields	9:35	A-149
R10	Emma Sloan	Beam Test of the Muon g-2 Tracker	1:45	A-115
R11	Lia Vallina	Constructing a Model of the Muon g-2 Magnet in Opera-3d	9:35	A-117

Psychology

ID	Presenter	Title	Time	Room
S01	Marissa Brock Alexandra Johnson	The Correlation Between Exercise and Stress of Adolescents in Academically Rigorous Environments	10:00	A-119
S02	Al-Jalil Gault	The Experience of Homelessness and Stress and the Effect on Memory Functioning in Homeless Youth	9:35	A-138 Acad. Pit

S03	Leehwa Hong Vivian Liu	A Cross-Cultural Study of the Relationship Between Empathy and Social Dominance	11:15	B-108
S04	Nisha Kishore	The Emotional Intelligence of Illinois Mathematics and Science Academy Students	9:35	B-206 Lect. Hall
S05	Patty Li Yiqiao Wu	Investigating the Origins of Suicide in Asian American and Pacific Islander Youth and Elderly	9:10	E-115 Kids Inst.
S06	Hsing-Duan Louh Malachi Loviska	Relieving Stress by Increasing Stress Awareness	10:50	A-119
S07	Saraswathi Nookala	The Effect of Methylenedioxymethamphetamine on Generosity	9:35	A-135
S08	Aniruddha Shekara	Associations Between Impulsive Choice and Risk-Taking in Relation to Gambling	8:45	A-138 Acad. Pit
S09	Remmie Spinks	The Effect of Time in Captivity on a Gray Wolf's Capacity of Trust in Humans	1:20	B-206 Lect. Hall
S10	Poornima Sundaravelu	Catechol-O-Methyltransferase Allelic Variation and Interpersonal Stressors on Adolescent Well-Being	10:00	A-149
S11	Rachel Thain	The Effects of Visual Speech Cues on the Speed of Spoken Language Perception in Adults	12:55	A-147
S12	Ryan Yang	Anxieties: Effects on Self-Concept and Common Methods of Relieving Anxiety	10:00	B-206 Lect. Hall

Social Science

ID	Presenter	Title	Time	Room
T01	Anna Borromeo	An Evaluation of the Effectiveness of the Millennium Villages Project to Eradicate Global Poverty	11:15	A-151
T02	Amy De La Torre Laura Lehmann	The Invisible Social and Emotional Struggles of Women in Law Enforcement and the Military	11:15	A-119
T03	Molly Fane Alonzo Marsh	Measuring the Health of the News Industry	10:50	B-133

Space Science

ID	Presenter	Title	Time	Room
U01	Austin Cao Dayna Lei	Characterizing Charge-Coupled Device and Naked-Eye Telescope Observations at the Doane Observatory	1:20	A-119
U02	Kieran Groble	Measuring Diffuse Interstellar Bands in Henry Draper Catalogue Stars	8:45	A-115
U03	Ujwal Kiran Megan Roller	Numerical and Visual Modeling of Comet Dust Trails	1:45	A-119
U04	Alec Mangan	Designing a Radiation Shield for the NASA Exploration Design Challenge	9:10	B-110

Poster Map

Cafeteria

A01	A07 B06	B12 C06	C12
A02	B01 B07	C01 C07	C13
A03	B02 B08	C02 C08	C14
A04	B03 B09	C03 C09	C15
A05	B04 B10	C04 C10	C16
A06	B05 B11	C05 C11	C17

C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31
C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45

D01	D02	D03	E01	E02	E03	E04	E05	E06	E07	E08	F01	F02	F03	F04	F05	F06	F07
F08	F09	F10	F11	G01	G02	G03	G04	G05	G06	G07	G08	H01	H02	I01	I02	I03	I04

I09	I10	J01	K01	K02	K03	K04	K05	L01	M01	M02	M03	N01	O01	O02	O03

I05
I06
I07
I08

O04	P01

P02
P03

Old Cafeteria/Commons

Diagram Not to Scale

* Biochemistry: A01-A07
* Bioengineering: B01-B12
* Biology: C01-C45
* Business: D01-D03
* Chemistry: E01-E108
* Computer Science: F01-F11
* Economics: G01-G08
* Education: H01-H02
* Engineering: I01-I10
* English: J01
* Environmental Science: K01-K05
* Fine Arts: L01
* History: M01-M03
* Law: N01
* Mathematics: O01-O04
* Medicine: P01-P03

continued

Old Cafeteria/Commons

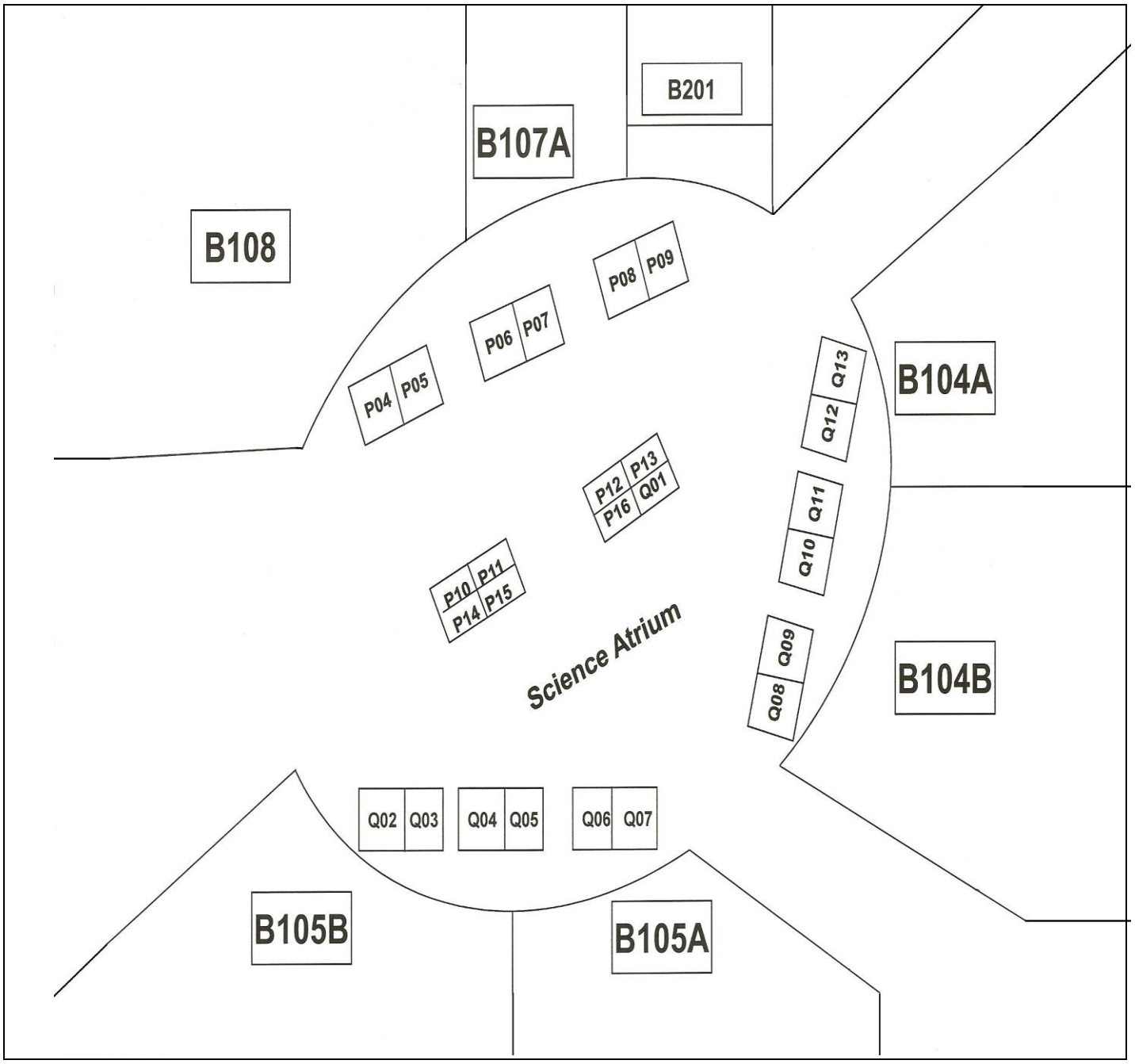

Diagram not to Scale

* Medicine Continued: P04-P16
* Neurobiology: Q01-Q13
  continued

Poster Map

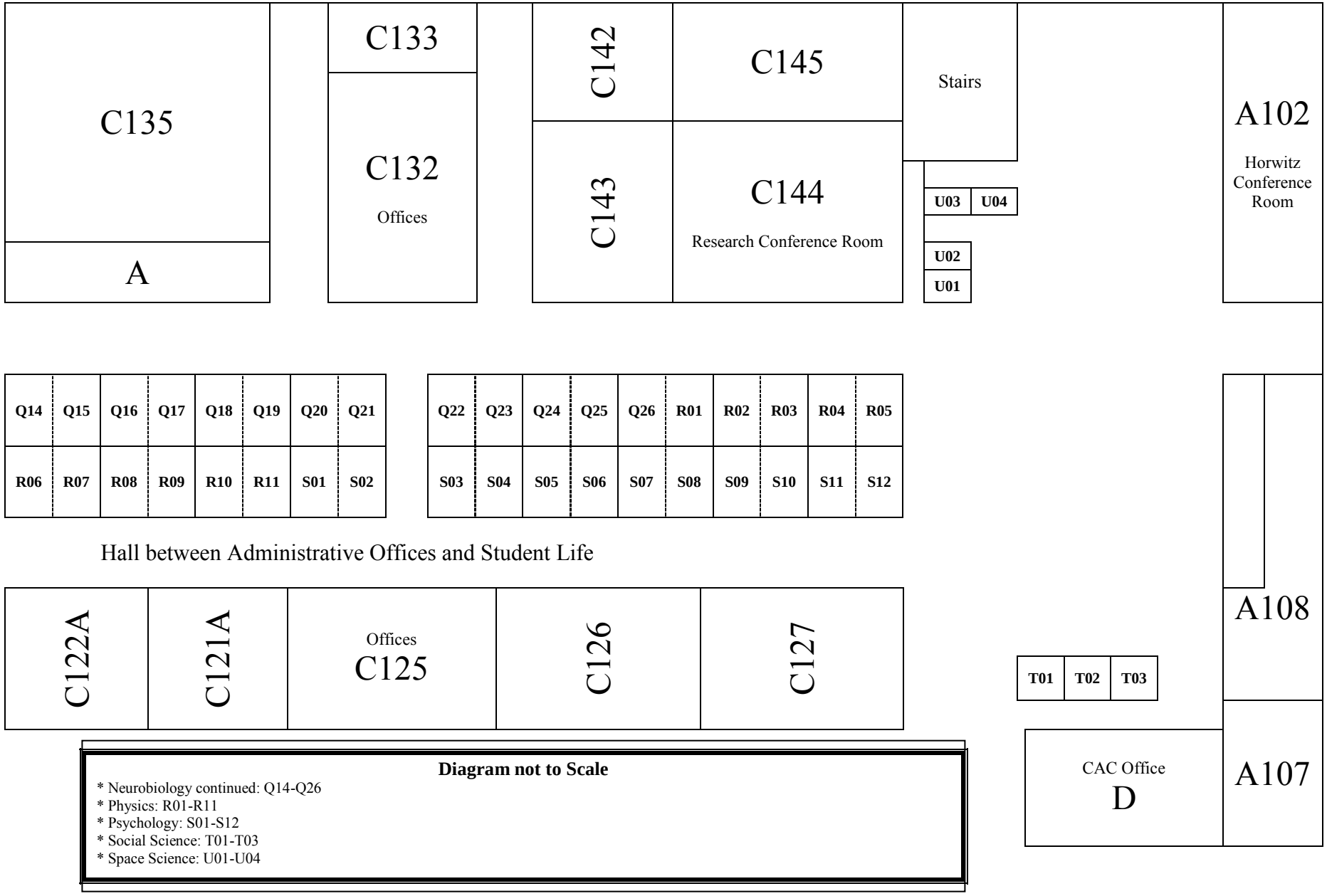

Diagram not to Scale

* Neurobiology continued: Q14-Q26
* Physics: R01-R11
* Psychology: S01-S12
* Social Science: T01-T03
* Space Science: U01-U04

Time and Room Schedule for Presentations

8:45 - 9:00

Room	ID	
A-115	U02	**Measuring Diffuse Interstellar Bands in Henry Draper Catalogue Stars** Kieran Groble; Advisor(s): Don York
A-117	P15	**Identifying the Melanosomal Component Responsible for Selective Sensitivity to Bleaching Phenols** Irina Wirjan; Advisor(s): Jonathan Eby, I. Caroline Le Poole
A-119	K03	**The Role of Climate Change in the Biodiversity of Ant Species** Eveline Liu; Advisor(s): Gracen Brilmyer, Corrie Moreau
A-121	C42	**Determining Gene Recruitment Sequences for Targeting ACT1 Gene to the Nuclear Periphery in Yeast** Amanda Walsh; Advisor(s): Donna Brickner, Jason Brickner
A-131	C18	**Phenotypic Characterization of OX40L-Expressing Dendritic Cells Expanding T-Regulatory T-Cells** Elijah Jimenez; Advisor(s): Palash Bhattacharya, Bellur Prabhakar
A-133	E01	**Characterization of Polymer Modification via Sequential Infiltration Synthesis Process** Kyle Chen; Advisor(s): Leonidas Ocola
A-135	P01	**Assessment of the Degree of Variation of Histologic Inflammation in Ulcerative Colitis** Max Ackerman; Advisor(s): Sarah Goeppinger, Adam Mikolajczyk, David Rubin
A-138 Acad. Pit	S08	**Associations Between Impulsive Choice and Risk-Taking in Relation to Gambling** Aniruddha Shekara; Advisor(s): Jessica Weafer, Harriet de Wit
A-147	Q08	**The Effects of Neurotrophic Drugs on the Degeneration of Cochlear Hair Cells in Guinea Pigs** Mohamed Kady, Harishankar Logaraj; Advisor(s): Claus-Peter Richter
A-149	C13	**Examining Cell-Cell Communication in Filamentous Cyanobacteria Using Electron Tomography** Geronimo Garcia, Priya Trivedi; Advisor(s): Robert Haselkorn, Amin Nasser
A-151	C26	**Identification of Fate Regulators in Human Embryonic Stem Cells** Gina Liu; Advisor(s): Fei Wang
A-155	R02	**Cosmic Ray Background in the NOvA Neutrino Experiment** Mason Dearborn; Advisor(s): Lisa Goodenough, Maury Goodman
B-110	I07	**Modifying Wind Turbine Blade Design to Reduce Noise While Retaining or Increasing Power Generation** Evan Derse; Advisor(s): Eric Hawker
B-116	E05	**Computational Study of Propane Dehydrogenation Over Palladium Alloy Catalysts** Anna Kryczka; Advisor(s): Randall Meyer
B-133	G06	**Investigating Central Banking Development, Policies, and Actions Throughout the World** Derek Lubecke; Advisor(s): Eric Smith
B-206 Lect. Hall	Q26	**Quantifying the Effects of Amyotrophic Lateral Sclerosis on Axon Continuity and Larval Motility** Timothy Zhou; Advisor(s): Yang Li, Jane Wu

E-115 Kids Inst. Q05 **Age-Related Changes in Visual Learning Strategies**
Anastasia Fafara, Brianna Pusey; Advisor(s): Kelly Brandstatt, Anthony Ryals, Joel Voss

9:10 - 9:25

Room	ID	
A-113	R07	**Synthesis of Carbon Nanotubes Used in Thermoelectric Devices by Chemical Vapor Deposition** Dennis Rich; Advisor(s): Venkat Chandrasekhar, Tanuj Gupta
A-115	C30	**Functions of Transcriptional Corepressor Groucho on Neuronal Differentiation** Emily Mu; Advisor(s): Wei Du, Tianyi Zhang
A-119	B11	**Development of a Simulation Visual Prosthetic Device** Vivek Vermani; Advisor(s): Gayatri Kaskhedikar, Philip Troyk
A-121	F02	**Constructing and Optimizing a System to Store and Protect Corporate Records** Remy Bubulka; Advisor(s): Brian Gravelle
A-131	I03	**A Physical and Chemical Investigation of the Heusler Alloy Fe_2TiSn** Tahj Alli-Balogun, Thomas Wu; Advisor(s): Susan Meschel, Philip Nash
A-133	M01	**An Examination of the Causes of World War II and the Cold War** Max Kontorovich; Advisor(s): Lee Eysturlid
A-138 Acad. Pit	Q18	**Monitoring the Time and Extent of Neurodegeneration in the Motor Cortex of a Novel Amyotrophic Lateral Sclerosis Mouse Model** Vignesh Ravi; Advisor(s): Mukesh Gautam, Pembe Hande Ozdinler
A-147	A01	**Functional Characterization of the HopZ Family of Type III Effectors** Kaia Ball; Advisor(s): Andrew Manning
A-151	C27	**Creating an Efficient Code Pipeline to Analyze *Caenorhabditis elegans* Drug Sensitivity** Gina Liu; Advisor(s): Erik Andersen
A-155	F06	**Constructing a Web Interface for the NOvA Experiment** Eric Hennenfent; Advisor(s): Maury Goodman, Jonathan Paley, Louise Suter
B-108	K02	**Building an Efficient Egg-Based Antibacterial Water Filter** Anna Gupta, David Lisk; Advisor(s): Mark Carlson
B-110	U04	**Designing a Radiation Shield for the NASA Exploration Design Challenge** Alec Mangan; Advisor(s): Eric Hawker
B-116	K04	**Chlorella's Effect on Ammonium and Nitrate Levels** Bailey Simmons-Brown; Advisor(s): Peter Clancy
B-133	M02	**Vikings and Monasteries: An Analysis of the Conversion of Medieval Europe** Andrew Salij; Advisor(s): Eric Smith
B-206 Lect. Hall	P02	**An Evaluation of Chicago Public Schools' Health-Related Policies** Prachi Aggarwal, Jenson Phung, Shreya Santhanam; Advisor(s): Ashley Dyer, Ruchi Gupta, Victoria Rivkina
E-115 Kids Inst.	S05	**Investigating the Origins of Suicide in Asian American and Pacific Islander Youth and Elderly** Patty Li, Yiqiao Wu; Advisor(s): Mark Chiang, Rooshey Hasnain

9:35 - 9:50

Room	ID	
A-113	B08	**Construction of a Human Gene Regulatory Network** Susie Shin; Advisor(s): Insuk Lee
A-115	C04	**Regulation of Interleukin 17 Receptor D by MicroRNA193a-3p in Colon Cancers and Associated Diseases** Xindi Chen; Advisor(s): Katherine Meckel, Joel Pekow
A-117	R11	**Constructing a Model of the Muon g-2 Magnet in Opera-3d** Lia Vallina; Advisor(s): Brendan Kiburg
A-121	O03	**Upset Definition and Prediction in Tennis** Suraj Sinha; Advisor(s): Yea-Jane Chu, Jing Shyr
A-131	B07	**Ocular Vestibular Evoked Myogenic Potentials in Chronic Stroke Subjects** Sagar Punhani, Kyle Thomas; Advisor(s): Derek Miller, William Rymer
A-133	R04	**Ultrasonic Thermometry for the Analysis of Thermal Protection Materials** Ka wai Lee; Advisor(s): Donald Yuhas
A-135	S07	**The Effect of Methylenedioxymethamphetamine on Generosity** Saraswathi Nookala; Advisor(s): Matthew Kirkpatrick, Harriet de Wit
A-138 Acad. Pit	S02	**The Experience of Homelessness and Stress and the Effect on Memory Functioning in Homeless Youth** Al-Jalil Gault; Advisor(s): Scott Hunter
A-147	P06	**Effects of T1L Reovirus Infection on Antiviral Response of Human Lamina Propria Cell Types *in vitro*** Fengling Hu; Advisor(s): Romain Bouziat, Reinhard Hinterleitner, Bana Jabri
A-149	R09	**A Search for Strong Gravitational Lenses in the Dark Energy Survey Supernova Fields** Janani Sivakumar; Advisor(s): Elizabeth Buckley-Geer, H. Thomas Diehl
A-151	Q21	**Audiotactile Interactions in Texture Perception in Humans** Vimig Socrates; Advisor(s): Sliman Bensmaia
A-155	R03	**Measuring the Energy of Antineutrinos** Daniel Gonzalez; Advisor(s): Zelimir Djurcic
B-108	I05	**Purifying Contaminated Water With Silver Nanoparticle-Infused Ceramic Filters** Eric Barrientos; Advisor(s): Mark Carlson
B-110	G04	**How Rigged is the London Interbank Offered Rate?** Huajie Huang; Advisor(s): Doug Adams
B-116	K05	**Investigation of the Ecological and Economical Effects of Green Roofs** Aaron Victor, Ziang Wang; Advisor(s): Peter Clancy
B-206 Lect. Hall	S04	**The Emotional Intelligence of Illinois Mathematics and Science Academy Students** Nisha Kishore; Advisor(s): David Evenson, Christopher Kolar
E-115 Kids Inst.	D03	**Investigation of the Implementation of Global Positioning Systems in Missiles and New Technologies** Jonathan Peloquin; Advisor(s): Timothy Vaughan

10:00 - 10:15

Room	ID	
A-113	B03	**Confirmation of Protein Immobilization on Carbon Nanofibers Through Imaging Labeled With Glucose Oxidase-Coupled Gold Nanoparticles** Ashley Kim; Advisor(s): In Seop Chang
A-115	B04	**Centrosome and Spectrosome Orientation in *Drosophila* APC2-mut Stem Cell Asymmetric Division** Danielle Madsen; Advisor(s): Chi Bang, Jun Cheng
A-117	P09	**Effects of Transcranial Direct Current Stimulation on Reaching Distance of Impaired Arm Post Stroke** Frances Seo; Advisor(s): Fleur Veltink, Jun Yao
A-119	S01	**The Correlation Between Exercise and Stress of Adolescents in Academically Rigorous Environments** Marissa Brock, Alexandra Johnson; Advisor(s): David Lundgren, Jerald Thomas
A-121	A02	**The Effect of pH and Nitrogen, Phosphorous, and Potassium Concentration on Two-Chambered Microbial Fuel Cells** Ryan Franks; Advisor(s): Jeong Choe-Hwang
A-131	Q12	**Inhibitable Plasma Cholinesterases as Biomarkers of Alzheimer's Disease** Jessica Lee; Advisor(s): Changiz Geula
A-135	Q13	**Activated c-Jun N-Terminal Kinase Contributes to the Differential Vulnerability of Neurons in Huntington's Disease** Judy Li; Advisor(s): Rodolfo Gatto, Gerardo Morfini
A-138 Acad. Pit	M03	**Confucius to Fake Gucci? A Historical Approach to Explaining the Development of China's Black Market** Stephanie Wang; Advisor(s): Kirsty Montgomery
A-147	C16	**CRISPR/Cas9 RNA-Guided Upregulation of Utrophin as a Therapy for Duchenne Muscular Dystrophy** Alyda Huerta; Advisor(s): Renzhi Han, Andrew Mariano, Audrey Torcaso
A-149	S10	**Catechol-O-Methyltransferase Allelic Variation and Interpersonal Stressors on Adolescent Well-Being** Poornima Sundaravelu; Advisor(s): Eva Telzer
A-151	P11	**Clinical Studies in Venous Leg Ulcers and Incisional Hernias** Vimig Socrates; Advisor(s): Jing Liu
B-108	E08	**Detecting and Quantifying Trace Amounts of Silver Nanoparticles and Ions in Solution** Mateusz Wojtaszek; Advisor(s): Mark Carlson
B-110	G05	**How Efficient is the Foreign Exchange Market?** Huajie Huang; Advisor(s): Doug Adams
B-116	I02	**Development of a Quantitative System for Evaluating At-Home Standing of the Mobility Disabled** Timothy Akintilo, Vimal Bellamkonda; Advisor(s): Arun Jayaraman, Luca Lonini, Timothy Reissman
B-133	C21	**Effects of Environmental Factors, Immune Evasion, and Reservoir Population on the Prevalence of Lyme Disease** Nicholas Kiene; Advisor(s): Donald Dosch, Megan Schrementi
B-206 Lect. Hall	S12	**Anxieties: Effects on Self-Concept and Common Methods of Relieving Anxiety** Ryan Yang; Advisor(s): David Evenson

E-115 Kids Inst.	Q17	**Analysis Comparing Defective RNA Binding Proteins in Association With Amyotrophic Lateral Sclerosis** Haneesha Paruchuri; Advisor(s): Warren McGee, Jane Wu

10:25 - 10:40

Room	ID	
A-113	C15	**Engineering a Luminescent Reporter Protein to Track Influenza A Virus Infection *in vivo*** Annika Gomez; Advisor(s): Balaji Manicassamy
A-115	F11	**Constructing High Quality Three-Dimensional Models With Economical Hardware** Nicholas Magerko, Jonathan Reynolds; Advisor(s): Namrata Pandya, Jason Rock
A-117	R05	**Measurement of the Ratio of $\sigma(pp \rightarrow Z + bb)/\sigma(pp \rightarrow Z + jj)$ at $\sqrt{s} = 1.96$** Jameson O'Reilly; Advisor(s): Ashish Kumar
A-119	H02	**Black and Latino Student Motivation Engaged in Science, Technology, Engineering, and Mathematics** Kayla Ingram; Advisor(s): Adrienne Coleman
A-121	Q24	**Functional Analysis of Dopaminergic Neurons Derived From Human Embryonic Stem Cells** Wenhan Wang; Advisor(s): Zhong Xie
A-133	C19	**Error Correction Approach of Next Generation Sequencing Data for Analysis of HIV-1 Variability** Vivian Jin, Shuchi Patel; Advisor(s): Eunyoung Kim, Sudhir Penugonda, Ramon Redondo Lorenzo
A-135	C20	**The Effect of Photoperiod and Thyroid Hormone on Innate Immune Response in *Phodopus sungorus*** Omkar Kelkar; Advisor(s): Kenneth Onishi, Brian Prendergast, Tyler Stevenson
A-138 Acad. Pit	P14	**The Future of Healthcare Reform: The Quantitative and Qualitative Implications of Value-Based Care** Paul Wang; Advisor(s): Samir Itchhaporia, Rebecca Maroon
A-149	B02	**Molecular Cloning of Cellulolytic Enzymes From *Acidothermus cellulolyticus*** Jennifer Du; Advisor(s): Aldwin Anterola
A-155	C32	**Homozygous Genotypes Long Adenine and Short Variant of Serotonin Transporter Gene and Link to Autism** Breanna Pederson; Advisor(s): Edwin Cook, Kelley Moore
B-108	I09	**Modifying and Reinforcing Bimetallic Strips for Application in Expanding Structures** Vinesh Kannan; Advisor(s): Mark Carlson, Vandana Chinwalla, Carl Heine
B-110	G08	**A Visually Intuitive Approach to Market Profiles** Michael Zeng; Advisor(s): Doug Adams, Sergiy Mesropyan, Dennis Wang
B-116	I04	**Separating Carbon Dioxide Gas From Lawn Mower Exhaust Gases** Daniel Atten, Marissa Borchering; Advisor(s): Peter Clancy, Robyn Fischer
B-133	A03	**Determining the Optimal Conditions for Inducing Apoptosis in MCF-7 Cells With Aspirin Treatment** Deborah Park, Ruchi Patel; Advisor(s): Donald Dosch
B-206 Lect. Hall	Q03	**A Comparison of the Magnitude of Visual Simon Effect in High School Students With and Without Music** Joseph Donermeyer, Dawson Patel; Advisor(s): Robyn Fischer

E-115 Kids Inst.	Q14	**Using Microfluidic Chambers to Evaluate the Effect of MitoQ on Fused in Sarcoma-Mediated Neurotoxicity** Emily Ling; Advisor(s): Jane Wu

10:50 - 11:05

Room	ID	
A-113	Q06	**Infant Tractography of the Anterior Limb of the Internal Capsule** Kayla Hannon; Advisor(s): Jeffrey Neil
A-115	E06	**Phase Transitions From Amorphous to Crystalline in Polyethylene Terephthalate Polymer** Nida Normantaite; Advisor(s): Steven Sibener
A-117	R08	**Fiber Optic Interferometers as Acoustic Sensors for Bubble Chamber Dark Matter Detectors** Bhairvi Shah; Advisor(s): Eric Dahl
A-119	S06	**Relieving Stress by Increasing Stress Awareness** Hsing-Duan Louh, Malachi Loviska; Advisor(s): Kathryn Grubbs
A-131	Q09	**Effects of Vindeburnol on Alzheimer's Disease-Type Pathology** Vandana Karan; Advisor(s): Douglas Feinstein
A-133	C05	**The Effect of Different Meat Types and Chemicals on Carrion Insect Attraction** Mary Cody; Advisor(s): Susan Styer
A-135	P13	**The Effects of the Novel Agonist 390 on the CXC Type 4 Chemokine Receptor** Shruti Topudurti, Selam Zenebe-Gete; Advisor(s): Richard Miller
A-138 Acad. Pit	G03	**A Comparison of Accuracy and Validity of Risk Adjustment Models Used in the Health Care Industry** Yasmine Gordon; Advisor(s): Samir Itchhaporia, Rebecca Maroon
A-147	P07	**The Correlation Between Gestational Age and Independent Oral Feeding in Preterm Newborns** Sharon Johnson, Sophia Lam; Advisor(s): Jonathan Muraskas, Sarah van Nostrand
A-149	Q11	**Identifying Chaperones and Co-Chaperones Affecting Mechanisms of FUS R521G Aggregation in N2A Cells** Lakhena Leang, Xueyang Ren; Advisor(s): Sue Fox, Richard Morimoto, Anan Yu
A-155	Q07	**Following Speech Through the Brain: Three Successive Parallel Networks** Rhea Harsoor, Shveta Thakkar; Advisor(s): Vernon Leo Towle
B-108	D02	**An Ethnographic Study of Start-Up Businesses and Their Approaches to Defining Target Markets** Rohit Mahankali; Advisor(s): Carl Heine
B-110	G01	**Effect of Refinery Outages on Petroleum Administration for Defense District - West Coast Gasoline Prices** Timothy Gietl; Advisor(s): Josh Matalon
B-133	T03	**Measuring the Health of the News Industry** Molly Fane, Alonzo Marsh; Advisor(s): Eric Smith
B-206 Lect. Hall	C08	**Optimizing DNA Sequencing Using DNA Isolation, Polymerase Chain Reaction, and Gel Electrophoresis** Natalie Dong, Atene Poskute, Saigopal Somasundaram; Advisor(s): Donald Dosch, Robyn Fischer
E-115 Kids Inst.	Q15	**Screening Potential Treatments for Amyotrophic Lateral Sclerosis** Emily Ling, Hye Jean Yoon; Advisor(s): Mengmeng Chen, Xiaoping Chen, Kazuo Fushimi, Jane Wu

11:15 - 11:30

Room	ID	
A-113	I01	**Design of a Double Rotor Vertical Takeoff and Landing Prototype** Michael Adams; Advisor(s): Francisco Ruiz
A-115	J01	**Gender-Driven Perceptions of Women in Nineteenth Century British Literature** Ana Curtis; Advisor(s): Leah Kind
A-117	G07	**International Pharmaceutical Markets and Patent Law** Daniel Pechi; Advisor(s): Christian Nokkentved
A-119	T02	**The Invisible Social and Emotional Struggles of Women in Law Enforcement and the Military** Amy De La Torre, Laura Lehmann; Advisor(s): James Bondi, Kristen Ziman
A-121	B06	**Engineering Vascularized Bone** Sean Potempa; Advisor(s): Eric Brey, Brianna Roux
A-131	Q10	**Acute Ischemic Stroke in Pregnancy: A Nationwide Inpatient Sample** Taylor Knopf; Advisor(s): Sarah Song
A-133	C43	**The Role of ER71 in Blood Vessel Development** William Widjaja; Advisor(s): Changwon Park
A-135	O01	**Taking the Red Pill: Degenerations of Matrix Space** Lael Costa; Advisor(s): Nir Avni
A-138 Acad. Pit	F05	**Showing Ego Depletion and Motivation in Video Games** Diana Chen, Sneha Thakkar; Advisor(s): Ian Horswill
A-147	B10	**Highlighting Cancerous Tissue During Brain Tumor Resection Surgery** Rajiv Trehan; Advisor(s): Lagnojita Sinha, Ken Tichauer
A-149	I08	**A Multiplexed Readout Scheme for a Large Array of Photomultiplier Tubes** Kevin He, Adit Suvarna; Advisor(s): Edward Kearns, Jinyuan Wu
A-151	T01	**An Evaluation of the Effectiveness of the Millennium Villages Project to Eradicate Global Poverty** Anna Borromeo; Advisor(s): Juliet Sorensen
A-155	Q22	**Method to Find the Language Region in the Brain Using Electrocorticography From Natural Conversation** Rashmi Thimmapuram; Advisor(s): Vernon Leo Towle
B-108	S03	**A Cross-Cultural Study of the Relationship Between Empathy and Social Dominance** Leehwa Hong, Vivian Liu; Advisor(s): Joan Chiao, Vandana Chinwalla
B-110	G02	**Development of Trading and Risk Management Strategies for Ibovespa Index Futures** Timothy Gietl; Advisor(s): Mark Glasberg, Max Rhee
B-116	P12	**The Role of Gut Microbes in Regulating Dietary Fat-Mediated Alterations of Nuclear Hormone Receptor Expression** Simona Stancov; Advisor(s): Eugene Chang, Kristina Martinez
B-133	P16	**Effects of KBU2046 on Common Chemotherapeutics and Androgen Regulation in Breast and Prostate Cancers** Luke Zhan; Advisor(s): Raymond Bergan, Xiaoke Huang, Megan Schrementi
B-206 Lect. Hall	A04	**Optimizing Light Absorption in Cyanobacteria** Archit Potharazu, Zachary Yager; Advisor(s): Robyn Fischer

E-115 Kids Inst. Q25 **Developing Therapeutic Approaches to TAR DNA Binding Protein 43 and Fused in Sarcoma Proteinopathies**
Hye Jean Yoon; Advisor(s): Mengmeng Chen, Xiaoping Chen, Jane Wu

12:30 - 12:45

Room	ID	
A-113	P05	**Pain Trajectories Across Different Variables for Inpatients at the University of Illinois at Chicago Medical Center** Taylor Herr; Advisor(s): William Galanter
A-119	C06	**Effects of Dietary Fat on Secreted Frizzled-Related Protein 1 in Normal Mouse Colon** John Deng; Advisor(s): Anas Almoghrabi, Marc Bissonnette, Urszula Dougherty
A-121	C10	**Physical Interactions of Regulatory Sequences Within Schizophrenia-Associated MIR137 Locus** Kristy Fang, Nahee Park; Advisor(s): Jubao Duan
A-133	E04	**Engineering Self-Assembling Peptides to Tune the Coordination Environment of Metalloporphyrins** Jacob Kronenberg; Advisor(s): H. Christopher Fry
A-135	C31	**Association Between Diabetes-Related Single Nucleotide Polymorphisms and Various Cancer Types** Julian Pacheco; Advisor(s): Brandon Pierce, Chenan Zhang
A-155	O04	**Counting Rational Space Curves Meeting Lines and Points Using the Method of Degeneration** James Tao; Advisor(s): Izzet Coskun
B-110	H01	**Agent-Based Modeling and the Understanding of Causality in College Biology Students** Karin Han; Advisor(s): Matthew Lira, Mike Stieff
B-206 Lect. Hall	C09	**The Effect of microRNA on the Proliferation of Non-Small Cell Lung and Breast Adenocarcinoma** Nisa Faheem, Somie Park, Lajvanthi Sudhakar; Advisor(s): Robyn Fischer
E-115 Kids Inst.	C39	**Designing an Algorithm to Analyze Images of Moving Mitochondria** Yash Thacker; Advisor(s): Yang Li, Jane Wu

12:55 - 1:10

Room	ID	
A-117	B05	**An Investigation of a Novel Peptide Amphiphile for Diagnosing Atherosclerosis *in vivo*** Rajiv Patel-O'Connor; Advisor(s): Eun Ji Chung, Matthew Tirrell
A-131	I10	**Improving the Efficiency of Power Amplifiers in Radio Frequency Plasma Lamps** Alan Yang; Advisor(s): Hung Yu David Yang
A-147	S11	**The Effects of Visual Speech Cues on the Speed of Spoken Language Perception in Adults** Rachel Thain; Advisor(s): Tina Grieco-Calub, Kristi Ward

A-151	E03	**Using Granular Silicon-Graphene Anodes to Boost the Capacity of Lithium-Ion Batteries** Arjit Jaiswal, Varun Patel; Advisor(s): R. Stephen Berry, George Tolley
B-108	C24	**Analysis of Retinoblastoma I and Lysine (K)-Specific Demethylase 5A on Metabolic Pathways** Kathryn Kuna; Advisor(s): Elizaveta Benevolenskaya
B-116	O02	**Examining Influential Factors for Team Pitching Environments in Major League Baseball** Luke Musgrave; Advisor(s): Christopher Kolar
B-133	Q16	**Extracting the Hemodynamic Response With the Finite Impulse Response Filter** Matthew Park; Advisor(s): Jennie Yufen Chen, Todd Parrish
B-206 Lect. Hall	C34	**The Relationship Between Enrichment Type and Daily Activity in a Mountain Lion** Maureen Reiser; Advisor(s): Robyn Fischer, Randy Johnson
E-115 Kids Inst.	F01	**Creating a Fast and Accurate Physics Engine Modeling Soft-Body Collisions with OpenGL and Java** Ethan Bian, Benjamin Rabe; Advisor(s): Phadmakar Patankar

