IMSA

Illinois Mathematics and Science Academy

17th Annual Presentation Day

April 27, 2005

IMSA®
Illinois Mathematics and Science Academy

A Pioneering
Educational Community

Stephanie Pace Marshall, Ph.D.
President

Dear IMSA Friends:

Students who attend the Illinois Mathematics and Science Academy 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.

Through the IMSA Student Inquiry and Research (SIR) Program, IMSA's young apprentice investigators open our eyes to what is possible in fields such as cell biology, genetics, computer science, biomedical engineering, science education, economics, bacteriology, archeology, biotechnology and immunology.

And the world is paying attention to what our students are saying.

Professional associations such as the American Association for the Advancement of Science (AAAS), the National Association of Biology Teachers, the American Society of Microbiology, and professional research journals such as Nature, Biology of Reproduction, Neuroscience Research Communications and Ceramic Engineering and Science Proceedings have all featured the research work of IMSA students through presentations and publications.

The Student Inquiry and Research Program fosters the development of students as highly skilled and integrative problem finders, problem solvers, and apprentice investigators, all skills required to succeed in the global workplace of the 21st Century. IMSA's SIR Program serves as a model learning environment for the future and provides a variety of research learning experiences (both in and out of class) for students to pursue compelling questions of interest, conduct original research in science, French-American history, and creative and performing arts, create and invent products and services, share their work through presentation and publication, and collaborate with other students, mentors, scholars, researchers and inventors throughout the world.

As you begin to turn the pages and learn about the extraordinary research work of IMSA's young investigators, I hope you will begin to see what is possible. We believe that our goal of creating "decidedly-different learners" is already being met and will make a profound impact on the future of humanity.

For additional information about Student Inquiry and Research Program contact IMSA Director for Curriculum and Assessment Dr. David Abler (630) 907-5886.

Sincerely,

Stephanie Marshall

Stephanie Pace Marshall, Ph.D.
President

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ILLINOIS MATHEMATICS AND SCIENCE ACADEMY

"A Pioneering Educational Community"

SEVENTEENTH ANNUAL IMSA PRESENTATION DAY

April 27, 2005

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Front Cover: - Photograph by Yuxi Ji (IMSA '07) and Cathy Gao (IMSA '07).

Pictured on Front Cover -- Carl Carman (IMSA '06) and Kavin Arasi (IMSA '06).

ILLINOIS MATHEMATICS AND SCIENCE ACADEMY

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SEVENTEENTH ANNUAL IMSA PRESENTATION DAY

April 27, 2005

SCHEDULE OF ACTIVITIES

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

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A-135	**BRAIN DEATH AND ITS PERCEPTION IN SOCIETY** Robert Forler, David Qasem, Dr. Jeffry I. Frank
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B110	**EFFECTS OF INCREASED LOAD ON FORCE OUTPUT DURING LOCOMOTION** Jennifer M. Kang, Dr. David A. Brown
B-116	**ARCHITECTURAL DESIGN AND DEVELOPMENT OF THE SPERTUS INSTITUTE OF JEWISH STUDIES** *Aria Reynolds, Mr. Mark Sexton*
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D-103	**CYTOTOXIC EFFECTS OF BACTERIAL ELECTRON TRANSPORT PROTEIN RUSTICYANIN IN CAENORHABDITIS ELEGANS** Laura T. Cladek, Dr. Ananda Chakrabarty
D-107	**MUON CHARGE RATIO FOR DATA FROM THE MINOS FAR DETECTOR** Junwei Ye, Dr. Maury Goodman
Kids Institute E-115	**IMSA ON WHEELS WEB DESIGN** Christine Foster, Mr. Christopher Lin
Lecture Hall	**THE EVOLUTION OF ELECTRONIC MARKETS: HOW TRADING FIRMS SHOULD APPROACH ASIA** Sharad Kumar, Mr. Robert Khoury

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A-119	**DEVELOPING A SCIENTIFIC MODEL: THE HISTORY OF ACTIVE GALACTIC NUCLEI** Christopher Trigg, Dr. Robert Brazzle
A-133	**DESIGNING AN INTERACTIVE MATH PROGRAM USING MACROMEDIA FLASH MX** David Liu, Joseph Phan, Dr. Don Porzio
A-135	**ASSOCIATION STUDY OF POLIOVIRUS RECEPTOR GENE POLYMORPHISMS IN SPORADIC ALS** Thomas J. Mullins, Dr. Saeed Khan
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B-133	**HOW TO PREPARE A BRANTA CANADENSIS SKELETON FOR A DISPLAY** Anna Wilewska, Ms. Vicki Burgholzer, Dr. David Workman
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1:20 - 1:35

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D-103	**AN INQUIRY CONCERNING HUMAN INTERPRETATION** Carl Herrmann, Dr. Robert Kiely
D-107	**DEVELOPMENT OF INTELLIGENT SEARCH SOFTWARE** Ovidiu Hentea, Daniel Moorehead, Brian P. Sawicki, Dr. Jay Budzik
D-110	**AGGREGATION OF POLYGLUTAMINE EXPANSION PROTEIN IN A C. ELEGANS MODEL** Rebecca M. Krock, Dr. Richard Morimoto
Kids Institute E-115	**5ASA SUPPRESSED INDUCTION OF DYSPLASIA ON AOM/DSS MODEL: CORRELATION WITH INHIBITION OF WNT/BETA-CATENIN TRANSCRIPTIONAL ACTIVITY** Vyas Viswanathan, Mr. Gery Grimm
Lecture Hall	**STUDENT LEADERSHIP AND CIVIC RESPONSILIBITY** Codi L. Kuhlemeier, Mr. Robert Hernandez

2:35 - 2:50

A-117	**MULTILOCUS DNA FINGERPRINTING OF WREATHED HORNBILLS** Esther Shyu, Dr. Jean Dubach
A-119	**THE EFFECTS OF SIVA-1 ON COMMON CHEMOTHERAPEUTIC DRUGS SUCH AS PACLITAXOL** Tatiana M. Green, Dr. Prasad Kanteti
A-133	**THE SCALABILITY OF THE AMD X86_64 ARCHITECTURE IN A HIGH PERFORMANCE CLUSTERING ENVIRONMENT USING COMMONLY AVAILABLE CONSUMER COMPUTER COMPONENTS** Aaron B. Caveglia, Jason Petsod, Mr. James Gerry
Academic Pit A-138	**THE FEASIBILITY OF INTRODUCING BROWN TROUT TO BUCK CREEK** Casey Lewis, Anthony Waymire, Joseph Zearing, Mr. David Gossman
B-108	**HOMEOPATHIC REMEDIES VERSUS THE PLACEBO EFFECT** Arielle Kanters, Dr. Susan Styer
B-110	**CLONING AND EXPRESSION OF HUMAN FC RECEPTOR LIGAND BINDING DOMAINS** Edward Nepomuceno, Dr. Barry Arnason
B-116	**FISH SKINS AS A NOVEL SOURCE OF BLOOD ANTICOAGULANT PHARMACEUTICALS** Aravind Bommiasamy, Dr. Walter Jeske, Dr. Jeanine Walenga
B-133	**IDENTIFICATION OF REGIONS OF DOUBLECORTIN EXPRESSION IN ZEBRAFISH** Raymond Buhr, Jonathan Chou, Ms. Anne Christiansen, Dr. Jill Morris
D-101	**EFFECT OF ALCOHOL CONSUMPTION ON ANTIBODY RESPONSES** Raj Gala, Mr. Rick Heinz, Dr. Carl Waltenbaugh
D-103	**THE JUVENILE DEATH PENALTY IN AMERICA** Bansi N. Shah, Mr. Robert Schultz
D-107	**TIME SERIES ANALYSIS IN MACROECONOMICS** MengFei S. Yin, Dr. Lars Hansen
D-110	**PREVALENCE OF G AND D ALLELES IN ANGIOTENSIN-1 CONVERTING ENZYME GENE IN ABDOMINAL AORTIC ANEURYSM PATIENTS** Stephanie H. Lee, Isabella T. Rossi, Dr. William Pearce, Ms. Vera Shively
Kids Institute E-115	**THE PERSISTENT INFECTION OF MESOTHELIAL CELLS WITH THE SV-40 VIRUS** Manisha Chandar, Dr. Kathleen Rundell
Lecture Hall	**A PHILOSOPHICAL EXPLORATION OF ARTIFICIAL INTELLIGENCE, EVOLUTION, SELF, AND THE NATURE OF REALITY** Jordan Burdinie, Anna Wu, Mr. Michael Ososky

THE ROLE OF UBIQUILIN 2 IN THE PATHOGENESIS OF AMYOTROPHIC LATERAL SCLEROSIS (ALS)

Presenter
Ivy Abraham, Illinois Mathematics and Science Academy

Mentors
Dr. George Gorrie, Northwestern University Medical Center

Dr. Teepu Siddique, Northwestern University Medical Center

Ubiquilin 2 is a candidate protein in the development of a hereditary form of ALS. Previous studies have shown that ubiquilin 2 may have a role in marking misfolded proteins for degredation in the ubiquitin proteasome system. Understanding the protein's function has been the objective of the experiments that I have undertaken in my mentorship. My study has primarily been conducted by biochemistry and cell biological approaches. To find the role of this protein, we have tried to identify other proteins that ubiquilin 2 interacts with. We hypothesized that the identification of these associating proteins, whose functions are already known, would enable us to determine the role of ubiquilin 2 in the cell. Results of our experiments have suggested that ubiquilin 2 may interact with an ubiquitin hydrolase, fat facets in mouse (FAM) and an ADP-ribosylation factor GTPase-activating protein, AGAP1, which could be involved in the regulation of actin in the cytoskeleton of neurons with a particular reference to the synapse.

HOW DOES SLEEP AFFECT PEOPLE PHYSICALLY AND PSYCHOLOGICALLY?

Presenters
Oluwemino Adeyanju, Illinois Mathematics and Science Academy

Xi Ye, Illinois Mathematics and Science Academy

Advisor
Dr. Kirk Hallowell, Illinois Mathematics and Science Academy

This research was conducted to achieve a more comprehensive understanding of the physical, psychological, and neurological effects of sleep on humans. Sleep profoundly affects humans through the rapid eye movement (REM) stage (dream stage). By employing modern techniques in a polysomnogram, scientists were provided an opportunity to peek into the various bodily functions of sleep. During REM, the human brain's visual center and sensual center are highly active, while motor center paralyses are under the influence of atonia. Distinctive physical changes occur during transitions from non-REM stages to REM stages. Particularly during REM, most parts of the human body enter the stage of atonia — complete loss of muscle tone and deep relaxation — that was generated by lesion and medial medulla. REM sleep without atonia is usually associated with REM behavior disorder. However, without lesion to keep part of the muscle tense, people could be easily in danger of obstructive sleep apnea, which is caused by the impediment of breath through the upper airway muscles. Irregularities concerning REM sleep are also closely related to human psychology, especially perception. Problem-solving and mood regulations occur during this period. Thus, psychological disorders such as schizophrenia and depression have been identified with abnormal REM.

ROMANTICISM: A SONATA OF PHILOSOPHY AND THE ARTS

Presenter
Eunho (Joyce) Ahn, Illinois Mathematics and Science Academy

Advisor
Dr. Christian Nokkentved, Illinois Mathematics and Science Academy

Romanticism swept across the European Continent in the late 1700s and into the 1800s. It dealt not simply with the emotion of love, but all intense emotions that are part of human nature. To the Romantics, all aspects of life circulated around intuition and Nature. This inquiry studied areas of Romanticism in order to form a stronger understanding of this revolutionary period of time, and the context for the music of the transitional Ludwig Von Beethoven. Beethoven's music shows various Romantic and Classical (Rationalist) styles within itself, and I studied his first Sonata in order to determine those. This presentation will include a piano performance of Beethoven's first Sonata, in which I will discuss different stylistic aspects. I also examined the causes of this movement and how it was a contrast and response to the preceding Rationalists. Some causes for the Romantic Movement include the French Revolution, which served as a trigger, and the Industrial Revolution, which at the time was taking the world by storm. Using all this knowledge, I was able to determine how Romanticism has been monumental in the molding of society's thoughts and views.

PERFORMANCE OF DISADVANTAGED BUSINESS ENTERPRISES IN CHICAGO TRANSIT AUTHORITY'S BUSINESS DEVELOPMENT PROGRAM

Presenters
Alisa K. Albrecht, Illinois Mathematics and Science Academy

Rachael Parrish, Illinois Mathematics and Science Academy

Mentor
Dr. Eugene Fregetto, University of Illinois at Chicago

As a developing city with a large minority population, it is important that all major agencies in Chicago support the growth and development of Disadvantaged Business Enterprises (DBEs). As a result, Chicago Transit Authority implemented a requirement that a significant percentage of procurements be contracted to DBEs. To achieve the goals of this mandate, CTA created a Business Development Program (BDP) designed specifically for providing business education to DBEs. The objective of the BDP is to expand small firms' capacities and train and develop DBEs to become competitive outside of the DBE program. In return for educating DBEs, CTA should receive higher quality work and more DBE participation in contracts. Since establishment, the BDP has not achieved its anticipated success, with a graduation rate of 33%, currently defining success as creating a business plan and completing the program, leading us to believe that a more effective definition of success exists.

The purpose of this research is to determine how participation in CTA's BDP by CTA-certified DBEs affects the DBE's performance. Also, a measurement for performance of the DBE in the BDP must be established in order to determine to what extent the BDP should be modified to achieve greater success.

REPORTING AT WAR: THE TENUOUS RELATIONSHIP BETWEEN THE MILITARY AND THE MEDIA

Presenter
Sarah Alef, Illinois Mathematics and Science Academy

Advisor
Dr. Jim Victory, Illinois Mathematics and Science Academy

My research this year has investigated how the military's relationship with the media has changed the civilian perspective on the Vietnam War. The relationship between the military and the media in war-time can either be a tenuous one or a relationship of commitment to the truth. The media has an overwhelming responsibility; what it chooses to report can affect the ultimate outcome of an event. The lack of cooperation between the media and the military in Vietnam influenced how the civilian population reacted to the war, and convinced the US military of the need in future conflicts to deny media access, and to limit the accessibility of official information. Now, long after Vietnam has ended, the relationship between the media and the military is still littered with distrust, with the civilian bystander caught in the middle. The underlying cause of the conflict lies within each party's opposing viewpoints on information management and the public's right to know. These results are supported by the Grenada Invasion, in which the media was completely excluded from all military proceedings, and the current Iraqi conflict, in which embedded journalism is consistently relied upon as a means of reporting.

THE EFFECT OF CYTOKINES ON MHC-I PRODUCTION

Presenter
Kavin A. Arasi, Illinois Mathematics and Science Academy

Advisors
Dr. Judith Scheppler, Illinois Mathematics and Science Academy

Dr. Susan Styer, Illinois Mathematics and Science Academy

MHC-I (major histocompatibility complex) proteins display antigens made by a cell, and are used to mount an immune response. The purpose of this Inquiry is to determine the relationship between cytokines and the amount of MHC-I produced in a cell. Cytokines, produced by T-helper cells, act as messengers and send signals to cells to produce more MHC-I and thus potentially enhance the immune response. For this experiment, CEM cells were grown and RNA was isolated when the cells were growing in log phase. Gel electrophoresis was then run to confirm that the RNA had been isolated. After that confirmation, RT-PCR (reverse transcriptase-polymerase chain reaction) will be performed to amplify and quantitate specifically the MHC-I mRNA in cells. Once RT-PCR is optimized for MHC-I mRNA, another culture of cells will be grown in various cytokines. RT-PCR will be done again on those cells and a gel will be run with the two cell samples. The effect of cytokines on MHC-I mRNA production will be determined by the intensity of the bands on the gel.

NOVEL GLYCOBIOLOGY-BASED GENE THERAPY OF BRAIN TUMORS

Presenter
Cici Bai, Illinois Mathematics and Science Academy

Mentor
Dr. Roger Kroes, Falk Center

Glioblastoma multiforme (GBMs) are highly invasive gliomas that represent 23% of all primary brain tumors. GBM therapies are ineffective and over 80% of patients die within the first year after initial diagnosis. Altered glycosylation has been correlated to cancer cell invasivity and metastasis. Previous studies have shown that manipulating glycosyltransferase and/or glycosylhydrolase gene expression alters aberrant cell surface glycosylation patterns found in glioma cells, and profoundly affects tumor formation in animal models. Using custom fabricated microarrays containing all of the cloned human glycobiology-related genes, a panel of differentially expressed glyco-genes in human brain tumor specimens and glioma cell lines was identified. Among these was the gene encoding human sialyltransferase 7E (hSIAT7E). The initial phase of my project was to create a novel gene therapy reagent by cloning the specific portion of the hSIAT7E cDNA containing the protein coding region from normal human brain specimens. The correct sequence of two independent clones was verified by direct DNA sequencing. The RT-PCR subcloning strategy and methodologies used will be presented and discussed. The next phase of my project will involve expressing this gene in human glioma cell lines and to determine the effects of modulation of SIAT7E on tumor invasivity and growth.

A LOOK INTO THE WORLD OF MODERN FINANCIAL CREDIT RATING

Presenter
Joseph A. Baker, Illinois Mathematics and Science Academy

Mentor
Mr. James Wiemken, Standard and Poors Credit Market Services

Standard & Poor's, as a company can be traced back to 1860. In 1966, it was acquired by the McGraw-Hill Inc. publishing company and now is an independently operating business unit of McGraw-Hill. Today, S&P rates over $11 trillion in bonds and other financial obligations in more than 50 countries. Standard & Poor's began rating debt from corporate and government issuers over 75 years ago. Since then, the rating criteria has grown immensely and become much more methodical. A Standard & Poor's rating is the opinion of rating analysts concerning the amount of risk associated with purchasing, selling, or holding a security. This project has formed its conclusions based on one on one work with analysts located in the Chicago Standard & Poor's office. These analysts are professionals experienced in ratings conducted for school districts, counties, cities, and other municipalities throughout several Midwestern states. The research uncovered from this project has allowed several conclusions to be made about the importance of a financial credit rating in the modern markets and the consequences of different ratings. The intricacies of the rating process have also been explored and examined with first-hand experience.