1:20 - 1:35

Room	ID	
A-113	C33	**Toll-Like Receptor 4 and Amyloid Precursor Protein Gene Roles in the Onset of Alzheimer's Disease** Michael Pradaxay; Advisor(s): Ken-Ichiro Fukuchi
A-115	C14	**Patterns Behind Degeneration of Retinal Ganglion Cells in Glaucoma on Oscillatory Potential Waves** Cammille Go; Advisor(s): Xiaorong Liu
A-117	K01	**Synthesis of Isobutanol From Lignocellulosic Biomass Inoculated With Fungus and Bacteria** Elise Douglas, Gregory O'Bannon; Advisor(s): Donald Dosch, Branson Lawrence
A-119	U01	**Characterizing Charge-Coupled Device and Naked-Eye Telescope Observations at the Doane Observatory** Austin Cao, Dayna Lei; Advisor(s): Larry Ciupik, Mark Hammergren, Lou Nigra, Ken Walczak
A-121	C45	**The Effects of Adiponectin on Fibrosis** Sung Yeo; Advisor(s): Roberta Goncalves Marangoni
A-131	C12	**Using Golden Helix to Analyze Data From Whole Genome Sequences of Polycystic Ovarian Syndrome** Natasha Freund; Advisor(s): Margrit Urbanek
A-133	C37	**Effect of Apolipoprotein E4 Allele on Deterioration of Brains in Patients With Alzheimer's Disease** Sachi Singh; Advisor(s): Lei Wang
A-138 Acad. Pit	C17	**Effect of High Nitric Oxide Microenvironment on Cancer Cell Migration** Shreya Jain; Advisor(s): James Radosevich
A-147	C07	**New Regulators of Lysosome Motility** Vishrut Dixit; Advisor(s): Vladimir Gelfand, Michael Winding
A-149	C40	**Developing an Efficient Immunization Method to Elicit CD8+ T Cells** Lynette To; Advisor(s): Yao Bian, Chyung-Ru Wang

A-151 F04 **Comparing the Rate Monotonic and Earliest Deadline First Scheduling Algorithms**
Advitheey Chelikani; Advisor(s): Shangping Ren

A-155 A06 **Phthalates and Phthalate Alternatives: Effects on Proliferative and Estrogenic Target Genes**
Ranjani Sundar; Advisor(s): Serdar Bulun, Ping Yin

B-108 C28 **Correlation Between Intracellular Calcium Release and T-Tubule Organization in Failing Rat Myocytes**
Shruthi Mothkur; Advisor(s): J. Andrew Wasserstrom

B-110 Q19 **Optimization of a Magnetic Resonance Probe for Early Detection of Alzheimer's Disease**
Sreyesh Satpathy; Advisor(s): William Klein, Kirsten Viola

B-116 C44 **The Absence of Gut Microbes Alters Hepatic Nuclear Receptor Expression**
Mayuri Yasuda; Advisor(s): Eugene Chang, Kristina Martinez

B-133 Q02 **Automatic Switching Point From Perfusion to Permeability Using a Single Full-Dose Contrast Injection**
Greeshma Chilukuri, Jayathi Varadheeswaran; Advisor(s): Jennie Yufen Chen, Todd Parrish, Xue Wang

B-206 Lect. Hall S09 **The Effect of Time in Captivity on a Gray Wolf's Capacity of Trust in Humans**
Remmie Spinks; Advisor(s): Robyn Fischer, Randy Johnson

E-115 Kids Inst. F08 **Development of Mechanical Turk Simulations for Auction Theory Research**
Andrew Kuznetsov; Advisor(s): Phadmakar Patankar

1:45 - 2:00

Room ID

A-113 C01 **Effects of Kallikrien Gene Polymorphisms on Prostate Cancer Risk and Prostate Specific Antigen**
Joshua-Paul Ajayi; Advisor(s): Rick Kittles

A-115 R10 **Beam Test of the Muon g-2 Tracker**
Emma Sloan; Advisor(s): Brendan Casey

A-117 N01 **A Study of the Application of Death Penalty Law in Sub-Saharan Africa**
Edward Jun; Advisor(s): Sandra Babcock, Delphine Lourtau, Shubra Ohri

A-119 U03 **Numerical and Visual Modeling of Comet Dust Trails**
Ujwal Kiran, Megan Roller; Advisor(s): Larry Ciupik, Mark Hammergren, Lou Nigra, Ken Walczak

A-121 C02 **Utilizing Nuclear Morphometry to Differentiate Between Salivary Gland Cancers**
Waleed Ali; Advisor(s): Ryan Deaton, Andre Kajdacsy-Balla, Virgilia Macias

A-131 B12 **The Effects of the Overexpression of *MAN1A1* and *MGAT2* in Glioblastoma Multiforme**
Elizabeth Weiss; Advisor(s): Roger Kroes, Joseph Moskal, Mary Schmidt

A-133 Q20 **The Relationship Between the Hippocampus and Long-Term Memory Loss in Alzheimer's Disease**
Sajishnu Savya; Advisor(s): Lei Wang

A-135 C23 **Evaluating Molecular Function of Proteins Through Integrase-Mediated Cassette Exchange**
Sanjay Kottapalli; Advisor(s): Debabrata Chakravarti, J. Brandon Parker

A-138 Acad. Pit B01 **Investigating Methylation Patterns in Cancer Suppressor Genes Through Gene Sequencing**
Ashok Arjunakani, Philip Nebres; Advisor(s): Berna Demircan, Kim Elseth, James Radosevich

A-147 R01 **Performance Validation of the QIE10 Application Specific Integrated Circuits for the Phase I Upgrade of the Compact Muon Solenoid Detector at CERN's Large Hadron Collider**
Vikram Anjur, Alexander Moreno; Advisor(s): James Hirschauer, Elliot Hughes, Titas Roy

A-149 P08 **Burn Injury Alters the Intestinal Microbiota and Increases Inflammation and Risk of Sepsis**
Omair Khan; Advisor(s): Mashkoor Choudhry, Zackary Earley, Xiaoling Li

A-151 F03 **Using Markov Decision Processes to Determine Optimal Claim Policy for Automobile Accidents**
Advitheey Chelikani, Saurabh Kumar; Advisor(s): Piotr Gmytrasiewicz

A-155 C36 **The Role of Viral Protein 1/2 in Herpes Simplex Virus 1 Replication**
Christopher Shin; Advisor(s): Nick Huffmaster, Greg Smith

B-108 C29 **Characterization of *EZH2, KDM5A,* and *KDM5B* Alterations in Human Breast Cancer**
Shruthi Mothkur; Advisor(s): Elizaveta Benevolenskaya

B-110 Q23 **The Role of Microglial Transient Receptor Potential Ankyrin 1 in Alzheimer's Disease**
Rashmi Thimmapuram; Advisor(s): Maira Bicca, William Klein

B-116 C11 **Deoxycholic Acid Alters Expression of Cancer and Epigenetic Genes in Mouse Intestinal Epithelium**
Yan Lin Feng; Advisor(s): Eugene Chang, Kyle Dolan

B-133 Q04 **Active Brain Regions During Sleep Using Electroencephalography Functional Magnetic Resonance Imaging**
Grace Duan, Sameeksha Malhotra; Advisor(s): Todd Parrish, Xue Wang

B-206 Lect. Hall C35 **Factors Influencing the Effectiveness of Enrichment for Captive Gray Wolves (*Canis lupus*)**
Nicole Schubert; Advisor(s): Robyn Fischer, Randy Johnson

E-115 Kids Inst. D01 **Possible Short Term Investment Strategy**
Sun Kim, John Satter; Advisor(s): Richard Kolsky, Kevin Lynch

2:10 - 2:25

Room	ID	
A-113	P04	**Assessment of Non-Rapid Eye Movement Delta Sleep and its Correlation to Excessive Daytime Sleepiness** Lohitha Guntupalli; Advisor(s): Samir Patel
A-117	B09	**Capture of Circulating Tumor Cells Using Functionalized Capture Surfaces** Tera Sparks; Advisor(s): Seungpyo Hong, Hao-Jui Hsu
A-119	I06	**Integration of Sensors in a Wireless High Altitude Balloon Cut-Down System** Brendan Batliner, Milan Shah; Advisor(s): Lou Nigra, Ken Walczak
A-121	C38	**The Effects of A4V Superoxide Dismutase 1 Mutant Protein Incorporation on Calcium Ion Membrane Conductance** Shelly Teng; Advisor(s): Michael Allen, Ana Correa, Jacob Riehm
A-131	R06	**Analyzing the X-Ray Spectra of Nova V339 Delphi and Nova KT Eridani Using Model Atmospheres** Sattvic Ray; Advisor(s): Daniel van Rossum
A-133	C41	**The Effects of the Microflora on Corneal Epithelial Cell Migration *in vitro*** Brian Vien; Advisor(s): Ali Djalilian
A-135	P10	**Does Connective Tissue Growth Factor Cause Left Atrial Fibrosis in Dilated Cardiomyopathy?** Abhishek Sethi; Advisor(s): Allen Samarel
A-138 Acad. Pit	C03	**The Effect of Nitric Oxide on Cellular Adhesion in Various Cancer Cell Lines** Ashok Arjunakani, Philip Nebres; Advisor(s): Kim Elseth, James Radosevich
A-147	P03	**Epidermal Growth Factor Ameliorates Transforming Growth Factor β-Induced Collagen Deposition in Pancreatic Stellate Cells** Ryan Chiu; Advisor(s): Paul Grippo, Windel Emman Mascariñas, Daniel Principe
A-151	F07	**Measurement of Alzheimer's Disease Diagnostic Accuracy Using Machine Learning Algorithms** Saurabh Kumar; Advisor(s): Paul Kump, Miles Wernick
A-155	A07	**Elucidating Proteins Involved in Mitochondrial Division and Tethering Using the Yeast Two-Hybrid System** Sai Talluru, Amy Zhu; Advisor(s): Laura Lackner, Holly Ping
B-108	A05	**Analysis of Metabolic Pathways and the Relationship to Lysine (K)-Specific Demethylase 5A and the Retinoblastoma 1 Gene** Aishwarya Raj; Advisor(s): Elizaveta Benevolenskaya
B-116	C25	**Effects of a Nuclear Receptor Agonist on Gene Expression of Hepatocyte Organoids** Quinn Lewis; Advisor(s): Candace Cham, Eugene Chang, Kristina Martinez
B-133	Q01	**Alteration of Brain Connections in Resting State Networks After Performing Simple Motor Actions** Kristin Carlson; Advisor(s): Todd Parrish, Xue Wang
B-206 Lect. Hall	F09	**Transition From Biological Life to the Development of Artificial Intelligence** Claire Lee, Emily Rader; Advisor(s): Mike Ososky
E-102 Aud.	L01	**Thematic Development in Beethoven’s Piano Sonatas and its Applications to Modern Composition** Daniel Collins; Advisor(s): Peter Dong

A01
Functional Characterization of the HopZ Family of Type III Effectors

Presenter(s)
Kaia Ball, Illinois Mathematics and Science Academy

Advisor(s)
Jean Greenberg, University of Chicago
Andrew Manning, University of Chicago

Tomato production is a major industry worldwide, with the average American eating over twenty pounds annually. Tomato crops can be afflicted by a wide variety of pathogens that reduce the output of the crop. The bacteria *Pseudomonas syringae* is a model laboratory pathogen for understanding bacterial-plant interactions in numerous species, including tomatoes. It utilizes a type III secretion system (T3SS) to infect host cells. Understanding the role of T3SS effectors in *P. syringae* infection allows researchers to dissect mechanisms of pathogenesis. During infection, *P. syringae* produces many effector proteins, including members of the HopZ protein family. Previous studies have shown that HopZ3 aids in virulence by transferring an acetyl group to several defense proteins, interrupting defense signalling. I studied whether close relatives of HopZ3 (HopZ1a, HopZ1b, HopZ1c, HopZ2) also transfer acetyl groups onto proteins. The genes of these proteins were cloned, optimal expression conditions were found, and the samples were tested to determine whether the proteins had acetyltransferase activity. Activity of at least HopZ1a suggests that these proteins are similar to HopZ3 in function. Further studies will look into how to block this activity and lower the virulence of *P. syringae*.

A02
The Effect of pH and Nitrogen, Phosphorous, and Potassium Concentration on Two-Chambered Microbial Fuel Cells

Presenter(s)
Ryan Franks, Illinois Mathematics and Science Academy

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

Microbial fuel cells (MFC) are a viable method of utilizing waste to generate energy. The conditions under which marine MFCs operate are changing. For instance, carbon dioxide emissions and increased nitrogen, phosphorous, and potassium (NPK) can change the ocean environment and may further affect the MFC performance. To investigate the influences of these factors, voltage generation was measured in a methylene blue-mediated, two-chamber microbial fuel cell. *Saccharomyces cerevisiae* was subjected to an environment with varied pH levels and NPK concentrations. MFC performance was found to be optimal at pH 6.4 and a nitrogen concentration of 0.00313 grams/liter. Measurements suggest that ocean acidification and fertilizer run-off may increase voltage production in MFCs but will reduce voltage at more excessive levels. Based on this, MFC voltage generation may be optimized when submerged in waters with higher NPK concentrations which could have some applications in wastewater treatment facilities that accumulate NPK in their sludge dewatering streams.

A03
Determining the Optimal Conditions for Inducing Apoptosis in MCF-7 Cells With Aspirin Treatment

Presenter(s)
Deborah Park, Illinois Mathematics and Science Academy
Ruchi Patel, Illinois Mathematics and Science Academy

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

Case studies of tumor samples taken from colorectal cancer patients with the phosphatidylinositol-4,5-bisphosphonate 3-kinase, catalytic subunit alpha polypeptide (PIK3CA) gene mutation on low dosage regimens of aspirin have indicated longer patient survival. Studies conducted with cancer cell lines with PIK3CA mutations showed an increase in apoptosis when treated with aspirin. The specific connection between PIK3CA mutations and aspirin has yet to be determined as these findings are still new and developing. Our investigation delved into the reasons and range of the effectiveness of aspirin on apoptosis in the MCF-7 cell line. Using well cultures of MCF-7 cells with highly varied concentrations of aspirin, we determined the optimal growth time and aspirin concentrations to use for apoptosis detection. Our results found the optimal growth time to be 48 hours and the optimal concentrations to be 5-10 mM of aspirin. The Fluorometric TUNEL System stained the cells to identify apoptotic cells. We predict that the cells treated with increasing amounts of aspirin will show increased level of apoptosis. This result is significant when considering different treatment options for cancer patients involving use of aspirin.

A04
Optimizing Light Absorption in Cyanobacteria

Presenter(s)
Archit Potharazu, Illinois Mathematics and Science Academy
Zachary Yager, Illinois Mathematics and Science Academy

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy

The purpose of our experiment is to optimize environmental conditions for maximum light absorption by the core membrane linker protein (LCM) in *Synechocystis* sp. PCC 6803, a strain of cyanobacteria. LCM is a major constituent of the terminal energy acceptor in the phycobilisome (PCB), a complex that sits on the chloroplast thylakoid membrane and is responsible for most of the light absorption for photosystem II. We also worked with the PcyA and Ho1 genes, which encode proteins that are co- expressed so that LCM can absorb light. We are cloning the three genes into an expression vector and will transform the vector into *Escherichia coli* for protein production and testing. Preliminary results from other studies show that LCM absorption is extremely red- shifted (~667 nanometers) at a neutral pH and room temperature (26^{o}C) with strong light. We aim to test absorption while varying pH, temperature, light intensity, and the presence of specific metal ions. Maximizing light absorption in cyanobacteria can lead to improved biofuel production.

A05

Analysis of Metabolic Pathways and the Relationship to Lysine (K)-Specific Demethylase 5A and the Retinoblastoma 1 Gene

Presenter(s)
Aishwarya Raj, Illinois Mathematics and Science Academy

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

The retinoblastoma 1(Rb1) and (K)-specific demethylase 5A (KDM5A) genes have critical roles in cell cycle regulation and metabolism that consequently affects cancer metabolism. Rb1, when inactivated, causes defects in cell differentiation. Interestingly, the inactivation (double knock down) of *Kdm5a* in addition to *Rb1*, rescues the defects resulting from loss of *Rb1*. To test *Kdm5a's* effects further, gene expression in cells induced to differentiate were analyzed for the following gene ontologies: muscle system, cell cycle, and metabolic-related ontologies glutathione, mitochondrion, and alanine, aspartate, glutamate (AAG). The effects on gene expression due to the loss of *Rb1*, *Kdm5a,* or both were analyzed relative to wild type due to their direct impact on cell regulation and metabolic pathways. Using Microsoft Excel, GI tools software, and experimental work, *Kdm5a* and *Rb1* were confirmed to have both a cooperative and inverse relationship in regulation of gene expression through various cellular processes. Thus, results of the investigation illustrate that the inactivation of both *Kdm5a* and *Rb1* significantly restores gene expression for metabolic and muscle system ontologies but not for cell cycle ontology. The application of this research would allow for *Kdm5a* focused drug targets.

A06

Phthalates and Phthalate Alternatives: Effects on Proliferative and Estrogenic Target Genes

Presenter(s)
Ranjani Sundar, Illinois Mathematics and Science Academy

Advisor(s)
Serdar Bulun, Northwestern University
Ping Yin, Northwestern University

Phthalates are used as plasticizers in many of the products found in medical, household, and industrial applications. Little research has been completed on the negative effects of these phthalates as potential endocrine disrupting chemicals. As these chemicals are ingested, the mechanism by which they affect the reproductive system is largely unknown. The purpose of this study was to observe how two phthalates, Di-n-butyl phthalate and diisononyl phthalate, and two phthalate alternatives, dioctyl terephthalate and butylated hydroxytoluene, tested in conjunction with and without estradiol, affect uterine cells in comparison to control and 17β-estradiol treatment. Reverse transcription polymerase chain reaction was used to observe changes in expression of mRNA with chemical treatment. Results show, based on change in proliferative and estrogenic target genes, each of the chemical treatments (in conjunction with and without estradiol) increased proliferation in Ishikawa cells. All compounds led to upregulation of the majority of the estrogen mediated genes tested. These results opened possible classifications for mechanisms of these compounds and led to evidence that these phthalates and phthalate alternatives can be classified as potential endocrine disruptors based on increase of proliferative and estrogen mediated gene expression, supporting the hypothesis that these chemicals can have negative effects on the female reproductive system.

A07
Elucidating Proteins Involved in Mitochondrial Division and Tethering Using the Yeast Two-Hybrid System

Presenter(s)
Sai Talluru, Illinois Mathematics and Science Academy
Amy Zhu, Illinois Mathematics and Science Academy

Advisor(s)
Laura Lackner, Northwestern University
Holly Ping, Northwestern University

Mitochondria are dynamic organelles that are primarily responsible for energy production in cells. The shape and distribution of mitochondria affect its function and cellular function. The four main activities that determine mitochondrial shape and distribution are division, fusion, motility, and tethering. Tethering describes the anchoring of mitochondria to cellular structures. The purpose of this investigation is to elucidate the proteins involved in the molecular systems that mediate mitochondrial division and tethering. Using the yeast two-hybrid system, we are able to test for novel protein-protein interactions with genome library screening, plasmid isolation, restriction digests, spot tests, and yeast transformations. Preliminary results suggest a novel interaction between the two tether components Caf4 and Mdm36. We also used the mitochondrial division protein Dnm1 and the tether protein Num1 in yeast two-hybrid screens against a library of six thousand yeast proteins. Our screening suggests a potential interaction between Mth1 and Num1. Early results suggest potential interactions between Dnm1 and the following candidate proteins: Fir1, Slx5, Ade2, Cyc8, Sym1, Nis1, and Gat4. More research is necessary to validate and functionally assess these interactions. Elucidating molecular structures that regulate mitochondrial division and tethering may further our understanding of neurological diseases, which have been associated with defects in mitochondrial shape and distribution.

B01
Investigating Methylation Patterns in Cancer Suppressor Genes Through Gene Sequencing

Presenter(s)
Ashok Arjunakani, Illinois Mathematics and Science Academy
Philip Nebres, Illinois Mathematics and Science Academy

Advisor(s)
Berna Demircan, University of Illinois at Chicago
Kim Elseth, University of Illinois at Chicago
James Radosevich, University of Illinois at Chicago

One flourishing area of cancer research is the observation of DNA methylation patterns. DNA methylation is used in the body to turn genes on and off. Cancers usually have aberrantly methylated genes and scientists have avidly researched these methylation patterns. This investigation involves identifying and comparing the methylation of several genes in lung cancer cells. First cancer cells were cultured and then the genomic DNA was extracted. Methylation specific polymerase chain reaction was used to amplify the cancer DNA and to select the specific gene that was under observation. Gel electrophoresis was run so that the unmethylated and methylated portions of genes could be identified. Potentially this research could find a universal trait in common between several cancer types. This in turn would enable scientists to manufacture drugs that combat mutations found in tumor- suppressor genes.

B02
Molecular Cloning of Cellulolytic Enzymes From *Acidothermus cellulolyticus*

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

Advisor(s)
Aldwin Anterola, Southern Illinois University at Carbondale

Bioethanol is currently made by digesting and fermenting starch, but cellulose in plants can also be digested to create alcohol. Because this process usually involves treating the cellulose with heat and acid beforehand, engineering cellulolytic proteins that are able to function in highly acidic and hot conditions can greatly advance the future of bioethanol in viable alternative energy sources. We cloned the fusion tag vector PCHalo with DNA inserts from *Acidothermus cellulolyticus*, a thermoacidophilic bacterium that can digest cellulose. Then we sought to express the protein from this vector in competent *E. coli* cells. We were able to clone the plasmid containing the insert successfully, but we were not able to express the proteins in a soluble form. The protein's failure to be expressed could have been caused by a variety of reasons, such as the amino acid composition of the expression vector, or the failure of the bacterial cells used for expression. Successful expression of thermoacidophilic cellulase may greatly improve the efficiency and cost of bioethanol production in the future.

B03
Confirmation of Protein Immobilization on Carbon Nanofibers Through Imaging Labeled With Glucose Oxidase-Coupled Gold Nanoparticles

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

Advisor(s)
In Seop Chang, Gwangju Institute of Science and Technology

Enzymatic biofuel cells are devices that are able to generate electricity by catalyzing the reduction-oxidation reactions occurring at the cathode of its functioning system. Protein immobilization on carbon nanofibers plays the most important part of the electricity production in certain enzymatic biofuel cells. Gold nanoparticle labeling is utilized to display that the protein was immobilized onto the carbon nanofibers, as the gold nanoparticles, which attach to the protein, are evident through transmission electron microscope imaging. The gold nanoparticles in this investigation were coupled with glucose oxidase (GOx), an enzyme that instigates a reduction-oxidation reaction, which is the protein being immobilized. There are two different ways of labeling; carbodiimide chemistry and streptavidin-biotin attraction. The streptavidin-biotin attraction method was more difficult in that the attachment of GOx to biotin is hard to confirm completely because it resulted in varied sizes of the gold nanoparticles. With carbodiimide chemistry, the gold nanoparticles were more uniform in size and spread throughout the carbon nanofiber, making it easier to support the attachment. The attachment is vital as the gold nanoparticles represent the immobilization of glucose oxidase on the carbon nanofiber. After testing both methods, carbodiimide chemistry resulted in being more effective.

B04
Centrosome and Spectrosome Orientation in *Drosophila* APC2-mut Stem Cell Asymmetric Division

Presenter(s)
Danielle Madsen, Illinois Mathematics and Science Academy

Advisor(s)
Chi Bang, University of Illinois at Chicago
Jun Cheng, University of Illinois at Chicago

Germline stem cells (GSCs) divide asymmetrically to maintain tissue homeostasis through balance of self-renewal and differentiation. The adenomatous polyposis coli 2 (APC2) is a tumor suppressor protein that is hypothesized to localize to the apical cortex, serve as a binding protein for the apical aster microtubules during mitosis, and regulate the spindle orientation. Spectrosome is a cytoskeletal organelle that is hypothesized to regulate the spindle orientation in male GSCs. Immunofluorescence staining and confocal imaging of *Drosophila* testes via APC2 mutation revealed the roles of the APC2 on centrosome and spectrosome orientations in GSCs. A significant increase in misoriented centrosomes ($P<0.001$) was observed, although the spectrosome positioning was not significantly different. In wild-type GSCs, the spectrosome location shifted from basal to apical when the centrosomes were misoriented. In contrast, the spectrosome location change was diminished in APC2-mut. Furthermore, APC2 mutation had a statistically significant increase ($P<.001$) in GSC number. Our data suggests that the spectrosomes re-positioned to the apical cortex when the centrosomes are misoriented, and the APC2 is important to the spectrosome localization in GSCs with misoriented centrosomes.

B05
An Investigation of a Novel Peptide Amphiphile for Diagnosing Atherosclerosis *in vivo*

Presenter(s)
Rajiv Patel-O'Connor, Illinois Mathematics and Science Academy

Advisor(s)
Eun Ji Chung, University of Chicago
Matthew Tirrell, University of Chicago

Atherosclerosis is the leading cause of cardiovascular disease, a disease which has prevailed as the leading cause of morbidity and mortality in the United States for the past eighty years. It has recently been elucidated that one of the defining characteristics of the onset of atherosclerosis is the overexpression of CCR2 receptors on sub-endothelial cells. We developed a monocyte-targeting peptide amphiphile micelle with gadolinium (MPAM-Gd), using a peptide head already known to bind to the CCR2 receptor, and tested its functionality as a contrast agent for nuclear magnetic resonance imaging. MPAM-Gd was synthesized via conjugation of a peptide head to a hydrophobic tail. The peptide head was purified through high performance liquid chromatography and mass spectroscopy. Overall micelle size and structure was determined via dynamic light scattering, transmission electron microscopy, and potency as a contrast agent was determined by measuring relaxivity values *r1* and *r2*. Preliminary results have revealed that overall micellar structure is spherical. This spherical structure could potentially allow MPAM-Gd to function not only as a diagnosing agent but also as a therapeutic agent.

B06
Engineering Vascularized Bone

Presenter(s)
Sean Potempa, Illinois Mathematics and Science Academy

Advisor(s)
Eric Brey, Illinois Institute of Technology
Brianna Roux, Illinois Institute of Technology

One major problem with engineering tissues is the need for blood vessels. Mesenchymal stem cells (MSC) are used in conjunction with human umbilical vein endothelial cells (HUVEC) to create blood vessel networks. This study had two goals: 1) to optimize the ratio of MSCs to HUVECs for creating the best network as measured by vessel area, length, and diameter, and 2) to optimize culture conditions to differentiate MSCs into bone, while still maintaining a complex vessel network. Co-culture spheroids ranging from 0 to 100% MSCs were cultured for up to three weeks. Cultures with 50% MSCs produced the longest vessels and highest vessel area, while 70% MSCs produced the largest diameter vessels. The optimal ratio (50% MSCs) was used to find the growth media combination that created a large, complex vascularized bone network. Three types were tested: osteogenic media (induces bone growth), endothelial media (induces blood vessel growth), and a combination of the two. Control groups were measured after 10, 20, and 30 days; the experimental groups had the media type switched after 10 or 20 days and were grown for 30 days. The results suggested there was no statistical difference in the outgrowth area between groups.

B07
Ocular Vestibular Evoked Myogenic Potentials in Chronic Stroke Subjects

Presenter(s)
Sagar Punhani, Illinois Mathematics and Science Academy
Kyle Thomas, Illinois Mathematics and Science Academy

Advisor(s)
Derek Miller, Rehabilitation Institute of Chicago
William Rymer, Rehabilitation Institute of Chicago

Previous studies have demonstrated that there are asymmetries in descending vestibular drive to cervical motoneuron pools post-stroke. However, it remains unknown if ascending vestibular drive to ocular motoneuron pools is also disrupted. We investigated the hypothesis that ascending vestibular drive is asymmetrically distributed to the clinically-affected (CA) and clinically-spared (CS) ocular motoneuron pools post-stroke, due in part to a stroke mediated disruption of cortical pathways which modulate vestibular reflex excitability. We measured ocular vestibular evoked myogenic potentials (oVEMPs), a biphasic surface potential recorded from the ocular musculature, in the eye muscles of eleven chronic stroke subjects using high intensity acoustic stimulation. The mean normalized population CA oVEMP amplitude (mean ± sd: 3.2 ± 2.3) was significantly larger than the mean normalized population CS oVEMP amplitude (2.0 ± 0.6) [Wilcoxin test, $p=0.0322$]. In conclusion, these data support our hypothesis that following stroke, there is an asymmetric distribution of vestibular drive to the CA and CS ocular motoneuron pools. This finding coupled with future research in the field may have implications in stroke rehabilitation.

B08
Construction of a Human Gene Regulatory Network

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

Advisor(s)
Insuk Lee, Yonsei University

The complete understanding of the human genome will open doors to treatments for many diseases. While genes and their phenotypes have previously been identified separately, they are recently combined in a network for a more comprehensive and accurate representation of an organism. Other than the physical and functional regulatory network, a transcriptional regulatory network will specifically serve as a critical data set in the future because it involves direction. Computational work was done to select (from scholarly articles) gene regulation between transcription factors and their target genes, and then a closer review was conducted to confirm their accuracy. The project will continue until about three thousand interactions are collected. The completed data set will be used in various ways such as a reference set for other networks.

B09
Capture of Circulating Tumor Cells Using Functionalized Capture Surfaces

Presenter(s)
Tera Sparks, Illinois Mathematics and Science Academy

Advisor(s)
Seungpyo Hong, University of Illinois at Chicago
Hao-Jui Hsu, University of Illinois at Chicago

The capturing of circulating tumor cells (CTCs) is important because the cells can be analyzed to provide information that is capable of predicting disease relapse, overall survival, as well as the response to therapy for patients who currently or could potentially have metastatic cancer. To accomplish this, we made cell capture surfaces by conjugating the anti-epithelial cell adhesion molecule (aEpCAM) to either epoxy-functionalized glass or dendrimer-immobilized surfaces. We targeted EpCAM because it is usually expressed on CTCs and not on regular hematological cells, which results in CTC-specific capturing. To test these surfaces, we used a flow chamber to run cancer cells in suspension over the surfaces and used the results to determine each type of surface's capturing efficiency. Our results show that aEpCAM-functionalized surfaces are able to capture CTCs. In addition, using dendrimer-functionalized surfaces further enhanced the capturing efficiency, which could be attributed to the multivalent binding effects introduced by dendrimers.

B10
Highlighting Cancerous Tissue During Brain Tumor Resection Surgery

Presenter(s)
Rajiv Trehan, Illinois Mathematics and Science Academy

Advisor(s)
Lagnojita Sinha, Illinois Institute of Technology
Ken Tichauer, Illinois Institute of Technology

Since the 1950's scientists have been working to use fluorescence imaging to help visualize tumors in brain cancer surgery, allowing surgeons to have point accuracy with real time scanning. In this study, fluorescence image analysis software was developed to optimize tumor-to-healthy tissue contrast in surgical data from human and rat brains. Various mathematical analysis tools were employed to accentuate abnormal drug delivery characteristics of brain tumors. Preliminary results are suggesting that tumor tissue does not always follow the same pattern in retention of the fluorescence solution. This changes the amount of luminescence exhibited by the healthy and tumor tissue. Mathematical models are currently being developed to explain the various uptake kinetics of fluorescence that are observed in different brain tissues. This advanced image analysis tool is expected to provide at least two orders of magnitude improvement in the contrast between tumor and healthy tissue, providing surgeons with a more sensitive means of determining which tissues to remove and which to avoid.

B11
Development of a Simulation Visual Prosthetic Device

Presenter(s)
Vivek Vermani, Illinois Mathematics and Science Academy

Advisor(s)
Gayatri Kaskhedikar, Illinois Institute of Technology
Philip Troyk, Illinois Institute of Technology

A pressing issue in our society is blindness, and a revolutionary breakthrough in this field comes in the form of visual prostheses. The purpose of this investigation is to provide a method for the family members of prospective volunteers who will receive the visual prostheses to understand the type of vision that can be given, as well as for use in general education about visual prostheses. The guiding question for this investigation is: How can we design a simulation of the visual prosthetic device? The coding for this investigation was done in the language Visual C++ on Microsoft Visual Studio. A Raspberry Pi, a portable single board Linux computer, was used to process the images obtained from a camera and video eyewear goggles were used to display the images to the user. Tests still need to be done to determine the effectiveness of the simulated vision.

B12
The Effects of the Overexpression of *MAN1A1* and *MGAT2* in Glioblastoma Multiforme

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

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

Glioblastoma multiforme (GBM) is one of the most common types of highly invasive primary brain tumors for which there is no effective treatment. As cell surface oligosaccharide structures are critical to tumor invasivity, modulation of the expression of the genes involved in the production of these cell surface sugar structures may have potential as a therapeutic for GBM. Several genes that synthesize oligosaccharide structures have been identified, including the *MAN1A1* and *MGAT2* mRNA, which are down-regulated in glioma stem cells. This year focused on the creation of GBM cell lines with different levels of expression of *MAN1A1* and *MGAT2*. In this study, these two human glycogenes were cloned into expression vectors and used to create individual stable transfectants in the human U373MG glioma cell line. Quantitative polymerase chain reaction demonstrated high levels of mRNA expression of each of these genes in forty-eight newly created cell lines as compared to the parental U373 cells. Western blot analysis was performed to ensure that the proteins were subsequently expressed in the respective clones. Proper function of each of the clones was evaluated by the use of lectins specifically recognizing oligosaccharide structures produces by each of these glycogenes. Adhesion and signal transduction assays were performed to determine the resultant changes in tumor invasivity in these overexpressing cell lines.

C01
Effects of Kallikrien Gene Polymorphisms on Prostate Cancer Risk and Prostate Specific Antigen

Presenter(s)
Joshua-Paul Ajayi, Illinois Mathematics and Science Academy

Advisor(s)
Rick Kittles, University of Illinois at Chicago

Prostate cancer (Pca) is the most common malignancy and the second leading cause of cancer related deaths in the United States. Unfortunately, African Americans (AA) suffer from this burden more than any other race/ethnic group, as approximately one in six AAs will be diagnosed with Pca during their life time. Along with high Pca rates, AAs also have the highest prostate specific antigen (PSA) levels in the United States. This study analyzed a set of twelve single nucleotide polymorphisms (SNP) within five kallikrien (KLK) genes to investigate their association with elevated PSA levels and increased risk of Pca. A SNP is a genetic variation when a single nucleotide is changed. Data on 621 AA men recruited at Howard University Hospital in Washington, DC were used for analyses, and classified into three different groups: healthy controls (no cancer), controls with PSA $\leq$4 ng/ml, and Pca cases. The results of the analyses showed one SNP, rs266870, was associated with increased Pca risk and six SNPs were associated with PSA levels; the two most significant SNPs were rs2569526 ($P = 0.013$) and rs12461743 ($P = 0.013$). This study demonstrated that KLK gene polymorphisms affect both Pca risk and PSA levels in AA men.

C02
Utilizing Nuclear Morphometry to Differentiate Between Salivary Gland Cancers

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

Advisor(s)
Ryan Deaton, University of Illinois at Chicago
Andre Kajdacsy-Balla, University of Illinois at Chicago
Virgilia Macias, University of Illinois at Chicago

Salivary gland cancers have proven to be difficult to properly diagnose, a troubling fact because certain ones require widely different treatments. In nuclear morphometry, the analyzing of the characteristics of the nuclei of the cell, lies the possibility to accurately differentiate salivary gland cancers such as adenoid cystic carcinoma (ACC) from polymorphous low grade adenocarcinoma (PLGA). After extracting characteristics of eight samples of each of these two types of cancer, I created a model using MATLAB™ which I hypothesize could discriminate between nuclei of ACC and PLGA. Preliminary results so far support this hypothesis. Statistical regression analysis has selected certain traits such as nuclear shape and chromatin density as the baseline to discern between the two aforementioned cancers. We are currently examining a validation set of ACC and PLGA for confirmation. With nuclear morphometry and other diagnostic tools, doctors will be better able to more quickly and safely treat sufferers of salivary gland cancers.

C03
The Effect of Nitric Oxide on Cellular Adhesion in Various Cancer Cell Lines

Presenter(s)
Ashok Arjunakani, Illinois Mathematics and Science Academy
Philip Nebres, Illinois Mathematics and Science Academy

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

Cellular adhesion, the binding of a cell to a surface or another cell, plays a major role in the progression of cancer. Studies show that nitric oxide (NO), which is found in elevated levels in cancer cells, greatly affects the cellular adhesion. However, the data is conflicting as to whether NO promotes or inhibits cellular adhesion. In this investigation the cell adhesion of several cell lines were analyzed to clarify the relationship between NO and cell adhesion. Each cell line used was divided into two groups: 1) parental cell line, unmodified cultured cancer cells; and 2) high nitric oxide (HNO) cells that were adapted to survive in high levels of NO. Five sets of cell solutions from both groups were placed on a mixer for one to five hours. Cells were then counted as either single, double (two cells bound together), or clumps (three or more cells bound together). For the HNO cell lines, the percentage of single cells increased while the double and clumped cells decreased as time went on. The parental cell lines showed the opposite trend with single cells decreasing and double cells and clumps increasing. Consequently, NO causes a decrease in cell adhesion in cancer cells.