EFFECTS OF CUEING ON CLINICAL AND QUANTITATIVE MEASURES OF BRADYKINESIA IN PATIENTS WITH PARKINSON'S DISEASE

Presenter
Rashi Bamzai, Illinois Mathematics and Science Academy

Mentor
Dr. Colum MacKinnon, Northwestern University Medical Center

Patients with Parkinson's disease (PD) experience a slowness of movement (bradykinesia) when attempting voluntary actions. The severity of bradykinesia is assessed clinically by testing repetitive movements. However, it is known that bradykinesia is affected by the presence or absence of external cues. Clinically, there is a lack of standardization in the administration of repetitive movement tasks; sometimes cues are used (auditory or visual), sometimes not. In this study we examined the effects of cueing on clinical and laboratory measures of the performance of a repetitive finger-tapping task. We hypothesized that cueing would improve both clinical and laboratory measures of movement performance. Patients were videotaped performing the movements under three conditions (no cues, auditory cues and visual cues). These videos were then evaluated by a neurologist blind to the method of cueing used for each task. The laboratory component used electromyographic and accelerometer recordings to objectively movement performance. Patients were tested both off and on anti-parkinsonian medication. Preliminary observations indicate that cues improve performance, further suggesting the necessity of standardized testing protocols.

MATH CURRICULUM AND METHODS FOR THE CYCLE WIZ FACTORY OF LEARNING

Presenters
Grant L. Barbosa, Illinois Mathematics and Science Academy

Simileoluwa O. Odueyungbo, Illinois Mathematics and Science Academy

Mentor
Ms. Constance Van Brunt, CYCLE (Community Youth Creative Learning Experience)

In any after school program math is a subject that must not fail to be taught. Considering that the environment in which the students who attend CYCLE live generally leaves students unprepared in math. My task was to create such a curriculum that the students who attend CYCLE will reinforce what they already know and also learn new facets of mathematics. Since CYCLE attendees age varies, the age group addressed by the mathematics curriculum was that of student's shortly thereafter entering middle school, more specifically grades third and fourth. The goal of the curriculum is to present mathematics in an enjoyable and entertaining fashion so that the students will want to attend this lab at CYCLE. The topics placed into this curriculum include: prime numbers, Fibonacci numbers, pre-algebra, basic algebra, advanced multiplication and division, basic operators with fractions and decimals, square and cube roots, percents, and graphing. Along with the topics for each lab, tutoring for the homework which the students bring is also addressed in this lab. The topics and tutoring can be taught in many manners with such things occurring as standard teaching situations, games, scavenger hunts, and timed contests, among others. Through addressing these topics through the multiple activities, the students who attend the CYCLE Math Lab will be engaged and educated in manner which reinforces and improves their understand of material in mathematics.

THE LINCOLN PARK ZOO SOUTH POND PROJECT

Presenters
Kathleen M. Barnes, Illinois Mathematics and Science Academy

Ashley Levato, Illinois Mathematics and Science Academy

Brittany L. Oleson, Illinois Mathematics and Science Academy

Mentor
Mr. John Thompson, Illinois Mathematics and Science Academy

The Lincoln Park Zoo South Pond Project began with collaboration between the Chicago Park District and Lincoln Park Zoo (LPZ) in an effort to determine the best course of action for redesigning South Pond and establishing a model for teaching inquiry-based learning for area schools. It is expected to be a five-year project, culminating in reconstructing South Pond and creating a database of baseline biological information on the original pond. LPZ also intends South Pond to become a more active learning site; zoo programs will be modified based on this pilot study. LPZ invited IMSA to join the project in spring of 2004. This year, we developed an experimental design and acquired and tested a variety of aquatic monitoring equipment. Many issues have been resolved, allowing us to collect data in the most effective and reliable manner. We established sampling sites on the pond perimeter and developed a GPS grid for sampling across the pond. Biological (benthic, bacterial, plankton and vertebrate populations), chemical (turbidity, dissolved oxygen, and mineral concentrations) and morphology surveys are being conducted. Studies on human impact and visitation are also being carried out. We will continue the study during the summer and 2005-2006 academic year.

OPTIMIZATION OF GROWTH MEDIA TO ENHANCE PRODUCTION OF ERYTHROMYCIN

Presenter
Chelsey E. Bayer, Illinois Mathematics and Science Academy

Advisors
Dr. Donald Dosch, Illinois Mathematics and Science Academy

Mr. Jason J. Orloff, Abbott Laboratories

Erythromycin is a naturally occurring macrolide antibiotic, produced by the bacteria *Saccharopolyspora erythraea (S. erythraea)*. Prescribed for the treatment of a range of infectious diseases, from bronchitis, pneumonia, and whopping cough to acne and other skin infections, erythromycin has been a valuable tool in the medical community. The goal of this inquiry is to optimize erythromycin production by altering the growth medium. The yield was hypothesized to vary with modifications to the magnesium concentration, amino acid composition, and pH range of the bacterial growth media. Production can be determined by bioassay using *Micrococcus luteus (M. luteus)* as a susceptible microorganism. The quantity of erythromycin produced is proportional to an area of inhibition, a zone where *M. luteus* cannot grow, around the antibiotic sample. Various difficulties, including lack of a beginning media recipe, slow growth of the bacteria, and equipment problems were a hindrance to the acquisition of quantitative data. The results from this optimized growth media could be used to manufacture erythromycin more economically for medical and research purposes.

A SAMPLER: CONGRESS AND ENVIRONMENTAL LEGISLATION

Presenter
Paras D. Bhayani, Illinois Mathematics and Science Academy

Mentor
Ms. Jennifer Hensley, Sierra Club

When dealing with environmental policy, it is easy to lose sight of the fact that the lives of real people are at stake. This is most evident in our nation's capital, where the federal government has set about undoing years of progress in building a dynamic body of environmental law. Over the past four years, we have seen the dismantling of hundreds of tools used to reduce pollution and conserve natural resources.

While a great deal of this blame lies with the Bush Administration, much of it lies with Congress as well. Last year's presentation focused primarily upon the administration's regulatory changes; this year, the focus will be on the legislative agenda that threatens our natural environment. Some of this agenda has already been enacted, but much of it is still being considered.

The trademark of Congress is that it acts deliberatively. For the past four years, the U.S. Senate has been the burial ground of much of the most anti-environmental legislation. But with a more anti-environmental majority in Congress this year, there will be a renewed push for legislation that was defeated or stalled in the past. This presentation will focus on a few of the key pieces of environmental legislation, while specifically analyzing their consequences on the law that has been built over the past thirty-five years.

CONTROLLED LARGE-SCALE SYNTHESIS AND MAGNETIC PROPERTIES OF SINGLE CRYSTAL COBALT NANORODS

This abstract will not be presented today.

Presenter
Rohan Bhobe, Illinois Mathematics and Science Academy

Mentor
Dr. Vinayak Dravid, Northwestern University

Nanostructured magnetic materials are drawing considerable attention for their potential applications in ultra high-density magnetic data storage, sensors, and other electronic devices. One-dimensional structures such as nanorods and nanotubes exhibit interesting properties not characteristic of their bulk-material counterparts. Nanorods created from single crystalline ferromagnetic materials have the added advantage of being magnetically polarized in the same direction along the entire length of the nanorod. We report detailed synthesis studies and a novel procedure for the large-scale fabrication of single crystalline cobalt (Co) nanorods using thermally evaporated gold as a conducting electrode on a nanoporous anodic aluminum oxide (AAO) template. Cobalt was chosen over other ferromagnetic materials because of recommendation by previous literature. Electrodeposition was used to fabricate the cobalt nanorods inside the pores of the AAO membrane, after which a mild hydrofluoric acid (HF) solution was used to dissolve the AAO, yielding a large-scale ensemble of isolated Co nanorods. A preferred perpendicular anisotropy is observed in these nanorod arrays. Scanning electron microscopy and transmission electron microscopy (SEM and TEM, respectively) examination show clear evidence of single crystal metallic Co nanorods (approx. 100 nm in diameter and 10 μm in length). Superconducting quantum inference device magnetometer (SQUID-M) studies demonstrate ferromagnetic behavior in the cobalt nanorods. Magnetic properties indicate both coercivity and thermal activation volume increase with increasing nanorod length.

OMFG (ORNITHOLOGICAL MAPPING ON FARMING GROUNDS): AN ORNITHOLOGICAL SURVEY OF THE GOSSMAN FARM IN ZWINGLE, IOWA

Presenters

Tracey Blasingame, Illinois Mathematics and Science Academy

Jessica Bubert, Illinois Mathematics and Science Academy

Raymond Colletti, Illinois Mathematics and Science Academy

Jason N. Edes, Illinois Mathematics and Science Academy

William Hahm, Illinois Mathematics and Science Academy

Amanda Heikes, Illinois Mathematics and Science Academy

Christopher Kervick, Illinois Mathematics and Science Academy

Clement J. Robinson, Illinois Mathematics and Science Academy

Mentor

Mr. David Gossman, Gossman Consulting, Inc.

The Gossman Farm is located in Jackson County, Iowa. There are 403 species of birds known to reside in Iowa, 138 specific to Jackson County. The 670-acre farm was surveyed and twelve spots were pinpointed for observation. Thus far, 42 species have been identified. Population surveys take many years to produce substantial data; it was our main goal this year to continue the research that began last year with the initiation of the survey. This year our team focused on several different aspects of ornithology, including bird songs, geographical and botanical impacts on bird populations, and even bird psychology. Throughout the year, our team learned how to identify birds given only a bird call and even used sound recording equipment in the field to prepare our own bird song archive.

FISH SKINS AS A NOVEL SOURCE OF BLOOD ANTICOAGULANT PHARMACEUTICALS

Presenter

Aravind Bommiasamy, Illinois Mathematics and Science Academy

Mentors

Dr. Walter Jeske, Loyola University Medical Center

Dr. Jeanine Walenga, Loyola University Medical Center

Heparin and its derivatives the low molecular weight heparins (LMWH) are used widely in medicine as anticoagulant drugs. Both heparin and LMWH bind to a naturally occurring protein antithrombin (AT) and enhance its ability to interact with and inhibit many coagulation factors. Most heparin comes from the intestinal mucosa of cows and is imported from foreign countries. With the recent spike in the cases of Bovine Spongiform Encephalopathy (BSE) there is concern of how this affects human health. Also, trade relations with major producers of heparin are not always stable, so an alternate source of heparin is being sought. The project's aim is to extract, structurally characterize, and test the potency of fish skin-based heparin in relation to clinical grade porcine heparin. The assays that were used in this project include Heptest, 5 unit Thrombin Time, and Activated Partial Time Thrombin (APTT). The different assays allow heparin to be tested for its inhibitory potency at certain parts of the coagulation cascade. The results to date with cod, tuna, and salmon heparins are promising; in many of the tests, the potency of the fish skin heparins is comparable to that of porcine heparin. The anticoagulant effect of the fish skin heparins can also be neutralized with the standard heparin antagonist protamine sulfate. Overall, the results show that fish skin-derived heparin may be used in the future as an alternative to bovine and porcine based heparin.

IDENTIFICATION OF REGIONS OF DOUBLECORTIN EXPRESSION IN ZEBRAFISH

Presenters
Raymond Buhr, Illinois Mathematics and Science Academy

Jonathan Chou, Illinois Mathematics and Science Academy

Mentors
Ms. Anne Christiansen, Children's Memorial Hospital

Dr. Jill Morris, Children's Memorial Hospital

Schizophrenia is the most chronic and disabling of the severe mental disorders affecting more than 2 million Americans. The illness, which typically develops in the late teens or early twenties, may impair a person's ability to manage emotions, interact with others, and think clearly. Doublecortin is one of several genes that are believed to be related in the neuropathology of schizophrenia. Mutations in the doublecortin gene have been linked to defects in neuronal migration and disruption of multi-layered cerebral cortex. The purpose of our study was to determine the locations of the expression of the doublecortin gene. We accomplished this task by using specific antibodies for doublecortin and staining techniques at various post-fertilization periods in our zebrafish model. By staining the doublecortin protein in zebrafish at different stages of development, our goal was to see where it is expressed during neuronal migrations. We have tested various antibodies for doublecortin at one day post-fertilization and worked on determining the locations of doublecortin expression in later stages of development.

A PHILOSOPHICAL EXPLORATION OF ARTIFICIAL INTELLIGENCE, EVOLUTION, SELF, AND THE NATURE OF REALITY

Presenters
Jordan Burdinie, Illinois Mathematics and Science Academy

Anna Wu, Illinois Mathematics and Science Academy

Mentor
Mr. Michael Ososky, Applied Computer Technology

Everything in the universe is the product of an ongoing evolutionary process. Evolution gives rise to ever-increasing levels of complexity, producing, as a result, emergent phenomenon, such as consciousness. The physical laws responsible for the evolution of the universe produced a planet on which biological life could evolve, which lead to systems of greater complexity including society and eventually, sentient engineered intelligence.

Memes, the agents of cultural evolution, influence our perceptions of reality, affecting our decisions and defining who we are. An intrinsic characteristic of evolution is that it does not produce the optimum solution to a problem; the solution only has to be effective enough to allow the system to reproduce itself. Consequently, it is impossible to perceive absolute reality; our subjective perceptions of reality evolved in a manner that was merely sufficient for our immediate survival.

Technological advancements are being made at an ever-increasing rate. Advances in quantum computers, nanotechnology, and robotics will prove to have numerous beneficial applications in modern society. Through the research of biological evolution and the human mind, researchers hope to be able to create artificial beings which will have the capacity to self organize and evolve, ushering in a new era of intelligence.

A GEOLOGICAL STUDY OF THE GOSSMAN FARM IN ZWINGLE, IOWA

Presenters
Meghan Carroll, Illinois Mathematics and Science Academy

Mary Logue, Illinois Mathematics and Science Academy

Max Silvestre, Illinois Mathematics and Science Academy

Tiffany Todd, Illinois Mathematics and Science Academy

Mentor
Mr. David Gossman, Gossman Consulting, Inc.

The geology team performed a geological survey of the Gossman farm in Zwingle, Iowa. After some preliminary research on geological techniques, we divided the exposed bluffs on the farm into different layers and collected samples from each, as well as some fossils. We then analyzed the samples and correlated our findings with professional literature on the area. Both our data and research confirmed that this area of Iowa was once located near the equator and was covered with a shallow inland sea. The limestone and dolostone, types of sedimentary rocks, were deposited during the Silurian period (443 to 417 million years ago) in an area under the influence of oceanic upwelling. The dominant wind patterns moved warm surface water away from the shore, bringing up underlying organic-rich water, allowing marine life to flourish. Rock samples contained fossil remains of creatures that would have lived in a tropical marine environment. The results of our geological study were therefore in agreement with previous studies and reference sources.

THE SCALABILITY OF THE AMD X86_64 ARCHITECTURE IN A HIGH PERFORMANCE CLUSTERING ENVIRONMENT USING COMMONLY AVAILABLE CONSUMER COMPUTER COMPONENTS

Presenters
Aaron B. Caveglia, Illinois Mathematics and Science Academy

Jason Petsod, Illinois Mathematics and Science Academy

Advisor
Mr. James Gerry, Illinois Mathematics and Science Academy

AMD's x86_64 architecture was a breakthrough in personal computing because it natively supported the x86 architecture while enabling 64-bit computing. In our Inquiry, we used commonly available off-the-shelf computer components and explored the outwards scalability of the architecture in various high performance clustering implementations under Gentoo Linux, a distribution of Linux we chose due to its inherent ability for customization and optimization. To test scalability, we ran a battery of tests both with a kernel-based process migration clustering implementation and with applications that had integrated clustering implementations; for the latter, the tests were rerun under the kernel-based clustering implementation with each application's clustering features disabled to compare clustering implementations. In tasks which were influenced by latency, such as network-distributed code compilation, we saw a diminishing-returns scenario; there was a greater change between using one node to two nodes than from two nodes to three – the overall rate of change was not constant. However, in tasks such as authentication strength analysis and multimedia encoding and rendering which have nearly infinite parallelism, we found that tasks scaled linearly; changes between using one node to two nodes, two nodes to three nodes, and from three nodes to four nodes were nearly identical.

THE PERSISTENT INFECTION OF MESOTHELIAL CELLS WITH THE SV-40 VIRUS

Presenter
Manisha Chandar, Illinois Mathematics and Science Academy

Mentor
Dr. Kathleen Rundell, Northwestern University Medical Center

Simian Virus 40 (SV40) is a tumor virus which has been shown to be a cause of some rare forms of cancer in humans including mesothelioma. Two mesothelial cell lines, DL x DL and DL x WT, differ only by the presence of the small-t viral antigen, found in DL x WT but not DL x DL. Though very similar, these cell lines exhibit very different behaviors when plated in methyl-cellulose (MeC), a media that tests for achorage independent growth in cells, which serves as a marker for progression towards cancerous cell transformation.

Gene chip analysis and real-time polymerase chain reaction (RT-PCR) data suggests that TIMP3 is expressed up to eight times more in the 5AWT than in 5ADL, which are two mesothelial cell lines clonally related to DL x WT and DL x DL. In addition, transfection of 5ADL with a plasmid that expresses TIMP3 led to its increased growth in MeC. Tissue inhibitor of metalloprotease 3 (TIMP3) inhibits some metalloproteases, enzymes that degrade the proteins in the extracellular matrix (ECM) to which cells attach, lifting the edges of the cells off the plate, allowing continued growth. It was hypothesized that DL x DL would behave in the same manner as 5ADL due to the absence of small-t. This was tested by the transfection of DL x DL with TIMP3, and it was observed that colonies formed in MeC, indicating that TIMP3 can partially replace small-t in DL x DL cells and is, in fact a downstream target of small-t. Current research will also analyze the comparative levels of TIMP3 expression in the ECM produced by DL x DL cells relative to DL x WT cells, via western immunoblot techniques.