C04
Regulation of Interleukin 17 Receptor D by MicroRNA193a-3p in Colon Cancers and Associated Diseases

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

Advisor(s)
Katherine Meckel, University of Chicago
Joel Pekow, University of Chicago

Inflammatory bowel diseases (IBD) are autoimmune diseases, such as ulcerative colitis (UC) and Crohn's disease, causing chronic intestinal tract inflammation. A patient with extensive IBD-associated colitis for over ten years has a higher probability of developing colorectal cancer (CRC). Previous studies identified changes in microribonucleic acid (miRNA) and related protein target concentrations in IBD-associated colon cancers. Regulation of interleukin 17 receptor D (IL17RD) by miRNA193a-3p, a tumor suppressor that is dysregulated in colon cancer, indicates the role of IL17RD in the transition from IBD to IBD-associated colon cancer. IL17RD concentrations in human umbilical vein endothelial cells were measured using Western blotting and real time polymerase chain reaction after transfection of miRNA193a-3p. Using immunohistochemistry, IL17RD concentrations from different types of colon tissue (normal control, various UC, sporadic, and IL17RD- associated CRC) were compared; concentrations were higher in tumors than in UC or control tissues. Due to the downregulation of IL17RD after a miRNA193a-3p transfection, it is a likely protein target of miRNA193a-3p. These findings demonstrate a novel mechanism likely involved in IBD-associated cancer. Further studies could solidify the role of miRNA193a-3p and IL17RD as biomarkers for the transition from IBD to IBD-associated colon cancers.

C05
The Effect of Different Meat Types and Chemicals on Carrion Insect Attraction

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

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

In forensics research, different types of meats have been used to represent corpses. However, the research emphasis has been on the effects the environment plays on the insects' attraction, rather than the attraction from the type meat and its decay chemicals. In outdoor trials, I measured the time it took for carrion insects to be attracted to three different types of meat: chicken, liver, and beef. Additional variables included adding blood and putrescine, a chemical found on corpses, to the samples, as well as raising the temperature of the sample to 37^{o}C and increasing the surface area. Indoor trials were conducted using chicken samples and testing the same variables tested outdoors, using the rate of meat eating the by dermestid beetles. I combined the outdoor trials in a two-way ANOVA test which showed that the meat type and chemicals made a significant difference, but there was no interaction between them. I ran a one-way ANOVA comparing beef with an increased surface area to a regular sample. These results were again significantly different, showing that factors such as meat type and the state of the meat do affect the attraction of carrion insects.

C06
Effects of Dietary Fat on Secreted Frizzled-Related Protein 1 in Normal Mouse Colon

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

Advisor(s)
Anas Almoghrabi, University of Chicago
Marc Bissonnette, University of Chicago
Urszula Dougherty, University of Chicago

Colon cancer is the second leading cause of cancer-related death in the United States. Western diet has been suggested to play an important role in colon cancer development. Since tumor suppressor Secreted frizzled-related protein 1 (Sfrp1), which suppresses Wnt signaling, is downregulated in colon cancer, we hypothesized that diet might influence its expression. In this study, we used immunohistochemistry and Western blotting to investigate diet effects on colonic Sfrp1 expression in normal mouse colon. Immunostaining suggested that high fat diet reduces Sfrp1 expression compared to low fat diet. These results were confirmed by Western blotting with lower Sfrp1 in Western diet compared to low fat diet. Mice fed a combination of Western diet plus fish oil fat showed the highest colonic Sfrp1 expression. Since Western diet increases colonic tumor development compared to low fat diet and fish oil diet inhibits tumor development, our preliminary results suggest that diets may modulate tumor development by altering Sfrp1. Additional samples will be run to confirm these results. This research offers new insights into how diet might influence colon cancer development via complex molecular mechanisms involving tumor suppressor genes. Through consumption of healthier diets, individuals might decrease their risk of colon cancer.

C07
New Regulators of Lysosome Motility

Presenter(s)
Vishrut Dixit, Illinois Mathematics and Science Academy

Advisor(s)
Vladimir Gelfand, Northwestern University
Michael Winding, Northwestern University

The cellular cytoskeleton comprises a network of microtubules that, together with microtubule motors, is essential for intracellular transport of various protein complexes and organelles. We used time-lapse microscopy in combination with a genome-wide RNAi screen to search for factors regulating lysosome motility along microtubules. To classify hits, we modified a temporal color code analysis plugin to visualize lysosome movement in a single frame. Initial screening results showed that the knockdown of proteins encoded by genes CG1193, CG14435, and CG14351 results in decreased lysosome motility. To further verify these hits, each gene was tested individually with quantitative data analysis. We are currently working on analyzing data for both lysosome and peroxisome motility to confirm preliminary results; this quantitative data analysis will be completed in the next few weeks. The results of this study increase our knowledge about factors affecting organelle transport, which may have future implications in understanding transport in neurons with possible links to neurodegenerative diseases. Disruptions in axonal transport, including abnormal accumulations of protein and organelles, have been shown to link to major human neurodegenerative diseases.

C08
Optimizing DNA Sequencing Using DNA Isolation, Polymerase Chain Reaction, and Gel Electrophoresis

Presenter(s)
Natalie Dong, Illinois Mathematics and Science Academy
Atene Poskute, Illinois Mathematics and Science Academy
Saigopal Somasundaram, Illinois Mathematics and Science Academy

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

At the molecular level, DNA can be broken down to a sequence of four different nitrogenous bases. The process of determining this sequence is known as DNA sequencing and can provide important information in biological research. DNA from MO59K fibroblast cells, donated human cheek cells, CEM white blood cells, and U937 white blood cells was isolated. Primers were selected and designed, adjusting the sequence included in each primer in order to adjust the annealing temperature for each pair. Optimization of polymerase chain reaction as well as isolation of mitochondrial DNA (mtDNA) is ongoing. Changes in the source of mtDNA as well as changing annealing temperatures are also ongoing.

C09
The Effect of microRNA on the Proliferation of Non-Small Cell Lung and Breast Adenocarcinoma

Presenter(s)
Nisa Faheem, Illinois Mathematics and Science Academy
Somie Park, Illinois Mathematics and Science Academy
Lajvanthi Sudhakar, Illinois Mathematics and Science Academy

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy

Microribonucleic acid (miRNA), twenty to twenty-five nucleotide long strands of genetic expression regulators, may have some function in the proliferation of a variety of carcinomas. The microRNA strand Hsa-miR-122-5p is designed to inhibit the expression of tumor suppressor genes, thus potentially inducing proliferation of MCF-7 breast adenocarcinoma and H522 non-small cell lung cancer cells. We tested the effect of miRNA on H522 and MCF-7 cells by transfecting miRNA into the cell lines with DharmaFECT reagent. Quantitative cell counts were taken of non-transfected cells and cells transfected with Hsa-miR-122-5p miRNA, positive control miRNA, and negative control miRNAto determine the proliferation of transfected cells. We determined a significant ($P < 0.05$) proliferation in the MCF-7 cells which contained the transfected miRNA against the negative control. However the data were not conclusively supported by the positive and negative controls as they were not significantly different from each other. We are in the process of plating the cells on slides to determine transfection efficiency. Our results will reveal more about the function of miRNA and its relationship in cancer development, providing insight into different therapeutic methods.

C10
Physical Interactions of Regulatory Sequences Within Schizophrenia-Associated MIR137 Locus

Presenter(s)
Kristy Fang, Illinois Mathematics and Science Academy
Nahee Park, Illinois Mathematics and Science Academy

Advisor(s)
Jubao Duan, NorthShore University HealthSystem

Although the non-coding MIR137 locus has been identified as a new schizophrenia susceptibility locus, it is unknown what gene the disease risk variants affect. The objective of this study is to determine the physical chromatin interactions between putative regulatory sequences flanking the common disease risk variant (rs1198588) and the promoter/enhancer sequences adjacent to MIR137 and other genes such as dihydropyrimidine dehydrogenase (DYPD). A chromosome conformation capture (3C) assay using SH-SY5Y (a neuroblastoma cell line) was carried out. Cells were fixed, chromatins were cut and re-ligated to test interacting segments, segments were amplified by polymerase chain reaction (PCR), and bands were visualized using gel electrophoresis. Amplified DNA was then sequenced to confirm these interactions. Previous results suggested that sequences flanking the rare disease risk variant adjacent to MIR137 did not interact with DPYD promoters. However, the sequence flanking the common risk variant rs1198588 yielded a robust and specific PCR amplification with DPYD as well as the MIR 137 adjacent promoter and enhancer sequences. Thus, the regulatory sequence flanking the rs1198588 regulated the expression of DPYD, but did not regulate the expression of the pseudogene LOC 729987 promoter. By pinpointing the regulatory sequence interactions, the molecular mechanisms of MIR137 locus with schizophrenia can be better understood.

C11
Deoxycholic Acid Alters Expression of Cancer and Epigenetic Genes in Mouse Intestinal Epithelium

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

Advisor(s)
Eugene Chang, University of Chicago
Kyle Dolan, University of Chicago

Studies have shown that bacterial metabolites in the gut may alter intestinal gene expression, leading to colorectal cancer. We suspect epigenetics plays a role in cancer development since cancer cells display aberrant epigenetic patterns. We assessed the effects of deoxycholic acid (DCA), a bacterial metabolite linked with colorectal cancer, on certain cancer and epigenetic-related genes in the small intestine. In a culture model of intestinal epithelium derived from mouse stem cells, DCA exposure decreased the abundance of transcripts for DNA methyltranferases (*Dnmt1*, *Dnmt3a*) and methylcytosine oxidases (*Tet2*, *Tet3*). DCA exposure also increased the expression of growth arrest and DNA damage 45 (*Gadd45*), a cellular stress response gene. These results suggest that DCA causes abnormal methylation patterns by suppressing DNMT and TET expression at the transcriptional level. Additionally, the increase in GADD indicates that significant DCA-induced DNA damage occurred. This finding proposes a possible link between DNA damage and reduced DNMT and TET expression. Further studies on DCA's effects on gene expression may provide more insight into the mechanisms underlying how this bacterial metabolite promotes colorectal cancer.

C12
Using Golden Helix to Analyze Data From Whole Genome Sequences of Polycystic Ovarian Syndrome

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

Advisor(s)
Margrit Urbanek, Northwestern University

High throughput Next Generation Sequencing (NGS) is used to compare genetic information of affected subjects to that of control subjects to assess the likelihood that genomic variants are linked to causes of complex diseases, such as polycystic ovarian syndrome (PCOS). NGS develops large amounts of data that must be filtered by quality using bioinformatics technology, such as Golden Helix. This study used previously sequenced genomes of fifty-four women with PCOS and eighteen controls. These genetic files were formatted and uploaded to Golden Helix SNP and Variation Suite. After reading NGS articles and software manuals, I applied various filters to determine how this technology analyzes variant linkage to complex diseases. By viewing the filtered outputs in Golden Helix's genome browse, I found that alleles with a call rate higher than 85%, and genotype quality and read depth greater than 20 were sufficiently filtered for genotype marker annotations, including those for clinically important genotypes, known alternative nucleotides, and allelic variants found in previous studies. Golden Helix's call rate, genotype quality, read depth, and cross-annotation filters are most effective in providing the highest quality data for comparing to the reference sequence. These findings will help develop a standard for these new programs in future genetic association studies.

C13
Examining Cell-Cell Communication in Filamentous Cyanobacteria Using Electron Tomography

Presenter(s)
Geronimo Garcia, Illinois Mathematics and Science Academy
Priya Trivedi, Illinois Mathematics and Science Academy

Advisor(s)
Robert Haselkorn, University of Chicago
Amin Nasser, University of Chicago

Cyanobacteria are green-blue gram-negative prokaryotes that carry out photosynthesis, fixing carbon dioxide and generating oxygen. In response to nitrogen deprivation, about 10% of vegetative cells of filamentous cyanobacteria *Anabaena* sp. PCC 7120 differentiate into nitrogen-fixing heterocysts, providing an anaerobic environment required for nitrogen fixation. Cell communication is important between these specialized cells as amino acids are transported from heterocysts to vegetative cells while sugar is transported from vegetative cells to heterocysts. Our goal was to examine the structure and composition of heterocysts and vegetative cells in order to determine function, composition, and location of possible channels between these cells. Cells grown in medium with and without a nitrogen source were high pressure frozen, sectioned, and visualized by electron microscopy. Three-dimensional tomograms were generated and used to model the cells. We found that channels exist between cells. We determined the dimensions of the channels and found that between a heterocyst and vegetative cell the channels are 14 nanometers in diameter and 21 nanometers long (±2 SD) while the average measurements of channels between vegetative cells are 12 nanometers in diameter and length ($^{\pm}$2 SD). We also noticed that these channels might serve as molecular markers, dictating where the heterocyst's neck develops.

C14
Patterns Behind Degeneration of Retinal Ganglion Cells in Glaucoma on Oscillatory Potential Waves

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

Advisor(s)
Xiaorong Liu, Northwestern University

Glaucoma is the second leading cause of blindness worldwide. It is a group of neuropathic diseases that result in the degeneration of retinal ganglion cells (RGCs), leading to blindness. In closed-angle glaucoma, the patient possesses high intraocular pressure (IOP), as the aqueous humor cannot drain through the blocked trabecular meshwork. We established a model mimicking this condition by using laser illumination and microbead injection to cause elevated IOP for eight weeks. Full-field electroretinography (ERG) was used to stimulate *in vivo* mouse eyes and to measure the electrical responses, allowing us to monitor the degeneration of retinal function over time. ERG records a-waves, b-waves, and oscillatory potentials (OPs). A-waves and b-waves are created as a response to stimulation by photoreceptor cells and bipolar cells respectively. OPs, created in the inner retina, reflect functional changes in RGCs. By measuring the decrease in the amplitude of OPs, we chronicled the effects of glaucoma on RGCs. In our ocular hypertension model, we noted that there was a decrease in OPs, demonstrating the degeneration of RGCs. Furthermore, the extent of degeneration can be estimated because the OPs gradually decrease with time. In conclusion, our mouse model enables us to extrapolate patterns about the human disease and test potential cures.

C15
Engineering a Luminescent Reporter Protein to Track Influenza A Virus Infection *in vivo*

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

Advisor(s)
Balaji Manicassamy, University of Chicago

This study aims to develop a novel reporter system that would allow us to follow influenza A virus (IAV) infection *in vivo* in a mouse model of influenza infection using firefly luciferase (FFluc) as a reporter. IAV promoter and terminator sequences were added to the reporter gene to ensure that it can only be translated into FFluc protein in the case of IAV infection. The gene was cloned into plasmids containing a mouse polymerase promoter. These DNA constructs where transfected into mouse fibroblast cells. Cells were cotransfected with Renilla luciferase, which served as a normalizing control. The transfected cells were infected with IAV, or a mini genome assay was performed, to determine if the construct functioned correctly. Luciferase assays were performed on the cell lysates to determine the amount of luciferase in each group. Results from the mini genome assay showed a high amount of FFluc production compared to the control (2,061,510 relative light units (RLU) compared to 1,786 RLU). Results from the transfection/infection experiments also showed a high amount of FFluc production in infected cells compared with uninfected cells (216,623 RLU compared to 39,857 RLU). These results indicate that the DNA construct containing FFluc reporter is functional and can be used to track IAV infection *in vivo*.

C16
CRISPR/Cas9 RNA-Guided Upregulation of Utrophin as a Therapy for Duchenne Muscular Dystrophy

Presenter(s)
Alyda Huerta, Illinois Mathematics and Science Academy

Advisor(s)
Renzhi Han, Loyola University
Andrew Mariano, Loyola University
Audrey Torcaso, Loyola University

Duchenne muscular dystrophy (DMD) is an X-linked recessive trait that affects one out of every thirty-six hundred male infants. It is caused by mutations in the *DMD* gene that encodes for dystrophin. Dystrophin links the muscle cytosketeleton to the extracellular matrix and prevents stress to the plasma membrane and damage to myofibers. Upregulating utrophin could compensate for the lack of dystrophin in the muscle cells of patients with DMD because utrophin's homology with dystrophin allows it to interact with the same proteins in the cytoskeleton network. As a possible therapy for DMD, we used the engineered transcription factor dCas9-VP64 and utrophin-targeting guide ribonucleic acid (gRNA) to upregulate utrophin. We transfected cultured cells with the pLKO-dCas9-VP64 construct only or with an equal ratio of the three pLKO-dCas9-VP64-hUtr constructs. RNA extracts were obtained 48 hours after transfection and then reverse transcribed into complementary DNA. Polymerase chain reaction (PCR) and gel electrophoresis indicated that there was an increase in the utrophin mRNA with the three pLKO-dCas9-VP64-hUtr constructs compared to dCas9- VP64 only. Additional reverse transcriptase PCR and Western blot analysis is currently in progress to test each single gRNA individually along with the dCas9-VP64 construct for upregulation of utrophin.

C17
Effect of High Nitric Oxide Microenvironment on Cancer Cell Migration

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

Advisor(s)
James Radosevich, University of Illinois at Chicago

Cancer cells are unique because they resist cell death, form new blood vessels, and metastasize or spread cancer in the body. Nitric oxide (NO) is a chemical that can help a microenvironment thrive or diminish. In large quantities, NO inhibits expression of cell adhesion molecules, causing metastasis. The aim of the present study was to find a correlation between the cell migration rates of high nitric oxide cells (HNO) and parent cells in cancerous cell lines. Five cell lines were investigated and a scratch assay protocol was executed to study cell migration by creating an artificial gap on a cell monolayer and capturing images at regular intervals to measure the distance of the gap over time. The study found that the parent breast tissue cell lines migrated faster than the HNO cells. On the other hand, the parent lung tumor cell line had a slower metastatic rate compared to the HNO cells. There was minimal difference between the migration rates of HNO cells and parent cells in each cell line. Further research will need to be conducted to discover how NO reacts to certain environments so researchers and doctors can cure cancer or alleviate pain for patients.

C18

Phenotypic Characterization of OX40L-Expressing Dendritic Cells Expanding T-Regulatory T-Cells

Presenter(s)
Elijah Jimenez, Illinois Mathematics and Science Academy

Advisor(s)
Palash Bhattacharya, University of Illinois at Chicago
Bellur Prabhakar, University of Illinois at Chicago

Earlier work has shown that bone marrow cells isolated from mouse femurs can be cultured *ex vivo* in the presence of the cytokine granulocyte macrophage colony-stimulating factor to differentiate into bone marrow dendritic cells (BMDC). These cells can be classified into two distinct populations based on the expression of the co-stimulatory molecule OX40L. Only OX40L-expressing BMDCs have the capacity of selectively proliferating regulatory T-cells in co-cultures. Thus, these cells could be relevant for regulating immunological tolerance. To better understand the phenotype of OX40L positive BMDCs and to correlate this with its tolerogenic function, we conducted a whole genome microarray to determine relative gene expression between OX40L positive and OX40L negative BMDCs. Our data revealed that OX40L positive BMDCs expressed higher levels of CD80 and CD86, co-stimulatory molecules related to antigen presentation. They also expressed higher levels of the cytokines CCL5 and CCL22, which are chemoattractants for T-cell subtypes. Finally OX40L positive BMDCs differentially expressed the transcription factors NFAT5 and c-REL. We further confirmed some of these findings through quantitative and semi-quantitative polymerase chain reaction. We also cultured BMDCs in the presence of various inhibitors to determine which cell-signaling pathway affected OX40L expression. Flow cytometry-based data revealed that the NF-kB and PI3K pathways are involved in OX40L expression in BMDCs.

C19
Error Correction Approach of Next Generation Sequencing Data for Analysis of HIV-1 Variability

Presenter(s)
Vivian Jin, Illinois Mathematics and Science Academy
Shuchi Patel, Illinois Mathematics and Science Academy

Advisor(s)
Eunyoung Kim, Northwestern University
Sudhir Penugonda, Northwestern University
Ramon Redondo Lorenzo, Northwestern University

Human immunodeficiency virus type 1 (HIV-1) constitutes one of the major medical challenges due to infectious diseases that the world is facing, affecting more than thirty million people. Due to its high mutation rate, enormous population sizes, and rapid turnover, HIV-1 generates a swarm of mutants, known as a quasispecies, whose variability constitutes a major mechanism in the HIV-1 virus adaptability and evasion to drugs. Next generation sequencing (NGS) technologies can be used to analyze the highly variable HIV-1 in order to understand host-virus interactions and viral evolution. However, these sequencing machines can introduce errors that become difficult to distinguish between low-frequency variants and viral mutations. In the present project we have developed an analysis pipeline for 454 sequencing data that is an NGS platform. We used control sequences of known composition tagged with two identifiers to quantify sequencing errors. This data was analyzed to identify the frequencies at which errors occurred, the relationship between the errors and sequence frequency, and the existence of specific error-prone regions. The error correction approach will distinguish between naturally occurring mutations and sequencing errors. This study will provide insight for an accurate analysis of the HIV-1 viral variability and evolution that is critical to successful treatment development.

C20
The Effect of Photoperiod and Thyroid Hormone on Innate Immune Response in *Phodopus sungorus*

Presenter(s)
Omkar Kelkar, Illinois Mathematics and Science Academy

Advisor(s)
Kenneth Onishi, University of Chicago
Brian Prendergast, University of Chicago
Tyler Stevenson, University of Chicago

Short day lengths (SD) enhance multiple aspects of immune function and recent research indicated that thyroid hormone (T3) is sufficient to mimic the effects of SDs on some aspects of immune function (white blood cell counts and T cell mediated inflammatory responses). This study examined whether photoperiod and T3 likewise affect innate immune responses to lipopolysaccharide (LPS), which simulates a bacterial infection. In the study, long day (LD) and SD hamsters, along with LD hamsters pre-treated with 1 μg of T3, were injected with LPS or saline (as a control). SD hamsters exhibited reductions in sickness behaviors and hypothalamic cytokine (*NFKb* and *IL-beta*) production, as compared to LD hamsters. T3 treatment, however, was without effect on any of these responses to LPS. The data suggest that photoperiod significantly affects behavioral and molecular sickness responses, but that thyroid hormones are not sufficient to mimic the effects of SD photoperiods on these aspects of immune function. Effects of thyroid hormones on immune function appear to be trait-specific.

C21
Effects of Environmental Factors, Immune Evasion, and Reservoir Population on the Prevalence of Lyme Disease

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

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

Lyme disease, caused by the spirochete, *Borrelia burgdorferi*, and transported to humans by the deer tick, *Ixodes scapularis*, is the most common vector-borne illness in the United States. Yearly case estimates previous to 2013 approached twenty to thirty thousand cases, but the Centers for Disease Control now estimates around three hundred thousand cases per year. This study explored factors contributing to elevated prevalence of *B. burgdorferi* infection. A literature review examined factors like vector and reservoir population, climate, acorn density, and antigenic variation. The factors contributing highly to the occurrence of Lyme disease were determined to be acorn density feeding the reservoir population and *B. burgdorferi* variation of outer surface proteins, leading to avoidance of host immune response. Further, *B. burgdorferi* is able to effectively evade immune response, which may contribute to increased severity and reinfection of human hosts. Correlation studies of case numbers in local areas indicate that environmental variables do not affect Lyme disease infectivity.

C22
The Role of E2F1 in Regulating Bone Marrow Cell Oxidative Metabolism and Ischemic Cardiac Repair

Presenter(s)
Srisha Kotlo, Illinois Mathematics and Science Academy

Advisor(s)
Gangjian Qin, Northwestern University
Tianjiao Sun, Northwestern University
Shiyue Xu, Northwestern University

Myocardial ischemia is a condition leading to hypoxia and an environment in which the heart tissue is damaged. Endothelial progenitor cells have therapeutic potential for ischemic cardiac repair. Recent studies suggest that E2F1 suppression enhances oxidative phosphorylation in progenitor cells and is associated with cell differentiation. Our goal was to see how E2F1 regulates bone marrow (BM) progenitor cell differentiation, thereby impacting ischemic cardiac repair. We cultured BM lineage negative progenitor cells under hypoxic and normoxic conditions. BM lineage negative cells were isolated through magnetic cell sorting and analyzed for PDK expression level, cell metabolic profile, and cell function. E2F1 deficiency leads to a reduction of expression of PDK2 and PDK4, which results in a decrease of PDH-E1a phosphorylation. Compared to wild-type BM cells, E2F1 deficient cells showed about a two-fold increase in expression of endothelial markers. Genetic deletion of E2F1 in BM progenitor cells enhances oxidative metabolism and differentiation towards endothelial lineage in vitro and in the ischemic tissue environment. This suggests that inhibition of E2F1 in BM progenitor cells enhances differentiation of BM cells which are recruited to the ischemic heart, and may improve the recovery from cardiac ischemic injury.

C23
Evaluating Molecular Function of Proteins Through Integrase-Mediated Cassette Exchange

Presenter(s)
Sanjay Kottapalli, Illinois Mathematics and Science Academy

Advisor(s)
Debabrata Chakravarti, Northwestern University
J. Brandon Parker, Northwestern University

One method for investigating protein function involves lowering expression of the endogenous protein by RNA interference (knockdown) in order to examine the resulting cellular phenotype. However, problems arise when attempting to rescue the phenotype by reintroducing mutants of the protein at its original expression level, due to position effects. Here, we introduce a method for site-specific integrase-mediated cassette exchange (IMCE), which utilizes the enzyme ΦC31 integrase to swap the genetic material between attP sites on an acceptor cassette with the DNA between attB sites on a donor vector. Our acceptor cassette was constructed with the phosphoglycerate kinase promoter and the mCherry red fluorescent protein gene, flanked by attP sites. The donor cassette was constructed with the enhanced green fluorescent protein (EGFP) gene, flanked by attB sites. A cotransfection of the acceptor and donor cassettes +/- integrase into cells showed several instances of EGFP expression, indicating moderate success of IMCE between transient plasmids. These preliminary results show promise for planned knockdown/rescue experiments involving cotransfections of integrase and donor cassettes incorporating rescue transgenes in cells containing the acceptor cassette integrated at a stable locus. This method will have broader uses in molecular analyses by ensuring uniform expression of wild type and mutant proteins.

C24
Analysis of Retinoblastoma I and Lysine (K)-Specific Demethylase 5A on Metabolic Pathways

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

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

Retinoblastoma 1 (*Rb1*) and lysine (K)-specific demethylase 5A (*Kdm5a*) are regulators of several cell processes, such as the cell cycle, muscle differentiation, and metabolism. *Rb1* -/- cells are defective in differentiation, and the double knockout of *Rb1* and *Kdm5a* genes rescues differentiation. They were analyzed in relation to the metabolic pathways mitochondrion, the citrate cycle, and the electron transport chain. Analysis of previous research was used to create diagrams describing how pathways were affected by gene expression and how specific genes were affected in *Rb1*-deficient cells. *Esrrg* is a regulator of cell metabolism that rescued by the double knockout of *Kdm5a* and *Rb1*. The expression levels of *Esrrg* in C2C12 myoblasts with different levels of differentiation were analyzed using quantitative polymerase chain reaction. The data from the diagrams suggested that gene expression of the citrate cycle decreases in *Rb1*-inactive cells compared to wild type cells, and the double knockout of *Rb1* and *Kdm5a* rescues the expression of the mitochondrion genes. The data indicates that as differentiation progresses, *Esrrg* expression levels rise. Cancer cells often have abnormal differentiation due to *Rb1*- inactivation, so the antagonistic relationship between *Kdm5a* and *Rb1*could be used to create a drug that targets *Kdm5a*, an easier target, while affecting *Rb1*.

C25
Effects of a Nuclear Receptor Agonist on Gene Expression of Hepatocyte Organoids

Presenter(s)
Quinn Lewis, Illinois Mathematics and Science Academy

Advisor(s)
Candace Cham, University of Chicago
Eugene Chang, University of Chicago
Kristina Martinez, University of Chicago

The constitutive androstane nuclear receptor (CAR) upregulates the expression of xenobiotic enzymes and proteins involved in lipid metabolism in response to the known CAR agonist, 1,4-bis[2-(3,5-dichloropyridyloxy)] benzene or TCPOBOP (TCP). It is expected that microbial metabolites may also activate CAR in hepatic organoids (hepanoids). Thus the aim of the project was to first determine the effective dose of TCP that induces CAR target gene expression. We treated hepanoids with various concentrations of TCP and analyzed gene expression by quantitative polymerase chain reaction of the low density lipoprotein receptor gene, Insig-1, and Cyp2b10 genes; all of which are genes known to be affected by TCP in hepatocyte cells. We observed an increase in gene expression of Cyp2b10 at the 100 nM dose, but not Insig-1. Further investigation will assess the effect of microbial metabolites, such as short chain fatty acids and hydrogen sulfide, on CAR-regulated gene expression. Resultant findings may implicate an important role of intestinal bacteria in regulating lipid metabolism in the liver.

C26
Identification of Fate Regulators in Human Embryonic Stem Cells

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

Advisor(s)
Fei Wang, University of Illinois at Urbana-Champaign

Human embryonic stem cells (hESCs) are well-known for pluripotence, the ability to differentiate into any mature cell type. This property makes them ideal for studying the molecular mechanisms involved in early development, a process not easily observable *in vitro*. Genes of interest showed significantly altered expression during chemically stimulated differentiation. hESCs were transfected with lentiviral vectors which introduced short hairpin RNA (shRNA) constructs, silencing a specific gene; expression of established genetic markers was then measured to further verify the function of this silenced gene in either suppressing or promoting a particular path of differentiation. Genes *PAX6*, *SOX17*, and *T* were tested as markers of ectoderm (nerve), endoderm (inner organs), and mesoderm (skeletal muscle) differentiation, respectively. The study found multiple previously uncharacterized genes which exhibited major expression pattern change during either neural or endoderm differentiation. Further analysis of individual genes found two genes potentially contributing to the mechanisms maintaining pluripotency. These potential regulatory genes will be further characterized in future studies, contributing to knowledge of early development and stem cell biology which can enable regenerative therapies and birth defect avoidance.

C27

Creating an Efficient Code Pipeline to Analyze *Caenorhabditis elegans* Drug Sensitivity

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

Advisor(s)
Erik Andersen, Northwestern University

Caenorhabditis elegans, a roundworm found worldwide, is commonly used as a genetic model organism. In traits such as drug sensitivity, phenotypic differences between geographically distant strains can be traced back to genetic factors through genomic mapping. Due to the high volume of data gathered, a code pipeline which would automate analysis became necessary. Using the R environment and language, I wrote a script which would automatically apply a series of analytical commands to given lists of control and test assays. This script is able to account for manually entered data, eliminating wells deemed contaminated by the researcher. After incorporation of the R Markdown markup language and knitr package, the R script output automatically generates a formatted HTML report with plots created using the ggplot2 package. I am currently testing the applicability of my script to different experimental trials and improving the readability of my report outputs. I have also begun preliminary work to connect both drug dose response and genomic divergence to the existing code. This work will greatly increase the efficiency of future drug sensitivity trial analysis and graphical output.

C28

Correlation Between Intracellular Calcium Release and T-Tubule Organization in Failing Rat Myocytes

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

Advisor(s)
J. Andrew Wasserstrom, Northwestern University

Heart failure afflicts about 5.7 million people in the United States a year and is a causative agent in one in nine deaths. Intracellular calcium cycling regulates cardiac systolic and diastolic function in a process called cardiac excitation-contraction coupling. Contractions are caused during the cardiac action potential as calcium enters the cell through depolarization-activated calcium channels placed along invaginations along the sarcolemma called t-tubules. During heart failure, this process is disturbed and the contractile phase is effectively prolonged and t-tubule organization is disturbed. The goal of this study was to investigate the relationship between t-tubule remodeling and calcium release in heart failure. Intact hearts from spontaneously hypertensive rats were analyzed to obtain a measurement of organizational index of t-tubules and the heterogeneity index, or standard deviation of calcium transients in individual heart cells. Results indicate that t-tubule remodeling causes a non-linear increase in the variability of calcium release along the cell length as the efficiency of calcium-induced calcium release decreases due to distance from type 1 calcium channels located on the t-tubule increases.

C29
Characterization of *EZH2, KDM5A,* and *KDM5B* Alterations in Human Breast Cancer

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

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

The American Cancer Society estimates that about 232,670 new cases of breast cancer will be diagnosed in 2014. Understanding the role of epigenomics during mammary tumorigenesis may elucidate the process of tumor development. Evidence suggests that deregulation of *EZH2*, *KDM5A*, and *KDM5B* is linked to tumorigenesis. Through the use of publicly available cancer profiling databases, we analyzed gene expression level, DNA copy number alterations, and somatic mutations of the three genes in different tissue samples of human breast cancer. We found significant overexpression of *EZH2*, *KDM5A*, and *KDM5B* compared to normal breast tissue samples. We correlated gene expression level of these genes with tumor grade, stage, expression of hormone receptors, and patient survival in these breast cancer datasets. Consistent with published data, EZH2 expression level was increased in high grade cancers. Additionally, we analyzed gene expression changes in response to drug treatments. We generated a map of somatic mutations in the genes and a cross species analysis was run. The results show that the mutation sites are conservative across species, suggesting the functional significance of the mutations. This finding indicates that reduction of *EZH2*, *KDM5A*, and *KDM5B* levels in tumor cells may lead to inhibition of cancer progression.

C30
Functions of Transcriptional Corepressor Groucho on Neuronal Differentiation

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

Advisor(s)
Wei Du, University of Chicago
Tianyi Zhang, University of Chicago

In humans, neural tubes differentiate into neurons and glial cells before birth. Accurate and regulated differentiation is necessary for healthy brain development. Within *Drosophila melanogaster* and humans exist a number of transcription cofactors with homologous functions in neuronal differentiation including corepressor Groucho (GRO). In this study technologies including RNA interference, tissue dissection, immunostaining, and fluorescent microscopy imaging were used to clarify protein mechanisms in both early and late-stage neuronal differentiation in the *D. melanogaster* model organism. Our *Drosophila* model established two novel functions for GRO in neuronal development: loss of function GRO upregulates rhomboid and activated epidermal growth factor receptor (EGFR) expression and increases rough expression. This study developed a new model for the binary function of GRO: under normal conditions, GRO promotes atonal by suppressing EGFR activity, however, removing EGFR allows for GRO to instead suppress atonal, inducing an extra level of regulation in early neuronal differentiation. The development of a neural differentiation model can facilitate the creation of new therapies to aid developmental regulation.

C31
Association Between Diabetes-Related Single Nucleotide Polymorphisms and Various Cancer Types

Presenter(s)
Julian Pacheco, Illinois Mathematics and Science Academy

Advisor(s)
Brandon Pierce, University of Chicago
Chenan Zhang, University of Chicago

The goal of this project was to determine if diabetes-related genetic variants [single nucleotide polymorphisms (SNP)] are associated with cancer risk. Prior studies have shown that diabetics are at increased risk for cancer. Data from the Genome Wide Association Studies (GWAS) for various cancer types (ovarian, prostate, breast, colorectal, and lung) was used to estimate associations with cancer for SNPs known to influence fasting insulin, fasting glucose, and type 2 diabetes risk. Diabetes-related SNPs were identified using prior literature. A program was then run to identify and extract association estimates for these SNPs in the cancer GWAS results files. Scatterplots were created to show which SNPs showed an association with cancer risk, and association trends were plotted as a line. The slope of the line corresponded to one of three results: positive, negative, or no association. Seventeen graphs showed some association between the diabetes-related SNPs and different subsets of cancer. Some showed diabetes risk alleles were associated with decreased chance of a certain subtype of cancer. By showing that there are associations between diabetes-related and various subtypes of cancers, it became evident that preventative research should be conducted. In conclusion, our results suggest that for certain cancer subtypes, cancer risk is influenced by diabetes-related SNPs.

C32
Homozygous Genotypes Long Adenine and Short Variant of Serotonin Transporter Gene and Link to Autism

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

Advisor(s)
Edwin Cook, University of Illinois at Chicago
Kelley Moore, University of Illinois at Chicago

Autism spectrum disorder (ASD) is a mental condition that exhibits deficits in social communication/interaction, and restricted/repetitive behaviors. Although most cases of ASD have unknown causes, many genetic variants are associated with ASD. This project, the Simons Simplex Collection, examined the phenotypic expression of the homozygous long adenine (L_AL_A) 5-HTTLPR genotype of the serotonin transporter gene *(SLC6A4)* compared to the homozygous short genotype (SS) in 1,906 autistic subjects. This study attempted to replicate the University of Illinois at Chicago Autism Center of Excellence results which found a relationship between these genotypes and phenotypes. Polymerase chain reaction and Msp I digests were performed to determine the genotype of each subject, including the length of the gene and which nucleotide was present at the cut point. To measure phenotypic expression the Repetitive Behavior Scale-Revised factor compulsion, rituals, and sameness (CRS) was used. The low and high CRS groups were compared to the SS genotype and the L_AL_A genotype groups. The Pearson chi-square value was 0.95 (p-value of .33) showing that there was no statistical significance in the relationship of these genotypes and CRS levels. Therefore, the L_AL_A genotype does not coincide with a higher CRS level than the SS genotype in people with Western European heritage in this sample.

C33
Toll-Like Receptor 4 and Amyloid Precursor Protein Gene Roles in the Onset of Alzheimer's Disease

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

Advisor(s)
Ken-Ichiro Fukuchi, University of Illinois at Peoria

The amyloid hypothesis regarding Alzheimer's disease states that the neurodegeneration may be caused by beta amyloid (Aβ) buildup in the human brain leading to dementia. Aβ is produced from its precursor, amyloid precursor protein (APP). Toll-like receptor 4 (TLR4) has a large role in immune systems and is a part of the IL-1/toll receptor family. Polymerase chain reaction and restriction fragment length polymorphism were used in order to amplify APP and TLR4 and identify mutated copies of TLR4 respectively. Several mice have been genotyped for APP and TLR4 gene throughout the investigation. A further understanding on TLR4's role in Alzheimer's disease was attained throughout testing. Mice were tested to see if they possessed different numbers of copies of the TLR4 gene (0, 1, 2, 6 or 7). Larger quantities of TLR4 were tested in amyloid detection and clearance. The APP genotyping done in the experiment allows for a more accurate idea of disease causation. Results of this investigation include the genotyping of mice DNA samples which may assist in mapping the differences in the number of TLR4 gene copies. These results, with other investigations, may lead to a better understanding of Alzheimer's disease origins and possible therapeutic treatments.

C34
The Relationship Between Enrichment Type and Daily Activity in a Mountain Lion

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

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy
Randy Johnson, Phillips Park Zoo

It is crucial to prevent stereotypical or repeated negative behaviors of captive animals in zoos. The most efficient method to halting these behaviors is the practice of enrichment activities which can stimulate animals to be more active. I observed and recorded the successfulness of enrichment activities by comparing the amount of time spent by two mountain lions during and after the activity. I ran a two-way ANOVA to compare the mean times of activity for each mountain lion. There was not a statistical difference between the mean times, however the analysis showed that Tonka (the male) on average, spends more time on enrichment and is active longer compared to Macha (the female). Macha and Tonka both like the same activities and spend about the same amount of time on activities. There is no correlation between times spent after the enrichment activity. Tonka is stimulated by the enrichment activities to be more active than Macha. The preliminary results indicate that successful enrichment activities motivate animals to be active and prevent stereotypical behaviors.

C35
Factors Influencing the Effectiveness of Enrichment for Captive Gray Wolves (*Canis lupus*)

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

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy
Randy Johnson, Phillips Park Zoo

Enrichment activities are created to trigger the natural instincts of captive animals to prevent them from exhibiting negative characteristics. In this study, two eight-year-old wolves were observed for a half hour after being introduced to the day's activity. Details regarding the activity were recorded, including the type of activity it was (food or scent-based), the zookeepers involved in the activity, and the amount of time each wolf spent on the activity. A one-way ANOVA with repeated measures test was used to determine if there was a significant difference between the activity types. It was found that there was no significant difference in the amount of time the wolves spent doing either activity ($p = 0.64296$). There was also no significant difference between the amount of time the wolves spent on the activities with more than one zookeeper present ($p = 0.86632$). It was found, however, that the male wolf in the study spent significantly more time on the activities ($p = 0.006889$). These results do not suggest that any of the factors examined affect the amount of time the wolves are involved in the activity, but they do suggest that it would vary between individuals, as expected. It was noted that the female wolf often got distracted by the zookeepers and another wolf in a connected exhibit after being given enrichment. It is possible that this distraction was the reason the female did not participate.

C36
The Role of Viral Protein 1/2 in Herpes Simplex Virus 1 Replication

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

Advisor(s)
Nick Huffmaster, Northwestern University
Greg Smith, Northwestern University

The focus of this study is to investigate how ubiquitination, a protein modification on the amino acid lysine known to alter protein function, regulates herpes virus neuroinvasion. The neuroinvasive herpes viruses, such as herpes simplex virus 1 (HSV-1), can cause lifelong infections in humans. The viral protein 1/2 (VP1/2) plays an important role in neuroinvasion. Therefore, we mutated two potential sites of ubiquitination in VP1/2 and determined the contribution of these sites to HSV-1 replication. Experiments were completed by infecting cultured epithelial cells. Mutating site 636 had no impact on viral replication. However, mutating site 1976 caused a defect in viral propagation and spread. The data indicates that site 1976 is critical for VP1/2 function. This novel information regarding the regulation of VP1/2 in HSV-1 can potentially provide more insight into the mechanisms behind herpes virus infections of the nervous system.

C37
Effect of Apolipoprotein E4 Allele on Deterioration of Brains in Patients With Alzheimer's Disease

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

Advisor(s)
Lei Wang, Northwestern University

Apolipoprotein E (ApoE) has three allele variations: ApoE2, ApoE3, and ApoE4. The ApoE gene is involved in plasma lipoprotein metabolism and lipid transportation in tissues. The presence of ApoE4 in the central nervous system increases the risk of developing Alzheimer's disease (AD); however, the mechanisms behind the allele ApoE4's connection to AD are unclear. This investigation tests the effect of ApoE4 on the deterioration of the brain in AD patients by comparing the volume of the hippocampus of AD patients one year prior to onset of AD (pMCI patients) carrying ApoE4+ to the volume of the hippocampus of pMCI patients who do not carry the ApoE4 allele. The data was compared quantitatively by running correlation tests on FreeSurfer data analysis software. This investigation hopes to show that the presence of the ApoE4 allele in patients effects deterioration of the hippocampus one year prior to onset of AD. If this is the case then other parts of the brain will be examined for the effect of the ApoE4 allele to see what about the allele causes increased deterioration of the brain. These insights to the ApoE4 allele can help better understand and treat and diagnose patients suffering from AD.

C38
The Effects of A4V Superoxide Dismutase 1 Mutant Protein Incorporation on Calcium Ion Membrane Conductance

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

Advisor(s)
Michael Allen, University of Chicago
Ana Correa, University of Chicago
Jacob Riehm, University of Chicago

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease characterized by a progressive loss of control in the motor neuron system. One possible cause of the familial form of ALS results from mutations in the Cu/Zn superoxide dismutase 1 (SOD1) gene, that lead to defective proteins. The point mutation caused by a substitution of alanine to valine leads to the A4VSOD1 mutant, which is the most deleterious. Our study specifically targets the incorporation of this protein into lipid bilayers and its ability to create ion conducting pores. In our investigation, we used a computer-based system that controls the voltage across lipid membranes in order to measure protein-induced conductance perturbations. These effects were measured by the quantitative differences in the amount of current across the lipid bilayer, due to changes in transmembrane ion flow. Data was obtained for control experiments and other experiments that also included the A4VSOD1 mutation protein. We then analyzed this data to determine the effects of this protein and its ability to create pores that can conduct calcium. Thus far, our results suggest that A4VSOD1 allows higher calcium conductance and more current jump events in the membrane. From these results, we infer that the A4V mutation causes greater toxicity by promoting lipid bilayer instability through its own incorporation into the membrane and that it may contribute to cell death by creating calcium conductive pores.

C39
Designing an Algorithm to Analyze Images of Moving Mitochondria

Presenter(s)
Yash Thacker, Illinois Mathematics and Science Academy

Advisor(s)
Yang Li, Northwestern University
Jane Wu, Northwestern University

Neuron morphology is a useful tool for understanding a neuron's function in terms of processing the synaptic information of the neurons in patients with neurodegenerative conditions such as Alzheimer's and Parkinson's disease. I researched coding an algorithm using MATLAB software based on research findings and equations designed by previous researchers. The algorithm is being written to de-noise images of moving of mitochondria, therefore there is still some time before the data can be collected. While constructing the algorithm we are using particle enhancement techniques and Haar-like features to make the algorithm analyzing capabilities more accurate. Statistical data such as p-values can be used to determine effectiveness of the algorithm in terms of accuracy, in addition to using other tests to compare any significant deviation the algorithm will have in comparison to present algorithms. Based on the statistical tests, we will be able to test the new algorithm for mitochondrial imaging analysis.

C40
Developing an Efficient Immunization Method to Elicit CD8+ T Cells

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

Advisor(s)
Yao Bian, Northwestern University
Chyung-Ru Wang, Northwestern University

Most vertebrate animals express the major histocompatibility complex (MHC) region that codes for MHC molecules responsible for antigen processing and presentation to circulating lymphocytes in order to produce an immune response. Critical to disease survival and pathogen eradication, these immune responses are driven by CD8+ T cells and cytokines such as IFN-gamma to amplify the response. It has been shown that HLA-E, the human homologue for MHC-Ib molecule Qa-1, may be involved in controlling *Mycobacterium tuberculosis* (Mtb) infections. This study investigates two immunization methods, CpG as an adjuvant and Freund's complete adjuvant (CFA), to generate a Qa-1-restricted Mtb-specific CD8+ T cell response in naive B6 and class-II knockout (CII-KO) mice. After sacrificing immunized mice, cells from the spleen and lymph nodes were used as effector cells in an ELISPOT to detect an interferon- gamma immune response. Results show moderate Mtb specificity in CpG-immunized B6 mice, but no Mtb specificity in immunized CII-KO mice, suggesting the importance of CD4+ T cells in priming CD8+ stimulation. Further investigations can determine the Mtb specificity of CFA immunization in B6 mice, possibly leading to the determination of select Mtb peptides' potential to be used in vaccine strategies for humans.

C41
The Effects of the Microflora on Corneal Epithelial Cell Migration *in vitro*

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

Advisor(s)
Ali Djalilian, University of Illinois at Chicago

Damage to the cornea will cause impairment of vision, but it will normally heal with time. This investigation tested whether or not bacteria may improve recovery rates of the corneal epithelia and decrease the amount of time necessary for patients to recover. We tested the secretions of *Staphylococcus epidermis*, a prominent corneal bacterium, and other microfloral bacteria in addition to their respective heat-killed variants on the human corneal epithelial cell line HCLE to examine resulting differences in migration rates via a method called scratch assay. The results indicate that only the secreted products of *Staphylococcus epidermis* increase the rate of migration, an indicator of wound healing. The cells treated with heat-killed bacterial residues and with the secreted products of other bacteria all displayed inhibition of migration rate. Based on the results, we conclude that *Staphylococcus epidermis* may provide the cells with some benefits in corneal epithelial cell migration while heat-killed bacterial residues tested inhibits cell migration.

C42
Determining Gene Recruitment Sequences for Targeting ACT1 Gene to the Nuclear Periphery in Yeast

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

Advisor(s)
Donna Brickner, Northwestern University
Jason Brickner, Northwestern University

The genome in eukaryotic nuclei is spatially organized and has been proposed to function as a regulator of gene expression. In brewer's yeast, many genes are targeted to the nuclear periphery, which promotes their full expression. Gene recruitment sequences (GRS) located within the promoters of genes control their targeting. This inquiry sought to identify the GRS(s) responsible for targeting the gene encoding the essential cytoskeletal protein actin (ACT1) to the nuclear periphery. Fragments of the ACT1 promoter were inserted into a test location in the yeast genome. This strain possesses green fluorescent protein marking the test location and red fluorescent protein marking the nuclear envelope. Images of these cells were captured on a confocal microscope and scored as to whether or not the green dot (the gene) overlapped with the red envelope. The results show that an eight base pair GRS is sufficient to confer localization of the test location to the nuclear periphery. This activity is not affected by the orientation of the fragment. We will test if peripheral localization is lost when a mutated GRS is inserted. Future studies will identify the protein that interacts with this GRS to mediate targeting to the nuclear periphery.

C43
The Role of ER71 in Blood Vessel Development

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

Advisor(s)
Changwon Park, University of Illinois at Chicago

Vascular endothelial cells play a key role in pathophysiological angiogenesis. The purpose of this research was to understand the biology of endothelial cells by performing a series of experiments. To this end, we focused on the ER71 protein which is a member of the ETS transcription factor family. First, we examined whether ER71 could regulate endothelial genes with special focus on FLK1, which is an indispensable gene for endothelial cell development. ER71 cDNA was amplified by polymerase chain reaction (PCR) and cloned into mammalian expressed plasmids. Then, the plasmid was transfected into mammalian cells together with plasmids in which luciferase activity was under control of the promoter of the FLK1 gene. After confirming the proper expression of transfected ER71 with quantitative real-time PCR, luciferase activity was measured. We found that ER71 significantly upregulated the activity of the FLK1 promoter, suggesting that ER71 can act as an upstream regulator of FLK1. We were able to reproduce the results that the principal investigator's lab group found and successfully learned some experiments important for biological science research.

C44
The Absence of Gut Microbes Alters Hepatic Nuclear Receptor Expression

Presenter(s)
Mayuri Yasuda, Illinois Mathematics and Science Academy

Advisor(s)
Eugene Chang, University of Chicago
Kristina Martinez, University of Chicago

Alterations in the gut microbiota may have direct impact on metabolic pathways in the gut and liver. We expect that gut microbes significantly alter the function of hepatic nuclear receptors (NR), constitutive androstane receptor (CAR), and peroxisome proliferator-activated receptor alpha (PPARα), which are major regulators of lipid metabolism. To test this hypothesis, specific pathogen free (SPF) and germ free (GF) mice were fed standard chow diets and high saturated milk fat (MF) diets for twelve weeks. Body weight and food intake were measured weekly. Fat pad weight and liver weight were measured at the end of the study. Liver tissue was collected for measurement of CAR and PPARα target genes via quantitative polymerase chain reaction. MF feeding increased the body weight of SPF mice, but not GF mice. Additionally, the MF-mediated increase of mesenteric fat pad weight was higher in SPF versus GF mice. In the liver, CAR and its target gene cyp2b10 and the PPARα target cyp4a10 were highly expressed in GF compared to SPF mice on chow diet. Interestingly, the MF diet induced CAR and cyp4a10 expression compared to the chow diet in SPF, but not in GF mice. Collectively, these findings suggest a relationship between the gut microbiota and hepatic NR expression.

C45
The Effects of Adiponectin on Fibrosis

Presenter(s)
Sung Yeo, Illinois Mathematics and Science Academy

Advisor(s)
Roberta Goncalves Marangoni, Northwestern University

Systemic sclerosis, a fibrotic disease that has no cure, causes the accumulation of collagen in the extracellular matrix. Adiponectin, a protein secreted in fat tissues, has potent anti-fibrotic effects *in vitro*, and is a current target of research for fibrosis therapy. We hypothesized that adipose adiponectin attenuates fibrosis *in vivo*, and we tested the hypothesis by analyzing the effect of adiponectin on the thickness of the dermis of the mice samples. We first confirmed that our given transgenic mice samples have increased levels of adiponectin using enzyme-linked immunosorbent assay. Using a bleomycin mouse model, a well-known model for the induction of skin fibrosis, we ran the Western blots to detect the amount of collagen in our samples. In addition, we used eosin and hematoxylin and trichrome staining to visually examine the effect of adiponectin on the thickness of the dermis under a bright field microscope. We quantified these thicknesses in each of our samples to test whether the effect of adiponectin on fibrosis was significant or not. All of our results confirmed that adiponectin attenuates fibrosis *in vivo*. Our findings are significant in further research of adiponectin as a novel target for fibrosis therapy.

D01
Possible Short Term Investment Strategy

Presenter(s)
Sun Kim, Illinois Mathematics and Science Academy
John Satter, Illinois Mathematics and Science Academy

Advisor(s)
Richard Kolsky, Northwestern University/Morgan Stanley
Kevin Lynch, Northwestern University/Morgan Stanley

The Super Bowl is one of the most watched events on television on Earth. One of the most anticipated aspects of this event are the famous, comedic, and unique commercials utilized by a multitude of international corporations. This investigation seeks to find a correlation between stock price performance and Super Bowl advertising. If a strong correlation exists, it could then be used to create a strategy for investing in Super Bowl advertising companies during a certain time period after the Super Bowl in order to generate above market returns. The correlation was researched on a short term and a long term basis where the stock prices of companies that advertised were tracked along with their respective indices on specific dates before and after the Super Bowl. The data was inconsistent at times, which made the regressions inaccurate. After several more samples were taken, an applicable correlation between the companies that advertised in the Super Bowl and their short and long term success in stock price could not be found. Therefore, we do not believe one can develop a successful investment strategy based upon whether or not a company is willing to advertise during the Super Bowl.

D02
An Ethnographic Study of Start-Up Businesses and Their Approaches to Defining Target Markets

Presenter(s)
Rohit Mahankali, Illinois Mathematics and Science Academy

Advisor(s)
Carl Heine, Illinois Mathematics and Science Academy

Start-ups today must take the needs of the customer into consideration if they are going to succeed. But how do they do this? This investigation addresses this question to discover how exactly start-ups in 1871, a digital start-up incubator in Chicago, acquire customers and communicate with them. In order to collect data for this project, interviews with professional entrepreneurs were conducted at 1871 using a specific questionnaire regarding their approaches to marketing and defining target markets. The objectives of this investigation were to: 1) Investigate the relation between net quarterly revenue obtained by a business and its customer research funding while simultaneously keeping track of the company in consideration; that is, technology companies, retailers, e-business, and so forth; 2) Understand the mechanisms in a company's selection of target market; and 3) Find out which target markets can yield the most monetary success for various types of start-up companies. Findings indicate that the type of start-up company strongly influences investment in customer research. For example, digital applications, in comparison to traveling companies, invest a lot less into customer research. Other types of companies, such as energy-related companies tend to invest even more money into customer research. Analyzing these patterns is instrumental to understanding start-up companies.

D03
Investigation of the Implementation of Global Positioning Systems in Missiles and New Technologies

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

Advisor(s)
Timothy Vaughan, Richardson RFPD

Global positioning system (GPS) technology is a quickly growing field. This investigation examines both how GPS technology is currently put into use by looking at how it is tested and implemented, as well as the future of the product in several fields. To answer the question of how GPS technology is currently put to use, we looked at the guidance chip used in the AGM-154 missile, testing the signal using a Noise and Gain Analyzer to determine if there's a more efficient method of testing or a way it could be used in non-military applications. To determine the future of GPS technology, the investigation focused on readings by companies that use the technology to see what they are developing. Our results revealed that using a Hewlett-Packard Internet Bus cable instead of a floppy disk would make the testing process of GPS chips more efficient, but that there is no other practical use for the missile's chip as it would be cost-prohibitive in any other field. Our preliminary results indicate that global navigation satellite systems, the field that GPS belongs to, is key to the development of drone technology and other autonomous machines that require accurate location.

E01
Characterization of Polymer Modification via Sequential Infiltration Synthesis Process

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

Advisor(s)
Leonidas Ocola, Argonne National Laboratory

The creation of etch resistant coatings with a polymethyl methacrylate (PMMA) film has benefits in assisting the production of electronic devices, notably hard drives. Using the sequential infiltration synthesis (SiS) process, water and trimethylamine gases alternate injection into a vacuumed chamber onto a PMMA film, and we can form aluminum oxide within the coating. As higher levels of aluminum oxide generate higher etch resistance, we can find an optimal point of etch resistance by testing for the highest amount of aluminum oxide. We examined variables such as temperature, and the delay between the pulses of the gases in an atomic layer deposition (ALD) system. Our results show that the optimal point for delays between gases in the ALD system is around 0.5 seconds since there is the greatest amount of aluminum oxide present. Additionally, the greatest modification in the carbon double oxygen bond takes place at this delay. We also deduced that for PMMA films, a higher temperature also allows for greater aluminum oxide deposits. Our research will lead into a better understanding of SiS processing, which can lead to next generation hard drives.

E02
Atomic Layer Deposition of Hafnium Oxide on a Silicon Substrate

Presenter(s)
Siva Gangavarapu, Illinois Mathematics and Science Academy

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

Atomic layer deposition (ALD) has recently emerged as a cornerstone tool in chemical engineering, especially involving nanomaterials. Using an apparatus that allows modification of temperature and pressure settings with alternating cycles of precursor and inert gas purging, ALD deposits thin films in a layer-by-layer fashion onto a substrate in a highly controlled manner. This study concerned the deposition of hafnium oxide on silicon substrate. The thin film deposition on the substrate surface after the deposition was analyzed through ellipsometry. Preliminary results suggest that certain hydroxyl-containing compounds, such as ethanol and methanol, positively influence deposition of this particular oxide using its organometallic precursor. Specifically, alcohols widen the window of opportunity, which consists of a certain range of temperature, during which the deposition can occur with maximum precision. These results can be applied to deposit thin hafnium oxide coatings for bio-implants, energy, and semiconductor applications.

E03
Using Granular Silicon-Graphene Anodes to Boost the Capacity of Lithium-Ion Batteries

Presenter(s)
Arjit Jaiswal, Illinois Mathematics and Science Academy
Varun Patel, Illinois Mathematics and Science Academy

Advisor(s)
R. Stephen Berry, University of Chicago
George Tolley, University of Chicago

As oil becomes scarce, researchers are looking towards the next generation of vehicle power - batteries. Although lithium-ion batteries have been in production for a few years, they are currently not as cost effective or power efficient as is desirable for general consumption. Our research primarily consisted of analysis of reports on lithium batteries from Argonne National Laboratory as well as universities. We were able to collaborate with scientists leading the national research on batteries and observe the full production of test batteries. We discovered that silicon anodes can provide the battery with 750 watt hours per liter as opposed to 400 to 620 watt hours per liter from traditional graphite anodes. However, silicon is harder to implement in batteries because of swelling and cracking in the battery when ions are transferred to and from the anode. We concluded that silicon grains embedded in graphene sheets would allow the silicon to expand without breaking, while using grains would also reduce the cost. The graphene is able to expand and contract with the transfer of ions, maintaining conductivity. Our findings show that the battery for electric cars can be improved greatly by utilizing granular silicon-graphene anodes, aiding an increase in popularity for electric vehicles.

E04
Engineering Self-Assembling Peptides to Tune the Coordination Environment of Metalloporphyrins

Presenter(s)
Jacob Kronenberg, Illinois Mathematics and Science Academy

Advisor(s)
H. Christopher Fry, Argonne National Laboratory

Metalloporphyrin-binding proteins such as hemoglobin, cytochrome c, and light harvesting proteins play key roles in biology. Materials with similar tunable properties could have applications in areas as diverse as chemotherapy, chemical catalysis, and sustainable energy. A series of heme-binding peptides which self-assemble into long aspect-ratio fibers were designed and synthesized. Techniques such as infrared and circular dichroism spectroscopies were used to analyze the β-sheet peptide secondary structure, whereas scanning electron microscopy was employed to analyze the supramolecular fiber structure. Electron paramagnetic resonance and ultraviolet/visible spectroscopies were used to examine the coordination environments of the bound porphyrins in the fibers. Preliminary findings suggest that the peptides c16-$AHL_3K_3CO_2H$ and c16-$MHL_3K_3CO_2H$ yield a high spin heme, and the peptide c16-$H_2L_3K_3CO_2H$ yield a low spin system. Additionally, results suggest that all peptides can bind carbon monoxide whereas initial results suggest that only c16-$H_2L_3K_3CO_2H$ can reversibly bind oxygen. As a result, we have successfully demonstrated the ability to modulate the coordination environment of a heme molecule within a self-assembled peptide amphiphile construct. Future experiments will determine how these peptide assemblies interact with cells, where it is believed that they may be able to mechanistically trigger cell death in cancer cells similar to that found for cytochrome c.

E05
Computational Study of Propane Dehydrogenation Over Palladium Alloy Catalysts

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

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

Propene, a product of propane dehydrogenation, is a commonly used molecule in industry as a polymer building block. This project examined the energetics of propane dehydrogenation and hydrogenolysis over the PdZn(111) row structure and Pd(111) surfaces using quantum-based computer simulation. Although our experimental collaborators have demonstrated some success with PdZn alloy catalysts, we do not know how the surface geometry influences the result. Using computer simulations, we evaluated the potential energy surface for the dehydrogenation of propane to propene as well as further dehydrogenation and C-C cleavage. Propane dehydrogenation was found to have a lower energy barrier over Pd(111) than over PdZn(111) row structure. However, once formed, propene desorption was favored over further dehydrogenation on the PdZn(111) row surface whereas further dehydrogenation was favored over desorption on Pd(111). Understanding the factors that govern propane dehydrogenation can aid in improvement of the industrial catalyst and thereby decrease production costs and increase yield.

E06
Phase Transitions From Amorphous to Crystalline in Polyethylene Terephthalate Polymer

Presenter(s)
Nida Normantaite, Illinois Mathematics and Science Academy

Advisor(s)
Steven Sibener, University of Chicago

With increased temperatures, a phase transitioning polymer will form lamellar structures, such as spherulites, that originate from a specific nuclei. Polyethylene terephthalate (PET) is a thermoplastic polymer that can be prepared in an amorphous state at room temperature. In order to determine the crystallinity of a PET sample, an atomic force microscope (AFM) was used to probe the surface of a 2.0 millimolar solution of the polymer before and after annealing at high temperatures. Preliminary imaging results suggest a distinct pattern of crystalline structures in the annealed PET that are significantly more organized than the structure of the PET in the amorphous phase. Phase transitions from amorphous to crystalline in semi-crystalline polymers are currently being considered for application in nanocomposite reinforcements.

E07
The Effects of Process Parameters on Metal-Assisted Chemical Etching

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

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

Silicon nanostructures have a wide range of uses, revolutionizing solar cells and sensors for biological systems. One method of fabricating such structures is metal-assisted chemical etching. The rate at which this etching occurs is very sensitive to a variety of parameters. This study observed the effects of different temperatures, solution concentrations, pattern geometry, and metal catalysts on the etching rate. Higher temperatures were observed to correlate with faster etching rates, but also with higher delamination of the metal catalyst from the silicon structures. Lower temperatures correlated to slower etching rates and less delamination. Ideal etching parameters would result in high etching rates and low delamination rates. Varying concentrations of the etching solution resulted in different etching rates. Smaller areas of metal result in higher etching rates. Silver etched faster than gold, but had considerably more delamination.

E08
Detecting and Quantifying Trace Amounts of Silver Nanoparticles and Ions in Solution

Presenter(s)
Mateusz Wojtaszek, Illinois Mathematics and Science Academy

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

This investigation explored methods for quantifying silver ions and nanoparticles in solution. Because silver is a potent antimicrobial that affects humans and the environment, the quantification of free silver is important. The methods explored included light absorbance, light scattering, and quenching of fluorescence. Based on the results, absorbance, scattering, and fluorescence quenching of unaltered quinine with silver have been ruled out as potential assays for silver concentration. These can measure concentrations in the millimolar range, but the desired sensitivity is at least in the micromolar range. Currently, attachment of iodine to quinine is being attempted. Iodine is a potent quencher and published research shows that silver displaces iodine from other fluorophores more readily than other ions likely to be found in ground water. The desired compound for this purpose is quinine iodosulfate. Crystals of a compound with the desired characteristics have been made; the fluorescence is depressed until silver is added. Unfortunately, the sensitivity is still unsatisfactory. However, this method is likely to be more selective for silver than others. Once a simple method for silver quantification is devised, it can be used to ensure silver based products, including water filters, are safe for the population and the environment.

F01
Creating a Fast and Accurate Physics Engine Modeling Soft-Body Collisions with OpenGL and Java

Presenter(s)
Ethan Bian, Illinois Mathematics and Science Academy
Benjamin Rabe, Illinois Mathematics and Science Academy

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

The ability to realistically simulate physics with computers allows experiments to run accurately, efficiently, and at low cost. Modeling soft-body objects is one such realm of computer-simulated physics that has only recently become feasible, as computing power continues to rapidly increase. This investigation has aimed to produce a fast and accurate real-time physics engine with the primary intent of modeling soft-body collisions using OpenGL and Java. However, modeling a variety of types of physics was also a major goal of the investigation. The engine is composed of modules for simulating mechanics, electricity and magnetism, and planetary (large-scale gravitation) effects. The investigation explores a variety of algorithms such as the Runge-Kutta approximation algorithm and the bounding-box collision-detection algorithm. The physics engine produced is an aggregation of such algorithms selected for accuracy and speed. Calculations performed with the chosen algorithms show reasonable adherence to both theoretical and experimental values.

F02
Constructing and Optimizing a System to Store and Protect Corporate Records

Presenter(s)
Remy Bubulka, Illinois Mathematics and Science Academy

Advisor(s)
Brian Gravelle, Business Solutions, Inc.

With the increased widespread use of cloud and mobile computing, many businesses are moving toward an online-only record keeping system. In this investigation the goal was to create a system catered to a specific company before working to make it broad enough to suit the needs of many businesses. The website runs on a server using SQL, which handled the innermost and vital functions such as preserving data. We constructed the user interface using a combination of HTML, JavaScript, and CSS in order to make the system easy to use and aesthetically pleasing. The manipulation of the data was handled by ASP.Net and Visual Basic, which also acted as the connection between the user interface and the server. As a result it is now a quick, efficient, and user friendly way for users to browse any amount of data and all previous records for which they have clearance. It allows users to freely find all information pertaining to their activities and is customizable in order to be usable by businesses in any industry and of any size. In addition to this the system implements an encryption algorithm and restrictive parameters in order to preserve the integrity of the data.

F03
Using Markov Decision Processes to Determine Optimal Claim Policy for Automobile Accidents

Presenter(s)
Advitheey Chelikani, Illinois Mathematics and Science Academy
Saurabh Kumar, Illinois Mathematics and Science Academy

Advisor(s)
Piotr Gmytrasiewicz, University of Illinois at Chicago

Markov decision processes provide a framework for determining the solution to a sequential decision problem. Utilizing the well-known technique of value iteration, we programed a general solver to output the optimal decision given a time horizon. The general solver was applied to a maze environment in which an agent travels through states with a set of possible moves that each result in a specific benefit or loss. The solver calculated the optimal route for the agent given a starting state and a time horizon. The general solver was then adapted to address whether or not a policy holder in Illinois should, or should not, make a claim after having an accident with particular damage amounts. With regards to results, what is important is not to have a chart of optimal behaviors for every possible type of consumer but rather to have a method of calculating such a chart or portion of a chart whenever necessary, and this is what we have achieved. Using the program, insured clients can enter in relevant data following a crash and be advised on a financially optimal decision to make.

F04
Comparing the Rate Monotonic and Earliest Deadline First Scheduling Algorithms

Presenter(s)
Advitheey Chelikani, Illinois Mathematics and Science Academy

Advisor(s)
Shangping Ren, Illinois Institute of Technology

Rate-monotonic (RM) and earliest deadline first (EDF) are two of the most popular scheduling algorithms used for scheduling tasks on processors for applications with deadline constraints. Through researching these two algorithms, I hope to develop a clearer picture as to the differences between the two algorithms and the situations where each should be used. Utilizing the Java programming language, I programmed several different algorithms for task set generation. Using open source tools, my own code, and other available code, I examined the distributions of task sets generated by different task set generators. It is evident that an inherent bias is present in these task set generators. Results show that a more concentrated task set favors the RM algorithm. Further investigation shows that tasks sets with harmonic relations will increase the schedulable utilization of RM. With these results we hope to improve the utilization of computer systems by selecting appropriate scheduling algorithms. By understanding the advantages and disadvantages of RM and EDF, we can make appropriate and application-dependent choices so that the real-time application deadlines can be satisfied and system resources are better utilized.

F05
Showing Ego Depletion and Motivation in Video Games

Presenter(s)
Diana Chen, Illinois Mathematics and Science Academy
Sneha Thakkar, Illinois Mathematics and Science Academy

Advisor(s)
Ian Horswill, Northwestern University

We are investigating the simulation of the psychological phenomenon known as ego depletion in order to realize the best way a programmer can demonstrate more complex psychological concepts in life-simulation games such as the *Sims*. More specifically, we will be showing the process of ego depletion, as recognized by Roy Baumeister. Our coding for this project could be adapted to show other psychological phenomena as well as be used as a possible educational tool. First, we had to learn the basics for C# coding and using Unity. Then, using a pre-made two-dimensional tile-based Sims-like program to create the level design for the space that the characters would be navigating in, we created a scenario upon which we used formulas that we derived to have the character use a more rational decision-making system until it is depleted to switch to the more spontaneous decision-making system. We are using procrastination in our scenarios to demonstrate ego depletion. As of now, the necessary algorithms and coding for the higher level programming are still in the process of being derived, but we are working to attain the desired results: a game that can, as accurately as technologically possible, show the process of ego depletion.

F06
Constructing a Web Interface for the NOvA Experiment

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

Advisor(s)
Maury Goodman, Argonne National Laboratory
Jonathan Paley, Argonne National Laboratory
Louise Suter, Argonne National Laboratory

The NuMI Off-Axis ν_e Appearance (NOvA) experiment searches for subatomic particles called neutrinos in order to answer questions about our universe. This experiment sought to simplify the process of generating graphs from the data in the database by constructing an easy-to-use web interface. A computer program written in the Python programming language was used to assemble and process data from the database. This program then uses the ROOT framework, a data processing system developed by the European Organization for Nuclear Research, to generate plots of this data. A second Python-based web program takes input from a user's web browser and uses the first program to generate a plot based on the user's request. At the time of writing, the interface allows users to easily specify the timeframe and desired data set for a plot. More potential datasets will be added to enhance the utility of the interface, but even in its current form, this investigation has already demonstrated that web technology can be used to enormously simplify access to data for the NOvA experiment.

F07
Measurement of Alzheimer's Disease Diagnostic Accuracy Using Machine Learning Algorithms

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

Advisor(s)
Paul Kump, Illinois Institute of Technology
Miles Wernick, Illinois Institute of Technology

This investigation's purpose is to assess the diagnostic accuracy of machine learning algorithms when applied to diagnosing Alzheimer's disease (AD) from brain images. The work is focused on positron emission tomography (PET) images and magnetic resonance images (MRI) of the brain. Three-dimensional PET scans were used to train algorithms that determine whether AD is present in a patient's brain. First, principal component analysis (PCA) was used to reduce the data's dimensionality, and a Fisher linear discriminant (FLD) was trained to discriminate AD from normal. In the second algorithm, FLD was replaced by a support vector machine (SVM) for discrimination. Finally, FLD replaced PCA for dimensionality reduction, and then SVM was used to perform the discrimination. The performance of the algorithms was evaluated and compared using receiver operating characteristic (ROC) curves, which plot the probability of correct disease detection versus the probability of a false positive result. The ROC curves were computed using k-fold cross validation in which multiple subsets of the training data are used to test the algorithm's accuracy. Surprisingly, of the three algorithms, the first (which uses older techniques) produced the best performance in preliminary evaluations. The next step involves applying the algorithms to three-dimensional MRI scans and comparing performance results with the PET images.

F08
Development of Mechanical Turk Simulations for Auction Theory Research

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

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

Since the development of the internet industry, auctions have become the dominant method of allocation, excelling at systematically and efficiently distributing virtual goods, which are often sold in large batches with many bidders. This investigation seeks to compare the efficiency of human bidders to that of various machine learning algorithms by simulating auctions through the crowdsourcing website Amazon Mechanical Turk using the Python library boto. Workers, recruited within Mechanical Turk, are directed to a Django server running a simulation. Workers are then compensated for participating and are paid a bonus directly proportional to their performance in the simulation. The lack of documentation within our initial Turkit setup and various security issues with the implementation of java applets required us to switch to Python. Currently, our implementation suffers from several issues regarding the simulation website; including the lack of a proper security certificate and bugs with user input. Once complete, it will be possible to pursue human subject testing and to continue with data collection. This project represents a stepping stone in the spread of Mechanical Turk as a resource for experimental economics and the development of the field as a whole.

F09
Transition From Biological Life to the Development of Artificial Intelligence

Presenter(s)
Claire Lee, Illinois Mathematics and Science Academy
Emily Rader, Illinois Mathematics and Science Academy

Advisor(s)
Mike Ososky, Applied Computer Technology

We are constantly surrounded by advancing technology, but will there come a point when our creation becomes sentient? Through the ongoing research of the understanding of neural networks in the brain, such as The Human Genome Project and the Connectome project, scientists can better comprehend the development of biological intelligence, applicable to developing advanced machines. In addition, the recent trends in computer technology such as Moore's Law, an observation that computer hardware has decreased in size and exponentially increased in information storage capacity, suggest that there is also technological potential to engineer an artificially intelligent being. The convergence of both biological and computer science fields could result in the creation of systems capable of exceeding human intelligence. We are already making headway in creating artificial intelligence with robots such as Jeopardy-winner Watson and the computer chess champion Deep Blue. We are not far from building a robot that is self-aware. We can do this by learning how our brains are wired and understanding the capacity for utilizing the developing computer hardware in our society. From our knowledge of neurology, computer intelligence, and the mind, we can make several predictions about what the ramifications may be if intelligent beings are created.

F10
Simulating Bandwidth Reuse Methods to Maximize Speed and Coverage for Cellular Customers

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

Advisor(s)
Randall Berry, Northwestern University
Vijay Subramanian, Northwestern University

The rapid advancement in cellular technology has caused an increase in demand for cellular data services. We must reuse frequencies to compensate for this demand. Frequency reuse is the idea of reusing bandwidth by non-adjacent transmitters. In this investigation, we used MATLAB to simulate various reuse methods in a modern cellular network in which nodes were randomly deployed. We used this simulation to find the rate users would receive when controlling the admission of users and taking into account several parameters: switching thresholds, outage thresholds, and load (users per base station). Our data show that full reuse, using one channel within a system, is the best option with respect to efficiency in bandwidth allocation. Other researchers have come to the same conclusion but did not consider load; however, even when considering load, we came to the same conclusion. Eventually we can implement this reuse method in to the modern system and optimize the speed and coverage for future cellular customers.

F11
Constructing High Quality Three-Dimensional Models With Economical Hardware

Presenter(s)
Nicholas Magerko, Illinois Mathematics and Science Academy
Jonathan Reynolds, Illinois Mathematics and Science Academy

Advisor(s)
Namrata Pandya, Illinois Mathematics and Science Academy
Jason Rock, University of Illinois at Urbana-Champaign

Microsoft's Kinect for Xbox is an inexpensive platform for reconstructing indoor scenes. In comparison to other systems, which commonly cost several thousands of dollars to employ, the Kinect's cost is within the reach of consumers. We utilize two Kinect-based systems: one which generates models by combining multiple views of an object (KinectFusion) and another which extracts best-fit planes from three-dimensional point clouds (RANSAC). This allows us to gain a general understanding of a Kinect-based system's capacity for reconstructing accurate models. The models produced by each implementation are evaluated through quantitative and qualitative methods, respectively. Ultimately, the KinectFusion implementation reconstructs a model which possesses only a moderate difference between the estimated model and the actual model. Visual analysis of the reconstruction suggests that this difference is largely due to issues related to scaling. The RANSAC system, which ideally estimates planes that correspond exactly to the objects in the scanned scene, composes a model that appropriately represents simple objects, such as walls, but has difficulty representing more complex objects, such as three-dimensional printed objects. These observations lead us to believe that using Kinect-based systems for simple reconstructions will generally produce models of a respectable quality.