PATHOGENIC MECHANISMS OF THE ATRIOVENTRICULAR SEPTAL DEFECTS IN CCN1-DEFICIENT MICE, AN ANIMAL MODEL FOR HUMAN AVSD

Presenter
Grady Chang, Illinois Mathematics and Science Academy

Mentor
Dr. Lester Lau, University of Illinois at Chicago

CCN1 is critical for cardiac morphogenesis, likely, through regulation on cardiac cell growth and/or differentiation. (To characterize CCN1 deficiency as a mouse model for atrioventricular septal defects (AVSD).) Taking advantage of Ccn1-deficient mice being an animal model of human AVSD, the role of CCN1 in atrioventricular valvuloseptal morpohgenesis and cardiac functions will be examined through a detailed characterization of Ccn1-deficient mice on a series of developmental events.

Our experiments initially investigated the rate of apoptosis and cell proliferation in the Ccn1-deficient mice. Using the TUNEL assay, we were able to compare the rate of apoptosis to the numbers of cells. From what our data has shown, there is no excessive apoptosis in the cushion tissue of the defective hearts. This shows that the septal defects are not caused by apoptosis but by another mechanism. We also determined that the cause is not from defects in proliferating cells. We are currently testing the possibility of a defect in the matrix matalloproteinase (MMP). Improper MMP activity may lead to the lack of bonding between the septum and the cushion tissue.

THE STUDY AND IMPLEMENTATION OF LUMELSKY'S BUG ALGORITHM ON THE NOMAD SUPER SCOUT II PLATFORM

Presenter
Kevin Chang, Illinois Mathematics and Science Academy

Mentor
Dr. Milos Zefran, University of Illinois at Chicago

The study of mobile robotics has grown out of the demand from both industry and public consumers for robots that can take into account the environment and adapt to any unexpected changes. The NOMAD Super Scout II is a wheeled, mobile robot system with ultrasonic, tactile, and odometry sensing capabilities that allow it to detect and avoid obstacles in its path. We have recently been writing a maze-traversing program that employs Lumelsky's Bug Algorithm, which defines a start and an end point for the robot, with unknown obstacles between the two. The robot is programmed to follow the line created by the two points until it reaches an obstacle, whereupon it will pick an arbitrary direction to turn in (right or left), called the local direction. The robot will then "hug" the wall of the obstacle, and go around it once, recording the point closest to the line. Then it will continue around the obstacle until it reaches the predefined point, and move back to the line. The process is repeated until the robot reaches its goal, or completes a turn around the obstacle and determines the goal cannot be reached.

INSTRUMENT REQUIREMENTS FOR THE NUCLEAR MEDICINE IMAGING OF VULNERABLE PLAQUE

Presenter
Jason Chen, Illinois Mathematics and Science Academy

Mentor
Dr. Douglas Wagenaar, Siemens Medical Solutions

Background. Vulnerable plaque (VP) is now recognized to cause 85% of myocardial infarctions and is often asymptomatic. Occlusion of coronary arteries causes symptoms such as angina and is treated by surgical or angioplasty techniques. VP, on the other hand, is found to be systemic and generally non-occlusive, but potentially forms fatal thrombi. External imaging techniques such Nuclear Medicine (NM) can potentially localize and determine disease progression or response to treatment. This work evaluates the feasibility of NM imaging of VP. Methods. To boost the signal emitted from the VP, the concept of "multi-labeling" was investigated. Multi-labeling is the use of a targeting agent that contains more than one radioactive atom per interacting molecule. Simulating a simplified square lesion modeled with receptor-ligand binding, the signal-to-noise ratio (SNR) was calculated for planar nuclear medicine images. Results. The result of this simulation shows that SNR increases as the number of radioactive atoms per molecule increases, indicating potential improvement in VP visibility through the use of high-payload nanoparticles. The model shows that if the background is non-specific, then the signal amplification is maximal. Conclusion. For small volume lesions, NM SNR can be improved and visibility enhanced through the use of multi-labeling techniques.

DEMOGRAPHIC EFFECTS ON IMPULSIVITY

Presenter
Mi (Amy) Chen, Illinois Mathematics and Science Academy

Mentor
Dr. Harriet de Wit, University of Chicago

The purpose of this study was to determine demographic effects on impulsivity, as defined by the inability to see long-term consequences. Impulsivity in a person is directly correlated with his/her likelihood to use drugs.

Basic demographic data, including age, years of education, family income, and gender, was obtained from the 830 human subjects who participated in this study. The subjects also took an IQ test, the Barratt Impulsiveness Scale (BIS), and performed the behavioral task, Delay Discounting Task (DDT), in which they were asked to make some choices about (hypothetical) money available immediately or after some amount of time. The data obtained was analyzed through the statistical program SPSS to determine correlations between the demographics and measures of impulsivity.

While age was not correlated with impulsivity, all other demographics were significantly correlated. Age didn't correlate because the subjects were all past adolescent age (>30 years), but their years of education, family income, and gender affected their impulsivity.

ETHICAL VOTING AND VOTER TURNOUT

Presenter
Jenny S. Cheng, Illinois Mathematics and Science Academy

Mentor
Dr. Timothy Feddersen, Northwestern University

Recent political science and economic theories propose a model of turnout under costly voting that shows how in large elections, only voters with "non-selfish" preferences turn out to vote. Selfish voters properly estimate their impact on the election as negligible. Only voters who are motivated to participate for non-selfish reasons are expected to turn out. If this theory is correct then large elections feature "benevolence amplification." That is, since the only voters who participate do so because of non-selfish motivations, it suggests that election outcomes would reflect non-selfish preferences as opposed to selfish ones. In this project, we develop an experimental treatment that allows us to test the thesis that large elections will select for ethical voters.

In our study, human subjects will be matched into groups that select one of two options that affect the money payoff for all group members. Participants must decide whether to (a) participate in the voting process, and (b) what choice they will support if they participate. By manipulating the group size and the discrepancy in payments, the theory described above can be exposed to a strong, informative test.

NANOWELL SYNTHESIS ON ALUMINUM SURFACE THROUGH ANODIZATION

Presenters
Nathan Cheng, Illinois Mathematics and Science Academy

Sylvia Li, Illinois Mathematics and Science Academy

Mentor
Dr. Hsien-Hau Wang, Argonne National Laboratory

Nanoscale synthesis has attracted much interest in recent years. Our research focuses on the synthesis of nanowells through the use of anodized aluminum oxide (AAO) templates, which consists of structured nanopores arranged in hexagonal shapes throughout the template. These nanopores would be used for storing chemical information much like microwells used in biological research. Preparation of AAO membranes begins with the removal of the outermost membrane from aluminum substrate of highly pure aluminum sheets (99.998%) through the usage of perchloric acid and ethanol, and then by anodizing them in aqueous solutions such as oxalic acid ($H_2C_2O_4$) and sulfuric acid (H_2SO_4). The anodization process involves multiple steps and can take 10 hours or more. The development of these nanopores is creating much excitement in the materials science field because of the potential applications of nanoscale synthesis for chemical sensing and magnetic memory devices.

INTERACTION OF ANTIMICROBIAL PEPTIDE PROTEGRIN-1 WITH SOLID SUPPORTED MEMBRANES

Presenters
Yishan Cheng, Illinois Mathematics and Science Academy

Karen Chien, Illinois Mathematics and Science Academy

Mentors
Mr. Yuji Ishitsuka, University of Chicago

Mr. Kinlok Lam, University of Chicago

Dr. Ka Yee Lee, University of Chicago

Due to increasing resistance to current treatments, a new variety of antibiotics must be developed. Antimicrobial peptides are part of the natural animal immune system that directly attack bacterial cell membranes due to their high affinity for the cell membrane lipids. Protegrin-1 (PG-1) is a cationic antimicrobial peptide from the porcine leukocyte. Despite of its toxicity shown against wide range of microorganisms, exact mechanism of its action is unclear. In previous research conducted, it was found that PG-1s disorder lipid monolayers composed of anionic lipids, which are found in bacterial membrane, than monolayers composed of zwitterionic lipids, which are found in mammalian membranes. Since cell membranes in nature are lipid bilayers, and not monolayers, the next step is to test the monolayer results on bilayers. The purpose of this project is to compare the interactions between PG-1 and two lipid bilayer systems. A NanoScope atomic force microscopy tapping mode measurement was used to study the peptide-bilayer interaction through measuring height and area of the supported bilayer patches as a function of peptide concentration. A zwitterionic phospholipid, 1,2 Dimyristoyl-*sn*-glycero-3-Phosphocholine (DMPC) was used to model mammalian membrane and 7:3 DMPC:1,2-Dimyristoyl-*sn*-Glycero-3-[Phospho-rac-(1-glycerol)] was used to model the bacterial membrane.

IMSA ON WHEELS: KIDS TEACHING KIDS

Presenters
Justin I. Chiou, Illinois Mathematics and Science Academy

Stephanie Song, Illinois Mathematics and Science Academy

Terry X. Tao, Illinois Mathematics and Science Academy

Advisor
Mr. Christopher Lin, Illinois Mathematics and Science Academy

This inquiry is the latest installment of an ongoing cycle of student-developed mobile science shows. Our show, *Force and Inertia*, teaches kids the basics of Newton's three laws and how fun science can be. We began by researching different physics' experiments. Then, our team collected the necessary materials and tested each demonstration. Demos include "Force Scales," "Baking Soda and Vinegar Car," and others. The goal of our show was to include more audience participation. After removing unsuccessful demos, the inquiry team focused on combining the demos into one cohesive show. The hardest part of this inquiry was making physics concepts easy for elementary students to understand. Teacher surveys were conducted after each show and results were used to make improvements. Our team took these results into account and made changes, like adding/removing demos. The average rating of each demo was 4.6 for fun and 4.5 for pertinent, informative, and interesting (5 being the highest). Average individual demo scores ranged from 3.7 to 4.9. Those experiments below average according to feedback, as well as those we didn't enjoy performing, were either revised or removed. Currently, our show has been presented to about 2250 students at fifteen schools.

CHRISTIANITY VS. ATHEISM: THE ULTIMATE DEBATE

Presenter
Connie Choi, Illinois Mathematics and Science Academy

Advisor
Dr. Lee Eysturlid, Illinois Mathematics and Science Academy

This study attempts to answer whether or not Christianity's teachings have any scientific or rational validity and is focused on two of the most controversial events of the Bible, Creation and Christ's Resurrection. The final goal of this study is to assess both the atheist and Christian arguments and determine if either is valid. Christians argue that the probability that the universe randomly formed in the state that it exists today is so small that Creation was virtually impossible, and therefore, there must be an intelligent "Creator" of the universe. Atheists contend that the creation of the universe is just as probable as the formation of another completely different universe, and that it is unreasonable to think that the universe was purposefully shaped to accommodate humans. In addition, atheists assert that there are inconsistencies in the Gospels, and that Christ's resurrection is biologically impossible and historically unsupportable. Christians claim that there is enough historical evidence to prove that the resurrection did indeed occur. These are among the few debates between the Christians and the skeptics. Evidence that both their arguments may lead to the same truth could be the revelation of the absolute truth that mankind has been searching for since Plato's time.

CYTOTOXIC EFFECTS OF BACTERIAL ELECTRON TRANSPORT PROTEIN RUSTICYANIN IN CAENORHABDITIS ELEGANS

Presenter
Laura T. Cladek, Illinois Mathematics and Science Academy

Mentor
Dr. Ananda Chakrabarty, University of Illinois College of Medicine

Rusticyanin is an acid-stable, soluble, blue copper protein that functions as a carrier in the electron transport system of the nonpathogenic soil bacterium Acidithiobacillus ferrooxidans. Previous research indicates that rusticyanin is capable of entering J774 cells and inducing either growth arrest or cell death. Rusticyanin's cytotoxicity may have significant implications in cancer therapy: rusticyanin-induced apoptosis and cell cycle arrest may be utilized in the treatment of certain types of cancer. Our experiments demonstrated that rusticyanin is also toxic to lower eukaryotic cells: Caenorhabditis elegans that ingested Escherichia coli BL21(DE3) hyperexpressing rusticyanin showed symptoms of cytotoxic poisoning. Rusticyanin's cytotoxicity may play an important role in predator-prey dynamics. We hypothesized that it acts as a defense mechanism against predators of A. ferrooxidans, such as the soil nematode C. elegans.

PICOSECOND TIME-OF-FLIGHT MEASUREMENT FOR COLLIDERS USING CHERENKOV LIGHT

Presenter
Timothy Credo, Illinois Mathematics and Science Academy

Mentor
Dr. Henry Frisch, University of Chicago

By measuring the final particles produced in a collision at a high energy accelerator, physicists can reconstruct the parent process and investigate the deeper questions of mass and flavor. Large detectors such as CDF consist of subsystems which measure the time, position, momentum, and energy of the secondary particles. Identifying the charged hadrons, which have very similar interaction characteristics, often relies on a calculation of mass provided by momentum and velocity measurements.

Currently, the 100 picosecond standard in time-of-flight (velocity) measurement only allows detectors to distinguish hadrons at momenta up to a few GeV/C. This research proposes a new time-of-flight scheme in which particles produce Cherenkov photons while traversing the window of one element in an array of microchannel plate (MCP) photomultipliers. The system under consideration requires a large area MCP design with an anode consisting of impedance-matched segments. Monte Carlo simulation of Cherenkov emission, MCP response, and multianode performance indicate that 1 picosecond resolution is possible with existing technology.

PEDIATRIC HOSPICE CARE: IMPROVING THE LIVES OF CHILDREN WITH LIFE THREATENING ILLNESSES

Presenters
Sandra Diaz de Leon, Illinois Mathematics and Science Academy

Dana A. Jensen, Illinois Mathematics and Science Academy

Audra A. Kramer, Illinois Mathematics and Science Academy

Mentor
Dr. Ileana Leyva, Central DuPage Hospital

Pediatric palliative and hospice care are used to raise the quality of life in ill children. Often times this method of treatment is used in terminally and chronically ill children. Our research was done through patients ages zero to eighteen who are enrolled in a pediatric palliative care program. Often when a patient is imminently dying, they experience respiratory distress. It is under these circumstances that children will receive music therapy to entrain their breathing and allow them to be more comfortable. The positive outcomes of music therapy are bountiful; the patient is able to breathe easier, relax, and concentrate on something other than their pain. Although the impact of this therapy is easily observable, the data is hard to quantify. This difficulty is due to great variations from child to child combined with their various diseases. Our research aims to quantify the affects of music therapy in the arena of Pediatric Palliative Care. Muscle spasticity, the FLACC pain scale, and breaths per minute before, after, and during music therapy were observed, there was a notable difference in teach of these measurements, with the end result of music therapy being a heightened level of comfort for the child.

CHARACTERIZING THE BOOSTER BEAM USING IPM DATA

Presenter
Matthew R. Drake, Illinois Mathematics and Science Academy

Mentors
Dr. Jim Amundson, Fermi National Accelerator Laboratory

Dr. Panagiotis Spentzouris, Fermi National Accelerator Laboratory

The purpose of this work is to study the behavior of the beam in the Fermilab Booster accelerator, and quantify its dependence on the Booster operational parameters. The Booster, the first circular accelerator in the Fermilab accelerator complex, accelerates protons from 400 MeV to 8 GeV in 20,000 turns. Ideally, the beam profile maintains a Gaussian shape throughout the cycle. In reality, however, various effects cause the beam to develop non-Gaussian tails, which create losses in the beam. Using the Ionization Profile Monitor detector within the Booster, we measured the turn-by-turn beam profiles for different operational parameters. We then extracted the ratio of the non-Gaussian to the Gaussian contribution by fitting the profiles. For this, we utilized GNU Octave, a scripting program which allowed us to plot and analyze the profiles as needed. Finally, we compared the ratios from the first 500 turns to the last 500 turns, for the different data sets, and identified which operational parameter set produced the lowest ratios, and consequently the most Gaussian profiles.

AN APPROACH TO NON-INVASIVE BUILDING DESIGN

Presenter
Danny L. Duong, Illinois Mathematics and Science Academy

Advisor
Dr. Kirk Hallowell, Illinois Mathematics and Science Academy

A boarding school for underprivileged children is planned to be built on a six acre plot in Zimbabwe by a private school developer. This project creates designs of the school with structural elements respecting Zimbabwean customs and maintaining a relative closeness to the surrounding building aesthetics. The project examines various facets of Zimbabwean life and reflects them in the design while keeping the overall concept novel. A final product that includes features from two different cultures was expected. Research of traditional Zimbabwean dwellings prompted the use of a hut as the building's atrium. It also indicated a Zimbabwean connection to nature which resulted in landscaping receiving careful attention. Close communication with the school developer regarding design progress and ideas was essential. The construction plans were reviewed by the school's developer as well as professional architects. A successful design was determined by approval of the school developer.

A BOTANICAL SURVEY

Presenters
Grace Dwyer, Illinois Mathematics and Science Academy

Khadijat Gbenro, Illinois Mathematics and Science Academy

Nahree Ki, Illinois Mathematics and Science Academy

Joshua Kinder, Illinois Mathematics and Science Academy

Michael Plachta, Illinois Mathematics and Science Academy

Mentor
Mr. David Gossman, Gossman Consulting, Inc.

In 1999 a botanical survey was begun on the property of Mr. David Gossman in Zwingle, Iowa. This project will not end until the final goal has been accomplished: a complete herbarium for IMSA, the farm, and Iowa State University. Consequently, the main work of the group is specimen collection and identification. The main, underlying purpose of the project is to better our understanding of the plant life on the farm. We also monitor the growth of selected trees, as we work on a tree farm. A botanical survey documents plant life by providing a dried specimen of a plant as viewed from both sides, including its leaves, stem, flower, root structure, and seeds. In addition to the specimen, careful notes on location and special features as well as photographic documentation are taken upon collection. After collecting and mounting samples, the finished specimens are identified using a dichotomous key. To date, we have identified 153 plant species. This year as a result of exploring more facets of the plant life on the farm, we have delved into the area of invasive species eradication, attempting to rid the farm of both the multiflora rose (Rosa multiflora) and garlic mustard (Alliaria petiolata). Also, in order to restore the natural prairie ecosystem on the farm, we plan to burn a small field, thus providing native plants the opportunity to thrive.

AN INQUIRY INTO THE DEVELOPMENT AND DOCUMENTATION OF A LEADERSHIP PROGRAM

Presenters
Alyse Eggertsen, Illinois Mathematics and Science Academy

Angela Rudolph, Illinois Mathematics and Science Academy

Advisor
Mrs. Kelly O'Sullivan, Illinois Mathematics and Science Academy

By marketing a leadership curriculum to young leaders in middle school, we hope to provide them with opportunities that are similar to those available to IMSA students through the Student Leadership Development (SLD) program. Our focus this year was to document each aspect of the developing program in order to create a sound structure for Outreach in continuing years. Because the program is new, much of this year has been devoted to logistics and organization. Our biggest event of the year is the Leadership Summit held in April. Up to 150 students and teachers participate in an afternoon conference focused on student-led modules. The four-hour Saturday convention is composed of a team introduction and four break-out sessions. The modules that the Outreach facilitators will be presenting are leadership skills, team dynamics, creating solutions, and public speaking. Throughout the day, we will film the activities and create a video collage of clips to use as a tool of evaluation. In addition to properly recording all sessions and meetings, we developed a survey from which we hope to gain useful information that will allow us to modify and improve the program in the future. The results of the survey will be presented.

A UNIQUE APPROACH TO THE KINETICS OF UREASE: THE MEASUREMENT OF THE HYDROLYSIS OF UREA FOR CLASSROOM EXPERIMENTS

Presenters
Justin Eusebio, Illinois Mathematics and Science Academy

Viral Shah, Illinois Mathematics and Science Academy

Mentor
Dr. Richard Dods, Illinois Mathematics and Science Academy

The catalysis of urea by urease to form ammonia and bicarbonate ion has been extensively researched and investigated using various methods to follow the reaction. We have developed a unique method for the analysis of this reaction using the change in pH associated with the formation of the ammonia. Using a simple pH meter, we have followed the reaction as it proceeds in the formation of ammonia, thus increasing the pH. The method was used to demonstrate the effect of temperature, concentration of urea, and various inhibitors on this reaction. Teachers will find these procedures especially useful if they wish to demonstrate the properties of enzymes in their classrooms using simple, inexpensive equipment.

THE SIGNIFICANCE OF PRESENILIN-1 IN REGULATING ADULT NEUROGENESIS

Presenter
Nida Faheem, Illinois Mathematics and Science Academy

Mentor
Dr. Ya-Ping Tang, University of Chicago

It was believed that there are no neurons in the brain once organisms passed the developmental stage. However, the use of advanced neurobiological technology has revealed this dogma to be incorrect. The dentate gyrus, a tiny region of the hippocampus, continues to produce new neurons during an organism's life-time. In this project, we wanted to determine the role presenilin-1 (PS1), a gene that has been significantly implicated in the pathogenesis of Alzheimer's disease, in regulating adult neurogenesis in PS1/PS2 double-knockout mice. These mice were generated by using an innovative Cre/lox P recombination system. BrdU staining, together with various cell-marker staining was used in this study. The results have shown a significant deficit in adult neurogenesis in the mice lacking PS1 expression. These results indicate that PS1 plays an important role in adult neurogenesis. To understand this process may provide insight into the neuronal mechanism underlying neuronal loss observed in Alzheimer's disease.

MODELING NEW NEUTRINO OSCILLATION EXPERIMENTS WITH GLOBES

Presenter
John C. Forbes, Illinois Mathematics and Science Academy

Mentor
Dr. Maury Goodman, Argonne National Laboratory

According to the standard model of particle physics, there are three massless neutrinos, the Electron, Muon, and Tau corresponding to their respective leptons. Observed amounts of electron neutrinos from the sun were far less than the amount predicted by the standard model. The explanation to this deficit was that neutrinos oscillate, and thus many of the electron neutrinos from the sun had become different types of neutrinos, and therefore were not detected. It follows from this that neutrinos have mass, and therefore could have great import to our understanding of certain fundamental questions remaining about the universe, most notably the question of Charge-Parity Symmetry violation. To determine neutrino oscillation properties, new experiments are being implemented, and more must be developed. To that end an experiment simulation program, GloBES, was created. I attempted to use this program to design new neutrino factory and long baseline experiments, and to show the long-term outlook of neutrino experiments in the coming decades.

BRAIN DEATH AND ITS PERCEPTION IN SOCIETY

Presenters
Robert Forler, Illinois Mathematics and Science Academy

David Qasem, Illinois Mathematics and Science Academy

Mentor
Dr. Jeffrey I. Frank, University of Chicago

There is varied comprehension about the prognosis of patients with devastating brain damage. Devastating brain damage can lead to irreversible cessation of all brain functions, known as brain death. To both medical and lay people, the line between brain death and devastating brain damage is ambiguous. Even when there is agreement on the definition of brain death, the methodology to make the diagnosis varies from hospital to hospital. Over the past 40 years, the medical definition of death has changed significantly from one based on cessation of heart function to one based on cessation of brain function. This definition of death as cessation of brain function has been accepted by the major world religions. Based on physicians' experiences with patient families, however, societal perception and acceptance of death defined as cessation of all brain function is not universal. Medical perception of what constitutes death is critical in diagnosing brain death: public perception of what constitutes brain death is critical in understanding death and accepting that death has occurred. This study explores perceptions regarding brain death and its significance in identifying that death has occurred.

IMSA ON WHEELS WEB DESIGN

Presenter
Christine Foster, Illinois Mathematics and Science Academy

Advisor
Mr. Christopher Lin, Illinois Mathematics and Science Academy

IMSA on Wheels is a student-developed mobile science program aimed at elementary school children, and has enjoyed immense success since its debut in January 2003. This inquiry explores the internet as a relatively untested educational medium to develop an effective online science curriculum for elementary school children and educators, to spread the program's influence to areas outside of IMSA's immediate reach, and to spark student interest in science. The web site expands upon *IMSA on Wheels* show materials and incorporates new elements for in-class or at-home education. Also, as a center for information on the *IMSA on Wheels* program, the site includes descriptions and digital photography from the shows, as well as feedback forms to maintain show and website quality. The site template was created using Macromedia Dreamweaver MX 2004. Digitally edited footage from the first *IMSA on Wheels* DVD was converted to Apple Quick Time format and placed onto the site in short, downloadable clips for educational use. At-home experiments from previous *IMSA on Wheels* shows and from new material are described and illustrated with digital images to engage site visitors and to encourage hands-on learning outside the classroom. The web site went active in March 2005 and the online feedback will be analyzed and presented.

INNOVATIONS IN MEDICAL SCIENCE: DEVELOPMENT OF ICE SLURRY COOLANTS FOR MEDICAL APPLICATION

Presenter
Rakesh Gadde, Illinois Mathematics and Science Academy

Mentors
Dr. Kenneth Kasza, Argonne National Laboratory

Dr. John Oras, Argonne National Laboratory

Under this mentorship, I am assisting in developing and testing a device that produces "ice slurry" for medical cooling applications. The slurry will be used in surgeries or other medical emergencies such as cardiac arrest or stroke to slow metabolic processes and reduce ischemic caused cell damage by inducing targeted hypothermia. The slurry consists of water, salt and very small ice particles at very high loading in suspension. For optimum delivery properties to the targeted organs, the slurry needs to have smooth, globular shaped ice particles for good fluidity. Ice particles with dendritic features (looking like snowflakes) entangle or attach to each other, creating sheets and can plug up delivery tubing preventing reliable delivery to a patient. The slurry production device we are developing cannot produce smooth, globular, ice particle slurry and hence it can not be used for delivery through small catheters. However, the slurry is deliverable through larger tubing into the lungs or stomach during minimally invasive laparoscopic surgery for cooling organs that require blood vessel clamp-off. I have conducted important parameter tests. These tests have allowed our group to make rapid progress in developing this method of making ice slurry.

AN INTERDISCIPLINARY APPROACH TO TEACHING AMERICAN HISTORY

Presenter
Pooja Gala, Illinois Mathematics and Science Academy

Mentor
Ms. Constance Van Brunt, CYCLE (Community Youth Creative Learning Experience)

The Community Youth Learning Experience (CYCLE) program has been offering educational and extracurricular opportunities to the children of Cabrini Green for the past 40 years. The main goal of this program has been to empower youth and increase their self-esteem and confidence. Through various labs CYCLE strengthens a student's study skills so that they enter high school with a strong academic base and the confidence to succeed. As a part of my mentorship, I conducted a lab dealing with issues in American History. I created interactive role-playing labs that incorporated science, math, reading and writing with studies in American History. These labs enabled the students to look at historical events from different angles and perspectives and connect past events with current events. In addition these labs reinforced the students' skills in other subject areas, and encouraged them to participate in thoughtful discussions about issues ranging from the causes of the Great Depression to issues they deal with in their own communities. Through these labs my goal has been to teach students the importance of history and how it can be used to learn other subjects and applied to everyday issues.

EFFECT OF ALCOHOL CONSUMPTION ON ANTIBODY RESPONSES

Presenter
Raj Gala, Illinois Mathematics and Science Academy

Mentors
Mr. Rick Heinz, Northwestern University Medical Center

Dr. Carl Waltenbaugh, Northwestern University Medical Center

Alcoholics are often at risk for frequent and severe infections, implicating an altered immune response. Alcohol decreases cell-mediated, but increases humoral, immune responses. We asked whether alcohol affects the quality, or affinity, of antibody. Several different methods may be used to determine antibody affinity or its ability to interact with an antigen. One method, enzyme-linked immunosorbent assay or ELISA, utilizes the ability of enzyme-labeled antibodies to bind to antigens. The ELISA method can be used to quantify antibodies, but is relatively insensitive for affinity determination. Another method is called FRET (fluorescence resonance energy transfer). This method assumes that energy is passed between bound compounds. A great example is the antigen-antibody complex. This complex can be excited at a wavelength specific for the antibody and the energy will be released at a wavelength specific for the antigen. These readings can also show the affinity of antibodies. Using monoclonal antibodies (all derived from the same clone), we used FRET to measure antibody affinity. Now we are in the process of translating this method to use with serum antibodies from immunized mice.

MUSIC THEORY AND PERFORMANCE

Presenters
Christine Gebler, Illinois Mathematics and Science Academy

Christopher Trigg, Illinois Mathematics and Science Academy

Xin (Cindy) Wang, Illinois Mathematics and Science Academy

Advisor
Dr. Gregg Porter, Illinois Mathematics and Science Academy

The academic study of music, or music theory, is important to any performer as it can help them to better understand and interpret the pieces they wish to perform. The music theory independent study looked to do just that; gain knowledge about the ideas behind the music and apply them to performance. Walter Piston's text *Harmony* was studied as well as various musical compositions to learn about types of chords, modes, and instruments' ranges. With the gained knowledge, new pieces for different types of ensembles were composed as well. In another form of application, the three students decided to perform some songs. The music theory independent study's presentation will feature Mark O'Connor's piece "Appalachian Waltz", a trio for bass, violin, and cello which utilizes the styles of Appalachia and the South. The presentation will also feature the world premier of "Harmonicalness", a duet written by students Christine Gebler and Chris Trigg. The idea behind the piece was creating a work which put a spin on the often stereotyped idea of classical music. Together, with a short presentation on the theory studied, the concert will provide an example of how academics and passion can come together.

DANCE TUNES AND DRINKING SONGS: THE EVOLUTION OF IRISH MUSIC

Presenter
Sara S. Goek, Illinois Mathematics and Science Academy

Advisor
Dr. Claiborne Skinner, Illinois Mathematics and Science Academy

Something about Irish music gives it a universal appeal and a place in global culture. Ireland has survived through much, from the British occupation, to the potato famine, and the mass migration of her people to the four corners of the globe. This study investigates how the traditional music of these people portrays what they have experienced over time. Through all the sorrow there was always readiness for laughter and joy, with a strong sense of identity and pride. The music reflects all of this, both the joys and the suffering. A power lies behind the melodies and lyrics, shaped by all the experiences its creators had over the centuries and carried with them as they emigrated from their native land. The memories have remained and caused it to evolve into what we know today.

THE ROLE OF GLYCOSYLATION ON PRP PROTEIN TRAFFICKING AND ACQUISITION OF PRION-LIKE CHARACTERISTICS

Presenter
Vijay Govind-Thomas, Illinois Mathematics and Science Academy

Mentor
Dr. James Mastrianni, University of Chicago

The glycoprotein PrP misfolds to form pathogenic prions, which cause fatal transmissible neurodegenerative disorders, including "mad cow disease." To better understand the role glycosylation PrP plays in prion formation, point mutations are introduced into the PrP gene to alter the normal glycosylation profile of the protein, which is also altered by treatment with the drug monensin. Results indicate that mono- and unglycosylated prion protein is apt to misfold and acquire pathogenic characteristics. Monensin treatment is shown to make misfolding more likely, suggesting the need for reevaluation of monensin's usage as a dietary supplement for beef cattle.

THE EFFECTS OF SIVA-1 ON COMMON CHEMOTHERAPEUTIC DRUGS SUCH AS PACLITAXOL

Presenter
Tatiana M. Green, Illinois Mathematics and Science Academy

Mentor
Dr. Prasad Kanteti, University of Illinois at Chicago

Siva-1, a gene that does not belong to the Tumor Necrosis Factor families, is linked to the inhibition of genes that protect the cell from UV-radiation induced apoptosis. This means that although Siva-1 is not found in the common apoptosis signals and pathways, it still sensitizes the cell to UV-radiation induced apoptosis. In cells where Siva-1 is over-expressed, the rate of apoptosis is greatly increased. This has the potential to affect the treatment of cancer cells. In order to see whether Siva-1 could be used in conjunction with common chemotherapy drugs, we began to test how it affected the rates of cell death when used with these drugs. The one that I helped to test was Paclitaxol, a drug commonly used to treat advanced breast cancer. We performed several experiments using Paclitaxol and MCF7-1 Breast cancer cells. In these experiments, we tested to see whether the addition of Siva-1 to the cells with Paclitaxol made any significant increase in the cell death potential of the cells. Although there was a 5% increase in cell death potential from the control, this number was not significant enough to show if Siva-1 and Paclitaxol can work together synergistically to induce apoptosis in breast cancer cells. To produce better results, we plan to increase the dose titration and the amount of time allotted for the Siva-1 to enter the cells. As for now, we conclude that although there was a slight increase in cell death, we cannot see any significant connection between the increase of apoptosis and the addition of the Siva-1 protein to the cells.

MICROELECTROMECHANICAL SYSTEMS: APPLICATIONS TO MICROACTUATORS AND MICROGRIPPERS

Presenters
Rishi Gupta, Illinois Mathematics and Science Academy

John Koval, Illinois Mathematics and Science Academy

Kaleigh F. Roberts, Illinois Mathematics and Science Academy

Mentor
Dr. Laxman Saggere, University of Illinois at Chicago

Microsystems, or Microelectromechanical Systems (MEMS), is an emerging process technology used to create integrated devices or systems that combine mechanical and electrical components. These devices (or systems), which can range in size from a few micrometers to millimeters, have the ability to sense, control and actuate on the micro scale, and generate effects on the macro scale. MEMS has been identified as one of the most promising technologies for the 21st century and has the potential to revolutionize both industrial and consumer products. Its techniques and microsystem-based devices have the potential to dramatically affect all of our lives and the way we live.

In our research, we worked on two projects in MEMS, viz. microactuators and micromanipulators. In the first project, we characterized the dynamics of a piezoelectrically driven microactuator using a Microscanning Vibrometer instrument. The microactuator is about 10μm thick and ranges in diameter from 300-1000μm. It is intended for transducing light energy into mechanical energy in a retinal prosthesis currently under development at UIC. In the second project, we studied the design of a multi-fingered micromanipulator for coordinated manipulation of objects at micro-scale for potential applications in microassembly and manipulation of a single biological cell.

USING TEXTILES TO DATE SITES IN THE NORTE CHICO, PERU

Presenter
Lyra Haas, Illinois Mathematics and Science Academy

Mentor
Dr. Jonathan Haas, Field Museum of Natural History

To understand complex civilizations, archaeologists need to know when people inhabited the given site or region. Without using radiocarbon dates, there had been no way to date sites from the preceramic occupation of the Norte Chico region (3000-1800 BCE) in Peru. However, since looms were rare in Peru until around 1800 BC, and non-loom techniques have an easily recognizable structure, textiles could be used to date preceramic sites. I examined the weaving techniques used at previously dated sites to create a checklist of characteristics of preceramic textiles. The results demonstrate the effectiveness of this non-radiocarbon method to date sites in Peru's Norte Chico region accurately.

ELECTROMAGNETIC PROPULSION IN TRANSPORTATION

Presenters
Neil W. Halmagyi, Illinois Mathematics and Science Academy

Nicholas Harker, Illinois Mathematics and Science Academy

Wit Riewrangboonya, Illinois Mathematics and Science Academy

Advisor
Ms. Laura Nickerson, Illinois Mathematics and Science Academy

Electromagnetism has, for over twenty years, been a possible method for public transportation. In our inquiry we take this a step further and research the feasibility of electromagnetic propulsion as a method for transportation in a frictionless environment. We have designed and built a magnetic propulsion system using NdFeB magnets. The goal is for the accelerator in this system to cause a significant difference between entrance and exit velocity of the accelerating object, such as a ball bearing. We have concluded from our data that magnetic propulsion has the potential to move an object a significant distance with little initial force. With our magnetic accelerator, we use the potential energy stored in a magnetic field. After conducting tests, we determined that after only one iteration, the velocity of the departing object is about 5 times greater than the initial velocity. This increases exponentially over successive iterations. We have yet to ascertain if there is a terminal velocity, but further investigations are pending. We are currently testing the system with a greater number of iterations and are varying the distances of the magnetic field in order to generate the maximum exit velocity.