G01
Effect of Refinery Outages on Petroleum Administration for Defense District - West Coast Gasoline Prices

Presenter(s)
Timothy Gietl, Illinois Mathematics and Science Academy

Advisor(s)
Josh Matalon, TransMarket Group

When oil refineries experience downtime, gasoline supply is disrupted. With the sudden drop in gasoline supply, gasoline spot market prices have a well-known tendency to rise. To better understand how these outages affect gasoline prices, we researched refining, distribution, gasoline, and commodities markets. We then pursued the development of a model for predicting how much these outages will affect gasoline prices in Los Angeles. Based on our preliminary research and similar models made by others, we put together a group of five variables (crude backup in barrels per day, refinery utilization, gasoline production, proximity to spot market, and gasoline stockpile) that we felt were the most significant and easily measurable factors in determining how a refinery outage affected gasoline prices. Using statistical analysis tools in Mathematica we were able to obtain a model that could predict the next day change in gasoline differentials within an average of +/- 2.07 cents of the actual price, or a standard deviation of approximately 0.018. There were still some outages that produced price changes very different from our predictions that had no other explanation than the unpredictability of commodities markets. This model could be useful for fuel hedging, commodities trading, as well as information for average consumers.

G02
Development of Trading and Risk Management Strategies for Ibovespa Index Futures

Presenter(s)
Timothy Gietl, Illinois Mathematics and Science Academy

Advisor(s)
Mark Glasberg, TransMarket Group
Max Rhee, TransMarket Group

Index futures contracts lock in a price of a theoretical stock portfolio, the index, for a specified delivery date. The Brazilian Bovespa Index is comprised of Brazilian domiciled companies and is unique due to its heavy concentration in a few companies such as Itaú, Vale, and Petrobras, which together make up about 22.585% of the total index value. Hedging strategies, such as spread trading, can be implemented to mitigate overall market risk. A spread can be traded explicitly through the exchange or implicitly, by buying the back month and selling the front month contract so as to trade the difference between the two. We focused particularly on the variation from the Fair Futures Value which is determined primarily by the spot market price, interbank deposit rates as cost of carry, and future dividend payouts. By analyzing market trends during the rollover period of a contract, usually starting approximately five days prior to a contract's expiration, we have developed strategies for hedging risk during this period.

G03
A Comparison of Accuracy and Validity of Risk Adjustment Models Used in the Health Care Industry

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

Advisor(s)
Samir Itchhaporia, Blue Cross and Blue Shield Association
Rebecca Maroon, Blue Cross and Blue Shield Association

The recently enacted healthcare law, the Affordable Care Act, is calling for a new process that allows health plans to be compensated based on the underlying health conditions of the member population they serve; this is called risk adjustment. The purpose of this investigation is to determine which model for assessing risk is the most effective based on a comparison of the predicted claim dollar amount to the experienced claim amount as well as the primary factors impacting the effectiveness. The two models being compared are the Health and Human Services federal model and the state of Massachusetts' model. Raw data containing historical member claims was organized by member identification, age, and gender; then processed through each model. The resulting scores were converted to a predicted claim dollar amount and compared to the allowed amount for accuracy. Preliminary results suggest that a model tailored to the specific needs and conditions of an individual state proves to be more effective and accurate than a model that covers all states. The results of this research identify margins of inaccuracy in the current risk adjustment models and will provide a strong foundation for the development and improvement of more refined and precise models for risk adjustment in the future.

G04
How Rigged is the London Interbank Offered Rate?

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

Advisor(s)
Doug Adams, TransMarket Group

In the modern world financial futures, a form of derivative contracts that allow one to lock in a futures price for purchase or sale of a good on a future date, play a larger and larger role in the economy. In the case of currency futures, the futures price is a function of the spot rate until maturity, and interest rate differential (domestic minus foreign risk free interest rates). In reality, the domestic risk free rate is usually approximated by some interest rate benchmarks, usually London Interbank Offer Rate (LIBOR) in this context. Through reading LIBOR-related materials and analyzing data for some of the most frequently traded currency futures, I discovered LIBOR to be ineffective (about 50% efficacy) in predicting futures prices and anomalies in futures prices highly correlated with the extent LIBOR was manipulated in at least one major currency. Overall, LIBOR still fared better than other alternative proxies like Federal funds, certificate of deposit, and Treasury bill rates (less than 40% efficacy).

G05
How Efficient is the Foreign Exchange Market?

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

Advisor(s)
Doug Adams, TransMarket Group

In the context of volatile emerging market conditions currency carry trades become increasingly attractive as investors chase for higher yields on bonds overseas. Fundamentally, a currency's forward value is directly related to its interest rate and thus, exchange rates are essentially based on interest rate differentials. The possibility of widening interest rate differentials means that carry trades prove increasingly viable. In the case of Brazil the bulk of the foreign exchange market lies in the forward market where participants trade today for delivery of currencies in the future. In the case of the Brazilian real against the United States dollar, the forward exchange rate of Brazilian real diverges significantly from its fair value. Since currency risk is a significant risk of these trades, carry trades with emerging market currencies (Brazilian real, South Korean won, Chinese yuan, and so forth) might not prove to be viable. The gain from carry trades could not be realized without taking extraordinary currency risk.

G06
Investigating Central Banking Development, Policies, and Actions Throughout the World

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

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

Central banks act as the primary authority in managing currency, money supply, and interest rates within the state they are located. The central bank acts as a catalyst in maintaining an economic equilibrium between factors such as employment and price stability. Through researching a specific economic crisis the bank's response can be observed, while the outcome of that event yields the success of that method. From such analysis it can be concluded that central banking establishments generally utilize the same strategies in similar circumstances. Their approaches are different with respect to their willingness to instigate change to balance between various factors. A bank such as the European Central Bank takes a very conservative approach, for decisions must be made among the large group of nations affected by these decisions. A bank such as the Federal Reserve is not as limited through having to satisfy multiple governments given that it needs to only work with one, allowing them to be more active in influencing the economy. The Central Bank of China is directly controlled by the government so it conducts the most radical changes to the economy through unusual methods such as manipulating restrictions on business to increase production.

G07
International Pharmaceutical Markets and Patent Law

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

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

The international pharmaceutical market has been dominated by large Western companies for the past century. However, companies which produce generic pharmaceuticals like those in India appear to pose an increasing threat to this long-established market dominance. This study examines the conflict through court cases, patent law, media sources, academic literature, and economic figures related to shifting market control. Through analysis of these sources it was determined that governments of countries with poor pharmaceutical accessibility have encouraged the importation of cheap generics from companies like the Indian Cipla, Inc. by reducing trade barriers and implementing patent law which encourages the production of generics. Conversely, governments of countries with many specialty pharmaceutical companies have largely discouraged the actions of Indian pharmaceutical companies through public declarations and in the past, through economic sanctions. Despite pressure from the international pharmaceutical industry and international governments, the production of generics has continued due to interpretation of patent law by the Indian Patent Office and the needs of unstable international markets. The production of generic prescription drugs in India did not have a significant impact on the international pharmaceutical economy, but did significantly impact the accessibility of drugs which target diseases like cancer and HIV.

G08
A Visually Intuitive Approach to Market Profiles

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

Advisor(s)
Doug Adams, TransMarket Group
Sergiy Mesropyan, Aardvark Trading LLC
Dennis Wang, Aardvark Trading LLC

In the 1960s J. Peter Steidlmayer, while attempting to find market value in chaotic commodities, developed the Market Profile technique to transform disorderly prices to orderly familiar normal distribution-like graphs. A Market Profile is generated by looking at the volume at certain prices and creating a histogram of the distribution of the prices. The Chicago Board of Trade introduced the Market Profile to the public in 1985 and traders all over the world incorporated it into their trading arsenal. During my investigation, I developed a program that accepts tick data and generates this type of histogram programmatically. In addition, I added multiple visually intuitive features to enhance the effectiveness of the Market Profile. My program features volume metrics, auto-generated statistics, color-coded information, and pattern-testing integration. After writing the library that created these histograms, I designed the graphical user interface in C# that retrieves real-time data from our servers and dynamically creates new histograms. Furthermore, settings pop-up to allow the user to adjust tick sizes, time intervals, and commodities. My program, relying on its visually intuitive approach, may allow traders and others to not only bring order to chaotic prices, but also to understand their underlying trends.

H01
Agent-Based Modeling and the Understanding of Causality in College Biology Students

Presenter(s)
Karin Han, Illinois Mathematics and Science Academy

Advisor(s)
Matthew Lira, University of Illinois at Chicago
Mike Stieff, University of Illinois at Chicago

Agent-based modeling environments provide learners with opportunities to explore how local interactions produce global phenomena. Importantly, agent-based models represent emergent phenomena through visual depictions and quantitative descriptions. Little is known about how students integrate visual and quantitative representations. To improve our understanding of learning with agent-based models and agent-based modeling design principles, we explored how students' explanations for emergent phenomena changed after experiencing a narrated animation or a quantitative simulation. Explanations were video and audio recorded for transcription and analysis. Using a constant comparative method, we first analyzed the transcript and identified all causal terms. Then we identified causal links between associated terms to generate causal nets: visual schematics that represent students' statements with a causal factor, a mechanism, and an effect. The results of a contrasting case analysis suggest that students with impoverished understandings can benefit from explicit support in the form of narration. In contrast, students with rich understandings can suffer if explicit support is removed as it was for the simulation. Given that agent-based models include quantitative representations, learning environments that employ them should provide students with scaffolds for making quantitative information explicit.

H02
Black and Latino Student Motivation Engaged in Science, Technology, Engineering, and Mathematics

Presenter(s)
Kayla Ingram, Illinois Mathematics and Science Academy

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

This study explored the phenomenon of motivational factors in gifted and talented Black and Latino high school students that are engaged in science, technology, engineering, and mathematics (STEM). This qualitative research was a case study based on focus group discussions with groups made up of one ethnic group and one gender. The focus groups were recorded and transcribed by the investigator. Common words were identified and quantified by each group individually and compared between groups. The data collected provided insight that could contribute in creating a detailed model of motivational factors of gifted and talented Black and Latino students. This model could help education professionals motivate their Black and Latino students engaged in STEM higher education and establish career goals in STEM.

I01
Design of a Double Rotor Vertical Takeoff and Landing Prototype

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

Advisor(s)
Francisco Ruiz, Illinois Institute of Technology

Vertical takeoff and landing vehicles are unique aircraft that eliminate the need for runways and have the ability to hover above ground. Despite these favorable characteristics, however, this technology is often inaccessible to the average consumer due to the high difficulty of operation. This investigation sought to redesign the drive gear of a double rotor prototype that would make this aircraft more user-friendly. After brainstorming several options to achieve this goal, a three gear system was selected to implement into the design. Major challenges of this project included finding gears with the same pitch that met our desired gear ratio and bridging the 100 millimeter gap between the propeller shaft and the engine shaft. The arrangement found most effective was an array of a ten tooth, forty tooth, and ninety-six tooth gear, two of which were made of steel and the other of a light-weight aluminum alloy material. This new design will allow future researchers to further the operation of the prototype and build a full size model.

I02
Development of a Quantitative System for Evaluating At-Home Standing of the Mobility Disabled

Presenter(s)
Timothy Akintilo, Illinois Mathematics and Science Academy
Vimal Bellamkonda, Illinois Mathematics and Science Academy

Advisor(s)
Arun Jayaraman, Rehabilitation Institute of Chicago
Luca Lonini, Rehabilitation Institute of Chicago
Timothy Reissman, Rehabilitation Institute of Chicago

Studies have shown that sitting for extended periods of time causes numerous health problems, but patients with mobility disabilities can opt to use a prosthesis to avoid these issues. Currently, appraisal of physical therapy relies on outcome measures made at the home or in a clinic. However, current state-of-the-art metrics often rely on questionnaires to evaluate progress at the home, which are not always accurate since they are based primarily on patient perceptions. To improve assessment of patient progress, we developed a radio-based tag and reader system to quantitatively measure the frequency with which patients stand up and reach for objects in a room. The system consisted of a wrist-mounted XBee reader (Digi International, Minnetonka, Minnesota) that stored time and signal strength variables, and several XBee tags placed around a room that reported their signal strengths to the reader. Our initial tests of the system involved healthy subjects reaching for tagged objects in commonly used kitchen locations. An evaluation of the data from these tests showed that there was a correlated increase in signal strength when subjects were reaching, suggesting that it was possible to design an algorithm to return the times during which the patients were standing. Analysis of the algorithm's results showed a low rate of false positives and classification errors, indicating that testing by people with mobility disabilities is a viable next step.

I03
A Physical and Chemical Investigation of the Heusler Alloy Fe_2TiSn

Presenter(s)
Tahj Alli-Balogun, Illinois Mathematics and Science Academy
Thomas Wu, Illinois Mathematics and Science Academy

Advisor(s)
Susan Meschel, Illinois Institute of Technology
Philip Nash, Illinois Institute of Technology

In this investigation we studied the properties of the alloy Fe_2TiSn. This specific composition belongs to a broader class named Heusler alloys. Heusler alloys are metal compounds, usually of the composition X_2YZ, where X and Y are transition metals and Z is in the groups III-V in the periodic table. Some of these ternary compounds exhibit useful properties such as ferromagnetism and shape memory phenomena. Among other properties, we measured the standard enthalpy of formation to be -34.0 ± 2.7 KJ/mol of atoms using a calorimeter. Using X-ray diffraction, we also determined that the crystal structure was face-centered cubic and calculated the lattice parameter to be 6.0683 Å. The results show that our compound is a Heusler alloy. We have not studied the practical application of the material, but our research has contributed to a worldwide database.

I04
Separating Carbon Dioxide Gas From Lawn Mower Exhaust Gases

Presenter(s)
Daniel Atten, Illinois Mathematics and Science Academy
Marissa Borchering, Illinois Mathematics and Science Academy

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

Carbon dioxide gas is a known greenhouse gas that has been accused of contributing to global warming. A major source of the carbon dioxide gas present in the atmosphere comes from exhaust fumes from automobiles, factories, and lawnmowers. We designed a filtration device that utilized a carbonate buffer solution of sodium carbonate and sodium bicarbonate that absorbed the carbon dioxide and separated it from the rest of the exhaust gasses. In our lab testing, we have confirmed that the sodium carbonate buffer system is able to absorb large quantities of the greenhouse gas. Our findings suggest that our filtration system will be able to measurably reduce the amount of carbon dioxide gas entering our atmosphere, creating the possibility of a car filter to reduce the effects of internal combustion engines on the environment.

I05
Purifying Contaminated Water With Silver Nanoparticle-Infused Ceramic Filters

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

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

Over a million deaths each year are caused by unsanitary drinking water. This investigation sought to make a water filter that kills 99.9% of bacteria, filters forty liters of water a day, and costs less than $15. The filter consisted of red clay mixed with sawdust and was molded onto various hemispherical objects. After firing, it was coated with silver nanoparticles in solution. When dry, the filter was hot-glued onto a three inch diameter pipe, approximately one meter in length. Kill rates were determined by running water contaminated with *Escherichia coli* through the filters, plating samples of the filtrates, and conducting colony counts. I have found that a hemispherical filter is superior to a flat disk and is able to kill up to 99.999% of bacteria at low pressure. At higher pressure, the best result so far has been a kill rate of 99.9% with a flow rate of thirty liters per day. These results suggest that the goal of forty liters per day with 99.9% killing may be attainable with further optimization.

I06
Integration of Sensors in a Wireless High Altitude Balloon Cut-Down System

Presenter(s)
Brendan Batliner, Illinois Mathematics and Science Academy
Milan Shah, Illinois Mathematics and Science Academy

Advisor(s)
Lou Nigra, Adler Planetarium
Ken Walczak, Adler Planetarium

High altitude balloons (HAB) are becoming increasingly useful for astronomical research, being an inexpensive and safe option for studying the Earth and the solar system in a near-space environment. At high altitudes (70,000 feet and above), HABs can burst, creating strands of balloon that can tangle themselves in the parachute, preventing it from opening and potentially destroying the payload on impact with the ground. For this reason, a wireless cut-down control system was developed with Arduino microcontrollers to determine if multiple sensor inputs from the balloon's payload can accurately detect user-programmed conditions for cut-down. If so, the system then communicates wirelessly with the cut-down module through Digi XBees to cut-down. We found that managing this critical aspect of HAB flights in this way helps ensure a successful flight. We used a Kalman filter to minimize the effect of noise on the measurements of HAB dynamics, allowing a precise cut-down. It also provides an accurate general logging capability that can be used throughout the flight, and not just for cut-down. The system helps make any HAB flight easy to program to let the user focus more on the research and less on the balloon.

I07
Modifying Wind Turbine Blade Design to Reduce Noise While Retaining or Increasing Power Generation

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

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

The work, continuing from the previous year, investigated methods to design wind turbines with blade shapes to reduce sound generated by blade turbulence while preserving or increasing the original power generated by the turbine. During the first year of the investigation, basic methodologies were established that continued to be used in its second year. Autodesk Inventor computer aided-design was used to create three-dimensional computer models of the turbines. The turbines were then analyzed for aerodynamic efficiency using Autodesk Simulation computational fluid dynamics (CFD). While some preliminary results from last year indicated the effectiveness of the modifications made to the wind turbine blades, there is currently no further quantitative data that supports this. A CFD flow analysis of stationary turbine blades has indicated a reduction in common turbulence patterns, but a more detailed CFD analysis is needed to confirm these observations. CFD progress has been slowed significantly due to licensing difficulties with Autodesk. Three-dimensional printed turbines are being created to test the effectiveness of the modifications in a real-world scenario.

I08
A Multiplexed Readout Scheme for a Large Array of Photomultiplier Tubes

Presenter(s)
Kevin He, Illinois Mathematics and Science Academy
Adit Suvarna, Illinois Mathematics and Science Academy

Advisor(s)
Edward Kearns, Boston University
Jinyuan Wu, Fermi National Accelerator Laboratory

The Hyper-Kamiokande detector is a future neutrino physics and nucleon decay experiment that is projected to take place by 2023. It consists of approximately 99,000 photomultiplier tubes, each of which functions as a light sensor that will, upon detecting light, send a signal to a central computer. Because of such a vast number of tubes, the cable layout must be optimized to reduce space, weight, and cost. Using materials of both computer simulations and physical circuit boards, in this investigation we tested one possible solution, a multiplexed array, which uses one cable to connect and transmit the signals from multiple tubes with minimal loss. This testing takes place using a signal generator and an oscilloscope. Preliminary results suggest that such a configuration is possible and likely practical. The current signal readouts show promising data that match what would be expected in the detector in reality. The circuit accomplishes its intended purpose by successfully transmitting a signal while connected to multiple sources without significant deterioration; this is being confirmed. It can therefore be seen that a multiplexed array would most likely be a pragmatic design scheme for the future Hyper-Kamiokande detector.

I09
Modifying and Reinforcing Bimetallic Strips for Application in Expanding Structures

Presenter(s)
Vinesh Kannan, Illinois Mathematics and Science Academy

Advisor(s)
Mark Carlson, Illinois Mathematics and Science Academy
Vandana Chinwalla, Illinois Mathematics and Science Academy
Carl Heine, Illinois Mathematics and Science Academy

Bimetallic strips consist of two metals with differing thermal expansion coefficients. When heated, this difference causes the strip to bend, an effect commonly applied in thermostats and circuit breakers to open or close connections. This investigation sought to extend this functionality to larger devices or spaces in temperature sensitive areas. A potential application could use bimetallic strips to unfurl a shade in response to heat. However, conventional devices require only minimal curvature or force. A variety of metals (brass, aluminum, steel, and tin) were combined in various dimensions (length 80-200 mm, width 5-10 mm, thickness 0.0125-0.5 mm) to assess the deflections and forces generated from 20^{o}C to 60^{o}C. Heating was done with nichrome wire or water baths. Thus far the brass-steel combination was most successful, but only deflected by 10 mm. Efforts to amplify the expansion effects using a coiled bimetal strip are ongoing. Baseline measurements on a commercially-acquired coil show that a bimetal strip of 180 cm in length can generate a force up to 0.4 Newtons. The deflections and forces thus far generated are insufficient for the proposed applications, but experimentation with a wider variety of metal combinations and dimensions in the coiled form may show greater promise.

I10
Improving the Efficiency of Power Amplifiers in Radio Frequency Plasma Lamps

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

Advisor(s)
Hung Yu David Yang, University of Illinois at Chicago

The radio frequency plasma lamp is an energy efficient and promising future high power light source due to its long operational lifetime, high brightness, and ideal color rendition. In order for this lighting system to be commercially viable, it is essential that the power amplification system powering the lamp is cost effective, compact, and above all, extremely efficient. In this investigation, we used simulation results as a starting point and applied different schematics to experimentally tune for maximum efficiency using distributed inductors and ceramic capacitors. We focused on the harmonic tuning of the power waveform, reducing the power absorbed by the system itself in order to maximize the power delivered to the bulb. As a result, the system's efficiency increased from 60% to a current maximum of 71%. A complete lamp system that outputs over ten thousand lumens is developed based on this highly efficient power amplifier.

J01
Gender-Driven Perceptions of Women in Nineteenth Century British Literature

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

Advisor(s)
Leah Kind, Illinois Mathematics and Science Academy

Physical descriptions of females in Victorian fiction often serve a dual purpose: providing a visual depiction as well as a physical representation of internal character. This investigation categorizes long-term descriptions of female characters in six nineteenth-century British novels as *physical* or *non-physical*. Utilizing these results, it determines the ratio between the categories, and determines whether or not male and female authors describe female characters in significantly different ways. This is accomplished by a thorough reading of the books, identification of descriptors, and entering the descriptive words and phrases into Excel. The data suggest that male and female authors describe female characters with similar numbers of physical and non-physical descriptors. In addition, the ratio of the number of non-physical words to physical words is determined for each character and contrasted with her end fate. Data currently suggest that women with more non-physical descriptors tend to have positive end fates, whereas women with more physical descriptors meet unhappier ends. These data are being confirmed. Additionally, it is likely that characters are described differently in dialogue as opposed to sections of expository writing. Whether these differences trend toward physical or non-physical has yet to be determined.

K01
Synthesis of Isobutanol From Lignocellulosic Biomass Inoculated With Fungus and Bacteria

Presenter(s)
Elise Douglas, Illinois Mathematics and Science Academy
Gregory O'Bannon, Illinois Mathematics and Science Academy

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

Biofuels are widely regarded as paramount in maximizing efficiency, environmental safety, and use of renewable resources, thus constituting a growing field of investigation in the scientific community. We aimed to optimize the biomass concentration and bacterial inoculation duration using an original procedure. Miscanthus grass was first treated with *Trichoderma reesei* to yield saccharides which were then inoculated with *Corynebacterium glutamicum* to produce isobutanol. The product was analyzed using gas chromatography and then compared to non-inoculated saccharides and a pure butyl gas chromatography graph. Our preliminary results suggested that we had identified the isobutanol peak on our graph. We then performed a simple distillation in order to find the concentration of isobutanol in our product and confirm our initial results. Based on these results we were able to determine the efficiency and practicality of our biofuel. However, we were unable to determine the optimum biomass concentration and inoculation time because trends were not apparent with such a small sample size and limited research time. Nonetheless, the study provides an innovative method to synthesize and analyze a low-cost alternative energy source.

K02
Building an Efficient Egg-Based Antibacterial Water Filter

Presenter(s)
Anna Gupta, Illinois Mathematics and Science Academy
David Lisk, Illinois Mathematics and Science Academy

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

Despite existing water filters, over a billion people lack potable water. Our goal was to create a filter that would produce a flow rate of forth liters per day while maintaining a kill rate of 99.9% and a cost of $15. Our filter consisted of one egg white mixed with approximately 10 ml of 0.5 M silver nitrate solution. For support, the mixture was combined with 40 ml of sand or grog, or alternatively percolated into three stacked scouring pads inside a three inch diameter plastic pipe with stainless steel mesh glued to the bottom. The filter was baked at 275˚F for 15-25 minutes. We made a standard dilution of *Escherichia coli*, ran a portion through the filter, and determined the kill rates by comparing the colonies in the plated filtrate to the plated initial dilution. Our optimal filter used scouring pads and produced a flow rate of eighty-six liters per day and a kill rate of 93%. Although most filters met either the flow rate or kill rate goal, only one has been close to meeting both. We are currently trying to achieve both targets by varying the support material and are developing a storage method to allow for repeated use of the filter.

K03
The Role of Climate Change in the Biodiversity of Ant Species

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

Advisor(s)
Gracen Brilmyer, Field Museum
Corrie Moreau, Field Museum

While researchers have predicted climate change to become a threat to biodiversity, it is difficult to track and analyze how humans are impacting native species. As such, the Field Museum's Gregg Collection, which contains over one million specimens of ants collected throughout the twentieth century, provides the ideal indicator species and circumstances to understand the impact of climate change on biodiversity. In order to use the collection's data, I first indexed and created a database of its specimens. For each vial of specimen, I recorded all information, such as habitat, collection method, and date collected, into an easily accessible and well organized spreadsheet. Then, I selected four specific genera (*Camponotus, Formica, Lasius,* and *Leptothorax*) to study. These genera are not only well represented in the collection, but they are also widespread throughout the United States, making them the ideal genera to analyze. By using ArcGIS mapping software and Excel to understand and model the raw data, preliminary results suggest that ant species have indeed experienced a northward move, which is expected under warming scenarios for North America. In addition, it appears that the elevation has increased for most genera. Further results will account for changes in habitat, location, and forest cover. Overall, these results support current trends and hypotheses regarding the impact of the changing climate on the biodiversity of ants.

K04
Chlorella's Effect on Ammonium and Nitrate Levels

Presenter(s)
Bailey Simmons-Brown, Illinois Mathematics and Science Academy

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

Agricultural runoffs from cattle feedlots have excess ammonium and nitrates due to fertilizers and animal waste. Algae typically thrive off these chemicals, so this project looks at using algae to try and rid the water of excess ammonium and nitrates. A high concentration solution and a low concentration solution were made for the *Chlorella* to grow in, and incubated for one week. An ammonium, nitrate, and light absorbance test was conducted each day. The light spectra test indicates the population size of the algae in the flask. An increase was noted in both nitrate and ammonium concentrations. Another test was conducted using the growth media with algae, and an increase was noted in both solutions. This was unexpected because the *Chlorella* was expected to metabolize the ammonium and nitrates. Others have noted that some strains of *Chlorella* have a bacteria living symbiotically with the plant that causes nitrogen fixation. This is a possible explanation for why there was an increase in the levels of ammonium and nitrates. The increase of nitrates and ammonium could be useful or other purposes such as fertilization of crops.

K05
Investigation of the Ecological and Economical Effects of Green Roofs

Presenter(s)
Aaron Victor, Illinois Mathematics and Science Academy
Ziang Wang, Illinois Mathematics and Science Academy

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

Green roofs provide immense benefits by providing extra insulation and reducing the urban heating island effect, air pollution, and flooding of storm water treatment plants. Our investigation studies whether or not green roofs provide sufficient benefits in order to justify their substantial installation and maintenance costs. We created a sedum-based green roof on top of pre-existing energy house and constructed a rainwater collection system. Then, we heated the room and measured the steady-state temperature difference in order to determine the insulation benefits. We also are using force plates and rain barrels to measure storm water delay and retention. We are still in the process of collecting data on runoff delay and retention. An energy balance analysis of the green roof found that 1500 watts of energy were lost at equilibrium. We expected that, at the same temperature conditions, the energy house, without a green roof, would lose more than 1500 watts, but our calculations concluded an energy loss of only 700 watts. This calculation was based on R-value data of the materials used to construct the energy house, which could be inaccurate. We are exploring alternate methods to quantify the energy benefits attributed to the green roof.

L01
Thematic Development in Beethoven's Piano Sonatas and its Applications to Modern Composition

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

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

The piano sonatas of Ludwig van Beethoven have long been considered a cornerstone of not only the piano repertoire, but of classical music itself. They are remarkable for the simultaneous achievement of both aesthetic appeal and compositional ingenuity. This study sought to analyze the means by which a representative group of these works accomplished their primary goal of thematic development and recast these findings in a contemporary context through the composition of the researcher's own sonata movement. Three sonatas from Beethoven's output, No. 8 in C minor, Op. 13 *Pathetique*; No. 16 in G major, Op. 31 No. 1; and No. 27 in E minor, Op. 90, were analyzed using a variety of techniques, including structure, voice, and Schenkerian analysis, intended to reveal overarching developmental patterns. These analyses exposed the primary methods of development to be thematic breakdown and motivic extrapolation; a tendency towards sustained dominant to tonic motion, especially at the end of the development; and reinterpretation of notes not the dominant or leading tone as such to facilitate modulation. Through the composition of a new sonata movement in the style of Beethoven, these techniques were shown to still be viable to a modern composer, speaking to their versatility and potential.

M01
An Examination of the Causes of World War II and the Cold War

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

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

World War Two (WWII) and the Cold War's origins are essential in understanding the modern world. By examining books, articles, documentaries, and primary sources I have tried to determine what caused WWII and the Cold War, and if they were inevitable. I found that WWII was inescapable due to four key factors: 1) the social unrest in Germany caused by the horrible post-World War I economy; 2) a growing Soviet military industrial complex set on exporting Communist ideology to Europe; 3) Japan's technological advantage over East Asia and its need for resources; and 4) the inaction of Anglo-American forces in the 1930's. The Cold War was caused by Soviet obduracy and America's decision of a middle road between appeasing the Soviets and being tough with them. Had America either wholeheartedly defended its ideologies or accepted the progress of the Red Army during WWII, the Cold War as we know it could have been avoided. The causes of these conflicts can never be known with certainty, but those above are the most likely, and allow us to objectively understand the twentieth century, prompting informed decision making in the twenty-first century.

M02
Vikings and Monasteries: An Analysis of the Conversion of Medieval Europe

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

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

In the Medieval era, Northern and Eastern Europe converted to Christianity and moved away from paganism. What circumstances brought this shift and has Christianity completely supplanted pagan traditions? This investigation utilized documents written by the churchmen of the Middle Ages, Viking religious texts, and modern analyses of Christian conversion efforts in order to build a body of knowledge of Christianity in multiple regions of Northern and Eastern Europe, most of which had Viking influences. Ultimately, it appears that conversion efforts typically began with missionaries converting a small number of a populace regardless of regal support. However, leaders often then converted in response to external political pressure, a desire for legitimacy, or earnest belief. Once a ruler converted, pagan reactions occurred, but they quickly subsided as the new region assimilated to Christianity. However, the converted regions rarely left their entire pagan past behind, for syncretism pagan traditions combined with Christianity. What had been Viking Europe converted to Christianity, but it maintained some of its initial culture through syncretism.

M03
Confucius to Fake Gucci? A Historical Approach to Explaining the Development of China's Black Market

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

Advisor(s)
Kirsty Montgomery, Illinois Mathematics and Science Academy

The black market is defined as the "illicit trade in goods or commodities in violation of official regulations." A free market for everything from drugs to organs to, perhaps more popular among unsuspecting customers, stolen or counterfeit retail and technology, it is a growing form of underground economy that has developed immensely in the past century, especially in China. China's counterfeiting issue has impacted not just domestic economy, but also international economy. This study examined China's black market in counterfeit retail and technology and, through the lens of history, came to several conclusions to help answer the question of how and why it has developed so rapidly. Scholar Peter K. Yu claims that ancient Confucian ideals predisposed the Chinese to counterfeit goods in the present. This study rejects the theory as a misinterpretation of text. Instead it proposes that the Great Divergence that began in the late eighteenth century left China scrambling to modernize in the last few decades. It is also proposed that China's slow development of intellectual property protection and strong centralized government led to a weaker legal system compared to its Western counterparts.

N01
A Study of the Application of Death Penalty Law in Sub-Saharan Africa

Presenter(s)
Edward Jun, Illinois Mathematics and Science Academy

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

This study investigates certain key judicial decisions relating to the death penalty in Sub-Saharan Africa, and analyzes their relationship to country-wide and regional trends in the application of the death penalty. This study observed how court rulings either reflected or were inconsistent with those trends, through thorough analysis of several landmark court cases in different regions of Sub-Saharan Africa, documentation by human rights bodies like the United Nations, and by data analysis of executions, laws, government statements, and other sources in Sub-Saharan African nations. These separate, yet equally important pieces of evidence were put together to display a large scale picture of the current application of the death penalty in Africa and trends moving into the future. Preliminary results suggest that while a growing number of nations are refraining from using the death penalty or abolishing it altogether, some countries still continue to use the death penalty at a high rate, often carrying out death sentences that are inconsistent with international human rights laws and governing trends in the application of the death penalty. This study looks to build a foundation upon which further investigations can study the death penalty in Sub-Saharan Africa as trends in both legislation and application change in future years.

O01
Taking the Red Pill: Degenerations of Matrix Space

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

Advisor(s)
Nir Avni, Northwestern University

A representation is an object that replaces the elements of a group with matrices. The groups we are looking at are the fundamental groups of surfaces and the matrices are inside one of five exceptional matrix groups. The collections of all such representations, called representation varieties, are pinched in some places. If the number of holes in the surface is big enough, these pinches are tame (they are technically known as rational singularities). Using Python, we have created routines that produce and degenerate the equations that describe the representation varieties. There are two kinds of degenerations that can be applied. One is lossless; the other is lossy (it increases the number of holes needed for the surface). By carefully applying a lossless degeneration, we have made the equations simple enough to draw as graphs. Using lossy degenerations, we can separate the graph into discrete edges, which demonstrates the rationality of the singularities. The work left to us is to optimize our use of lossy degenerations; potentially reducing the standing upper bounds from approximately three times dimension to one half the dimension. This research lays a foundation for similarly computational proofs.

O02
Examining Influential Factors for Team Pitching Environments in Major League Baseball

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

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

The complex game of baseball can be described using a vast variety of metrics and statistics. Analysis of these statistics can help to more accurately describe and make predictions about the game. Using a final set of data from 1998-2012, I examined the effect of different aspects of specific teams on a pitcher's performance. Using regression models from this data, I found the expected effect each team would have on a pitcher's earned run average based on that pitcher's fielding independent pitching value, and the team's defensive efficiency, pitching park factor, league, winning percentage, and errors. These models showed how significant each of these team factors is in influencing a pitcher's performance. For example, defensive efficiency showed a strong negative trend in earned run average output while pitching park factor showed a surprisingly weak trend in predicting earned run average. Understanding which variables are the most influential on pitching performance can help scouts, team management, fantasy owners, and fans of the game to make more accurate predictions about how a pitcher will perform over the course of the season.

O03
Upset Definition and Prediction in Tennis

Presenter(s)
Suraj Sinha, Illinois Mathematics and Science Academy

Advisor(s)
Yea-Jane Chu, IBM Business Analytics
Jing Shyr, IBM Business Analytics

Statistics have always been essential when discussing projections, ratings, and/or ranking certain players or teams in sports. These rankings are based on the International Tennis Federation points that are accumulated by each player over a two year span. When predicting the victor of matches, people use these rankings assigned to each player as a basis for their prediction. When a significantly lower seeded player defeats one of higher seed, the match is called an upset. The aim of this investigation was to provide an accurate and specific definition to the word significant. How much lower must a player be ranked in order for the match to be called an upset? The second challenge of the investigation, once an upset was defined, was to find out what factors might explain upsets and predict how likely these upsets were. As a whole, the goal of the investigation was to model an entire tournament based upon data from the US Open over the past ten years. Through this investigation, I have explored various methods of statistical modeling in order to attempt to adequately describe a complete tournament by assigning probability values for upsets to occur.

O04
Counting Rational Space Curves Meeting Lines and Points Using the Method of Degeneration

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

Advisor(s)
Izzet Coskun, University of Illinois at Chicago

Classical algebraic geometers used the method of degeneration to count rational curves meeting lines and points in space. Modern work has placed this method on the rigorous foundation of the moduli space of stable maps, and thereby given a precise description of the multiplicities and degenerations involved. Using dimension counting, we determine the numbers of points, lines, and secants that specify finite numbers of rational space curves of any degree. Next, we apply the method of degeneration by repeatedly specializing line and point constraints into a fixed plane and counting the limiting solutions with appropriate multiplicities. The structure of the moduli space of stable maps allows us to describe the result of this specialization. Combined with elementary geometric arguments, as well as the enumeration of rational plane curves meeting points in general position, this procedure allows us to recursively count the number of rational quadric, cubic, and quartic curves meeting certain combinations of points, lines, and secants, in a more systematic way than was possible classically. We conclude that our method is very effective for enumerating small degree rational curves, but it becomes difficult to carry out in practice as the degree increases.

P01
Assessment of the Degree of Variation of Histologic Inflammation in Ulcerative Colitis

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

Advisor(s)
Sarah Goeppinger, University of Chicago
Adam Mikolajczyk, University of Chicago
David Rubin, University of Chicago

In the past, disease activity of ulcerative colitis (UC) has been measured using endoscopic techniques, but more recently, undefined histologic measures have been employed. The adoption of this measurement technique has been hindered by a lack of evidence guiding interpretation and reproducibility of results. The aim of this study was to characterize intra-segment and inter-segment variation of histologic scores of colonic mucosal inflammation in patients with UC. In total, 1802 biopsy segments from the rectum, right side, or left side colon were graded using a novel, previously validated six-point histologic inflammatory activity (HIA) scale. The data was analyzed for intra-segment variability, and the mean maximum proportion for the rectum was 85.5%, the left side was 79.6%, and the right side was 82.7%. For the ordinal inter-segment analysis, the mean maximum proportion across all of the segments was 70.2%. Inter-segment variation in a continuous model demonstrated a coefficient of variation of 25.4% for HIA scores in patients with left-sided colitis and 14.7% in patients with pancolitis, neither of which were significantly greater than zero. Based upon these results, using the previously validated scoring system, minimal variability was demonstrated between biopsies within each colonic segment and among different segments in patients. These conclusions have meaningful effects upon the utilization of histology as a clinical trial and treatment endpoint for UC.