DETERMINATION OF THE HUMAN BLADDER CELL RECEPTORS FOR UROPATHOGENIC ESCHERICHIA COLI

Presenter
Jing Han, Illinois Mathematics and Science Academy

Mentors
Mr. Ben Billips, Northwestern University Medical Center

Dr. David Klumpp, Northwestern University Medical Center

Urinary tract infections (UTI's) are an important clinical problem. As the second most common bacterial infection, it is the cause of over 7 million US clinical visits annually. Acute UTI's are primarily caused by type-1 piliated uropathogenic Escherichia coli (UPEC); present in over 90% of clinical isolates, type-1 pili allow UPEC adherence to structures on the surface of cells lining the urinary tract. These apical structures, shown to facilitate UPEC binding, are composed of proteins termed uroplakins Ia, Ib, II, and III. The goal of this research is to determine which uroplakins facilitate UPEC binding via type-I pili. Uroplakin proteins were expressed, using adenoviral constructs, alone and in combination in the human epithelial cell lines HeLa and PD07i to identify which uroplakin subunits mediate UPEC adherence. At present, the basic procedures and conditions for UPEC adherence assays, and blotting parameters for uroplakin expression, have been established. Uroplakin antibody effectiveness has been evaluated and adenovirus titers have been determined. This system will be utilized to quantify UPEC binding to uroplakin-expressing cells by exposing the cells to UPEC and then determining the number of adherent bacteria by plating. This data is essential for further dissecting the mechanisms of UPEC adherence to uroplakins.

IN-VIVO PRE-CANCER DETECTION WITH OPTOELECTRONICALLY ENHANCED ENDOSCOPY

Presenter
Jing Han, Illinois Mathematics and Science Academy

Mentor
Dr. Timothy Kurzweg, Drexel University

Although epithelial cancer can be treated successfully if diagnosed early, detection is difficult due to the microscopic nature of cancerous cells. Current detection techniques are limited to biopsies, where slices of epithelial tissue are removed and examined for evidence of abnormal cell development called dysplasia. However, physicians are often unable to detect dysplasia until the cancer has reached an advanced stage of development. The research objective is to develop an endoscopic spectrometer probe that will allow for noninvasive in vivo detection of alterations of cell size in esophageal tissue, through the use of fiber optics. As many diseases are associated with the morphological transformation of cells, such an instrument could improve patient care and reduce medical costs. Through light-scattering spectroscopy, an attempt was made to relate fluctuations in wavelength patterns to the size of scattered particles. Optical fibers were used to transport light to and from microspheres of 4.5 and 10 microns. This tissue phantom represented a regular cell's spheroid nucleus versus the nuclear enlargement undergone in dysplasia. A receiving fiber then collected the reflected light and an Ocean Optics Spectrometer was used to analyze the light's intensity at individual wavelengths. Although reflectance intensities differed between microsphere sizes, wavelength frequencies were extremely similar. This data will be considered in future instrument designs.

KILLING CURVES OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS USING VANCOMYCIN, RIFAMPIN, AND GENTAMICIN

Presenters
Laura Hawkes, Illinois Mathematics and Science Academy

Azmina Lakhani, Illinois Mathematics and Science Academy

Mentor
Mr. Bill Kabat, Children's Memorial Hospital

The objective of this project was to examine the antimicrobial-induced bactericidal rate for Staphylococcus aureus with the antibiotics rifampin, vancomycin, and gentamicin at various concentrations. Previously, this topic was explored by conducting synergy studies with rifampin, vancomycin, and gentamicin. At that time, sub-inhibitory concentrations of gentamicin were found to positively influence the synergy between rifampin and vancomycin and resulted in reduced Minimum Bactericidal Concentrations (MBCs). This discovery introduced additional questions concerning the rate of antimicrobial-induced bacterial killing as time progressed (as opposed to observing the bactericidal activity that occurred at the conclusion of the incubation period). This phenomenon was explored using killing curves, which required data to be collected at certain intervals within the twenty-four hour incubation period. It was found that the killing curve experiments supported the conclusions drawn from previous synergy studies. Rifampin and vancomycin, combined with sub-inhibitory concentrations of gentamicin, resulted in enhanced bactericidal effects, as compared to a combination of only rifampin and vancomycin. Pharmacologic gentamicin concentrations improved bactericidal activity, although sterilization of the cultures did not occur.

DEFINING THE PERCEPTION OF FEMININE BEAUTY THROUGH ART

Presenters
Sarah Heaney, Illinois Mathematics and Science Academy

Catherine Xiao, Illinois Mathematics and Science Academy

Advisor
Dr. Robert Kiely, Illinois Mathematics and Science Academy

In our study, we examined visual representations of the female figure in painting and sculpture from two artistic movements—the Classical period, and the Italian Renaissance—and compared them to modern artwork. Through Classical literary work, we observed the associations of femininity with nature and chaos, and used this to construct a model of Classical beauty. This ideal model has symmetrical features, good bodily proportions, and devotes appropriate attention to improving her appearance with beautiful clothes and makeup, among other things. In humanist literature from the Italian Renaissance by Petrarch and Christine de Pizan, we noted attitudes of individuality and self-improvement that are also reflected in the artwork of this period. Beauty became more significant on an individual level, which we can see from the popularity of portraiture and the female nude. Although artists began to create unique styles, choosing subjects with specific facial features and body types, most Renaissance beauties still shared common attributes like a feminine figure with a slim waist and wider hips. We then compared these models of historical beauty to modern standards. Today's model woman has a thinner, less feminine figure than those of her Classical and Renaissance counterparts, but society still emphasizes the importance of features such as good proportion and symmetry.

DEVELOPMENT OF INTELLIGENT SEARCH SOFTWARE

Presenters
Ovidiu Hentea, Illinois Mathematics and Science Academy

Daniel Moorehead, Illinois Mathematics and Science Academy

Brian P. Sawicki, Illinois Mathematics and Science Academy

Mentor
Dr. Jay Budzik, Intellext

One of the most rapidly advancing areas of study in information sciences today is intelligent search and search algorithm design. At Intellext we have been given insight into modern search technologies while actively developing and implementing new search tools. Development and research was done for Intellext's Watson search, a proactive search assistant that interfaces with common desktop applications to provide information relevant to a user's task. Research included comparison of elements of the effects of Watson's statistical search tool by means of an ablation study in which one or more of the heuristic search components had been removed. Subjects were asked to complete a web-based survey backed by an SQL database (used to store results) comparing results for documents generated by the differing search algorithms. This allowed for an accurate judgment of the contributions as to different functions within the search algorithm. The study was crucial to the development of the search-tool due to the information it would offer, such as the relevance of each of the elements in the searches sent out by the tool. Other projects included a detailed study of potential competition in today's search tool market, in the interest of acquiring information regarding competitors and potential partners that might be able to offer the technology needed to complement the stature of the Watson serach engine in the marketplace segmentation. We also did a brief research project on the variety of desktop search-tools on today's market and their versatility in terms of integration with Watson. A final work in progress involves writing a plugin to allow Watson to interface with the Mozilla Firefox © web browser.

AN INQUIRY CONCERNING HUMAN INTERPRETATION

Presenter
Carl Herrmann, Illinois Mathematics and Science Academy

Advisor
Dr. Robert Kiely, Illinois Mathematics and Science Academy

My inquiry is in the area of epistemology, the philosophy of knowledge. A conflict exists between different epistemological approaches. Whether deductive or empirical, many epistemologies assume that the universe is basically consistent. On the other hand, relativists see the universe as very inconsistent, claiming that nothing forces the universe to be consistent aside from our desire, and we force consistency upon it. Relativism, however, is prone to having its conclusions declared irrelevant. My inquiry centers on an attempt to create an Epistemology that is both rigorous and relevant. To this end, I formulated the ideas of Constructs (things we assume exist), Entities (constructs with "will"), Interpretations, and the most important aspect: usefulness. My system uses usefulness as its meter of relevance. For example, a proof that either my toe or a rock exist would be difficult, but if I want to avoid stubbing my toe, the assumption that they both actually exist is useful. I would call the toe and the rock Constructs, I would be an Entity who doesn't want to feel pain. The interpretation is that stubbing my toe on a rock hurts, and they all are useful, too, if I don't like pain.

THE IMMEDIATE INFLAMMATORY RESPONSE OF THE NEURAL IMMUNE SYSTEM IN THE SUBSTANTIA NIGRA FOLLOWING 1-METHYL-4-PHENYL-1,2,3,6-TETRAHYDROPRIDINE INDUCED DAMAGE TO DOPAMINERGIC NEURONS

Presenter
Jamison A. Hill, Illinois Mathematics and Science Academy

Mentor
Dr. Jaime Grutzendler, Northwestern Feinberg School of Medicine

Parkinson's disease is a progressive neurodegenerative disorder, the clinical features of which were first described in 1817 by James Parkinson in his publication, "Essay on the Shaking Palsy". There are two pathological characteristics of Parkinson's disease, the significant loss of dopaminergic neurons in the substantia nigra pars compacta (SNpc) and the formation of Lewy bodies in surviving dopaminergic neurons. Currently, the understanding of the underlying mechanisms of the cellular and molecular processes by which PD causes neurodegeneration is limited. In order to develop a better understanding, animal models, such as that of 1-methyl-4-phenyl-1,2,3,6-tetrahydropridine (MPTP)-induced neurodegeneration have been created. MPTP, an analogue of meperidine, kills the dopaminergic neurons in the SNpc, just as PD does. To explore the reaction of the neural immune system to MPTP intoxication, the population of activated microglia, the resident microphage of the brain, was obtained in several areas of the murine brain before and after MPTP intoxication. The mice used in this experiment were genetically modified so that their microglia were fluorescent. When the densities of microglia were compared, a significantly higher concentration of activated microglia was found in the SNpc. These results suggest that the activation of microglia in the SNpc must be due to MPTP intoxication.

DESIGNING AND BUILDING PROTOTYPE WIRE CHAMBERS FOR DOUBLE-CHOOZ

Presenter
Nicholas Hinton, Illinois Mathematics and Science Academy

Mentor
Dr. Maury Goodman, Argonne National Laboratory

It has been discovered that neutrinos oscillate from one flavor to another. This finding brought about the need to measure the mixing angles of the three types of oscillations. Now, scientists are working on improving the accuracy of the measurement of the angle theta-13. This is a difficult measurement because neutrinos are difficult to detect, and there are many different types of unwanted background noise. In this mentorship, we worked on developing and constructing prototypes for the wire chambers used in the Double-CHOOZ project to reduce the backgrounds. We tested various elements of the design (which kind of adhesive would work best, what kind of labels to use, etc...) when creating our model. Also, we designed a system for identifying the individual wire chambers in their respective modules (84 chambers per module, 30 modules in all). After the sample module was finished, it was sent to Tennessee to be tested by other scientists working on the Double-CHOOZ project.

THE ROLE OF PENICILLIN-BINDING PROTEINS IN VARIOUS STRAINS OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

Presenters
Sharon Hong, Illinois Mathematics and Science Academy

Trisha Salkas, Illinois Mathematics and Science Academy

Mentor
Mr. Bill Kabat, Children's Memorial Hospital

β-lactam antibiotics, which target components of cell wall synthesis, are often combined with other antibiotics that target different metabolic pathways of bacteria. Recent reports have suggested that two β-lactam antibiotics, ceftriaxone and ampicillin, act synergistically in-vitro against Staphylococcus aureus strains. The goal of this study is to determine the in-vitro efficacy of this combination in methicillin-resistant (MRSA) versus methicillin-sensitive (MSSA) Staphylococcus aureus strains. Our research began with defining minimum inhibitory concentrations (MICs) of ten different MRSA and ten non-MRSA strains with ceftriaxone and ampicillin. Using the data from the MIC projects, we observed any changes in the MIC when the two antibiotics were combined, thus determining if the two drugs were synergistic, additive, partially synergistic, non-synergistic (indifferent) or antagonistic. The results of this study will be used to examine the role of penicillin-binding proteins (PBPs) in dual β-lactam antibiotic treatment of Staphylococcus aureus strains. When we finish our synergistic studies, we will discuss the PBPs that are correlated with the effects of ceftriaxone and ampicillin.

THE DEVELOPMENT OF A ROBOTIC IMAGING SYSTEM

Presenter
Thomas Houlahan, Illinois Mathematics and Science Academy

Advisor
Mr. Ray Urbanski, Illinois Mathematics and Science Academy

The goal of this project is to design a device that would allow machines to "see," while at the same time avoiding video cameras and other devices requiring the extensive use of pattern recognition software. To this end, this project is placing emphasis on the use of lasers to obtain data that would allow the computer to construct and continuously update (in real time) a 3-D, computer generated map. The acquisition of data for the computer generated map will be done by shining a stationary bundle of laser beams through a single lens. The lens will then redirect the bundle of lasers at known trajectories, which they will follow until striking solid surfaces. The diffuse light from each separate laser beam will then be detected by onboard sensors and the distance from the machine to each of the different surfaces will be calculated. Using this information, the computer will construct a 3-D map that will be updated in real time, and used for navigation. Thus far, this project has produced conceptual models and is drafting the technical blueprints required for construction. The methods of navigation employed will be similar to the path finding algorithms used by most computer strategy games.

FUNCTIONAL MAGNETIC RESONANCE IMAGING OF SOCIAL PHOBIA DURING APPRAISAL OF EMOTIONAL FACES

Presenter
Aiva M. Ievins, Illinois Mathematics and Science Academy

Mentor
Dr. K. Luan Phan, University of Chicago

Background: Persons with generalized social phobia (GSP) avoid social interaction and fear negative criticism by others. Little is known about the neural mechanisms of this disorder. The limbic brain, particularly the amygdala, has been linked to emotional processing and perception of threat. This study sought to investigate the role of the amygdala in perception of emotionally harsh faces in social phobia.

Methods: In a block-related functional magnetic resonance imaging (fMRI) experiment, ten patients diagnosed with GSP and ten healthy, age- and gender-matched controls viewed and identified the emotion of 96 gray-scale photographs of human faces expressing 6 emotions (anger, fear, disgust, sadness, happiness, neutral). fMRI images were processed and analyzed using Analysis of Functional NeuroImages (AFNI) according to the general linear model. Differences in brain activity were detected by standard subtraction analysis (e.g. anger vs. neutral) within individual subjects. Data from individual subjects were analyzed at a second-level random effects model to ascertain within and between group differences. In addition, brain activity was extracted from functionally-derived regions of interest (fROI).

Results: Persons with social phobia exhibited greater amygdala activation than healthy controls in response to fear as a discrete emotion, as well as more generally to harsh emotions (anger, fear, disgust) when grouped together in comparison with neutral or happy faces.

Conclusions: These findings support the role of the amygdala in the processing of harsh and/or negative emotions. An exaggerated amygdala response to expressions of threat and disapproval may underlie the neural pathophysiology of social phobia.

THE INVESTIGATION OF THE PTB DOMAIN IN THE SHC-A AND SHC-D GENES

Presenters
Swetha Jalli, Illinois Mathematics and Science Academy

Heena K. Mutha, Illinois Mathematics and Science Academy

Mentor
Dr. Piers Nash, University of Chicago

Marked by the excessive proliferation of cells, cancer is induced when mutations occur in genes involved in various signal transduction pathways. These genes are translated into protein and interact with other proteins through their domains, which are small amino acid sequences that bind to phosphotyrosines causing signals to be expressed. The interaction between the hormone and the receptor tyrosine kinase alters the physical structure of the cytoplasmic tail. This allows for inactive enzymatic modules to bind to the tail, creating signals. We investigated the main amino acids next to tyrosine that best bind with the PTB domain in SHC-A and SHC-D. Our focus was to observe this binding so that we may be able to better understand the PTB domain. We cloned our domains in a vector and then transformed into E. Coli bacteria the vector prior to DNA purification. Next, we expressed and purified our protein. Following protein purification, we used a Western Blot to determine what amino acids our domain binds to. Based on these results, we are able to better understand the binding of the PTB site. This critical point if mutated has the ability to cause cancer. The hope is to target the mutation at the site in order to prevent cancer.

NO TOLERANCE FOR ZERO TOLERANCE: THE ZERO TOLERANCE POLICY IN THE CHICAGO PUBLIC SCHOOLS

Presenters
Akta Jantrania, Illinois Mathematics and Science Academy

Conan Liu, Illinois Mathematics and Science Academy

Mentors
Ms. Lauren Girard Adams, Northwestern University School of Law

Dr. Bernardine Dohrn, Northwestern University School of Law

In the late 1980's and the early 1990's, America defined a new type of criminal, the "superpredator." These offenders were portrayed as vicious, immoral, and most prominently, they were the youth of our country. As a result of public fear and indignation, the zero tolerance policy was developed to prohibit children from making any mistakes. The zero tolerance policy has filled America's schools with drug sniff-dogs, security personnel, and metal detectors and administrators have suspended and expelled students for diminutive or even made-up violations. Since the prosecuting authorities have become more involved in cases where students break school conventions, more students are being suspended or expelled. Due to the fact that most of these students come from challenging environments this only puts the students back into an unstructured situation for days or even months at a time. With such harsh punishments, students are pushed out of the school system only to enter the juvenile system. Working alongside the Children and Family Justice Center and the Advancement Project, we are collecting data regarding the types of students in the Chicago Public Schools who are most directly affected by the zero tolerance policy and researching various facets of this issue.

BRINGING FORTH TRANSITION: BENJAMIN LUNDY AND THE HISTORY OF THE ABOLITION MOVEMENT

Presenter
Elizabeth Janusick, Illinois Mathematics and Science Academy

Advisor
Dr. Claiborne Skinner, Illinois Mathematics and Science Academy

Benjamin Lundy represents a transitional man in the history of the abolitionist movement. In 1821, he started *The Genius of Universal Emancipation*, the first abolitionist newspaper in the country. Memoirs, newspapers and other sources reveal that he supported a gradual approach wherein the enslaved would relocate to Haiti or similar countries where they would receive land and an education. For him, a black man could better improve himself outside of the United States. Consequently, he provided the nation with a more practical alternative to the religious crusade against slavery. While many view gradualists as wimpy abolitionists, Ben Lundy traveled around the country, usually on foot, convincing many slaveholders to turn their slaves over to him. He sometimes even escorted them to Haiti to ensure their possession of land. In 1838, he accepted an invitation to print his paper in Lowell, Illinois with the hope that the state would tolerate his ideas. Although fairly unknown, he served the country by opening up the minds of citizens to the notion of abolition. Without his efforts, William Lloyd Garrison, Abraham Lincoln, and others could never have gained the support needed to carry through with emancipation. Therefore, Ben Lundy's gradualist ideas allowed for the transition between toleration and abolition.

TESTING FOR EXPERIMENTAL VALUES FOR RESOLUTION ON AN OPTICAL COHERENCE TOMOGRAPHY SYSTEM

Presenter
Hemanth Jasti, Illinois Mathematics and Science Academy

Mentor
Dr. William Ellingson, Argonne National Laboratory Energy Technology Division

Optical coherence tomography (OCT), a recently developed imaging technology, is used in medicine, biology and material science. This project compares various scans by an OCT system to observe the effects of different variables. A glass plate with nine back drilled holes of different diameters and depths was used. Scans of each of the nine holes were evaluated to note the effects of object depth, and size. A ceramic plate with the same holes was scanned to compare the imaging of different materials. This project also compares the theoretical value of the FWHM of the axial resolution to that of the value found from experiments. Plots of vertical cross-sections of two glass plates, density one and two, were used to find the experimental value for resolution. The axial resolution of the system is found to be dependent on the FWHM and the wavelength of the light source used. The experimental value for resolution was larger than the theoretical value. This was expected since the theoretical value is the maximum resolution, while the experimental value factored in noise and the environment.

CREATION OF A MUTATED CYP33 GENE AND ITS EFFECTS ON EXPRESSION LEVELS OF HOX GENES IN MAMMALIAN CELLS

Presenter
Sarah Jeong, Illinois Mathematics and Science Academy

Mentor
Dr. Manuel Diaz, Loyola University Medical Center

Chromosomal translocations involving the Mixed-Lineage Leukemia (MLL) gene can lead to acute leukemias. This gene contains four zinc fingers of the Plant Homeodomain (PHD) type, which tend to occur in proteins that are regulators of certain gene activity. Cyp33, a nuclear cyclophilin that was shown to interact with the third MLL PHD finger, was also previously shown to alter the expression of HOX genes (which are targets of regulation by MLL) when overexpressed.

This study was designed to examine the effects of a mutated Cyp33 gene on the expression levels of HOX genes in mammalian cells. Creating a mutation in the Cyp33 gene would maintain the gene's ability to bind to the MLL protein but effectively alter the cis/trans prolyl isomerase enzymatic function of Cyp33. In doing so, after cloning and transfecting the new gene into mammalian cells, the expression levels of HOX genes were anticipated to remain the same as cells not expressing exogenous Cyp33.

In this process, I successfully created two point mutations within a specific region of the Cyp33 gene and amplified two halves of the full gene. With more time, I would have created a full-length mutated Cyp33 gene and transfected it into mammalian cells for observation.

THE EFFECT OF DOPAMINE, QUINPIROLE, AND ETICLOPRIDE ON HUMAN D2 RECEPTORS

Presenter
Abigail Johnson, Illinois Mathematics and Science Academy

Advisor
Dr. Donald Dosch, Illinois Mathematics and Science Academy

Dopamine is a neurotransmitter that plays a major role in the processes of addiction and numerous neurological disorders including Parkinson's disease, attention deficit-hyperactivity disorder, and schizophrenia. The majority of research done regarding the dopamine system has focused on the D1 dopamine receptor, previously thought to be the only dopamine receptor. The function and specifics of the D2 receptor are still being determined. This study investigated how different concentrations of dopamine and periods of exposure affect the levels of mitogen-activated protein kinase (MAPK), which is known to be activated by the human D2 receptors in the mouse cell line CRL-10225. In addition, the cell line was treated with the highly-selective D2 receptor antagonist, eticlopride, and the D2 receptor agonist, quinpirole, under the same conditions to determine how the chemically induced stimulation or repression of the receptor compared with the natural trigger, dopamine. Western blotting was used to analyze the amount of MAPK present as a result of treatment. The initial exposure periods and concentrations yielded no conclusive differences between the amounts of MAPK present, however distinct differences in cell growth and appearance were discovered. Further tests are being conducted with adjusted exposure periods and concentrations.

AN INTRODUCTION TO SIMPLE TRANSISTOR FABRICATION: CLEANING AND OXIDATION OF SILICON

Presenter
Jennifer M. Jones, Illinois Mathematics and Science Academy

Mentors
Dr. Christos Takoudis, University of Illinois at Chicago

Mrs. Deepthi Jopireddy, University of Illinois at Chicago

Ever since Bardeen and Brattain invented the transistor in 1950, the electronics industry has been rapidly evolving to make everyday electronics, such as cell phones and computers, cheaper, more efficient, and smaller. With the size of the transistors continuously being reduced to meet the increasing demand of miniaturization, the conventional manufacturing processes are reaching their limit. As a result, scientists have been looking into alternatives to transistors, such as nanowires. We investigated the established process of production of a simple transistor, more specifically; we looked into the oxidation of the silicon wafer to form silicon dioxide. The silicon dioxide layer acts as an insulator and is an important component of the transistor. The thickness of the oxide layer formed was characterized by changing the oxidation temperature and duration. We also observed and used some atomic-scale equipment used by scientists to make transistors, such as the atomic force microscope; more significantly, an ellipsometer was used to measure the thickness of silicon dioxide layers at the nanometer length scale.

EFFECTS OF INCREASED LOAD ON FORCE OUTPUT DURING LOCOMOTION

Presenter
Jennifer M. Kang, Illinois Mathematics and Science Academy

Mentor
Dr. David A. Brown, Northwestern University Feinberg School of Medicine

Stroke patients often suffer from a condition called hemiparesis. This condition weakens an arm and leg on the same side of the body, and more importantly for this proposed study, impairs their ability to walk. This leads to an increased susceptibility to falls and subsequent injury, and therefore must be addressed. However, we must first understand the mechanisms governing locomotion in non-impaired nervous systems.

The non-impaired nervous system has been studied in a variety of animals, and has been found to be controlled by both inhibitory and facilitory systems. Studies show that during isometric tasks, an inhibitory system limits the amount of force one can support. During locomotion, on the other hand, the load receptors elicit a response from the facilitory system, allowing the muscles to support a greater amount of force; if this response fails, then limb collapse will occur. Few studies, however, have been able to show this effect during human locomotion. We hypothesize that the load receptors in non-impaired humans will elicit the inhibitory response during isometric tasks, and the facilitory response during locomotion.

HOMEOPATHIC REMEDIES VERSUS THE PLACEBO EFFECT

Presenter
Arielle Kanters, Illinois Mathematics and Science Academy

Advisor
Dr. Susan Styer, Illinois Mathematics and Science Academy

This inquiry project continued previous investigations regarding the effectiveness of homeopathic remedies through the analysis of double blind clinical studies; the majority of which revealed that homeopathic remedies are more effective than placebos. Additional scientific research involved an *in vitro* experiment which tested the effects of *Calendula officinalis* on B cell growth. In the near future I plan on taking the results from the *in vitro* experiment and comparing them to the effects of *Calendula's* allopathic equivalent on B cell growth. This project also investigated the cultural acceptance of homeopathy as a valid form of medicinal therapy. Through literary research, as well as an interview with a doctor of internal medicine, I became aware that even allopathic doctors have begun recognizing homeopathy as a valid form of alternative medicine. I also investigated the growing acceptance of homeopathic remedies in the eyes of patients through a review of medical journals and newspaper articles. I found that while research supporting the effectiveness of homeopathic remedies is still limited, the number of people willing to try homeopathy is increasing.

REFRACTORY INCLUSIONS RENDER INSIGHT INTO THE FORMATION OF THE SOLAR SYSTEM

Presenter
Charles Keaton, Illinois Mathematics and Science Academy

Mentors
Dr. Larry Grossman, University of Chicago

Dr. Steve Simon, University of Chicago

4.5 Gya the volatile solar nebula with a temperature of approximately 2000K began cooling very rapidly. This event caused gaseous elements comprising the nebula to quickly condense and solidify. The sequence in which they did so is predicted by thermodynamic calculations. The aim of this research is to locate and study a small percentage of nebular condensates called refractory inclusions, which were predicted to have condensed very early in the history of the solar system. However, due to an aggregation process that simultaneously occurred, refractory inclusions are not found alone. Rather, the refractory inclusions of this study are found within the matrix of meteorites, namely very old ones called carbonaceous chondrites.

In order to study the inclusions, the sample must be dis-aggregated. Disaggregation is accomplished by employing a freeze-thaw technique, causing the sample to expand and contract, weathering it into a chondritic powder. Objects of interest (including refractory inclusions and other solids) within this powder are separated from the chondrites' matrix using a density separation method. These objects are then recovered and studied under a Scanning Electron Micrscope (SEM).

COMPUTATIONAL PREDICTION OF SONG GENRE WITH RECURRENCE QUANTIFICATION ANALYSIS

Presenter
Andrew Keller, Illinois Mathematics and Science Academy

Mentor
Dr. Charles Webber, Loyola University Medical Center

Music has been a part of human culture for several millennia and yet there remain plenty of unanswered questions. Through the use of a tool called recurrence quantification analysis, I have investigated the possibility of whether or not there is a way to quantitatively classify songs into their respective genres. Such a task has been undertaken before with different means of analysis (e.g. Fourier transforms), but remains in the experimental stages. Though time consuming, this idea of classifying songs by their recurrence patterning seems to hold great promise as some preliminary results have already been obtained. The researcher believes that the results at least show a way of classifying a given song with high accuracy as rock, classical, experimental electronic, or otherwise. If the accuracy of prediction and speed of analysis improve, the results will prove promising for other aspects of signal processing, such as voice recognition.

WEB-BASED APPLICATIONS OF THE PYTHON SCRIPTING LANGUAGE AND OTHER TECHNOLOGIES

Presenter
John W. Kenealy, Illinois Mathematics and Science Academy

Mentor
Dr. David Ritchie, Fermi National Accelerator Laboratory

Python, a widely used scripting language, has developed substantial capabilities for handling internet-based information. The purpose of this research was to explore some potential uses for Python, especially within Fermilab's computing environment, to aid productivity or cause other benefit. Some projects undertaken in the course of the research were a script to manipulate an online content managing system and a script to create a newsfeed based on postings in a newsgroup. Both of these projects required not only a basic grasp of Python, but also knowledge of other technologies, such as Plone, an online content manager, and RSS, which is used to create newsfeeds.

MOLECULAR DETERMINANTS OF PUFFER FISH TOXIN BLOCK OF NA CHANNELS

Presenter
Navin Kesari, Illinois Mathematics and Science Academy

Mentor
Dr. Dorothy Hanck, University of Chicago

Many plants and animals have developed toxins for protection and survival. Two such toxins, tetrototoxin (TTX) and saxitoxin (STX), found in puffer fish (Fugu) and the algae that forms red tide, are quite structurally similar although they have somewhat different size and shape, and TTX carries one positive charge while STX has two. In humans, there are 10 Na+ channel genes located on four different chromosomes. The channels formed by these genes differ in sensitivity to these toxins, i.e. at a given concentration of toxin some are completely, some partially and others blocked not at all. Some structural predictions about the binding site are known for these toxins, which block in the pore, preventing Na flow, and, therefore, action potentials. The purpose of our experiments was to determine further molecular determinants of the binding site. We studied methionine (M) at amino acid 1240 in the skeletal muscle Na channel isoform, where a single nucleotide change produces a threanine, valine, or isoleucine. Threanine substitutions are present in some isoforms that are less TTX sensitive. If methionine 1240 is mutated to threanine, we predict the channel will be less sensitive to TTX and/or STX. We mutated the channel DNA, made cRNA, injected it into Xenopus oocytes, and then used two-microelectode voltage clamp to assay the ability of TTX and STX to block. We found that 0.6 μM TTX and 50 nM STX blocked 50% of the M1240T channels. This represents an approximately 10-fold reduction in affinity, consistent with our prediction. Further experiments, testing M1240I, and M1240V are ongoing.

VENUS RISING: WOMEN OVERCOMING OBSTACLES IN THE PURSUIT OF SCIENCE

Presenter
Heidi Knappenberger, Illinois Mathematics and Science Academy

Advisors
Dr. Dennis Czerny, Illinois Mathematics and Science Academy

Dr. Lucy Fortson, Adler Planetarium

Dr. Grace Wolf-Chase, Adler Planetarium

Gender bias and discrimination against women in science can take many forms, from overt sexual harassment to the much more common problem of subtle and unconscious sexism. For my inquiry project, I interviewed four women scientists in the Department of Astronomy and Astrophysics at the University of Chicago to further understand the obstacles they have overcome in their careers. Dr. Lucy Fortson, Dr. Grace Wolf-Chase, Dr. Monica Valluri, and Dr. Angela Olinto have dealt with gender bias from both their teachers and colleagues and learned to juggle their careers and families, while still managing to make a name for themselves in the field of astrophysics. They have overcome the obstacles in their way by refusing to take "no" for an answer and by retaining an unshakeable passion for the science they love. By combining live footage from the women's interviews with archival material they provided, I've created a short documentary that provides valuable insights into the arduous process women scientists must undertake when trying to succeed in a male-dominated field. My hope is that this documentary will inspire and motivate young girls to actively pursue their interest in science by providing them with stories of other women who have faced the odds and succeeded.

DEVELOPING A CREATIVE WRITING SENIOR ELECTIVE FOR IMSA

Presenter
Anastasia Knasiak, Illinois Mathematics and Science Academy

Advisor
Dr. Dennis Czerny, Illinois Mathematics and Science Academy

The goal of this inquiry was to develop the curriculum for a semester long creative writing English class for IMSA. This inquiry was planned to offer all students with an interest in creative writing a chance to develop their skills as well as to offer more choices for senior English electives. These goals were cemented by background research which included journal articles and interviews with IMSA teachers. After that, a general curriculum based around three parts of creative writing (short story, poetry, and personal essay) was developed. Finally, specific assignments, such as writing poetry based off of art, were chosen in such a way as to be interesting and relevant to students while still accomplishing the goals. One unique feature of the curriculum is its basis on student workshopping and participation. Most of the classes allot time for in class writing that is supplemented by regular homework assignments. In addition, all students are expected to keep a journal for the duration of the course. At the end of the course, students will present a portfolio demonstrating their skills in two of the three writing areas studied. The result is a curriculum that will hopefully prove useful to teachers and students.

THE EVOLUTION OF MARKET DYNAMICS: LEVELING THE GLOBAL PLAYING FIELD

Presenters
William Konrad, Illinois Mathematics and Science Academy

Robert Main, Illinois Mathematics and Science Academy

Mentor
Mrs. Linda Thorp, Refco, LLC

Trading the markets used to be an exclusive game, limited to only the wealthiest individuals or institutions. With the introduction of the internet, various opportunities arose for the average investor to enter the market. Whereas all brokerage used to be over the phone, market participants can now choose between web based or proprietary trading platforms as well as standard brokerage. Different levels of brokerage service have also emerged ranging from simple order transaction to full service brokerage, all the way to managed funds. This introduction of short-term retail capital has permanently changed the dynamics of the financial markets in a quantifiable manner. Through our own trading and research with Refco LLC, the world's largest non-bank brokerage firm, we have witnessed the effects of these traders and have devised strategies to capitalize on our knowledge of their trading practices. We have concluded through analysis of these trading systems as well as experience on the disappearing trading floors not only that the markets are becoming more efficient, but that the nature of the markets is fundamentally and irreversibly changing.

CREATING A LANGUAGE: A HANDS-ON APPROACH TO LINGUISTICS

Presenters
Jakob Kotas, Illinois Mathematics and Science Academy

Scott Smedinghoff, Illinois Mathematics and Science Academy

Advisor
Dr. Christian Nokkentved, Illinois Mathematics and Science Academy

In an attempt to further our understanding of linguistics, we constructed a language consisting of the spoken word and two writing systems. Our language was based mostly on existing Germanic languages, and we borrowed most heavily from Swedish, German, Dutch, Danish, Norwegian, and Icelandic. The first task we completed was the creation of a Roman-style alphabet, followed by diction. We then moved onto syntax, parts of speech, and grammar. Near the end we created a runic futhark (alphabet,) as many tribal Germanic languages had before adopting a Roman-style alphabet. Throughout this time we have also been creating vocabulary in order to use our language in a variety of situations. At the end of our year of research, we have concluded that making a language requires one to think about aspects of grammar that are normally taken for granted. As no language is ever really considered "complete," our language could still be expanded upon further. Yet, we feel that in the past year we have gained a better understanding of the structures that constitute a language.