P02
An Evaluation of Chicago Public Schools' Health-Related Policies

Presenter(s)
Prachi Aggarwal, Illinois Mathematics and Science Academy
Jenson Phung, Illinois Mathematics and Science Academy
Shreya Santhanam, Illinois Mathematics and Science Academy

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

The goal of this investigation was to determine the effectiveness of the promotion and content of two Chicago Public Schools (CPS) health-related policies: the Food Allergy Management Policy and the Administration of Medication Policy. A questionnaire surveying the promotion, content, and impact of these policies was distributed to CPS parents, with and without food allergic children, and school nurses. Of the CPS parents surveyed, only 36.4% of parents with food allergic children and 25.2% of parents without food allergic children were aware of the new policies. Of the nurses surveyed, only 63.6% supported the new CPS health-related policies and only 47.1% reported their school(s) as having a written plan or protocol for food allergy emergencies. These findings suggest that many CPS parents still do not know about the health-related policies impacting their children, and school nurses are not fully on board with them. Therefore, there is a need for increased policy promotion and communication between the school district, clinical school staff, and CPS parents. In addition, it is recommended that the rest of the CPS health-related policies be evaluated to provide a more complete understanding of health-related policy promotion and impact in the district.

P03
Epidermal Growth Factor Ameliorates Transforming Growth Factor β-Induced Collagen Deposition in Pancreatic Stellate Cells

Presenter(s)
Ryan Chiu, Illinois Mathematics and Science Academy

Advisor(s)
Paul Grippo, Northwestern University
Windel Emman Mascariñas, Northwestern University
Daniel Principe, Northwestern University

Pancreatic ductal adenocarcinoma (PDAC) currently stands as one of the deadliest cancers in the United States, with an aggregate five year survival rate of only 4%. Recent therapeutic efforts for PDAC have centered around two potent cellular growth factors, epidermal growth factor (EGF) and transforming growth factor beta (TGFβ), which converge downstream to promote cell survival and proliferation in advanced carcinomas. However, a major barrier in the therapeutic targeting of the cancer is the expansion of surrounding stroma. In order to address the tumor-associated fibrosis observed in most pancreatic cancers, human pancreatic stellate (hPSC) cells were cultured *in vitro* and treated with recombinant EGF and TGFβ. Interestingly, in hPSC cells, these two factors did not seem to exhibit the downstream convergence observed in other cell types. In addition, EGF, generally considered a mitogen, unexpectedly led to rapid induction of the anti-proliferative factor p21. Furthermore, EGF drastically attenuated TGFβ-induced collagen deposition. These results challenge the canonical role of EGF in the tumor microenvironment, and may offer one possible explanation for the reduced clinical efficacy of EGF receptor-targeted therapies.

P04
Assessment of Non-Rapid Eye Movement Delta Sleep and its Correlation to Excessive Daytime Sleepiness

Presenter(s)
Lohitha Guntupalli, Illinois Mathematics and Science Academy

Advisor(s)
Samir Patel, Springfield Clinic

This project investigates the correlation between the amounts of delta wave sleep achieved by a person self-reporting to have excessive daytime sleepiness (EDS), to the scored Epworth sleepiness scale (ESS) and mean sleep latency on a mean sleep latency test (MSLT) in known idiopathic hypersomnia patients. Retrospective data of human sleep records from Touchworks, the Springfield Clinic's electronic database, was assessed to find the correlation of the achieved delta sleep to the EDS. The data was collected through polysomnograph studies. A Pearson's correlation coefficient test was conducted to see if a relationship existed between the amounts of delta sleep achieved to the ESS scored and mean sleep latency. It was concluded that no significant correlation existed between delta wave Stage 3 sleep and one's sleepiness in the morning (ESS and MSLT). Stage 2 sleep was found to be the only stage in which there was a significant, yet weak, correlation with both ESS and MSLT. If the sample size for ESS versus Stage 2 was increased to 103 patients, and the sample size for MSLT versus Stage 2 was decreased to 70 patients, a significant correlation may have existed. Time spent in Stage 2 may influence how sleepy a person is.

P05

Pain Trajectories Across Different Variables for Inpatients at the University of Illinois at Chicago Medical Center

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

Advisor(s)
William Galanter, University of Illinois at Chicago

There is no objective way to measure pain. Instead, the numeric rating scale (NRS) allows a patient to rate his or her pain on a scale from 0 to 10. The University of Illinois at Chicago Medical Center has collected this pain data in two data sets. The first data set contains pain scores from January 1 to March 31 of 2012 in inpatients who have taken at least one opioid medication, while the second set contains pain scores for all inpatients from March 1 of 2012 to February 28 of 2013. Data was analyzed by looking at relationships such as pain as a function of time. The graph of this relationship has a characteristic shape: it looks like a vertically shifted exponential function that flattens out after approximately 12 hours. Additionally, no statistical difference was found between the data of those that had taken opioids and all inpatients with initial pain above five. Finally, patients' pain trajectories differ based on the type of care. The fact that pain scores tend to drop exponentially but flatten out at a constant above 0 implies that there is still room to improve pain treatment, as optimally the graphs of pain should flatten out at as low a value as possible.

P06

Effects of T1L Reovirus Infection on Antiviral Response of Human Lamina Propria Cell Types *in vitro*

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

Advisor(s)
Romain Bouziat, University of Chicago
Reinhard Hinterleitner, University of Chicago
Bana Jabri, University of Chicago

Celiac disease (CD) is an inflammatory intestinal disorder with autoimmune components induced by gluten ingestion in susceptible patients characterized by loss of oral tolerance (LOT) to gluten. Preliminary studies show that T1L reovirus infection causes upregulation of type-1 IFN and interferon inducible genes (ISGs) in the lamina propria (LP), causing LOT to gluten. Human LP lymphocytes were isolated by flow cytometry. Human gamma delta T cells and alpha beta T cells from biopsies were sorted, expanded, and infected *in vitro* with T1L reovirus. Gene expression was measured using reverse transcriptase polymerase chain reaction. Data from LP lymphocytes of mice orally infected *in vivo* with T1L reovirus was used as a background for comparison and experiment design. MxA expression data shows human gamma delta T cells respond to T1L infection while alpha beta T cells do not, indicating functional differences between them. Preexisting data about Mx1, ISG15, and IRF7 expression shows oral T1L infection of mice can induce ISGs to different extents in most lymphocytes. These different levels of response among lymphocytes await further investigation in human cells. Overall this data provides important insights into interactions between T1L reovirus and the immune system which will broaden our understanding of how viral infections cause autoimmune disorders like celiac disease.

P07
The Correlation Between Gestational Age and Independent Oral Feeding in Preterm Newborns

Presenter(s)
Sharon Johnson, Illinois Mathematics and Science Academy
Sophia Lam, Illinois Mathematics and Science Academy

Advisor(s)
Jonathan Muraskas, Loyola University
Sarah van Nostrand, Loyola University

Preterm infants cannot coordinate sucking, swallowing, eating, and breathing until they approach forty weeks gestation (term pregnancy). The development of independent oral feeding is a major criterion for safe neonatal intensive care unit discharge to home. Our project investigated the gestational age (GA) at independent oral feeding in preterm infants. Specifically, we studied the GA, or the age of the infant (weeks since conception) at which the infant achieves independent oral feeding. We analyzed data from 3307 patient records compiled between 1978 and 2013. We evaluated the GA at independent oral feeding for three different categories: maternal age; birth weight; and appearance, pulse, grimace, activity, and respiration score at birth (APGAR). To analyze the categories, we used an Analysis of Variance test. All results were statistically significant (p values less than 0.05). The overall mean of the GA at independent oral feeding was 36+3/7 weeks with a standard deviation of 15 days. Our results demonstrated that maternal age, birth weight, and APGAR score significantly influenced the oral feeding maturation. Infants born to younger mothers (teenage) with birth weight exceeding 1500 g (3 pounds and 5 ounces) who did not require resuscitation at birth (high APGAR scores) achieved independent oral feeding significantly earlier.

P08
Burn Injury Alters the Intestinal Microbiota and Increases Inflammation and Risk of Sepsis

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

Advisor(s)
Mashkoor Choudhry, Loyola University
Zackary Earley, Loyola University
Xiaoling Li, Loyola University

Half a million cases of burn injury resulting in four thousand deaths are reported nationally every year. Previous studies have shown that burn patients suffer a global immune response characterized by a breakdown in epithelial barrier integrity in the gut, leading to inflammation and sepsis. However, the diversity of the intestinal microbiota following thermal injury and its implications in inflammation and infection are unknown. Male C57BL/6 mice were subjected to a 20% body surface area burn or sham burn and sacrificed on days one, three, and five. DNA was isolated and purified from the distal small intestine feces and the large intestine feces. This DNA was subjected to quantitative polymerase chain reaction to quantify specific bacterial groups found within the gut microbiome. Quantitative polymerase chain reaction analysis of the DNA isolated from the small and large intestine feces showed that burn increased total bacteria 20 fold, while also significantly altering specific bacterial groups. These results suggest that burn injury promotes a dysregulation of the gut microbiota, which may have a significant role in post burn inflammation and sepsis. Thus, these results may modify treatments for severe burn patients to restore the gut microbiome, reducing the risk of implications following thermal injury.

P09
Effects of Transcranial Direct Current Stimulation on Reaching Distance of Impaired Arm Post Stroke

Presenter(s)
Frances Seo, Illinois Mathematics and Science Academy

Advisor(s)
Fleur Veltink, Northwestern University
Jun Yao, Northwestern University

Abnormal joint coupling between shoulder abduction and elbow flexion (that is, flexion synergy) is prevalent in most individuals with moderate to severe stroke, which reduces their reaching ability. The objective of this study is to improve our understanding of the neuromechanisms involved in flexion synergy. We hypothesize that increased brain activity in lesioned hemisphere causes decreased flexion synergy and increased reaching distance, while the decreased brain activity in the non-lesioned hemisphere results in the inverse. Nine individuals with moderate to severe stroke participated in the three session study. In each session, they repeated reaching tasks with various shoulder abduction (SABD) loads before and after a 15-minute brain modulation. During brain modulation, one of the three transcranial direct current stimulations (tDCS), cathodal non-lesional, anodal lesional, or sham stimulation, was applied. A two factor (time before and after stimulation, SABD load) repeated measures ANOVA test reported significant effect of the stimulation on maximal reaching distance, and significant interaction between time and SABD load ($p=0.05$) for cathodal non-lesional tDCS. For other stimulations, we did not find any significance. Our results indicate that downregulation of cortical activity in the non-lesional hemisphere may upregulate the brainstem activity, thus increasing the flexion synergy.

P10
Does Connective Tissue Growth Factor Cause Left Atrial Fibrosis in Dilated Cardiomyopathy?

Presenter(s)
Abhishek Sethi, Illinois Mathematics and Science Academy

Advisor(s)
Allen Samarel, Loyola University

Connective tissue growth factor (CTGF) is a protein secreted by cardiomyocytes and fibroblasts. CTGF stimulates collagen production which may lead to atrial fibrosis and arrhythmias. CTGF expression is regulated by protein kinase C. Our laboratory is studying a transgenic mouse in which a constitutively active form of protein kinase C-epsilon (ca-PKCε) is expressed exclusively in cardiomyocytes. These animals have enlarged left ventricles and left atria (LA), producing a dilated cardiomyopathy (DCM). Our hypothesis is that PKCε causes over-production of CTGF, which in turn causes LA enlargement, fibrosis, and arrhythmias. We used echocardiography to measure LA diameter and found that ca-PKCε mice had a larger LA diameter than wildtype FVB/n mice. Furthermore, the difference in LA size increased with age. We performed Western blots to analyze CTGF expression in LA tissue and found that caPKCε mice had a much greater CTGF concentration than nontransgenic animals. We also analyzed hydroxyproline, a biochemical marker of excess collagens. We found that hydroxyproline was also significantly increased in ca-PKCε LA tissue. Finally we observed that atrial arrhythmias were much more common in caPKCε versus FVB/n mice. Studies are underway to determine if treating mice with CTGF blocking antibodies prevents atrial enlargement, fibrosis, and arrhythmias in this DCM model.

P11
Clinical Studies in Venous Leg Ulcers and Incisional Hernias

Presenter(s)
Vimig Socrates, Illinois Mathematics and Science Academy

Advisor(s)
Jing Liu, Northwestern University

New medical drugs or devices undergo extensive tests for effectiveness and safety assurance before they are mass produced and disseminated to the public. The final stage of drug testing involves human clinical trials, where volunteer patients are studied to see the practical consequences of new treatment. Through this investigation, treatment mainly continued in a spray solution for leg ulcers. I preformed the pre-clinical procedures before the doctor comes in for all patients with leg ulcers. This includes cutting off the compression bandages, applying Vaseline, and taking vitals for the patients. In addition, we manage the database for another clinical study for a polytetrafluoroethylene hernia mesh using Microsoft Access. Currently, both studies show significant improvement in quality of life for patients and a lowered rate of recurrence in both hernias and ulcers. While the study has yet to be concluded, all patients seem to continue to benefit from these new procedures.

P12
The Role of Gut Microbes in Regulating Dietary Fat-Mediated Alterations of Nuclear Hormone Receptor Expression

Presenter(s)
Simona Stancov, Illinois Mathematics and Science Academy

Advisor(s)
Eugene Chang, University of Chicago
Kristina Martinez, University of Chicago

The development of treatments for the prevention and amelioration of obesity is a major focus of the twenty-first century. Several groups postulate that the enteric microbiota plays a key role in the onset of the disease, partly because rodents without gut microbes are protected from diet-induced obesity. Notably, the lean and obese phenotypes are associated with certain expression levels of nuclear hormone receptors (NHR), transcription factors that regulate whole body metabolism. Therefore, it is useful to determine whether gut microbes serve as mediators of high fat (HF) diet-induced alterations in NHR expressions. To begin this ongoing investigation, we fed specific pathogen free (SPF) mice with low fat (LF) and HF diets for four weeks. We expected to observe downregulation of constitutive androstane receptor (CAR), which suppresses lipogenesis, in mice fed HF diets. Although these rodents gained the most weight and had significantly higher lipogenic gene expressions than mice fed the LF diet, CAR was not downregulated. Therefore, the observed upregulation might be attributed to increased activity of NHRs that promote energy storage. Comparison of the microbiomes of the mice fed the LF and HF diets can help us determine whether certain microbes are related to the NHR and target expressions that were measured.

P13
The Effects of the Novel Agonist 390 on the CXC Type 4 Chemokine Receptor

Presenter(s)
Shruti Topudurti, Illinois Mathematics and Science Academy
Selam Zenebe-Gete, Illinois Mathematics and Science Academy

Advisor(s)
Richard Miller, Northwestern University

The chemokine receptor, CXC receptor type 4 (CXCR4) aids in the movement, or chemotaxis, of stem cells. Hence drugs that activate this receptor may be useful in brain repair following stroke or trauma. Based on the use of modeling, drug 390 was previously determined as a small molecule agonist of the CXCR4 receptor due its similarities to the natural ligand of CXCR4, stromal-derived factor 1 (SDF-1). Varying concentrations of 390 were tested using a calcium imaging apparatus in order to find the optimal concentration that will cause maximum activation of CXCR4. The activation results in increased intracellular calcium production, which was recorded using fura-2 fluorescence, which binds to intracellular calcium, and a calcium imaging machine. Cultured human melanoma cells were used as a source of CXCR4 receptors. The results were analyzed into a dose response curve and indicate that 1 μM is the most effective concentration. Thus, a 1 μM concentration of 390 will provide the optimal agonist effect. The overall effects of the novel drug 390 appeared to be similar to those produced by SDF-1 on the same cells.

P14
The Future of Healthcare Reform: The Quantitative and Qualitative Implications of Value-Based Care

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

Advisor(s)
Samir Itchhaporia, Blue Cross and Blue Shield Association
Rebecca Maroon, Blue Cross and Blue Shield Association

In response to an ever-changing healthcare climate and increasing costs, this investigation focused on the research of innovative methods to improve all aspects of healthcare in the United States. Researchers formed a comparison between the twenty-first century concept of value-based care and traditional fee for service care. Value-based care focuses on a holistic approach that provides motivations for quality outcomes by rearranging incentives. In addition to a qualitative research component examining secondary sources, a data analysis was performed to investigate the cost and frequency associated with each type of care. The analyses were run on a data set provided by the Blue Cross Blue Shield Association using Microsoft SQL and Excel software. Preliminary results suggest that while value-based care may provide higher quality care and more preventive measures, the relative costs are higher than those of a fee for service arrangement. While only basic statistical analyses have been run thus far, researchers hope to substantiate their early findings with further insights into the cost of value-based care over time. This research will identify whether net savings can be derived from more preventive measures, though initially more expensive.

P15
Identifying the Melanosomal Component Responsible for Selective Sensitivity to Bleaching Phenols

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

Advisor(s)
Jonathan Eby, Loyola University
I. Caroline Le Poole, Loyola University

Tyrosinase binds to tyrosine, its substrate, to catalyze the production of melanin, the pigment found in melanocytes. Bleaching phenols are thought to cause death by conversion to toxic substances, as their structures can be mistaken for tyrosine. Which enzyme causes this cytotoxicity when melanocytes are exposed to phenols? We transfected human embryonic kidney 293 (HEK293) cells with mouse DNA encoding tyrosinase, tyrosinase-related protein 1 (Trp-1), tyrosinase-related protein 2 (Trp-2), glycoprotein 100, and melanoma antigen recognized by T-cell proteins. HEK293 served as the negative control because none of the proteins are naturally present, while B16F10 served as the positive control as all the proteins are there naturally. We used fluorescent activated cell sorting and Western blots to detect the presence of the proteins in the cells. We measured cell viability with methylthiazol tetrazolium assays after exposure to 125 μM and 250 μM monobenzyl ether of hydroquinone (MBEH) and 4-tertiary butyl phenol, the bleaching phenols. Our data shows that cells with tyrosinase had low viability to MBEH for both concentrations. Tyrosinase may contribute to cytotoxicity when exposed to phenols.

P16
Effects of KBU2046 on Common Chemotherapeutics and Androgen Regulation in Breast and Prostate Cancers

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

Advisor(s)
Raymond Bergan, Northwestern University
Xiaoke Huang, Northwestern University
Megan Schrementi, Illinois Mathematics and Science Academy

KBU2046 is a novel anti-metastatic prostate and breast cancer drug that suppresses tumor invasion *in vitro,* and metastatic formation in animals. This investigation determined how KBU2046 interacts with common chemotherapeutics in both breast and prostate cancers and analyzed the drug's effect on androgen regulation in prostate cancer. Using the MCF-7 breast carcinoma cell line and the PC-3M prostate cancer cell line, we performed a cell viability assay with KBU2046 in combination with chemotherapeutics vinblastine, paclitaxel, and doxorubicin. It was found that KBU2046 does not significantly alter the sensitivity of either cell line to chemotherapeutics. To test the effect of KBU2046 on androgen regulation in prostate cancer, we performed quantitative reverse transcription polymerase chain reaction with primers for prostate-specific antigen (PSA), whose expression is androgen-regulated. The LNCaP prostate adenocarcinoma cell line was cultured with varying combinations of KBU2046, R1881 (a synthetic androgen), and/or bicalutamide (an anti-androgen used to treat prostate cancer). It was found that KBU2046 inhibits PSA expression and supplements the efficacy of bicalutamide. Both sets of results are promising for the drug's clinical trials, as KBU2046 acts synergistically with common chemotherapeutics in breast and prostate cancers and does not aggravate androgen expression in prostate cancer.

Q01
Alteration of Brain Connections in Resting State Networks After Performing Simple Motor Actions

Presenter(s)
Kristin Carlson, Illinois Mathematics and Science Academy

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

Connected brain regions oscillate at similar frequencies in the resting state network (the active network during periods of no explicit activity also known as RSN) as shown by functional magnetic resonance imaging (fMRI) scans. Motor-related regions are expected to show increased connections after performing simple motor tasks. In this study, sixteen participants received an fMRI scan before performing the following actions: rest, squeezing a ball, chewing gum, or receiving a caffeine injection. After 10 minutes of performing the task, the subjects received another fMRI scan. Analysis of the post activity scans showed differences between brain activities in the RSN between each of the tasks performed. The hippocampus, posterior cingulate cortex, post-central, and pre-central networks showed the most significant differences in brain activity between tasks. These findings show that the performance of different actions affect the connections between brain regions after the task is finished.

Q02
Automatic Switching Point From Perfusion to Permeability Using a Single Full-Dose Contrast Injection

Presenter(s)
Greeshma Chilukuri, Illinois Mathematics and Science Academy
Jayathi Varadheeswaran, Illinois Mathematics and Science Academy

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

Obtaining both perfusion and permeability data is critical for diagnostic magnetic resonance imaging, staging, and treatment planning for patients with brain tumors. However, only one can be acquired typically. The purpose of this study is to create a method which will decrease the cost and time necessary to collect both data sets. The parameter was created using perfusion data from seven patients inputted into the Siemens Syngo software, which showed the data versus time. The parameter was then tested on seven other patients to check reliability. The perfusion maps of the full time course were identical to the truncated time when using the same arterial input function. The truncated perfusion dataset demonstrated normal values in each subject. The results indicated that there were no issues with modeling permeability data even though it was collected following the perfusion data. The parameter was accurate for fourteen different patients, including stroke and tumor patients. A method has been created allowing both perfusion and permeability data collection from a single dose of contrast agent through using a parameter which ensures a complete data set. Using this, the method can be automated by triggering a switch when the magnetic resonance signal reaches the end of the perfusion phase.

Q03
A Comparison of the Magnitude of Visual Simon Effect in High School Students With and Without Music

Presenter(s)
Joseph Donermeyer, Illinois Mathematics and Science Academy
Dawson Patel, Illinois Mathematics and Science Academy

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy

The Simon effect refers to a phenomenon that occurs when a person responds to a stimulus with the same side of the body relative to where the stimulus is perceived. This causes a decrease in reaction time compared to responses on the other side of the body. We used a computer program to test the magnitude of the Simon effect in high school students with and without music playing. Participants were shown either the letter H to prompt a left-hand response or the letter S to prompt a right-hand response. The program generates these letters in different screen locations so we could see how the response times changed based on location. The experiment is ongoing and results will presented. Our research will help scientists better understand the Simon effect and help us map neurological processes relating to stimuli response.

Q04
Active Brain Regions During Sleep Using Electroencephalography Functional Magnetic Resonance Imaging

Presenter(s)
Grace Duan, Illinois Mathematics and Science Academy
Sameeksha Malhotra, Illinois Mathematics and Science Academy

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

With techniques allowing the simultaneous acquisition of electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) data, active brain regions during different stages of the human sleep cycle were determined. This allows a greater understanding of sleep and its role in processing information. The oscillations of the EEG data determined the duration of each sleep stage. The respective MR images, visualized using Mango software, were analyzed separately to create brain networks with regions of interest (ROI). Using MATLAB, we created correlation matrices displaying neuronal activity. Results suggest that brain activity is localized in the ROI's during the second stage of sleep. In rapid eye movement (REM) sleep, brain activity associated with the selected ROI is also present in most other brain regions. Hippocampal activity is most prevalent in all investigated stages, followed by thalamus, posterior cingulate, and amygdala activity. Brain activity in stage one and REM is similar, although REM activity is less concentrated to the ROI. Stage two is considered deeper sleep than stage one, showing diminished brain activity. REM sleep, showing most neuronal connectivity, involves consolidating memories and dreaming. EEG-fMRI data can lead to an improved understanding of brain activity during sleep, which may help in diagnosing sleep disorders.

Q05
Age-Related Changes in Visual Learning Strategies

Presenter(s)
Anastasia Fafara, Illinois Mathematics and Science Academy
Brianna Pusey, Illinois Mathematics and Science Academy

Advisor(s)
Kelly Brandstatt, Northwestern University
Anthony Ryals, Northwestern University
Joel Voss, Northwestern University

The purpose of this study was to determine the effects of age on strategies that individuals use to improve their memory. The primary goal was to test whether memory deteriorates with age, or if the memory problems often associated with age are because of poor strategies. Two groups of subjects were tested with an eye tracking program (adults ages 18-24 and adults over the age of 65). In the test, subjects were presented with three images and asked to identify which image differed from the others. This was difficult because all of the objects closely resembled one another. By using eye-tracking data to analyze fixation patterns, we were able to compare the visual search strategies used by younger versus older adults. Older subjects (n=14) performed worse than younger subjects (n=14). Furthermore, older subjects demonstrated abnormal visual search strategies compared to younger subjects, indicating age-related changes in strategy use. We conclude that aging is associated with changes in strategy use that are more fundamental than changes in memory.

Q06
Infant Tractography of the Anterior Limb of the Internal Capsule

Presenter(s)
Kayla Hannon, Illinois Mathematics and Science Academy

Advisor(s)
Jeffrey Neil, Washington University

Magnetic resonance imaging (MRI) helps understanding about what the brain looks like and how it works. Diffusion tensor imaging (DTI) are MRI scans that measure water molecule movements in the brain. I used DTIs to learn about brain structure and fractional anistropy (FA), which is a measure of how compressed water molecules move in the brain. High FA implies mature myelinated sheaths; however, in a previous study, some infants had high FA in the anterior limb of the internal capsule (ALIC) but low cognitive scores. I used Analyze.10 to track the fibers and created an image of the ALIC called a tractography. If ALIC tractographies look mature, then they should have high FA. I found that most of the ALIC tractographies with high FA were not mature. This means a lack of correlation between high FA and mature ALICs in these infants which does not explain the low cognitive scores. Since DTIs are relatively new and tractography is old, the value of the information of combining these techniques should be further explored.

Q07
Following Speech Through the Brain: Three Successive Parallel Networks

Presenter(s)
Rhea Harsoor, Illinois Mathematics and Science Academy
Shveta Thakkar, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

The purpose of this inquiry is to study the temporal dynamics of language analysis. Three epileptic patients were given two language tasks, the Boston naming test and a noun-verb task, in order to map activation. Subdural grids were surgically implanted in the left hemisphere, from which electrocorticographic recordings were collected. These recordings have a higher temporal resolution than other imaging modalities, such as functional magnetic resonance imaging. The initial hypothesis, that the pathway of speech processing is serial, parallel, and widely distributed, was supported by the collected data. We observed three distinct networks of parallel activity whose onsets were sequential. The first network was dedicated to phonetic processing, the second to semantic processing, and the third to semantic processing and speech production. This study is a part of a larger endeavor to minimize the morbidity of neurosurgical procedures in order to prevent resection of areas vital to language processing.

Q08
The Effects of Neurotrophic Drugs on the Degeneration of Cochlear Hair Cells in Guinea Pigs

Presenter(s)
Mohamed Kady, Illinois Mathematics and Science Academy
Harishankar Logaraj, Illinois Mathematics and Science Academy

Advisor(s)
Claus-Peter Richter, Northwestern University

Through the use of sensory hair cells, the cochlea converts mechanical pressure waves from the environment into electrical signals that are interpreted by the brain as sound. These signals can be measured using electrodes as an auditory brainstem response (ABR) wave. Exposure to intense, prolonged noises can cause irreversible damage to the auditory system. Through the implementation of certain neurotrophic drugs such as brain-derived neurotrophic factors (BDNF), this damage may be prevented and hearing may be preserved. Guinea pigs were exposed to deafening frequencies of noise at various decibel levels. Their recovery was then measured over four weeks through several hearing tests and analysis of ABR graphs. Preliminary results suggest that BDNF has no statistically significant effect on hearing. At the end, histology will be conducted to observe the physical effect of deafening and recovery with neurotrophic drugs on the animals.

Q09
Effects of Vindeburnol on Alzheimer's Disease-Type Pathology

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

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

Alzheimer's disease (AD) is a dementia characterized by the aggregation of amyloid-β (Aβ) in the brain, forming plaques that contribute to loss of brain function. The aggregation of Aβ is regulated in part by the neurotransmitter noradrenaline (NA). Studies have found that vindeburnol increases production of tyrosine hydroxylase, the rate-limiting enzyme in the biosynthesis of NA, in the locus coeruleus. Two cohorts of AD model (5xFAD) and wildtype mice were treated with vindeburnol at 20 or 12 mg/kg over the course of four weeks. Afterwards, the brains were cut and stained with thioflavin S and analyzed with AxioVision®. Analyses found insignificant differences in plaque number and size both globally and in specific brain regions. Although we have found no significant difference between overall plaque number or size between vehicle-treated and vindeburnol-treated sections, the total percentage of small plaques (<50 μm) significantly decreased by 28% in the frontal cortex and subiculum of 20 mg/kg treated mice. This suggests that vindeburnol may be slowing the formation of new plaques without enhancing plaque degradation. The data does show a trend towards lower overall plaque number, however, suggesting that more animals may need to be processed to reach adequate statistical power.

Q10
Acute Ischemic Stroke in Pregnancy: A Nationwide Inpatient Sample

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

Advisor(s)
Sarah Song, Rush University

Women can present with acute ischemic strokes during antepartum, delivery, and postpartum periods, but there is no current consensus on how to treat these patients. This report describes the use of intravenous thrombolysis, or tissue plasminogen receptor (tPA), in pregnant ischemic stroke patients. Data was collected using the Nationwide Inpatient Sample, a database from the Healthcare Cost and Utilization Project which tracks information from over eight million hospital stays each year. Pregnancy-related stroke, including both ischemic and hemorrhagic strokes, along with stroke-related conditions and pregnancy-related conditions were extracted using codes from the International Classification of Diseases, Ninth Revision. We also ascertained clinical outcomes of these pregnant women with stroke, including mortality, discharge destination, and length of stay. Between 2005 and 2010, approximately 18,392 pregnancies were complicated by stroke. Of these pregnancies, hypertension and pre- eclampsia proved the most common risk factors. Ischemic stroke patients treated with intravenous tPA had a wide range of length of stay, ranging from 4-28 days. They were also found to have increased mortality compared to other pregnant women with stroke. More research is necessary to determine the safety of IV tPA in pregnant ischemic stroke patients.

Q11
Identifying Chaperones and Co-Chaperones Affecting Mechanisms of FUS R521G Aggregation in N2A Cells

Presenter(s)
Lakhena Leang, Illinois Mathematics and Science Academy
Xueyang Ren, Illinois Mathematics and Science Academy

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

The FUS R521G mutation is a toxic amyotrophic lateral sclerosis-related gene mutation causing cytoplasmic aggregates. Usually, the dissolution of insoluble protein aggregates is mediated by a network of protein chaperones, particularly those such as heat shock protein 70 (HSP70). Overexpression of four different HSP70 chaperones and six different DNAJB chaperones in Neuro2a cells co-transfected with FUS R521G was observed using supernatant and imaging analysis. Preliminary data analysis suggests that HSPH1, HSPH2, HSPA1A, HSPA8, and HSPH3 seem to reduce FUS R21G toxicity. However, DNAJB chaperones seem to have little or no effect on FUS R521G aggregation. We are in the process of observing Neuro2A cells co-transfected with FUS R521G and HSP70 chaperones under transient expression to verify the preliminary data. Finding chaperones that aid in FUS R521G aggregate degradation will help broaden our understanding of chaperone-aggregate machinery and find molecular targets for amyotrophic lateral sclerosis therapy.

Q12
Inhibitable Plasma Cholinesterases as Biomarkers of Alzheimer's Disease

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

Advisor(s)
Changiz Geula, Northwestern University

The purpose of this study was to test a biomarker that could lead to early diagnosis of Alzheimer's disease (AD) in living patients. We measured cholinesterase (ChE) activity in plasma samples from patients with AD and normal controls. The pathological hallmarks of AD, plaques and tangles, contain activities of the ChEs acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE). Unlike normal ChEs, ChEs in plaques and tangles are inhibited by indoleamines and protease inhibitors. Differences between the inhibition of AChE and BuChE by the indoleamine serotonin (5HT) and the protease inhibitor bacitracin were determined in AD plasma and compared with normal plasma. We tested thirty pairs of plasma for levels of inhibitable AChE and BuChE activities. There was a trend towards increased inhibition in AD plasma. There was a 32%-55% increase in inhibitable AChE activity in AD plasma when compared to normal plasma using bacitracin, and a 14%-45% increase in inhibitable AChE in AD plasma using 5HT. Similar trends were observed for BuChE. Further analysis is required to determine whether these trends are statistically significant. These results suggest that inhibitable plasma AChE and BuChE may be appropriate biomarkers for diagnosis of AD perhaps in its early stages to allow early treatment.

Q13
Activated c-Jun N-Terminal Kinase Contributes to the Differential Vulnerability of Neurons in Huntington's Disease

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

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

Huntington's disease (HD) is a genetic disorder characterized by mutations in the gene encoding huntingtin protein (Htt). Mutant forms of htt (mHtt) cause progressive degeneration in specific neuronal populations, especially within the cerebral cortex and the striatum. It has been previously shown that mHtt, which is expressed ubiquitously throughout the brain, activates c-Jun N-Terminal kinases (JNK), which in turn inhibit axonal transport and lead to dying-back degeneration of neurons. Based on these and other observations, we hypothesized that the tissue distribution of active JNK pathway components might contribute to the unique tissue pattern of neuronal degeneration observed in the early stage of HD. To evaluate this hypothesis, we performed immunohistochemical and Western blot analysis of JNK in control and R6/2 mice, a well-characterized HD mouse model. We found that activated JNK in the pre-symptomatic stage (post-natal day 30) is more prevalent in areas of the brain that endure greater damage during HD pathogenesis, such as the striatum and the cerebral cortex. This led us to conclude that activation of JNK might contribute to the early pattern of brain tissue degeneration in HD. In the future, we would like to further evaluate JNK activation in specific cell types including projection neurons, interneurons, and glial cells.

Q14
Using Microfluidic Chambers to Evaluate the Effect of MitoQ on Fused in Sarcoma-Mediated Neurotoxicity

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

Advisor(s)
Jane Wu, Northwestern University

The purpose of this investigation was to study MitoQ as a potential treatment for amyotrophic lateral sclerosis (ALS) and other neurodegenerative diseases associated with mutations in the RNA-binding protein, fused in sarcoma (FUS). Cortical neurons were isolated from day 18 rat embryos and transfected with control, wild-type FUS, and P525L mutant FUS plasmids. Neurons were plated in microfluidic chambers, which are specially designed devices that use microgrooves to organize axon growth. They were then treated with 0.1 μM, 0.3 μM, or 0.5 μM MitoQ, or the control. The neurons were fixed and stained after one week, and were imaged using a fluorescent microscope. Concentrations of 0.3 μM and 0.5 μM MitoQ treatments were toxic, so only the control and 0.1 μM MitoQ treatments were analyzed. Mitochondrial fragmentation, dendrite length, and branch point number were observed and quantified. The results showed that FUS transfections significantly worsened mitochondrial fragmentation as expected ($p < 0.0001$). However, MitoQ treatment significantly worsened all three aspects of neuronal health ($p < 0.05$). This unexpected result is likely due to toxic byproducts in the MitoQ, which may not have been sufficiently purified during production. Despite these results, MitoQ may still be a promising therapy for ALS, and further investigation is suggested.

Q15
Screening Potential Treatments for Amyotrophic Lateral Sclerosis

Presenter(s)
Emily Ling, Illinois Mathematics and Science Academy
Hye Jean Yoon, Illinois Mathematics and Science Academy

Advisor(s)
Mengmeng Chen, Northwestern University
Xiaoping Chen, Northwestern University
Kazuo Fushimi, Northwestern University
Jane Wu, Northwestern University

The purpose of this investigation was to test several chemical compounds as potential treatments for amyotrophic lateral sclerosis (ALS) and other neurodegenerative diseases caused by mutations in the RNA-binding proteins TAR DNA-binding protein and fused in sarcoma (FUS). This investigation used transgenic Drosophila expressing wild-type FUS 9 proteins in the motor neurons. Flies were treated with food containing 1% and 5% (by mass) of the compounds zinc, creatine monohydrate, and nicotinamide. Wandering stage larvae were observed for two minute intervals, and the velocity (mm/s) and rate of muscle contraction (Hz) were measured in order to classify level of degeneration. Nicotinamide of both concentrations was found to be toxic to the Drosophila embryos, hindering their growth into the larvae stage. Creatine significantly improved the larval motility over the control ($p < 0.05$). In addition, both concentrations of creatine were significantly more effective than zinc ($p < 0.01$). Although this study must be further investigated, creatine may be a promising treatment for ALS and other neurodegenerative diseases.

Q16
Extracting the Hemodynamic Response With the Finite Impulse Response Filter

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

Advisor(s)
Jennie Yufen Chen, Northwestern University
Todd Parrish, Northwestern University

Functional magnetic resonance imaging (fMRI) detects brain activation using blood-oxygen-level dependent (BOLD) signal changes. In stroke patients, hemodynamics are disrupted and it is often difficult to detect brain activation. Deoxygenated hemoglobin concentration in the brain changes the strength of the BOLD signal that can be utilized to plot the unique hemodynamic response function (HRF), or changes over time of a patient. The process of directly mapping the HRF through MRI scanning takes an extensive amount of time (30-45 minutes). In this investigation, the data from a traditional experiment that takes 8 minutes was analyzed using statistical parametric mapping. The protocol of the more efficient method utilizes a finite impulse response filter to generate the HRF. This new form of collection compiles corresponding blood flow data into two second time bins, averages the contents of each, and draws a single HRF for stimuli of a single experiment. Brain Voyager was used to directly measure the HRF. After examining trials in two stroke patients, the HRF plotted by this method remains accurate, and does not sacrifice precision for an improved acquisition time. With these conclusions in mind, patients, doctors, and staff will be able to diagnose stroke patients more accurately.

Q17
Analysis Comparing Defective RNA Binding Proteins in Association With Amyotrophic Lateral Sclerosis

Presenter(s)
Haneesha Paruchuri, Illinois Mathematics and Science Academy

Advisor(s)
Warren McGee, Northwestern University
Jane Wu, Northwestern University

Amyotrophic lateral sclerosis (ALS) is characterized as a fatal degenerative motor neuron disorder resulting in the loss of motor neurons and muscle movements. About ten percent of cases are inherited, mostly involving unidentified genes. The investigation analyzes the commonalities between the ALS-associated RNA binding proteins in terms of pathological features, clinical features, and protein properties. The specific ALS-associated RNA binding proteins analyzed are fused in sarcoma (FUS) and TAR DNA-binding protein 43. This study will help understand the common pathogenic mechanisms shared by different subtypes of ALS and provide information useful for future development of treatment.