AGGREGATION OF POLYGLUTAMINE EXPANSION PROTEIN IN A C. ELEGANS MODEL

Presenter
Rebecca M. Krock, Illinois Mathematics and Science Academy

Mentor
Dr. Richard Morimoto, Northwestern University

Huntington's disease (HD) is characterized by expansions of CAG repeats, which encode the amino acid glutamine. The expansion of glutamine repeats results in the appearance of protein aggregates, or clumps, which is associated with cellular toxicity and disease progression. The disease could be due to either the protein aggregate itself or some other biochemical state that leads to polyglutamine (polyQ) aggregation. Having observed the appearance of visible aggregates in Caenorhabditis elegans, a transparent nematode, I examined changes in the biochemical aspect of polyglutamine protein expression and aggregation in worms of different polyQ-lengths. I first optimized a protocol for extracting proteins from C. elegans, and found that using crushing, freeze/thaw, and the enzyme collagenase in combination was an efficient method of extraction. I then used this procedure to examine the relative amounts of aggregated and soluble (normal) proteins from C. elegans with various polyQ-lengths. Proteins were quantified using protein assays, fluorometry, native gels, dot blots, and Western blots. The comparison of the visual and biochemical aggregation can help us understand protein misfolding and aggregation in vivo.

STUDENT LEADERSHIP AND CIVIC RESPONSILIBITY

Presenter
Codi L. Kuhlemeier, Illinois Mathematics and Science Academy

Advisor
Mr. Robert Hernandez, Illinois Mathematics and Science Academy

The goal of this inquiry is to better understand student civic responsibility and then to examine the effect of student leadership programs at IMSA and other schools. Civic responsibility is the student's realization that participation in community programs, social events, and aiding others is important because it positively affects their environment and school experiences. IMSA has many leadership programs that students are required to participate in; in return, there should be fewer instances of theft or destruction of property on campus. Early this year, the student union was closed for an extended period of time due to destruction of the union's equipment. As part of civic responsibility to their school, students should help others, know the importance of participating in community programs, and take care of their environment. However, that is not always the case at IMSA as indicated by actions that do not improve the school culture. A survey is being constructed to ask students, faculty, and alumni about their feelings of their civic responsibility toward IMSA. Information from literature on this subject will also be used to better understand the data.

THE EVOLUTION OF ELECTRONIC MARKETS: HOW TRADING FIRMS SHOULD APPROACH ASIA

Presenter
Sharad Kumar, Illinois Mathematics and Science Academy

Mentor
Mr. Robert Khoury, Getco, LLC

GETCO, LLC, is a five-year-old trading company involved in short term, high volume, low margin securities and futures trading. The firm is a pioneer in the field of electronic trading; utilizing only automated trading models in order to generate high returns. With well-established offices in Chicago and London, the firm is looking to create an Asian operation in Hong Kong, Osaka, Shanghai, Singapore, or Sydney. The project consists of an initial analysis of electronic trading and recent regulatory changes in American and European exchanges, followed by an investigation of the same in several Asian exchanges. Research was conducted through conversations with members of management, directors of European operations and fixed income trading, a specialist in European exchanges, and Chicago-based securities traders. Empirical analysis involved collection of data from industry periodicals to assist in the formation of recommendations. Results and conclusions of this study include a report on how, why, and where a trading firm such as GETCO should invest in Asia, based on varying circumstances that could impact a firm's strategy. Additionally, success factors of such an operation are considered.

FUNCTIONALIZED BIOMOLECULAR VALVES FOR NANOCHANNELS ON A LEAD ZIRCONIUM TITANATE SURFACE

Presenters
Michael Kuo, Illinois Mathematics and Science Academy

William C. Pan, Illinois Mathematics and Science Academy

Mentor
Dr. Leonidas Ocola, Argonne National Laboratory

The purpose of this research was to determine the feasibility of functionalizing biomolecules to create an electrically-actuated valve capable of controlling nanofluidic flow in nanochannels patterned on a ferroelectric material. The nanochannels, which are 100 nm in width, are patterned on a ferroelectric lead zirconium titanate (PZT) substrate. The channel design is fabricated using a bilayer resist method with a 100kV e-beam lithography tool in order to create a ceiling for the channels. The biomolecules used are bacteriophages that express a specific heptapeptide. The heptapeptides are chosen, using an evolutionary technique called phage display, for demonstrating selective binding to PZT. After attaching the biomolecules in specific locations along the channels, an electric charge can be applied to the PZT, actuating the valve.

The research has progressed to the point where the materials involved in the fabrication of the channel have been tested to check their interactions with the PZT-binding biomolecules. A final design for the nanochannel array is being finalized, and a prototype is on schedule for fabrication. If constructed, this valve would prove useful in many applications, including the lab on a chip concept and in controlling medical drug delivery.

INVESTIGATING BONE MARROW-DERIVED STEM CELLS AND A SMALL MOLECULE AS POTENTIAL NEUROREGENERATIVE THERAPIES

Presenter
Shang-Pin (Anne) Kwei, Illinois Mathematics and Science Academy

Mentor
Dr. Kendrick Boardman, New Neural LLC

Neurodegenerative diseases like Alzheimer's disease, Parkinson's disease, and stroke affect 11 million patients and cost society $170 billion dollars per year. The key reason to the cause of such illnesses is the loss of neurons in the brain. Unless effective new treatments are developed, a double in the number of patients is predicted by year 2050. However, therapies that can regenerate new neurons to replace those lost to disease may be able to restore lost brain function. In fact, human neural stem cells have shown success in surviving, migrating and differentiating into neurons and improving brain function when transplanted into the brains of healthy but memory-impaired rats. One possible approach is to use stem cells from bone marrow, which have the potential to turn into neurons. Another approach is to use a drug that would stimulate native neural cell growth. Both approaches were examined here. First, the effectiveness of the drug NN818 to stimulate neural cell growth was monitored by measuring the growth of neurospheres treated with a range of NN818 concentrations (0uM, 0.1uM, 0.3uM, 1uM, 3uM, 10uM, 30uM, and 100uM) for up to two weeks. Second, the possibility of using other tissues' stem cells for neuron growth was experimented by gauging levels in cell media of Frizzed Related Protein (FRP), which is a potential indication of differentiation from marrow stem cells to ACT-N cells (i.e. pre-neuron cells). The resulting data suggests that therapies are plausible and indicates that additional investigations should be done.

MECHANISM ELUCIDATION OF NON-MITOGENIC ANTI-CD3 ANTIBODY TREATMENT IN EAE

Presenter
Daniel Lee, Illinois Mathematics and Science Academy

Mentor
Dr. Adam Kohm, Northwestern University Medical Center

It is widely accepted that autoreactive T cells escape the process of thymic negative selection to initiate autoimmune disease development and progression. Previous studies have investigated the therapeutic potential of numerous immunotherapy treatments to combat these autoreactive T cells, but unfortunately, protective outcomes have also been accompanied by non-specific negative side-effects. In this current study, we investigated the treatment potential of non-mitogenic versions of the CD3-IgG1 antibody to achieve a state of immune tolerance within the context of the Experimental Autoimmune Encephalomyelitis (EAE) model of multiple sclerosis. Our investigations of both the CD3-F(ab')2 antibody, with a truncated Fc region and the chimeric CD3-IgG3 antibody proved to effectively inhibit clinical disease progression and antigen-specific T cell proliferation, thereby suggesting the efficacy of the treatments. Importantly, both in vivo and in vitro non-mitogenic antibody treatments failed to induce apoptosis or deletion of antigen-specific CD4+ T cells. However, both treatments induced significant levels of intracellular Ca++ flux in the absence of cellular activation and proliferation, suggesting that the non-mitogenic treatments may be active signaling inhibitors. Taken together, our findings suggest that non-mitogenic antibody treatment may actively induce a state of immune tolerance and confer protection against the progression of autoimmune disease.

PREVALENCE OF G AND D ALLELES IN ANGIOTENSIN-1 CONVERTING ENZYME GENE IN ABDOMINAL AORTIC ANEURYSM PATIENTS

Presenters
Stephanie H. Lee, Illinois Mathematics and Science Academy

Isabella T. Rossi, Illinois Mathematics and Science Academy

Mentors
Dr. William Pearce, Northwestern Memorial Hospital

Ms. Vera Shively, Northwestern Memorial Hospital

Caused by a localized weakening and dilation of the aortic wall, abdominal aortic aneurysms (AAA) affect approximately 6-9% of the American population over the age of 65. If not treated properly, they continue to enlarge, which may eventually rupture and possibly lead to death. The cause is not fully known and appears to be multifactorial.

We investigated two polymorphisms of the Angiotensin-1 Converting Enzyme (ACE) gene in 25 patients with AAAs and in 25 healthy controls, which were age and ethnically matched. The D allele of the I/D and the G allele of the G2350A were found to be prevalent in patients with coronary disease in a previous study. We looked at whether the D and G alleles were also found to be prevalent in AAA. The polymorphisms of the ACE genes I/D and G2350A were examined using a polymerase chain reaction (PCR) method for both aneurysm patients and normal controls. After the polymorphic region was amplified by PCR, the polymorphisms were run on 3% agarose electrophoresis vs. a 100-bp ladder.

The majority of aneurysm patients in our study were found to be I/I homozygotes of the I/D gene versus normal patients. We are also currently assessing the prevalence of the G2350A ACE gene polymorphism in the same set of patients.

MATH EDUCATION ENHANCEMENT

Presenters
Melanie Leung, Illinois Mathematics and Science Academy

Stephanie Leung, Illinois Mathematics and Science Academy

Michelle A. Rogers, Illinois Mathematics and Science Academy

Mentor
Mr. Teodoro Alonso, Motorola, Inc.

Projects to enhance sixth grade math education were created and tested with students at Simmons Middle School in Aurora, Illinois. These strategies were designed as model projects with the state learning standards in mind. Projects were generated to grab students' attention and genuinely make learning math fun. This year's teaching topics included fractions, data analysis, and volume, and the designed projects complemented the teacher's regular lessons. After designing modules under the guidance of the mentors, projects were presented to sixth grade students at Simmons Middle School and refined to fit the realities of the classroom, and the needs of students. While the model was introduced to one school, the program itself reached beyond those boundaries to an extended educational community, state-wide and beyond, via the student-created website where state goals, mission, and the projects can be accessed.

THE FEASIBILITY OF INTRODUCING BROWN TROUT TO BUCK CREEK

Presenters
Casey Lewis, Illinois Mathematics and Science Academy

Anthony Waymire, Illinois Mathematics and Science Academy

Joseph Zearing, Illinois Mathematics and Science Academy

Mentor
Mr. David Gossman, Gossman Consulting

The feasibility of introducing Brown Trout into Buck Creek, a stream in eastern Iowa, is being considered. The parameters of similar streams where trout have been introduced were examined to gain better understanding of the collected data. Using a GPS (Global Positioning System) to designate sample points on the stream, several readings were taken from a two-mile long section. Data collected from these sites during different points in the stream's natural cycles assessed nitrates, nitrites, dissolved oxygen, ammonia, hardness, temperature, pH, phosphate, and turbidity. Data was recorded at different water levels and different temperatures, including samples taken when a layer of ice covered the stream. Using instruments and test kits, the content level of these chemicals were analyzed to determine the stream's overall chemistry and its suitability to sustain Brown Trout. Findings are being submitted to the Iowa Department of Conservation for approval for the introduction of Brown Trout. If approval is granted, the Iowa Department of Natural Resources will stock the stream with trout free of charge in an effort to *restore the population of a native species. The trout will then be monitored for their health and behavior* in the wild. The effects of species introduction on the environment will also be monitored. In addition to Buck Creek, two small ponds are also under consideration for species introduction. However, Rainbow Trout, Bluegill, Largemouth Bass, and Catfish are more likely candidates for this environment.

ANALYZING YOUNG STELLAR OBJECTS USING NEAR-INFRARED IMAGES

Presenters
Yang Li, Illinois Mathematics and Science Academy

John Powers, Illinois Mathematics and Science Academy

Mentors
Dr. Michael Smutko, Adler Planetarium

Dr. Grace Wolf-Chase, Adler Planetarium

Many questions still exist concerning the formation of stars. Recently, astronomers have discovered jets of material being expelled from newly formed stars. The purpose of this project is to study these jet streams. A series of near-infrared images have been obtained using the GRIM camera on the 3.5 meter telescope at Apache Point Observatory through a variety of filters. These images are reduced and viewed using the programs IRAF and ds9. These reduced images are analyzed to get relevant information about the jets. Using a 2.12 micron filter we have observed molecular hydrogen surrounding some objects. These observations support the current theories of material emissions from forming systems. Continued examination and processing of the images could potentially lead to the discovery of more examples of these jets and a better understanding of the role these jets play in star formation.

SOCIAL CLIQUES IN HIGH SCHOOL: A STUDY OF THE ILLINOIS MATHEMATICS AND SCIENCE ACADEMY.

Presenters
Kyung-gun (Sam) S. Lim, Illinois Mathematics and Science Academy

Daniel E. Montgomery, Illinois Mathematics and Science Academy

Mentor
Mr. Bernard Harcourt, University of Chicago

In society, people tend to congregate with others according to common characteristics and shared interests. In high school, this phenomenon often produces distinct cliques that are identified under recognized names such as "preps," "jocks," and "nerds." These cliques help define who a person is and how they express themselves and interact with others. In this study, we explore the unique social cliques at a math and science academy. We begin by exploring the different ethnographic and sociological studies that have been conducted in contemporary schools. The study then consists of four parts. First, we classify students into different cliques and define these social groupings. Second, we conduct correspondence analysis on the cliques to rigorously measure and relate them along important dimensions of academic, athletic, artistic, social and other interests. The next step uses lattice structures to examine and visually graph the relationships between the groups. Finally, we explore and document the unwritten rules for interaction between these groups. In this high school setting, as in other social settings, certain rules tend to form concerning the relation and interaction of the groups. These provide an interesting study of the groups by examining which follow certain rules and which can break these.

BATTLE CRY OF... SOMETHING

Presenter
Natnari N. Linwong, Illinois Mathematics and Science Academy

Advisor
Dr. Claiborne Skinner, Illinois Mathematics and Science Academy

Out of the confusion of reform in mid-nineteenth-century America came two very different political forces: one to free four million Americans from the bonds of slavery, the other to curtail the liberties of two million more. While the causes of abolition and nativism seem irreconcilable, the two movements were as often allied as opposed, and many Americans found themselves in both camps. In the course of my research, I analyzed speeches, newspaper articles, and personal correspondence to explore the relationship between the anti-slavery and anti-immigration movements, the role of the press in the reform furor, and the lasting effects of the convergence of these two forces on the American political landscape. I found that many of the men we revere as noble anti-slavery crusaders also brought their passion to the efforts to restrict immigrants' rights: Joseph Medill and Elijah Lovejoy, two of Illinois' most celebrated abolitionists, used their platforms to express violently anti-Catholic and anti-immigrant sentiments alongside anti-slavery ones. The emerging Republican Party found itself caught between its principles and politically-convenient nativism. It ultimately chose the low road and played to the nativists, and, a century and a half later, has still not recaptured the immigrant vote.

TESTING THE EFFECTIVENESS OF A MYST-BASED GAME IN TEACHING FRENCH CULTURE

Presenter
Yuan Liu, Illinois Mathematics and Science Academy

Advisors
Ms. Brenda Crosby, Illinois Mathematics and Science Academy

Ms. Willa Shultz, Illinois Mathematics and Science Academy

The goal of my inquiry was to create a Myst-based game that would teach French culture. Myst is a computer game that pioneered goal-oriented gaming. I wanted to use a goal-oriented approach in my game as well. My mentors and I decided to focus on contemporary slang. One phrase is "voir trente-six chandelles," which literally means to see thirty six candles but refers to being knocked out. The game was created in Macromedia Flash because of my familiarity with the program and its compatibility with every web browser. The game advances through a plot and along the way, the player is exposed to challenging puzzles and scenes that involve French slang. One of the puzzles asks the player to put into order five shapes according to three polygons that represent each of them. At the end of each of the three levels, an assessment that calls on what the player has learned is given. In order to test the effectiveness of the game, a pre and post-game test will be given to see how much the player has improved in terms of contemporary French slang. Completion and testing of the game will be accomplished by the end of the year.

DESIGNING AN INTERACTIVE MATH PROGRAM USING MACROMEDIA FLASH MX

Presenters
David Liu, Illinois Mathematics and Science Academy

Joseph Phan, Illinois Mathematics and Science Academy

Advisor
Dr. Don Porzio, Illinois Mathematics and Science Academy

The goal of our Inquiry project was to design a program that teaches the user the principles of limits, one of the fundamental aspects of calculus. We decided to use Macromedia Flash MX for this project due to its combination of interactivity and ease of use. We analyzed examples of other educational software to determine their strengths and weaknesses. We then proceeded to create a design that captures the attention of the user while maintaining academic focus. We arrived upon the idea of a two player adversarial situation. This was intended to provide replay value and challenge, since a human opponent is smart and unpredictable. This type of game provides more motivation to improve due to the embarrassment of losing to another human. The primary interface is similar to that of a table-top board game, where players control groups of units. The second mode presents a series of math questions, rewarding points to the player who answers first. As of now, all of the design aspects are finalized and many features have already been implemented into the code. Our work this year has provided us with valuable experience in software design, especially in the edutainment industry.

GOSSMAN PHOTOJOURNALISM AND WEB DESIGN

Presenters
Jessica H. Liu, Illinois Mathematics and Science Academy

Yifan Sun, Illinois Mathematics and Science Academy

Mentor
Mr. David Gossman, Gossman Consulting, Inc.

Our study in the area of photojournalism includes photographing and documenting the various branches of the Gossman Mentorship. We researched areas in both digital photography and website composition, as well as studying the background information for the other groups: ornithology, geology, ichthyology, and botany. Using digital cameras, Adobe Photoshop, and Microsoft FrontPage, we created a website with a selective collection of pictures, chosen from over 100 shots per trip. The site is designed with a photoshopped banner, combining our more artistic photographs to present an eye-catching, aesthetic element. It also includes an archive feature, linking low-quality thumbnail pictures with higher-quality full-sized pictures. Each page also includes a short description on the purpose and methods of the other mentorships. Our result is effective; we have documented the research of the entire Gossman mentorships.