Q18
Monitoring the Time and Extent of Neurodegeneration in the Motor Cortex of a Novel Amyotrophic Lateral Sclerosis Mouse Model

Presenter(s)
Vignesh Ravi, Illinois Mathematics and Science Academy

Advisor(s)
Mukesh Gautam, Northwestern University
Pembe Hande Ozdinler, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a progressively debilitating disease in which the cortical and spinal motor neurons show progressive degeneration. To study the cortical component of neurodegeneration in the TDP-43 mouse model, the motor cortex was analyzed. Since TDP-43 mutations were detected in ALS patients and reported to have loss of upper motor neurons, this study monitors the brains of the wild type (WT) and the TDP-43 mutant mouse model (n=3 for each genotype) at two different time points, P90 and P120. Silver staining was used to label neurons that underwent neurodegeneration and to monitor the appearance of dying neurons. Sections that represent comparable areas of the brain and were isolated from age-matched experimental samples and compared, based on the presence of silver precipitates. Preliminary studies suggest an increase in neuronal vulnerability in the TDP-43 mice, as more neurons in the motor cortex are labeled with silver staining. Overall, the time and rate of neurodegeneration will be determined at two time points in both WT and TDP-43 mice. The potential implications of this project extend far beyond the moral aspects of advancing disease research. Upon completion, we will have a better idea of the timing and extent of neurodegeneration in the motor cortex, essential information that is required prior to any therapeutic intervention.

Q19
Optimization of a Magnetic Resonance Probe for Early Detection of Alzheimer's Disease

Presenter(s)
Sreyesh Satpathy, Illinois Mathematics and Science Academy

Advisor(s)
William Klein, Northwestern University
Kirsten Viola, Northwestern University

Alzheimer's disease (AD) is the leading cause of dementia, but there currently exists no conclusive diagnostic for the disease. Evidence points to synaptotoxic amyloid beta (Aβ) or $A\beta_{1\text{-}42}$ oligomers (AβO) as a primary cause of the synapse failure and progressive memory loss characteristic of AD. AβOs act as initiators of disease mechanisms and may provide an optimal target for an AβO-specific antibody (NU4) conjugated to 12 nm and 18 nm diameter Fe_3O_4 nanostructures (NU4MNS). AβO localization and growth within the brain was determined by use of fluorescently tagged NU4 on eight month old mice with an Alzheimer's-like disease. NU4MNS was used to develop diagnostic magnetic resonance imaging (MRI) assays for these mice. The NU4MNS, bonded to a polyethylene glycol arm, forms an MRI probe for AβOs that can be delivered intranasally, bypassing the blood-brain barrier. Based on *in vitro* experiments, this NU4MNS is a non-invasive MRI contrast agent with the potential for early diagnosis of AD. The *in vivo* MRI response for the 18 nm probe matched the results of localization of AβOs treated with fluorescent NU4 *in vitro*. Iron stains indicated that the probe successfully distributed throughout the brain. Future research should observe AβO growth during disease progression, and more tests should be run to verify the efficacy of the probe.

Q20
The Relationship Between the Hippocampus and Long-Term Memory Loss in Alzheimer's Disease

Presenter(s)
Sajishnu Savya, Illinois Mathematics and Science Academy

Advisor(s)
Lei Wang, Northwestern University

Alzheimer's disease (AD) is a progressive brain disease that slowly destroys memory and thinking skills, and eventually the ability to carry out the simplest tasks. Since the hippocampus is affected first in AD (as with short term memory loss), I wanted to see if the degradation of the four subfields, CA2-4 + DG, in severe AD correlated with long term memory loss. I used test scores from the Auditory Verbal Learning Test (AVLT) to measure cognitive performance and average deformation values of the hippocampus. I ran ANOVA using Fisher Z values between the AVLT test scores and the average deformation values across AD patients, mild cognitive disease patients (MCI), and a control group. I was testing to see if there was a significant difference in correlation between the groups. My results showed there was no significant difference in correlation. This demonstrated that the degradation of the CA2-4 + DG subfields were not directly correlated with the long term memory loss in AD patients, but is possibly one factor in the process.

Q21
Audiotactile Interactions in Texture Perception in Humans

Presenter(s)
Vimig Socrates, Illinois Mathematics and Science Academy

Advisor(s)
Sliman Bensmaia, University of Chicago

Environmental vibrations excite receptors in both the hand and the ear. Signals from these receptors are ultimately processed in the somatosensory and auditory cortices, respectively. Previous evidence suggests that auditory and tactile signals are perceptually integrated. To further investigate these interactions, subjects were asked to explore texture pairs and discriminate between them while listening to touch produced feedback coming from a microphone attached to their finger. On a subset of trials, the frequency composition of the sound was modified before it was replayed to the subjects. We found that certain distortions in the auditory feedback (when the band pass was between 125 and 6000 Hz) caused distortions in the perception of texture, while others did not. The study replicates and extends the finding that touch and hearing interact in the perception of texture.

Q22
Method to Find the Language Region in the Brain Using Electrocorticography From Natural Conversation

Presenter(s)
Rashmi Thimmapuram, Illinois Mathematics and Science Academy

Advisor(s)
Vernon Leo Towle, University of Chicago

Electrocortical stimulation mapping (ESM) is currently the gold standard in neuroscience research to find the language region in epileptic patients. Unfortunately, it is difficult and tedious to perform. It is also invasive and not patient-friendly. The patient is conscious during the procedure and he or she may feel uncomfortable. Furthermore, the placement of electrodes and electrical stimulation can cause an unnatural seizure. Analyzing brain activity during natural conversations to find the language region would be an alternative method to ESM. In this project, the brain activity from natural conversation in high frequency gamma bands (70-100 Hz) was compared with that of the language task to see if it can provide the same results because language task was used in prior investigations to identify language regions. Though natural conversation activated more areas in the frontal and parietal lobes than language task, it localized only some of the areas in the language region. It was concluded that though natural conversation alone cannot be used to identify language region in clinical applications at present, it would be an asset to neurosurgeons if used alongside ESM to help refine the technique because it is non-invasive and patient-friendly.

Q23
The Role of Microglial Transient Receptor Potential Ankyrin 1 in Alzheimer's Disease

Presenter(s)
Rashmi Thimmapuram, Illinois Mathematics and Science Academy

Advisor(s)
Maira Bicca, Northwestern University
William Klein, Northwestern University

Alzheimer's disease (AD) is the most common form of dementia in elderly. During the progression of AD, the brain produces and accumulates amyloid beta oligomers (AβO), which are the main toxins of AD. AβOs induce neuronal toxicity and death and trigger oxidative stress and inflammatory process in AD. Recently, the Klein research group discovered that the expression of the transient receptor potential ankyrin 1 (TRPA1), a non-selective cation channel, involved in oxidative stress and inflammation in the periphery, was increased in Alzheimer's brains when compared with age matched control brains. The aim of this study was to shed light on the importance in AD of TRPA1 in the microglia, which is actively involved in the inflammatory process. We performed both qualitative (immunofluorescence) and quantitative (Western blot) techniques to analyze TRPA1 expression in primary microglial cultures derived from rat cortices treated with vehicle or AβOs. We found increased TRPA1 expression in AβO-treated microglia when compared to microglia treated with vehicle. This demonstrated for the first time that TRPA1 in the microglia could be important to the inflammatory process during Alzheimer's disease progression.

Q24
Functional Analysis of Dopaminergic Neurons Derived From Human Embryonic Stem Cells

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

Advisor(s)
Zhong Xie, Northwestern University

As the most common neurodegenerative movement disorder, Parkinson's disease (PD) affects more than one million individuals over 60 years of age in the United States. Recent studies shown that dysfunction of mitochondria and L-type calcium channels may lead to deterioration of midbrain dopaminergic (DA) neurons in PD. In this study I investigated the functional properties of DA neurons derived from human embryonic stem cells (hESC), focusing on mitochondrial reduction-oxidation (redox) and calcium oscillation. After expressing redox-sensitive green fluorescent protein (RoGFP) in the mitochondria of DA neurons, ratiometric cell images were captured with an inverted epifluorescence microscope. Images were used to determine baseline oxidation levels, as well as fully reduced and fully oxidized levels caused by reducing agents and oxidizing agents, respectively. The observed cells had an average baseline oxidation level of 1.664±0.130, with average oxidation of 38%. The cells also showed regular calcium oscillation indicating normal calcium channel electrophysiological activity. My findings help establish these basic functions and properties of hESC DA cells, which will be used for further PD research. As a promising therapeutic strategy, hESC retaining normal DA functions could be transplanted into PD patients to replenish the lost DA neurons and restore motor function.

Q25
Developing Therapeutic Approaches to TAR DNA Binding Protein 43 and Fused in Sarcoma Proteinopathies

Presenter(s)
Hye Jean Yoon, Illinois Mathematics and Science Academy

Advisor(s)
Mengmeng Chen, Northwestern University
Xiaoping Chen, Northwestern University
Jane Wu, Northwestern University

TAR DNA binding protein 43 (TDP-43) and fused in sarcoma (FUS) proteinopathies are diseases associated with mutations in these genes and aggregation of ß-amyloid misfoldings. Transgenic flies with TDP-43 and FUS genes expressed in their motor neurons and ommatidia of their eyes were treated with food containing creatine, zinc, and methylene blue. Results showed that zinc and creatine significantly improved the pupae eclosions and survival rates of the Drosophila and slowed down the degeneration of ommatidia conditions compared to the flies exempted from treatment ($p<0.05$; $p<0.01$). Results suggest that creatine is more effective than zinc in protecting the Drosophila against neurodegeneration ($p<0.01$). Drosophila flies treated with methylene blue were unable to form pupae and eclose as adult flies, concluding that methylene blue is toxic. Although further investigation is needed, creatine and zinc are suggested to be potential therapies for diseases with pathologic TDP-43 and FUS, such as amyotrophic lateral sclerosis and frontotemporal lobar dementia.

Q26
Quantifying the Effects of Amyotrophic Lateral Sclerosis on Axon Continuity and Larval Motility

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

Advisor(s)
Yang Li, Northwestern University
Jane Wu, Northwestern University

Amyotrophic lateral sclerosis (ALS) is a fatal neurodegenerative disease that primarily affects motor neurons. Significant effort has been put into building animal models to understand molecular pathogenesis and to develop therapeutic approaches. While much work has been done on examining ALS from a qualitative perspective with animal models, computational and biophysical techniques have also been applied to quantify data. Here fluorescent microscopy, video imaging, and data processing were used to assess the locomotive function in a Drosophila model for ALS. Using time-lapse video imaging of Drosophila larvae, we developed a method for quantitative determination of locomotive function. This investigation resulted in the creation of a more efficient algorithm for tracking multiple objects as well as an image extraction algorithm that reduces the need to manually edit image files. These algorithms speed up data analysis and eliminate human bias from results in biological assays. Our work will facilitate studies of human neurodegenerative disorders using Drosophila models, including investigating molecular pathogenesis of devastating diseases such as ALS.

R01
Performance Validation of the QIE10 Application Specific Integrated Circuits for the Phase I Upgrade of the Compact Muon Solenoid Detector at CERN's Large Hadron Collider

Presenter(s)
Vikram Anjur, Illinois Mathematics and Science Academy
Alexander Moreno, Illinois Mathematics and Science Academy

Advisor(s)
James Hirschauer, Fermi National Accelerator Laboratory
Elliot Hughes, Fermi National Accelerator Laboratory
Titas Roy, Fermi National Accelerator Laboratory

As part of the 2014-2018 upgrade of the Compact Muon Solenoid (CMS) detector at CERN's Large Hadron Collider (LHC), the CMS collaboration is improving its hadron calorimeter (HCAL). Hadrons produced in LHC collisions strike the HCAL producing light in plastic scintillators in proportion to their energy. By measuring this light, the energy of the incident particles can be determined. A new version of the QIE10 chip, which digitizes the analog current pulses of the photodetector and determines the arrival time of the pulse, is a primary part of the upgrade. The performance of the QIE10 was characterized by measuring the chip output to a known charge input. This was done using a test board and computer which could input various charges and output data files. Specific tests were programmed to measure different functionalities of the chips. The performance metrics include the response as a function of input charge, the pedestal (response to zero input), the measurement of arrival time, and the variation of these metrics over the sample of 325 prototype chips. Preliminary results indicate that the QIE10 chip meets performance requirements for CMS.

R02
Cosmic Ray Background in the NOvA Neutrino Experiment

Presenter(s)
Mason Dearborn, Illinois Mathematics and Science Academy

Advisor(s)
Lisa Goodenough, Argonne National Laboratory
Maury Goodman, Argonne National Laboratory

The observation of neutrinos, being of neutral charge and nearly no mass, requires massive detectors engineered by collaborations of scientists from around the world. A dominant background to neutrino signal in the detectors is the presence of cosmic rays that are far more numerous than neutrinos. My work will show whether or not this background is able to be made negligible through various methods of estimation and what the most efficient method of doing this is. Through the manual scanning of event displays generated from interactions in the detector, preliminary conclusions can be made. The cosmic ray background does not appear to be negligible, as can be seen from our recent analysis of the failings of a cosmic rejection filter. Our results so far have led us to conclude that the current cosmic ray estimation methods need revision. We plan to develop cuts to remove cosmic ray background and maintain efficiency for neutrinos as we expand the number of events tested. The estimation of this cosmic ray background for its removal is imperative to the fulfillment of the main purposes of the experiment. My work in cosmic ray background estimation will enable the study of neutrinos and their oscillations.

R03
Measuring the Energy of Antineutrinos

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

Advisor(s)
Zelimir Djurcic, Argonne National Laboratory
Maury Goodman, Argonne National Laboratory

Neutrinos and antineutrinos are the most abundant particles in the universe, besides photons. Scientists suspect that neutrinos played a major role in the evolution of the universe. Recent measurement of the mixing angle θ_{13} has established motivation to pursue measurement of the charge parity violation parameter for future neutrino experiments. If measured to be non-zero, the charge parity violation parameter will indicate a difference between matter and anti-matter and could explain why antimatter is not present in the visible universe. Determination of θ_{13} depends on how well we estimate energy of detected antineutrinos, and the energy depends on charge. The charge we measure is calibrated by deployment of radioactive sources that emit radiation of a known energy. We have studied the relationship between known source energy and collected charge to derive energy versus charge dependence. We analyzed data with the ROOT program to understand charge versus energy of events, with Double Chooz calibration data. Four calibration sources were used. Using program scripts, we were able to produce graphs and use histogram fitting to find energy deposited in the detector by an antineutrino. Analysis is ongoing to see how the measured antineutrinos spectrum agrees with our prediction, which in turn affects the measurement of θ_{13}.

R04
Ultrasonic Thermometry for the Analysis of Thermal Protection Materials

Presenter(s)
Ka wai Lee, Illinois Mathematics and Science Academy

Advisor(s)
Donald Yuhas, Industrial Measurement Systems

In aerospace science, the non-intrusive measurement of spacecraft surface temperature and recession is often useful in creating and evaluating thermal protection materials. Ultrasonic thermometry utilizes the relationship between the temperature and the time of flight of ultrasonic waves to estimate of the surface temperature. In this investigation, MATLAB is used to calculate transient temperature profiles using a one-dimensional analytical thermal model which is then combined with velocity calibration curves to create a forward model. This model calculates time of flight variations resulting from temperature profiles. In order to investigate more complex thermal events, including both heating and cooling of the surface, the model has been integrated with COMSOL, a commercial thermal transport program. The current model also incorporates the effect of a receding surface. This forward model provides a good resource for sensitivity studies useful for evaluating the ultrasonic method by determining the relative influence of thermal transport properties, ultrasonic properties, and surface heat flux. The forward model builds a foundation for the inverse model, which has the potential of estimating both unknown heat flux and temperature from experimental ultrasonic data. Results will be presented showing model calculations, sensitivity analysis, and progress on the inverse model.

R05
Measurement of the Ratio of σ(pp → Z + bb)/σ(pp → Z + jj) at √s = 1.96

Presenter(s)
Jameson O'Reilly, Illinois Mathematics and Science Academy

Advisor(s)
Ashish Kumar, Fermi National Accelerator Laboratory

The production rate of a Z boson in association with a bottom and an anti-bottom quark provides an important test for the theory of quantum chromodynamics. The Z with b and b-bar process is also an important irreducible background in the study of the Higgs boson in the Z plus H → bb channel. Using the proton-antiproton collision data from Fermilab's Tevatron collider at a center of mass energy of 1.96 TeV collected with the D0 detector during 2006 to 2011, the ratio of cross sections for Z+bb(bar) production to Z + 2 jets production was measured. The identification of bottom quark jets is performed by using a dedicated algorithm employing a multivariate analysis technique. Extraction of the b-jet fraction in the resultant sample is done by performing fit of the data distribution with templates of the discriminant which has different shapes for different flavored jets. Before further corrections, the ratio of cross section was found to be around 0.02, which is in line with theoretical predictions. This result further confirms calculations made using the Standard Model and the validity of that model to explain natural phenomena at the quantum level.

R06
Analyzing the X-Ray Spectra of Nova V339 Delphi and Nova KT Eridani Using Model Atmospheres

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

Advisor(s)
Daniel van Rossum, University of Chicago

A nova is a stellar outburst that occurs on a white dwarf (WD) that is part of a binary system with a red giant or main sequence companion star. After the white dwarf accretes enough material from its companion star, its surface will undergo a thermonuclear runaway resulting in an outburst that causes mass loss but leaves the WD mostly intact. I fit spectra from the novae KT Eridani and V339 Del using atmosphere models to determine the best-fit values of the following physical parameters: chemical composition, temperature (T_{eff}), radius (R), and interstellar absorption (N_H). For nine different sets of chemical compositions, the best-fit T_{eff}, N_H, and R combinations were determined using the reduced chi-square test. The fits for Nova Del are ambiguous for two reasons: the observed spectra are only visible up to 40 Å, and the temperature is at the lower end of the range of temperatures used by the model atmospheres. KT Eri has a wider wavelength range and is hotter; as a result, its parameters can be accurately fitted. The parameters calculated in this study describe the physical characteristics of the novae which are necessary for understanding the mechanisms through which novae occur and develop.

R07
Synthesis of Carbon Nanotubes Used in Thermoelectric Devices by Chemical Vapor Deposition

Presenter(s)
Dennis Rich, Illinois Mathematics and Science Academy

Advisor(s)
Venkat Chandrasekhar, Northwestern University
Tanuj Gupta, Northwestern University

Single-walled carbon nanotubes, which are cylindrical molecules made entirely of carbon, exhibit a wide range of interesting quantum mechanical properties. One of these properties is a remarkably efficient thermoelectric effect, which converts a temperature gradient over a material to electricity. The effect is more prevalent when nanotubes are synthesized at low temperatures through chemical vapor deposition, when methane is passed over a substrate, freeing the carbon radicals to form nanotubes on the substrate. Through testing gas flow rates of methane from 450 to 1000 standard cubic centimeters per minute and temperatures from 700 to 950^{o}C and observing the results with a scanning electron microscope, gas flow rate and temperature parameters were refined that consistently achieved synthesis at temperatures as low as 725^{o}C, while normal synthesis is performed around 900^{o}C. At these lower temperatures length, straightness, and density were all improved. All of these are important properties in crafting and testing thermoelectric devices. This improvement is a step in the right direction. If the trend is continued, mass production of nanotubes in thermoelectric devices could greatly increase the efficiency of many electric devices, from solar panels to refrigerators.

R08
Fiber Optic Interferometers as Acoustic Sensors for Bubble Chamber Dark Matter Detectors

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

Advisor(s)
Eric Dahl, Fermi National Accelerator Laboratory

I investigated fiber optic interferometric sensors as an alternative to piezoelectric acoustic sensors in a bubble chamber dark matter detector. The detection of dark matter will answer a long-standing mystery about the nature of the universe. The acoustic sensors on bubble chamber dark matter detectors are used to distinguish the dark matter signal from backgrounds due to natural radioactivity. The piezoelectric acoustic sensors currently used are both fragile and themselves sources of radioactive backgrounds. Fiber optic acoustic sensors, based on laser interferometry, are a promising alternative. I made several prototype sensors, building the sense arm of the interferometer by winding an optical fiber around a cylindrical mandril, which was then attached to the bubble chamber vessel. Acoustic vibrations in the chamber transmit to the mandril and stretch the fiber, changing the interference pattern at the output of the interferometer. I made sensors using both copper and polyether ether ketone (PEEK) mandrils. Data show that the PEEK sensors are many times more sensitive than the copper and show a response at frequencies up to 100 kHz. While still less sensitive than the piezoelectric sensors, this is an important first step to building a new type of acoustic sensor for bubble chamber dark matter detectors.

R09
A Search for Strong Gravitational Lenses in the Dark Energy Survey Supernova Fields

Presenter(s)
Janani Sivakumar, Illinois Mathematics and Science Academy

Advisor(s)
Elizabeth Buckley-Geer, Fermi National Accelerator Laboratory
H. Thomas Diehl, Fermi National Accelerator Laboratory

Gravitational lensing is an astronomical phenomenon where the gravity of a massive object warps the light of a far-away object, forming shapes called arcs, Einstein rings, and Einstein crosses. Gravitational lensing magnifies and brightens the distant objects and can be used to determine the mass of the lensing galaxies. Images from the Dark Energy Camera (DECam) were systematically scanned by the human eye (and brain) for rings, arcs, and crosses. The most promising of the candidates identified were selected for further analysis. Fifteen previously unidentified strong lens candidates were identified from seventeen tiles in the Dark Energy Survey supernova fields, and approximate redshifts, z ($z = \lambda/\lambda_0 - 1$), were obtained for eleven of the fifteen candidates from the SDSS3 galaxy catalog. The redshifts for the lenses ranged from 0.094 to 0.546. Spectra obtained using the Apache Point Observatory 3.5 meter telescope were used to match a few candidates to template spectra. Going forward, the redshift data will be used to confirm or reject all of the lens candidates.

R10
Beam Test of the Muon g-2 Tracker

Presenter(s)
Emma Sloan, Illinois Mathematics and Science Academy

Advisor(s)
Brendan Casey, Fermi National Accelerator Laboratory

The muon g-2 experiment will be studying a discrepancy between experiment and theory by measuring a beam of muons with a system of detectors. Using simulation and data, the tracking system was characterized for a test beam setup of 120 GeV protons from the Fermilab main beam line. A Monte-Carlo simulation helped determine the number and placement of detector stations and the material and thickness of a vacuum chamber necessary for high resolution. The simulated resolution, using the parameters that were used for the beam test, was 0.000225. Then resolution was computed using the beam test data. The resolution from the beam test was compared to the resolution from the simulation. This study will describe how resolution varied in simulation, with the addition of variables, and in the beam test.

R11
Constructing a Model of the Muon g-2 Magnet in Opera-3d

Presenter(s)
Lia Vallina, Illinois Mathematics and Science Academy

Advisor(s)
Brendan Kiburg, Fermi National Accelerator Laboratory

Our project aimed to construct a three-dimensional model of the extremely uniform magnetic field of the Muon g-2 superconducting storage ring using software called Opera-3d. Our project investigated the effects of implementing a hole with an inflector magnet at the muon beam injection point. To simulate the magnetic field in the model body, we specified the field and material properties, calculated the current density of the solenoid conductors, and constructed a mesh, which is the set of points where calculations are made. We analyzed the model to produce graphical data and measurements of the field. Using this data, we studied how the presence of a hole and inflector in the magnet body influences the magnetic field, which in turn affects the path of the muon beam. If the inflector magnet allows the entry of the muon beam without affecting the performance of the storage ring, we will endorse the current system. If the inflector has a detrimental effect on its performance, we will make suggestions to mitigate its interference. Modeling this critical region will allow us to understand how to minimize distortions in the magnetic field of the storage ring.

S01
The Correlation Between Exercise and Stress of Adolescents in Academically Rigorous Environments

Presenter(s)
Marissa Brock, Illinois Mathematics and Science Academy
Alexandra Johnson, Illinois Mathematics and Science Academy

Advisor(s)
David Lundgren, Illinois Mathematics and Science Academy
Jerald Thomas, Aurora University

Stress is the body's response to events that disrupt emotional homeostasis. Students in academically rigorous residential educational systems face constant bombardment with academic and social stressors. The purpose of this investigation was to examine the relationship of students' stress levels with a scientifically supported stress reliever, physical activity. According to previous similar studies, a correlation exists between participation in exercise and perceived stress level. Students (n=215) that attend schools within the National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology (NCSSSMST) were surveyed to gauge their stress levels and involvement in physical activity. The researchers adapted the Perceived Stress Scale and administered it as the stress portion of the survey. Students were then asked to select an option that most accurately described their involvement in physical activity. Data was analyzed for a correlation between amount of regular physical activity and stress level. The analysis of the data from this study should reinforce the importance of physical activity in a student's life and validate it as a significant method of stress reduction.

S02

The Experience of Homelessness and Stress and the Effect on Memory Functioning in Homeless Youth

Presenter(s)
Al-Jalil Gault, Illinois Mathematics and Science Academy

Advisor(s)
Scott Hunter, University of Chicago

Memory functioning is vital for informed executive functioning, and significant environmental and emotional stressors during adolescence render these skills' development vulnerable to adverse effects. This study investigated how stressors of time and frequency spent homeless, and symptoms of anxiety disorders, influence memory functioning in homeless youth. Participants were from urban-based homeless youth shelter programs (N = 116, mean age = 19 years, 86% African American, 54% female). The Mini International Neuropsychiatric Interview was administered to collect information on participants' symptoms consistent with diagnoses of generalized anxiety disorder (GAD), post-traumatic stress disorder (PTSD), and depression. Visual and verbal memory assessments were conducted using the Wide Range Assessment of Memory and Learning, Second Edition (WRAML-II) and California Verbal Learning Test, Second Edition (CVLT-II). Correlations showed non-significant relationships between the experience of homelessness and visual and verbal memory scores. T-tests showed individuals with and without GAD and/or PTSD symptoms had non-significant differences in scores on both memory assessments. Significant trends in t-tests showed individuals with depressive symptoms had higher scores in both memory assessments than those without depressive symptoms. Resilience despite significant environmental and emotional stress is likely due to arousal and greater attention to detail associated with these experiences.

S03
A Cross-Cultural Study of the Relationship Between Empathy and Social Dominance

Presenter(s)
Leehwa Hong, Illinois Mathematics and Science Academy
Vivian Liu, Illinois Mathematics and Science Academy

Advisor(s)
Joan Chiao, Northwestern University
Vandana Chinwalla, Illinois Mathematics and Science Academy

Recent studies have investigated associations between cultural influences and affective and cognitive empathy responses. In particular, native Koreans were found to exhibit significantly greater empathy when viewing Koreans (ingroup members) in pain relative to viewing Caucasian Americans (outgroup members) in pain, which can largely be attributed to a greater preference for social hierarchy. We administered a survey consisting of photographs and a social dominance orientation test to second generation or higher Caucasian Americans and zero or first generation Korean Americans. Based on a two-sample t-test, both Koreans and Caucasians exhibited no difference in empathic responses, whether looking at ingroup or outgroup members in pain. However, Korean Americans showed more cognitive (logical) empathy compared to Caucasian Americans, who showed more affective (emotional) empathy. Furthermore, Korean Americans exhibited statistically significant higher social dominance compared to Caucasian Americans, but unlike previous studies, their social dominance did not correlate to empathic responses. Therefore, first generation Korean Americans may still maintain views of traditional social hierarchy but show egalitarian responses toward pain, similar to their Caucasian counterparts. Understanding cultural differences to empathic responses and acceptance of authority can be a significant factor in motivating today's diverse global workforce.

S04
The Emotional Intelligence of Illinois Mathematics and Science Academy Students

Presenter(s)
Nisha Kishore, Illinois Mathematics and Science Academy

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

The purpose of this investigation was to gain understanding of our student body's current level of emotional intelligence. An emotional intelligence survey composed by emotional intelligence coach Robert Gramillano was emailed to all students at the Illinois Mathematics and Science Academy. This self-assessment asked participants to rank their ability to manage their emotions, motivate themselves, show empathy, have self-awareness, and utilize social skills. There were three ranges in which the scores could fall: low, average, or high. The average score for each category (including the total score) was calculated for each gender and year in school using a one-way analysis of variance. These averages were compared to look for differences in gender and year in school. It was discovered that the mean score for all categories fell into the average emotional intelligence range. The overall scores suggest that male students are more emotionally intelligent than female students. There is a significant difference between males and females in managing emotions. In all ages, males scored higher in managing emotions than females. Finally, the means for all categories lie in the average range, suggesting that our student body has an average level of emotional intelligence.

S05
Investigating the Origins of Suicide in Asian American and Pacific Islander Youth and Elderly

Presenter(s)
Patty Li, Illinois Mathematics and Science Academy
Yiqiao Wu, Illinois Mathematics and Science Academy

Advisor(s)
Mark Chiang, University of Illinois at Chicago
Rooshey Hasnain, University of Illinois at Chicago

Asian American and Pacific Islander (AAPI) youth aged 15-24 years and AAPI women over 65 years old have higher rates of suicide. AAPIs also underutilize mental health care services, or if they receive services, the quality of care is limited. This study investigates the similarities and differences of these two target groups in regard to mental health issues and suicide rates among these target groups. To answer our research question, we identified and analyzed relevant literary sources, collected information from various meetings related to AAPI populations and mental health, and identified themes in films that document issues of mental health and suicide in these two subgroups of AAPIs. Our findings for both subgroups indicate that depression plays a significant role. For example, Asian family dynamics and the conflict between American values and traditional values of their home countries play a critical role as well. The specifics, however, differed between the two groups. For youth, the principal stressors were academic-related, particularly pressures to succeed. Elders struggled mainly with feelings of loneliness and lack of support networks, along with feelings of being burdensome to their family. Evidence clearly shows that culturally competent mental health services and support systems that are accessible to these two populations are needed, and whether or not such services and systems become more easily accessible may influence future practices and policies in this under studied area.

S06
Relieving Stress by Increasing Stress Awareness

Presenter(s)
Hsing-Duan Louh, Illinois Mathematics and Science Academy
Malachi Loviska, Illinois Mathematics and Science Academy

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

Regardless of age, stress is commonly experienced by any living individual. Though stress is necessary for survival, negative stress often weakens the body so that it is prone to chronic diseases. We created a questionnaire based on the Schedule of Recent Experience to promote internalization of stressors. The questionnaire was used to measure the efficiency of our method on the degree of stress among high school students. We included a question at the beginning and at the end of the questionnaire asking about each student's perceived level of stress to measure our questionnaire's influence. We expected the majority of the students to select a higher number signifying a lower level of stress after completing the questionnaire but found that the majority of the numbers lowered. We concluded that since the majority of the sources of stress indicated by the students are not academically related, the questionnaire only managed to help students review their stressors but did not help relieve stress. Overall, the experience helped us to understand scientific collaboration both with each other and with other high schools. Even though we did not lower the stress level, we learned to promote internal reflection of stress.

S07
The Effect of Methylenedioxymethamphetamine on Generosity

Presenter(s)
Saraswathi Nookala, Illinois Mathematics and Science Academy

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

Methylenedioxymethamphetamine (MDMA), also known as ecstasy, is a recreational drug linked to prosocial behaviors which have been cited as reasons for its use. Though studies have been conducted on the prosocial behaviors of MDMA, these behaviors have never been measured. In this study, the effect of MDMA on generosity was measured. Healthy volunteers with MDMA experience were placed in either an isolated environment (that is, an empty room), or a social environment (that is, with one researcher). In this within subject, double-blind study, participants were given 1.0 mg/kg, of MDMA, 0.5 mg/kg of MDMA, and a placebo over a course of three sessions. During the sessions, heart rate, blood pressure, and prosocial behaviors were measured. The Welfare-Tradeoff Task, a behavioral task in which participants choose whether to allocate money to themselves or others, was administered 90 minutes (peak effect of drug) into each session. MDMA was found to increase measures of generosity in both the social and isolated groups, but there was no significant difference in generosity between the groups. Heart rate, blood pressure, and mood were found to have a dose-dependent increase. The effect of MDMA on prosocial behavior can be studied to further understand the possible reasons for its use.

S08
Associations Between Impulsive Choice and Risk-Taking in Relation to Gambling

Presenter(s)
Aniruddha Shekara, Illinois Mathematics and Science Academy

Advisor(s)
Jessica Weafer, University of Chicago
Harriet de Wit, University of Chicago

Impulsivity is a multifaceted construct associated with problem behaviors such as drug abuse and gambling. Previous studies have shown associations between these problem behaviors, and the aspects of risk taking and impulsive choices. We focused on these facets in relation to impulsivity and problem gambling. Healthy adults (n=435) were assessed for impulsive choice, risk taking, and gambling propensity with behavioral and self-reported measures. We found associations between measures of impulsivity and gambling behavior as well as associations between both facets. As we hypothesized, behavioral and self-reported risk taking were significantly correlated ($r = .177$, $p<.01$). Probability discounting was related differently from delay discounting to both behavioral and self-reported risk taking. A greater preference for uncertain reward was positively related with behavioral risk taking ($r = .178$, $p<.01$). Probability discounting was also related to self-reported likelihood of risk ($r = .150$, $p<.01$), and negatively correlated with risk perception ($r = -.185$, $p<.01$). No associations were found between delay discounting and risk-taking measures. However, in both aspects of impulsive choice and risk-taking only self-reported risk was associated with gambling behavior ($r = .105$, $p<.05$). These findings indicate an importance for future research on probability discounting in relation to other risky behaviors.

S09
The Effect of Time in Captivity on a Gray Wolf's Capacity of Trust in Humans

Presenter(s)
Remmie Spinks, Illinois Mathematics and Science Academy

Advisor(s)
Robyn Fischer, Illinois Mathematics and Science Academy
Randy Johnson, Phillips Park Zoo

The gray wolf, when hand-raised in captivity, experiences an attachment to the humans caring for it called imprinting. This attachment happens early in development and even small variances in exposure time can increase or decrease this attachment. My investigation tested the effect of the time that a gray wolf is in captivity on the trust that the wolf has towards humans. The subjects of observation were one female wolf of thirteen years, hand-raised from birth by the zoo keepers at her current habitat, and another female wolf of eight years that was not hand-raised by the zoo keepers and was introduced to the zoo at two months old. Using measurements of the wolves' enclosure, the distance between the wolf and the human at all times of interaction was recorded. My preliminary data suggests that there is a positive correlation between the time in captivity and the amount of trust that a wolf has in humans. These results can help raise awareness of the domesticating effects of captivity on wolves and discourage the unnecessary capture and breeding of wild wolves.

S10
Catechol-O-Methyltransferase Allelic Variation and Interpersonal Stressors on Adolescent Well-Being

Presenter(s)
Poornima Sundaravelu, Illinois Mathematics and Science Academy

Advisor(s)
Eva Telzer, University of Illinois at Urbana-Champaign

Adolescents show a significant increase in risk-taking behavior and substance use. Interpersonal stressors such as discrimination and family conflict have shown adverse effects on the well-being of adolescents, especially Latinos, with outcomes such as mental health problems, substance use, and rule-breaking and aggressive behavior. Recognizing the link between interpersonal stressors and negative outcomes, the present investigation seeks to examine how the different catechol-O-methyltransferase (COMT) genotypes (Val/Val, Val/Met or Met/Met) buffer or enhance the effects of interpersonal stressors on Latino adolescents. COMT is a regulator of dopamine in the brain and is linked to cognitive function and risky behavior. Existing findings are inconsistent as to which allele is protective and which one is risky. Sixty-nine Latino adolescents (52% female) completed a questionnaire and filled out a checklist every night for two weeks. Results suggest that the Met allele is protective; Met carriers show superior academic performance and are protected from the negative effects of discrimination and family conflict than Val allele carriers, who show an increase in substance use and externalizing problems in the presence of interpersonal stressors. The present findings suggest that the Met allele is protective against substance use and externalizing behavior and is linked to enhanced cognitive performance.

S11
The Effects of Visual Speech Cues on the Speed of Spoken Language Perception in Adults

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

Advisor(s)
Tina Grieco-Calub, Northwestern University
Kristi Ward, Northwestern University

Speech perception has both auditory and visual components. In the present study, we used the looking-while-listening paradigm to explore these perceptual processes. On each trial, participants were verbally prompted to look at one of two images presented on a screen. Participants' eye gazes were video recorded as they performed this task in four different listening conditions: quiet and in the presence of noise, with auditory only or audiovisual speech cues. Data is currently being analyzed to generate both speed and accuracy of spoken language processing in the four listening conditions. Because adults' dependence on visual components of speech tends to increase as the fidelity of the auditory signal decreases, we predict that adults will utilize visual cues to a greater extent in the presence of noise. If this prediction is accurate, we will see faster processing in the audiovisual conditions where noise is present. We are currently working to confirm these results through further data extraction and analysis. Access to the visual component of a speech signal is expected to increase adult processing efficiency when listening to speech in complex auditory environments.

S12
Anxieties: Effects on Self-Concept and Common Methods of Relieving Anxiety

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

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

Students in gifted communities feel greater pressures in their academics and social lives that are not prevalent in general populations. These pressures often appear in the form of anxieties that can cause adverse effects to the psyche. Through a survey, IMSA students were asked about particular perceptions in relation to physical traits, academics, and social interactions and students were asked to evaluate their level of anxiety related to anxiety producers. In addition, students were asked whether or not they believed that their self-perceptions had effects on their level of anxiety and whether the opposite was true. The results show that there is a statistically significant negative correlation relating anxieties to their respective perceptions. Most students also expressed that their anxieties have perceivable effects on their self-perceptions which shows a likely relationship based on cause of effect from anxieties on self-perceptions. Higher levels of anxiety that tend to lower self-perception levels show that worry causes many students to believe that they are lacking in those areas.

T01
An Evaluation of the Effectiveness of the Millennium Villages Project to Eradicate Global Poverty

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

Advisor(s)
Juliet Sorensen, Northwestern University

The United Nations established the Millennium Development Goals (MDG) to commence resolving extreme, global poverty. Jeffrey Sachs, a renowned economist, believes he has the solution to eradicate global poverty with his approach behind the Millennium Villages Project (MVP). Conversely, Sachs's purpose and methods have been questioned by many creating a debate. In order to evaluate this debate, I analyzed articles, published journals, books, and online videos. The critics of Sachs consistently accuse the MVP to be overambitious while utilizing an excessive amount of money. Their principal argument against the MVP asserts that the project does not have proper evaluations with concise data to measure progress and success. Sachs admits to some critiques and appropriately defends himself to others. Similar to other philanthropists, his primary focus is to create sustainable development in the poorest countries and villages to prove he can bring them up from poverty and achieve the MDGs simultaneously. The MVP has had success in reducing malaria rates, deaths at child birth, and improving agriculture within African villages. The analysis of this debate identifies the various opinions on eliminating global poverty and explains the accuracy of Jeffrey Sachs's approach while educating others on this worldwide crisis.

T02
The Invisible Social and Emotional Struggles of Women in Law Enforcement and the Military

Presenter(s)
Amy De La Torre, Illinois Mathematics and Science Academy
Laura Lehmann, Illinois Mathematics and Science Academy

Advisor(s)
James Bondi, Illinois Mathematics and Science Academy
Kristen Ziman, Aurora Police Department

Women in the law enforcement and military encounter many obstacles as a result of their chosen career paths. In addition to obvious physical differences between them and their male counterparts, the women in these male-dominated fields face social and emotional struggles as well. The purpose of this investigation was to focus on and identify the obstacles which women face in law enforcement and the military. This investigation utilized a research method known as the Q method. For this Q method we obtained various opinionated statements pertaining to women in law enforcement and military from prior interviews with female law enforcement officials. We used these statements to create a survey which asked participants to categorize the statements based on their level of agreement with them. The surveys were then administered to female participants who work in law enforcement or the military. We identified five distinguishable perspectives amongst the women. Our investigation's results describe the characteristics of each individual perspective group. Our findings also demonstrate the differences between them which help understand how women socially and emotionally engage their career in law enforcement and the military.

T03
Measuring the Health of the News Industry

Presenter(s)
Molly Fane, Illinois Mathematics and Science Academy
Alonzo Marsh, Illinois Mathematics and Science Academy

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

Free news articles made available online by newspaper companies have changed the state of the media. Following the economic recession of 2008, many newspaper corporations have suffered significant financial losses due to a drop in advertising revenue. We collected data regarding the volume of news publications as well as wired publications from LexisNexis. An analysis was conducted looking at the health of newspaper corporations through the volume of publishing and percentage of articles published from wired services such as Reuters and the Associated Press. Preliminary observations suggest correlations between the volume of publications, marketing strategy changes, historically significant events, and economic shifts. Statistical analysis to measure the extent of correlations is ongoing. It is hoped that our results will substantiate that a paywall has been effective for generating revenue. Based on our findings, we have been able to gauge the health of various newspaper corporations as they moved to online publishing.

U01
Characterizing Charge-Coupled Device and Naked-Eye Telescope Observations at the Doane Observatory

Presenter(s)
Austin Cao, Illinois Mathematics and Science Academy
Dayna Lei, Illinois Mathematics and Science Academy

Advisor(s)
Larry Ciupik, Adler Planetarium
Mark Hammergren, Adler Planetarium
Lou Nigra, Adler Planetarium
Ken Walczak, Adler Planetarium

Daytime observation limits at the observatory are currently unclear. To characterize the minimum magnitude of visibility, optimal conditions for viewing with the naked eye, integrating video cameras, and using charge-coupled devices (CCDs) must first be identified. Naked eye observations were characterized by viewing celestial objects through different eyepieces and filters to determine the lowest visible magnitude. CCD observations were characterized by analyzing the noises of single and multiple CCD exposures at various temperatures. Video camera observations were characterized by taking videos of the Sun, stars, and planets, adjusting the exposure time, and analyzing the video. Preliminary results suggest a naked eye daytime magnitude limit of 3.99 directly opposite the Sun. However, air turbulence can affect this limit greatly and distort bright objects like the Sun. Furthermore, we have found a mathematical relationship between the noise of a CCD photo, the temperature, and exposure time. The noise is directly related to temperature and inversely related to exposure time. Thus, we conclude, the most effective way of photographing dim objects with CCDs is taking long exposures at low temperatures without atmospheric disturbances. Finally, we have found that the visibility of particular features on a bright object like the Sun is affected by exposure length.

U02
Measuring Diffuse Interstellar Bands in Henry Draper Catalogue Stars

Presenter(s)
Kieran Groble, Illinois Mathematics and Science Academy

Advisor(s)
Don York, University of Chicago

Diffuse interstellar bands (DIBs) are clouds of interstellar material. They can be observed from Earth indirectly by analyzing their effects on the spectra of light that reach Earth from stars. Each DIB absorbs light in a certain narrow range of wavelengths. The spectra of certain stars in the Henry Draper Catalogue were analyzed to measure the strength (the magnitude of absorption) of known DIBs. The possibility of contamination from inherently stellar absorption, from DIBs in the same region of the spectrum, and from the Earth's atmosphere was accounted for, and measurements were designated as upper limits when appropriate. Measurements were taken using the Fortran program ewprog, which examines the area of the spectrum around a known DIB for a star likely to exhibit interstellar absorption and a star unlikely to exhibit absorption. Absorption present in the star in which it is expected, but not the star in which it was not expected, was measured. Measurements for nearly one hundred fifty stars have been taken; these measurements will be compiled with others to identify both trends and exceptions in how DIBs manifest themselves. These data will further the search to find what DIBs are made of.

U03
Numerical and Visual Modeling of Comet Dust Trails

Presenter(s)
Ujwal Kiran, Illinois Mathematics and Science Academy
Megan Roller, Illinois Mathematics and Science Academy

Advisor(s)
Larry Ciupik, Adler Planetarium
Mark Hammergren, Adler Planetarium
Lou Nigra, Adler Planetarium
Ken Walczak, Adler Planetarium

Using cosmic forces from the celestial bodies in our Solar System, cometary dust emission can be accurately integrated and analyzed in comparison to real imagery and data. This allows the mapping of cometary trails so we can accurately predict paths and possible collisions. We integrated numerical data using a Dormand-Prince integrator, DOPRI5, and modelled comets using openSCAD. Within our integrator, we currently include gravity from the Sun, eight planets, and other close celestial bodies, as well as radiation parameters from the Sun. In most comets examined, we found the majority of dust emission occurred before the comet’s perihelion. We found the rough density of cometary dust emission and concentration in spherical coordinates relative to the Earth. In addition to modelling the orbits and dust tails of comets, along with dust emission, density, and concentration, we visually modelled asteroids based off radar imagery, and would have added other celestial bodies as focal points, with time. This modelling will be helpful with approaching near-Earth celestial bodies, ensuring they aren’t a threat, and noting the emission of cometary dust that interferes with our atmosphere and our satellites. This will allow greater knowledge of cometary bodies, and hopefully other celestial effects, like radiation pressure.

U04
Designing a Radiation Shield for the NASA Exploration Design Challenge

Presenter(s)
Alec Mangan, Illinois Mathematics and Science Academy

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

Space radiation is a major obstacle in the path of interplanetary travel. Designing a light and effective radiation is very difficult to do. My SIR investigation is to participate in the NASA Exploration Design Challenge which is a national competition to design a light and effective radiation shield. We researched shielding materials and how radiation passes through matter. We used Space Environment Information System (SPENVIS) to run GEANT4, a particle simulator, to model particles moving through the radiation shield. Through our literature research we decided to build the shield out of tungsten, polyethylene, and boron 10. We chose to use tungsten for its high density of 19.1g/cm^3 which allows it to protect against ionizing radiation very effectively. We chose polyethylene because of its abilities to slow neutrons which when combined with boron 10`s high neutron cross section protects from most of the neutrons. Through our testing with SPENVIS, we decided to use four layers of material: tungsten, boron 10, polyethylene, and tungsten. We have submitted our shield designs and are waiting to see if we have won the challenge. If we win the challenge, our shields will be built and flown on the Orion mission in September 2014.

2012-2013 Student Recognition

The below accomplishments are a summary from the 2012- 2013 academic year.

Prachi Aggarwal: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisor: Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist

Charlene Angeles: The Impact of Narcolepsy on Self-Image and Quality of Life in Young Adults
Advisor: Mary Kapella, University of Illinois at Chicago
Co-presenter at 7th Annual Meeting of the Associated Professional Sleep Societies, June 1-5, 2013

Brian Chen: Growth Characterization of Electron Beam-Induced Silver Deposition From Liquid Precursor
Advisors: Leonidas Ocola and Ralu Divan, Argonne National Laboratory
*Poster presentation at the Joint NSRC Workshop on Nanoparticle Science at Argonne National Laboratory, Nov, 5-6, 2012; Co-author of paper published in the Journal of Vacuum Science and Technology B, November 8, 2012 (L. Ocola, A. Joshi-Imr, C. Kessel, **B. Chen, J. Park***, D. Gosztola, and R. Divan)*

Kathleen Chinetti: Searching for Dark Matter Using Charge Coupled Devices
Advisor: Thomas Schwarz, Fermi National Accelerator Laboratory
Poster presented at STEM Summit 2013: An Integrated Approach, March 8, 2013 at Stevenson High School

Kathleen Chinetti: Benefits of Student Research Opportunities
Advisor: Judy Scheppler, Illinois Mathematics and Science Academy
Presentation at STEM Summit 2013: An Integrated Approach, March 8, 2013 at Stevenson High School

Matthew Deng: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist: gold award, Best in Category Chemistry; Yale Science and Engineering Association, Inc. Science Fair Award

Kevin Emancipator: A Population-Based Approach to Define Risks Associated with Variable Hepatitis C Treatment Response in Individuals Coinfected with Human Immunodeficiency Virus
Advisor: Sudhir Penugonda, Northwestern University
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist

Kevin Emanipator: Associations between HIV Susceptibility and Mutations in the Vif-Associated APOBEC3G Proteasomal Complex
Advisor: Sudhir Penugonda, Northwestern University
*Co-Author of paper published in the Journal Experimental Secondary Science, April 2013, Vol. 2; Issue 4 (**Kevin Emancipator, Jack Michuda**, and Sudhir Penugonda)*

Kent Gang: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist: gold award, Best in Category Chemistry; Yale Science and Engineering Association, Inc. Science Fair Award

Siva Gangavarapu: Density Functional Theory Investigation of Silicene and Metal Adatoms
Advisors: Ron Hurlbut and Glenn "Max" McGee, Illinois Mathematics and Science Academy
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist: gold award, Best in Category Chemistry; Yale Science and Engineering Association, Inc. Science Fair Award

Anna Gupta: Building an Efficient Egg-Based Antibacterial Water Filter
Advisor: Mark Carlson, Illinois Mathematics and Science Academy
Illinois Junior Academy of Science, Region V Project Exposition Finalist, U.S. Army Special Award for Environmental Sciences, Stockholm Junior Water Prize Regional Certificate; IJAS State Finalist: gold award, Stockholm Junior Water Prize, Honorable Mention from the Illinois Water Environment Association

Shreya Jain: Achieving Hippocampus Activation Through fMRI Tests
Advisor: Todd Parrish, Northwestern University
Midwest Research Competition: Positive Impact Finalist, April 12, 2013 at Wheeling High School; Illinois Junior Academy of Science Region V Paper Exposition Finalist, Best in Category Behavioral Science; IJAS State Finalist: gold award

Samuel Kaufman: Determining the Value of a Baseball Player
Advisor: Chris Kolar, Illinois Mathematics and Science Academy
Poster presented at STEM Summit 2013: An Integrated Approach, March 8, 2013 at Stevenson High School

Omkar Kelkar: An Analysis of Regulated and Disrupted E4BP4 Circadian Waveforms in Siberian Hamsters
Advisor: Brian Prendergast, University of Chicago
Presentation at Rits Super Science Fair, November 10-14, 2012, Kyoto, Japan; Illinois Junior Academy of Science Region V Project Exposition Finalist; IJAS State Finalist: gold award

Srisha Kotlo: Analysis of Critical PKCδ Sites on Sarcomeric Protein Phosphorylation and Function
Advisors: Marcus Henze and John Solaro, University of Illinois at Chicago
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist; Illinois Junior Academy of Science Region V Project Exposition Finalist, Best in Category Cellular and Molecular Biology, Naval Science Award; IJAS State Finalist: gold award, Best in Category Cellular and Molecular Biology; Intel International Science and Engineering Fair Finalist; Intel ISEF fourth place, Cellular and Molecular Biology

Anna Kryczka: Achieving Hippocampus Activation Through fMRI Tests
Advisor: Todd Parrish, Northwestern University
Illinois Junior Academy of Science Region V Paper Exposition Finalist, Best in Category Behavioral Science; IJAS State Finalist: gold award

Dipen Kumar: The Effect of the Enteric Biome on Lysosomal Hydrolase Activity
Advisor: Glyn Dawson, University of Chicago
Presentation at Rits Super Science Fair, November 10-14, 2012, Kyoto, Japan

Jenny Lee: HPLC–MTT Assay: Anticancer Activity of Aaqueous Garlic Extract is From Allicin
Advisor: Bao-Shiang Lee, University of Illinois at Chicago
*Co-author of article in Analytical Biochemistry 436 (2013) 187–189 (**Jenny Lee**, Shalini Gupta, Jin-Sheng Huang, Lasanthi P. Jayathilaka, Bao-Shiang Lee)*

Shelly Li: Thymoquinone Inhibits Cigarette Smoke Extract-Induced SiHa Cell Invasion
Advisor(s): Kenneth Alexander, University of Chicago
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 13-17, 2013, in Boston, Massachusetts

Shelly Li: Effects of NF-κB Activation on E6 Oncoprotein Expression in Head and Neck Cancer Cells
Advisor: Kenneth Alexander, University of Chicago
Siemens Competition Regional Semi-Finalist; Illinois Junior Academy of Science, Region V Project Exposition Finalist, Best in Category Cellular and Molecular Biology; IJAS State Finalist: gold award, Best in Category Cellular and Molecular Biology; Intel International Science and Engineering Fair Finalist; Intel ISEF fourth place, Cellular and Molecular Biology

Claire Liang: Modeling Spatial Population Dynamics of Stem Cell Lineage in Tissue Regeneration
Advisor: Youfang Cao, University of Illinois at Chicago
*Presentation at 34th Annual International Conference of the IEEE EMBS, August 28 - September 1, 2012, San Diego, California. (Youfang Cao, **Claire Liang**, Hammad Naveed, Yingzi Li, Meng Chen, and Qing Nie)*
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 13-17, 2013, in Boston, Massachusetts

Emily Ling: Developing Therapeutic Approaches to Amyotrophic Lateral Sclerosis
Advisor: Jane Wu, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist: silver award

David Lisk: Building an Efficient Egg-Based Antibacterial Water Filter
Advisor: Mark Carlson, Illinois Mathematics and Science Academy
Illinois Junior Academy of Science, Region V Project Exposition Finalist; U.S. Army Special Award for Environmental Sciences, Stockholm Junior Water Prize Regional Certificate; IJAS State Finalist: gold award, Stockholm Junior Water Prize, Honorable Mention from the Illinois Water Environment Association

Peter Liu[**]: Energy Loss at Propagating Jamming Fronts in Granular Gas Clusters
Advisors: Sidney Nagel and Justin Burton, University of Chicago
*Co-author of paper in Phys. Rev. Lett. 111, 28 October 2013 (Justin C. Burton, **Peter Y. Lu**, and Sidney R. Nagel)*

Anuj Marathe: Heat Shock Protein 70 Maintains Intestinal Homeostasis Through the Regulation of IL-10 Producing Regulatory T Cells
Advisors: Yunwei Wang and Eugene Chang, University of Chicago
Presentation at the 2012 American Association of Pharmaceutical Scientists Annual Meeting and Exposition, October 14-18, 2012, in Chicago
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 13-17, 2013, in Boston, Massachusetts

Anuj Marathe: Transient Therapy-related Surge in Serum Tumor Biomarkers: Characterizing Behavior and Postulating its Biologic Role
Advisors: Suneel Mundle and Mohan Chelladurai, Rush University Medical Center
*Co-author of paper in Critical Reviews in Oncology/Hematology, April 2013 (SD Mundle, AS **Marathe,** M. Chelladurai)*

Aalap Mehta: The Role of RBP2 in MCF-7 Cancer Cell Drug Resistance
Advisor: Elizaveta Benevolenskaya, University of Illinois at Chicago
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 13-17, 2013, in Boston, Massachusetts

Jack Michuda: Associations between HIV Susceptibility and Mutations in the Vif-associated APOBEC3G Proteasomal Complex
Advisor: Sudhir Penugonda, Northwestern University
*Co-Author of paper published in the Journal Experimental Secondary Science, April 2013, Vol. 2; Issue 4 (**Kevin Emancipator, Jack Michuda**, and Sudhir Penugonda)*

Philip Nebres: Effect of Varying Lipid Concentration on Phase Separation in Model Cell Membrane
Advisor: Adam Hammond, University of Chicago
Illinois Junior Academy of Science Region V Paper Exposition Finalist, Best in Category Biochemistry/Chemistry; IJAS State Competition: gold award; IJAS Region V Project Exposition Finalist, Best in Category Biochemistry/Chemistry; IJAS State Finalist: gold award

Ruchi Patel: Engineering pH Dependent Anti-Caffeine Camelid VHH and Linked VHH:VHH Through Mutagenesis
Advisor: James Horn, Northern Illinois University
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist

Jenson Phung: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisors: Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Competition

Daniel Rosenthal: Metal-Assisted Etching of Silicon Molds for Electroforming
Advisors: Ralu Divan and Leonidas Ocola, Argonne National Laboratory
*Poster presentation at the 2013 APS/CNM/EMC Users Meeting at the Argonne National Laboratory, May 6-9, 2013. (**D. Rosenthal**, R. Divan, K. Ogando, L.E. Ocola, D. Rosenmann, N. Moldovan)*
*Poster presentation and co-presenter at the 57th International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication, May 28-31, Nashville, Tennessee. (R. Divan, **D. Rosenthal**, K. Ogando, L.E. Ocola, D. Rosenmann, N. Moldovan)*

Shreya Santhanam: Examining Asthma Prevalence and Improving Medication Access in Chicago Public Schools
Advisors: Ashley Dyer, Ruchi Gupta, Chris Warren, and Emily Zadikoff, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist

Robert Schurz: Improvements to Readout Electronics for CMS Hadron Calorimeter
Advisors: Jacob Anderson, Fermi National Accelerator Laboratory
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist, Chicago Region second alternate; Co-Author of paper published in the Journal Experimental Secondary Science, October 2013, Volume 3 Issue 1 (**Robert Schurz** and Jacob Anderson)

Carrie Sha: *Development of Novel Sensor to Reduce Postural Kyphosis*
Advisor: Peter Clancy, Illinois Mathematics and Science Academy
Intel Science Talent Search Semifinalist; 14th Annual Percy Julian Science Symposium Finalist[3], April 20, 2013, at Oak Park and River Forest High School, Illinois

Carrie Sha: Comparing Mathematical and Verbal Semantic Memory in Epileptic Patients Using Invasive Neurophysiologic Brain Mapping
Advisor: Vernon L. Towle, University of Chicago
Co-Author of paper published in the Journal Experimental Secondary Science, April 2013, Vol. 2; Issue 4
(**Carrie Sha** and Vernon L. Towle)

Navika Shukla: Nectin-1 Specific Entry of Herpes Simplex Virus-1 Is Sufficient for Infection of the Cornea and Viral Spread to the Trigeminal Ganglia
Advisor: Tibor Valyi-Nagy, University of Illinois at Chicago
*Co-author of paper in Molecular Vision (2012) 18:2711-2716. (**Navika Shukla,** Vaibhav Tiwari, and Tibor Valyi-Nagy)*
Poster presented at STEM Summit 2013: An Integrated Approach, March 8, 2013 at Stevenson High School

Simona Stancov: The Influence of Sugar Substitutes on Yeast Fermentation with Regards to Volume of CO_2 Produced
Advisor: Joe Traina, Illinois Mathematics and Science Academy
Poster presented at STEM Summit 2013: An Integrated Approach, March 8, 2013 at Stevenson High School

Nathan Suek: Identifying an Unknown Cyanobacterium by DNA Sequence Analysis
Advisors: Robert Haselkorn and Piotr Gornicki, University of Chicago
Siemens Competition Regional Semi-Finalist

Sai Talluru: The Experience of *GATA6* Mutations oof All Subjects in the Monogenic Diabetes Registry
Advisors: Graeme Bell, David Carmody, and Siri Atma Greeley, Univerity of Chicago
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist

Arjun Tambe: An Analysis of the Components of Azelaic Acid-Induced Systemic Acquired Resistance in *Arabidopsis*
Advisors: Nicolas Cecchini and Jean Greenberg, University of Chicago
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist;
Academy of Science Region V Paper Exposition Finalist, Best in Category Cellular and Molecular Biology; IJAS State Finalist: gold award

Stephanie Wang: A Novel Design Verifying Field Programmable Gate Arrays' Radiation-Tolerance
Advisor: Jinyuan Wu, Fermi National Accelerator Laboratory
Illinois Junior Academy of Science Region V Paper Exposition Finalist, Best in Category Physics, U.S. Army Special Award for Engineering; *IJAS State Competition: gold award; Illinois Junior Academy of Science Region V Project Exposition Finalist; IJAS State Finalist: gold award, Best in Category Engineering, Special Award from the American Nuclear Society*

Summer Wu: Characterization and Manipulation of Nanorods via an Applied Magnetic Field
Advisors: Vinayak Dravid and Shih-Han Lo, Northwestern University
Presentation at the American Junior Academy of Science conference at the American Association for the Advancement of Science annual conference, February 13-17, 2013, in Boston, Massachusetts

Summer Wu: Developing an Aβ Oligomer-Targeted MRI Probe for Diagnosis of Alzheimer's Disease
Advisors: Kirsten Viola and William Klein, Northwestern University
38th Annual Chicago Region Junior Science and Humanities Symposium Finalist

Hye-Jean Yoon: Developing Therapeutic Approaches to Amyotrophic Lateral Sclerosis
Advisor: Jane Wu, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; IJAS State Finalist: silver award

Luke Zhan: Regulation of Type II NKT Cell Cytokine Production by SLAM-Associated Protein
Advisors: Chyung-Ru Wang and Xiufang Weng, Northwestern University
Illinois Junior Academy of Science, Region V Project Exposition Finalist; Best in Category Cellular and Molecular Biology, Society for In Vitro Biology Award; IJAS State Finalist: gold award; Intel International Science and Engineering Fair Finalist

Kevin Zhang: The CAKE Clocking and the Trapezoidal Clocking Schemes: Principles and Demo Tests
Advisor: Jinyuan Wu, Fermi National Accelerator Laboratory
Co-presenter at the IEEE Nuclear Science Symposium and Medical Imaging Conference and Workshop on Room-temperature Semiconductor X-ray and Gamma Ray Detectors, 2013 Seoul Korea Oct 27-Nov 2, 2013 (J. Wu, S. Wang, **K. Zhang**)

* IMSA Alumnus, class of 2010
** IMSA Alumnus, class of 2012

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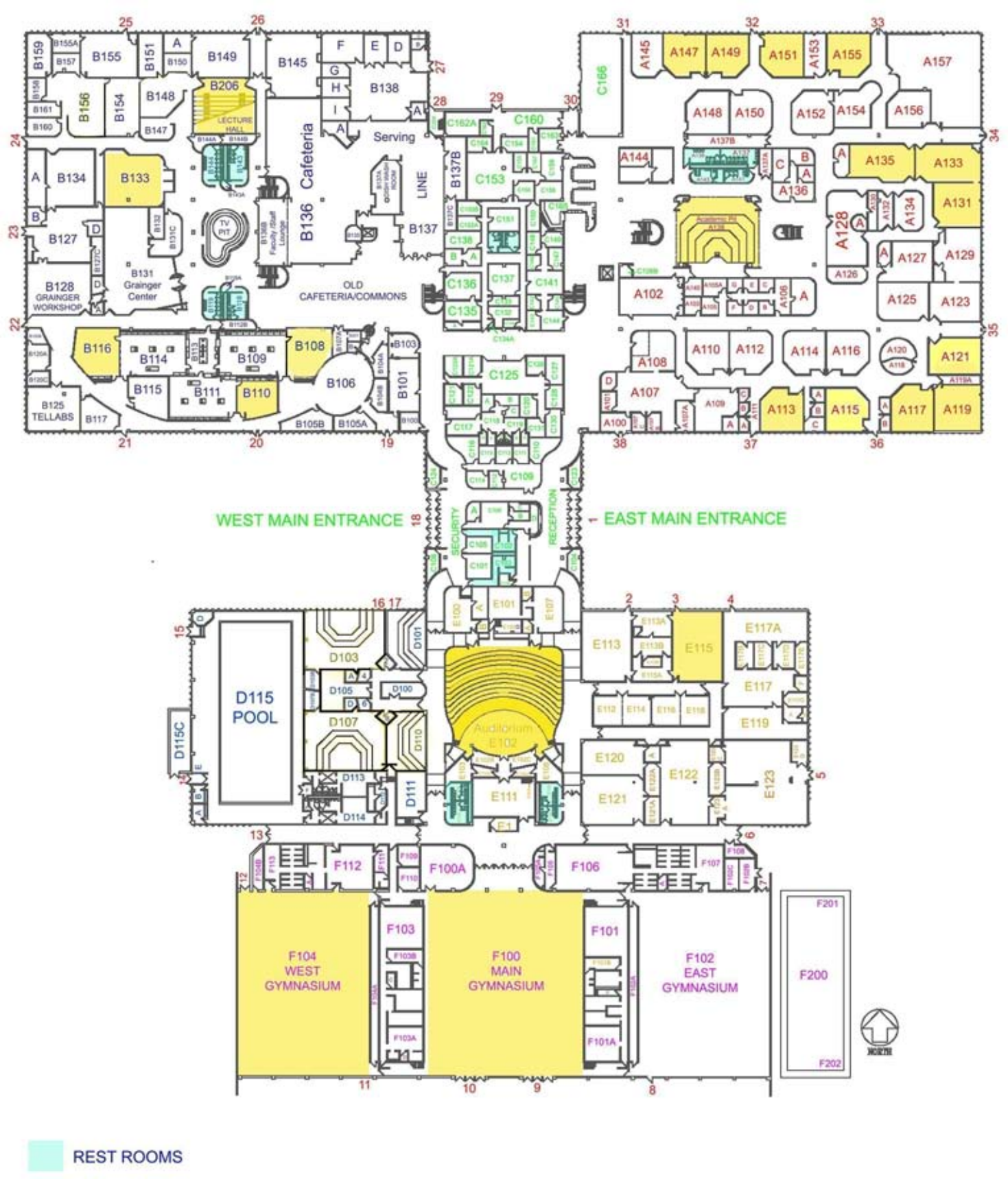
C17	54	Shreya Jain	1:20	A-138 Acad. Pit
E03	72	Arjit Jaiswal	12:55	A-151
C18	55	Elijah Jimenez	8:45	A-131
C19	56	Vivian Jin	10:25	A-133
S01	125	Alexandra Johnson	10:00	A-119
P07	102	Sharon Johnson	10:50	A-147
N01	95	Edward Jun	1:45	A-117
Q08	110	Mohamed Kady	8:45	A-147
I09	89	Vinesh Kannan	10:25	B-108
Q09	111	Vandana Karan	10:50	A-131
C20	56	Omkar Kelkar	10:25	A-135
P08	102	Omair Khan	1:45	A-149
C21	57	Nicholas Kiene	10:00	B-133
B03	41	Ashley Kim	10:00	A-113
D01	69	Sun Kim	1:45	E-115 Kids Inst.
U03	134	Ujwal Kiran	1:45	A-119
S04	127	Nisha Kishore	9:35	B-206 Lect. Hall
Q10	111	Taylor Knopf	11:15	A-131
M01	94	Max Kontorovich	9:10	A-133
C22	57	Srisha Kotlo		alternative day/time
C23	58	Sanjay Kottapalli	1:45	A-135

E04	72	Jacob Kronenberg	12:30	A-133
E05	73	Anna Kryczka	8:45	B-116
F03	76	Saurabh Kumar	1:45	A-151
F07	78	Saurabh Kumar	2:10	A-151
C24	58	Kathryn Kuna	12:55	B-108
F08	78	Andrew Kuznetsov	1:20	E-115 Kids Inst.
P07	102	Sophia Lam	10:50	A-147
Q11	112	Lakhena Leang	10:50	A-149
F09	79	Claire Lee	2:10	B-206 Lect. Hall
Q12	112	Jessica Lee	10:00	A-131
R04	121	Ka wai Lee	9:35	A-133
F10	79	Mack Lee		alternate day/time
T02	132	Laura Lehmann	11:15	A-119
U01	133	Dayna Lei	1:20	A-119
C25	59	Quinn Lewis	2:10	B-116
Q13	113	Judy Li	10:00	A-135
S05	128	Patty Li	9:10	E-115 Kids Inst.
Q14	113	Emily Ling	10:25	E-115 Kids Inst.
Q15	114	Emily Ling	10:50	E-115 Kids Inst.
K02	91	David Lisk	9:10	B-108
K03	92	Eveline Liu	8:45	A-119
C26	59	Gina Liu	8:45	A-151
C27	60	Gina Liu	9:10	A-151
S03	127	Vivian Liu	11:15	B-108
Q08	110	Harishankar Logaraj	8:45	A-147
S06	128	Hsing-Duan Louh	10:50	A-119
S06	128	Malachi Loviska	10:50	A-119
G06	83	Derek Lubecke	8:45	B-133
B04	42	Danielle Madsen	10:00	A-115
F11	80	Nicholas Magerko	10:25	A-115
D02	70	Rohit Mahankali	10:50	B-108
Q04	108	Sameeksha Malhotra	1:45	B-133
U04	135	Alec Mangan	9:10	B-110
T03	133	Alonzo Marsh	10:50	B-133
R01	120	Alexander Moreno	1:45	A-147
C28	60	Shruthi Mothkur	1:20	B-108
C29	61	Shruthi Mothkur	1:45	B-108
C30	61	Emily Mu	9:10	A-115
O02	96	Luke Musgrave	12:55	B-116
B01	40	Philip Nebres	1:45	A-138 Acad. Pit
C03	47	Philip Nebres	2:10	A-138 Acad. Pit
S07	129	Saraswathi Nookala	9:35	A-135
E06	73	Nida Normantaite	10:50	A-115
K01	91	Gregory O'Bannon	1:20	A-117
R05	122	Jameson O'Reilly	10:25	A-117
C31	62	Julian Pacheco	12:30	A-135
A03	38	Deborah Park	10:25	B-133
Q16	114	Matthew Park	12:55	B-133
C10	51	Nahee Park	12:30	A-121

C09	50	Somie Park	12:30	B-206 Lect. Hall
Q17	115	Haneesha Paruchuri	10:00	E-115 Kids Inst.
Q03	108	Dawson Patel	10:25	B-206 Lect. Hall
A03	38	Ruchi Patel	10:25	B-133
C19	56	Shuchi Patel	10:25	A-133
E03	72	Varun Patel	12:55	A-151
B05	42	Rajiv Patel-O'Connor	12:55	A-117
G07	83	Daniel Pechi	11:15	A-117
C32	62	Breanna Pederson	10:25	A-155
D03	70	Jonathan Peloquin	9:35	E-115 Kids Inst.
P02	99	Jenson Phung	9:10	B-206 Lect. Hall
C08	50	Atene Poskute	10:50	B-206 Lect. Hall
B06	43	Sean Potempa	11:15	A-121
A04	38	Archit Potharazu	11:15	B-206 Lect. Hall
C33	63	Michael Pradaxay	1:20	A-113
B07	43	Sagar Punhani	9:35	A-131
Q05	109	Brianna Pusey	8:45	E-115 Kids Inst.
F01	75	Benjamin Rabe	12:55	E-115 Kids Inst.
F09	79	Emily Rader	2:10	B-206 Lect. Hall
A05	39	Aishwarya Raj	2:10	B-108
Q18	115	Vignesh Ravi	9:10	A-138 Acad. Pit
R06	122	Sattvic Ray	2:10	A-131
C34	63	Maureen Reiser	12:55	B-206 Lect. Hall
Q11	112	Xueyang Ren	10:50	A-149
F11	80	Jonathan Reynolds	10:25	A-115
R07	123	Dennis Rich	9:10	A-113
U03	134	Megan Roller	1:45	A-119
E07	74	Daniel Rosenthal		alternate day/time
M02	94	Andrew Salij	9:10	B-133
P02	99	Shreya Santhanam	9:10	B-206 Lect. Hall
Q19	116	Sreyesh Satpathy	1:20	B-110
D01	69	John Satter	1:45	E-115 Kids Inst.
Q20	116	Sajishnu Savya	1:45	A-133
C35	64	Nicole Schubert	1:45	B-206 Lect. Hall
P09	103	Frances Seo	10:00	A-117
P10	103	Abhishek Sethi	2:10	A-135
R08	123	Bhairvi Shah	10:50	A-117
I06	88	Milan Shah	2:10	A-119
S08	129	Aniruddha Shekara	8:45	A-138 Acad. Pit
C36	64	Christopher Shin	1:45	A-155
B08	44	Susie Shin	9:35	A-113
K04	92	Bailey Simmons-Brown	9:10	B-116
C37	65	Sachi Singh	1:20	A-133
O03	97	Suraj Sinha	9:35	A-121
R09	124	Janani Sivakumar	9:35	A-149
R10	124	Emma Sloan	1:45	A-115
P11	104	Vimig Socrates	10:00	A-151
Q21	117	Vimig Socrates	9:35	A-151
C08	50	Saigopal Somasundaram	10:50	B-206 Lect. Hall

B09	44	Tera Sparks	2:10	A-117
S09	130	Remmie Spinks	1:20	B-206 Lect. Hall
P12	104	Simona Stancov	11:15	B-116
C09	50	Lajvanthi Sudhakar	12:30	B-206 Lect. Hall
A06	39	Ranjani Sundar	1:20	A-155
S10	130	Poornima Sundaravelu	10:00	A-149
I08	89	Adit Suvarna	11:15	A-149
A07	40	Sai Talluru	2:10	A-155
O04	97	James Tao	12:30	A-155
C38	65	Shelly Teng	2:10	A-121
C39	66	Yash Thacker	12:30	E-115 Kids Inst.
S11	131	Rachel Thain	12:55	A-147
Q07	110	Shveta Thakkar	10:50	A-155
F05	77	Sneha Thakkar	11:15	A-138 Acad. Pit
Q22	117	Rashmi Thimmapuram	11:15	A-155
Q23	118	Rashmi Thimmapuram	1:45	B-110
B07	43	Kyle Thomas	9:35	A-131
C40	66	Lynette To	1:20	A-149
P13	105	Shruti Topudurti	10:50	A-135
B10	45	Rajiv Trehan	11:15	A-147
C13	52	Priya Trivedi	8:45	A-149
R11	125	Lia Vallina	9:35	A-117
Q02	107	Jayathi Varadheeswaran	1:20	B-133
B11	45	Vivek Vermani	9:10	A-119
K05	93	Aaron Victor	9:35	B-116
C41	67	Brian Vien	2:10	A-133
C42	67	Amanda Walsh	8:45	A-121
P14	105	Paul Wang	10:25	A-138 Acad. Pit
M03	95	Stephanie Wang	10:00	A-138 Acad. Pit
Q24	118	Wenhan Wang	10:25	A-121
K05	93	Ziang Wang	9:35	B-116
B12	46	Elizabeth Weiss	1:45	A-131
C43	68	William Widjaja	11:15	A-133
P15	106	Irina Wirjan	8:45	A-117
E08	74	Mateusz Wojtaszek	10:00	B-108
I03	86	Thomas Wu	9:10	A-131
S05	128	Yiqiao Wu	9:10	E-115 Kids Inst.
A04	38	Zachary Yager	11:15	B-206 Lect. Hall
I10	90	Alan Yang	12:55	A-131
S12	131	Ryan Yang	10:00	B-206 Lect. Hall
C44	68	Mayuri Yasuda	1:20	B-116
C45	69	Sung Yeo	1:20	A-121
Q15	114	Hye Jean Yoon	10:50	E-115 Kids Inst.
Q25	119	Hye Jean Yoon	11:15	E-115 Kids Inst.
P13	105	Selam Zenebe-Gete	10:50	A-135
G08	84	Michael Zeng	10:25	B-110
P16	106	Luke Zhan	11:15	B-133
Q26	119	Timothy Zhou	8:45	B-206 Lect. Hall
A07	40	Amy Zhu	2:10	A-155


WEST MAIN ENTRANCE
EAST MAIN ENTRANCE
SECURITY
RECEPTION
B136 Cafeteria
Serving LINE
OLD CAFETERIA/COMMONS
B128 GRAINGER WORKSHOP
B131 Grainger Center
B125 TELLABS
B206 LECTURE HALL
D115 POOL
Auditorium E102
F104 WEST GYMNASIUM
F100 MAIN GYMNASIUM
F102 EAST GYMNASIUM
F200
NORTH
REST ROOMS