LIGHT POLLUTION: WASTED LIGHT AND MONEY

Presenter
Martha Malin, Illinois Mathematics and Science Academy

Advisor
Ms. Laura Nickerson, Illinois Mathematics and Science Academy

The goal of this inquiry was to find a light system for the city of Chicago that reduces light pollution and is cost effective. With the city's current lighting situation, the night sky is 91.6 times brighter than the natural night sky. Chicago uses high-pressure sodium light in partially shielded light fixtures, which causes two-thirds of the light to shine at the sky or onto another beam of light. This costs the city approximately $7.26 million a year. The city is wasting close to two million dollars a year in excess light. If the city used fully shielded fixtures and low-pressure sodium lights, the annual cost of street lighting would be $5.31 million a year. The change in lighting would not decrease the lights' mean lumens, but the night sky would only be twenty-five times as bright as the natural dark sky. This design would not only save the city of Chicago money and increase the effectiveness of existing lighting systems, but would provide an opportunity for budding city-bound astronomers to wonder at the night skies.

THE EFFECTS OF MUSICAL TRAINING ON TONE LANGUAGE PERFORMANCE

Presenter
Sriniwasan (Balaji) B. Mani, Illinois Mathematics and Science Academy

Mentor
Dr. Patrick Wong, Northwestern University

This study focused on the effects of music experience of a non-tone language speaker (e.g. English speakers) on his or her abilities in perceiving pitch embedded in Mandarin words. Native speakers of Mandarin, a tone language, convey meaning through four specific pitch patterns (called "lexical tones"); hence, a syllable can potentially have four meanings. For example, the syllable "ma" can be spoken in a level, rising, dipping, or falling pitch pattern to indicate mother, hemp, horse, and the verb to scold, respectively. It was investigated whether well-trained English-speaking musicians were better at identifying and discriminating Mandarin tones than non-musicians. Mandarin speakers were used as control subjects. The identification task prompted the test subject to indicate the specific tone of a Mandarin word. A discrimination task required the subject to indicate if pairs of stimuli contained the same tone. It was found that musicians significantly outperformed non-musicians on all tasks. It is probable that the musician group used musical knowledge and experience to identify with the linguistically meaningful pitch patterns of Mandarin tones.

TREATING EPILEPTIC SEIZURES IN THE HIPPOCAMPUS WITH ELECTRICAL STIMULATION

Presenter
Kevin McHugh, Illinois Mathematics and Science Academy

Mentor
Dr. David Mogul, Illinois Institute of Technology

Although there are currently several pharmacological treatments for epilepsy, many epileptic patients are unable to make use of these because either the patients do not sufficiently respond to these drugs or there are significant side-effects. Another alternative is surgery to remove parts of the brain that cause seizures but this can lead to neurological problems. This mentorship explored the possibility of a non-pharmacological alternative to treat epilepsy through an approach not yet taken by current epilepsy treatments, i.e., via electrical stimulation. In order to achieve our goal of finding a treatment based upon electrical stimuli, we chemically induced seizures in rats and stimulated the brain while recording brain waves with an electroencephalogram (EEG). We analyzed the data from such experiments by comparing normal brain activity to full blown seizures and then compared those periods with attempts to suppress the seizure with electrical stimulation at varying frequencies and current amplitudes. Even though this project has yet to yield the desired results of terminating a seizure-in-progress, refinements are constantly being made to improve the quality of the experimental procedure. In addition, my mentor and I have gained an improved understanding of epilepsy and its effects on the brain through our experiments.

NOVEL DRUG TREATS CISPLATIN INDUCED NEUROPATHIC PAIN IN RATS

Presenter
Yugarshi Mondal, Illinois Mathematics and Science Academy

Mentor
Dr. Vania Apkarian, Northwestern University Medical School

*Chronic pain is a problem many patients face after chemotherapy. This pain is a side effect of cis-*diamminedichloroplatinum-II (cisplatin), a drug used for chemotherapy. This paper explores the possibility of using D-cycloserine (DCS) as an analgesic to treat cisplatin induced chronic pain. We have reason to believe DCS affects a variety of pathways in the brain, including chronic pain pathways. Rats were tested using the von frey method (technique to evaluate 50% response threshold of) and the paw immersion (paw of the rat was held under water maintained at 4°C,10°C,44°C,49°C) methods. The weights of the rats were also recorded to generally gauge global health of rats. Although the results of the paw immersion were ambiguous, there is a significant dichotomy between the weights of the cisplatin rats and cisplatin w/ DCS rats. Furthermore there is a statistically significant difference (t-test was used) between the 50% percent thresholds of the cisplatin and the cisplatin w/ DCS rats. This data suggests that DCS may be used to treat chronic pain, specifically evolving from cisplatin used in chemotherapy.

THE CORRELATION BETWEEN THE GENETIC COMPOSITION OF THE BORNA DISEASE VIRUS AND THE GENETICS OF MOOD AND THOUGHT DISORDERS

Presenters
Kate Moss, Illinois Mathematics and Science Academy

Whitney Rossmiller, Illinois Mathematics and Science Academy

Advisors
Dr. David Evenson, Illinois Mathematics and Science Academy

Dr. Susan Styer, Illinois Mathematics and Science Academy

Last year, we examined the correlation between clinical depression and the Borna Disease Virus (BDV), a RNA virus that is now thought to be responsible for some mood and thought disorders. After reviewing literature which included *in vitro* experimentation we concluded that infection with BDV increases the risk of clinical depression. This year we have continued our research looking at BDV and mood and thought disorders at a genetic level. In clinical depression, the serotonin transporter gene, specifically the S or L allele, inherited through parents, has been a leading cause in increasing the risk of this disease. Similarly, in schizophrenia, the COMT gene, specifically the Val or Met allele, which codes for enzymes that metabolize neurotransmitters, predicts the rate of prefrontal dopamine activity in the brain. After reviewing new literature, there seems to be a lack of direct correlation between the genetic composition of BDV and of mood and thought disorders, but genetic makeup as well as environmental factors definitely play a role in whether an individual suffers from depression or schizophrenia.

ASSOCIATION STUDY OF POLIOVIRUS RECEPTOR GENE POLYMORPHISMS IN SPORADIC ALS

Presenter
Thomas J. Mullins, Illinois Mathematics and Science Academy

Mentor
Dr. Saeed Khan, Feinberg School of Medicine

Amyotrophic Lateral Sclerosis (ALS) is a progressive, degenerative disease of the nervous system. It is one of a group of diseases, called motor neuron diseases, in which specialized nerve cells that control movement of the voluntary muscles gradually cease functioning and die. The specific aims of my research were first and foremost to verify whether the poliovirus receptor gene polymorphisms, which are hypothesized to be concealing one of the disease causing mutations, are associated with sporadic ALS through the use of multiple single nucleotide polymorphisms (SNPs) to search for an indication of an inherited allele that is enriched in affected individuals. The second aim of my research was to understand the genetic background of ALS and the tools available to tease out the genetic architecture of a complex disorder such as ALS. Two different models were used to study the genetic material in this experiment. The most simple and widely practiced model of association is the case-control study, where we had 192 individuals who had been diagnosed with ALS and 192 unrelated subjects with no history of neurological disease. The second model was family based, where population stratification is irrelevant, and 128 trios, comprising 384 samples of mother, father, and an infected offspring were studied.

PREDICTING CHRONIC LUNG DISEASE (CLD) IN NEWBORNS LESS THAN 29 WEEKS GESTATIONAL AGE (GA) USING BLOOD GASES

Presenter
Lucy Na, Illinois Mathematics and Science Academy

Mentors
Dr. Jennifer Hesser, Loyola University Medical Center

Dr. Jonathan Muraskas, Loyola University Medical Center

Our hypothesis is that early elevated bicarbonate levels correlate with the severity and/or development of chronic lung disease (CLD) within infants of less than 29 weeks gestational age (GA). Using data from patients admitted to the NICU at Loyola University Medical Center between the years of 2000 to 2003, we charted blood gas levels from newborns less than 29 weeks GA from admission to discharge, including up to the 12th week of life. Newborns who expired before discharge were excluded from the data. The sample size was 137 patients total, with 27 controls and 110 CLD patients. Charting and viewing the trends of bicarbonate and base excess levels in infants with and without CLD, we noticed that, by the fourth week, CLD patients will tend to have higher blood gas levels. Thus, from this data, we have concluded that higher serum bicarbonate levels at 4 weeks can help clinicians identify newborns that are at increased risk of prolonged ventilation and oxygen need, as well as early identification of complex discharge planning.

EXPLORING SOFTWARE DEVELOPMENT THROUGH THE PROGRAMMING OF JAVA APPLICATIONS

Presenter
Puskar Naha, Illinois Mathematics and Science Academy

Advisor
Dr. Robert Flemming, Illinois Mathematics and Science Academy

After exploring software development by programming a calculator, brick bounce game, and network chatting program, it became obvious that design patterns and the theories behind them are essential to designing efficient and expandable programs. Design patterns are various patterns that appear among objects in object-oriented programming languages like Java. The programming ideal of low-coupling (few dependencies) between objects and high-cohesion (closely related tasks) within objects is an important part of software development as well. Refactoring (redesigning) programs with design patterns can make code simpler. For example, the brick bounce game had one object that handled all objects. The facade pattern allowed for the separation and simplification of code segments, which facilitated better collision detection. The theories behind design patterns that were invaluable are encapsulating variation (data hiding) and making objects responsible for themselves. Encapsulating variation made it possible for a console-based calculator and a graphical user interface-based calculator to share one engine. Data hiding made the network chatting program easier to modify, by allowing it to send any object rather than just objects with text. Design concepts also made it easier to use multithreading (doing multiple tasks concurrently). The brick bounce game became easier to expand by making objects responsible for displaying themselves instead of modifying a display object for each additional object. Making programs with design patterns in mind results in clear-coded programs that are easy to expand.

STRUCTURAL ANALYSIS OF AUTOCATALYTIC PROCESSES INVOLVING TWO RESOURCES

Presenter
Rajeev R. Nayak, Illinois Mathematics and Science Academy

Mentor
Dr. Satish Parulekar, Illinois Institute of Technology

This project explores the behavior of a chemical reactor system comprised of an autocatalyst and two resources. We find formulas that determine the rate of change of the amount of each chemical in the system. We then use these equations to determine the steady states, or equilibrium points, of the system assuming certain constants, such as the initial amounts of each chemical and the feed rate of the autocatalyst. We utilize a Jacobian matrix to determine the stability of each steady state. Finally, we change certain given quantities and observe how these changes affect the equilibrium points of the system.

TARGETING VASCULAR ENDOTHELIAL GROWTH FACTOR (VEGF) USING PEPTIDE AMPHIPHILES: A NANOSCIENCE PLATFORM FOR ANGIOGENESIS INHIBITION AND CANCER THERAPEUTICS

Presenter
Varun R. Nayini, Illinois Mathematics and Science Academy

Mentors
Dr. Krista Niece, Northwestern University Materials Science & Engineering

Mr. Stephen Soukasene, Northwestern University Materials Science & Engineering

Dr. Samuel Stupp, Northwestern University

The inhibition of angiogenesis in cancerous tissue has garnered much attention for cancer treatment as a method of starving tumors of oxygen and nutrients. Vascular endothelial growth factor (VEGF), which regulates new blood vessel growth, has thus become a molecular target of high interest. As a novel approach to angiogenesis inhibition, a peptide amphiphile (PA) gel designed to sequester and denature the VEGF produced by tumor cells is being designed. The PA molecules are capable of self-assembling into nanofibers with hydrophobic cores and exposed peptide groups on the surface. These nanofibers can further assemble to form three-dimensional networks, observed macroscopically as gels, offering great potential for use in targeted drug therapies and cancer treatment. Several peptide sequences were identified that tightly bind to VEGF using phage display, a technique in which phage virions with combinatorially diverse surface peptide moieties are assayed for binding against a given target. After several iterations of this procedure, DNA sequencing of the remaining phages yields surface peptide sequences, which can then be assayed to select the strongest binders. In the proposed work, the VEGF-binding peptide is incorporated into a PA nanofiber system that possesses the desired material characteristics at physiological pH. Quantitative assays are then used to determine how much VEGF the PA gel is capable of immobilizing. To further disrupt the VEGF signaling pathway, phage display will again be performed in designing a PA that binds a VEGF-degrading enzyme. In combination with the VEGF binding PA molecules, it is hoped that the resulting nanofiber gel can be injected at the site of the cancerous tissue, inhibit the angiogenic pathway, and consequently shrink the tumor.

CLONING AND EXPRESSION OF HUMAN FC RECEPTOR LIGAND BINDING DOMAINS

Presenter
Edward Nepomuceno, Illinois Mathematics and Science Academy

Mentor
Dr. Barry Arnason, University of Chicago

Immune complexes (ICs), antibodies bound to cognate antigens, serve as key regulators of the immune system by acting as liaisons between the adaptive and innate immune responses. Varying in size and structure, ICs bind preferentially to low-affinity Fc receptors (FcRs) which in humans are found to be FcγRIIa, FcγRIIb, FcγRIIc, FcγRIIIa, and FcγRIIIb. Growing evidence indicates that larger ICs preferentially bind FcγRIIIa (activatory receptor) as opposed to small ICs which interact predominantly with FcγRIIb (inhibitory receptor). The cDNAs for FcγRIIa and FcγRIIb were isolated from the cell lines K562 and U937 RNA respectively. Using splice-overlap extension, the ligand-binding domains of each receptor were subcloned, and a 6xHis tag was added to the sequences of interest for the purpose of single-step purification via immobilized metal affinity chromatography (IMAC). The LBD-6xHis cDNAs were transferred into the expression vector, pcDNA3.0. Chinese hamster ovary cells (CHO cells) were then used to express the FcR LBDs. The overall goal is to use the low-affinity FcRs, expressed as soluble proteins, to study LBD-Ligand interactions using techniques such as immunoprecipitation and ELISA. The yield from these studies will be a clearer understanding of the relationship between IC size and structure and its immunoregulatory properties.

GINSENOSIDES ON THE EPILEPTOGENIC EFFECT OF EARLY-LIFE SEIZURES

Presenters
Helene Nguyen, Illinois Mathematics and Science Academy

Dawn Tian, Illinois Mathematics and Science Academy

Mentor
Dr. Sookyong Koh, Children's Memorial Hospital

Children with epilepsy often suffer from status epilepticus(SE), a state where the patient undergoes repetitive or prolonged seizures. The experiences of SE make children more vulnerable to future seizures and epilepsy. Currently used anticonvulsants do little to stop epileptogenesis. Using an animal model of SE, this project tested whether ginsenosides, active ingredients of the popular herbal remedy ginseng, decrease future seizure susceptibility. At postnatal day (P)21, rats were injected i.p.(intraperitoneal) with saline (i.p. n=20) or kainic acid (KA) (10mg/kg, n=20), a chemoconvulsant that causes SE. For one week, the rats were given daily i.p. injections of either ginsengnosides (50mg/kg) or saline. At P35, all rats were injected with KA and latency to forelimb clonus and seizure severity recorded. Comparison was made among four groups: saline at P21, saline (SS); KA at P21, saline (KS); saline, ginsenosides (SG); KA, ginsenosides. Although no statistical difference in seizure severity or latency was found after KA at P35, there was a trend toward decrease in seizure susceptibility in animals treated with ginsenosides (seizure latency: SS 1,687 ±276; KS 1,112 ±171; SG 1,702±86; KG 1,352±59, one-way ANOVA, $p<0.07$). Ginenosides appears to have a potential as an antiepileptogenic agent in childhood epilepsy. Further work is needed.

INHIBITING THE LONG TERMINAL REPEAT OF HIV-1: A SOLUTION TO AIDS

Presenter
Raman Nohria, Illinois Mathematics and Science Academy

Advisors
Dr. Donald Dosch, Illinois Mathematics and Science Academy

Dr. Judith Scheppier, Illinois Mathematics and Science Academy

HIV-1 replicates through the use of a promoter known as the long terminal repeat (LTR). During this Inquiry, I propose that natural substances such as curcumin, beta lapachone, and topotecan will produce an inhibiting effect on the LTR because these substances possess inhibiting properties for transcription. Currently, I have a transfected SupT1 cell line with the reporter system through which I can test these inhibitors; however the cell line stability is unknown. Thus, I tested for stability of transfection of DNA into SupT1 cells through polymerase chain reaction. I analyzed the effect of curcumin on normal SupT1 cells in order to determine any non-specific toxic effects on SupT1 cells. Data regarding the transfected DNA is pending. Data showed that curcumin produced no noticeable effect on SupT1 cells and is therefore valid for testing on transfected SupT1 cells.

THE CREATION OF A YAC VECTOR THAT WILL INTEGRATE INTO A TETRAHYMENA MACRONUCLEAR CHROMOSOME THAT CAN THEN BE CLONED AS AN INTACT CHROMOSOME IN YEAST

Presenter
Neel Pancholi, Illinois Mathematics and Science Academy

Mentor
Dr. Carolyn L. Jahn, Northwestern University Medical School

The YAC vector, or the yeast artificial chromosome is a commonly used vector that has the ability to carry a large DNA fragment (up to 2 Mb). Dr. Jahn is trying to create a YAC vector that will integrate into a Tetrahymena macronuclear chromosome so that it can then be cloned as an intact chromosome in yeast. I am characterizing propagation of this Tetrahymena/ YAC vector in E. coli. DNA containing a gene of interest is inserted into the purified DNA genome of YAC which serves as a self replicating element. The focus of work being done in Dr. Jahn's lab has primarily dealt with finding the various inserts in the YAC vector. This has been done by ligating Bgl II fragments of Tetrahymena DNA. From preliminary findings it quickly became apparent that the vector was very unstable and deletion was prevalent. A vast majority of the resulting vectors were in fact smaller than the initial vector. However, there were 5 large inserts that warranted further inquiry. The DNA sequence of each of the 5 inserts was viewed using various computer programs. The ultimate goal was to determine if the two ends of each insert were derived from an identical spot in the Tetrahymena genome, thus, telling us if we had a single Bgl II fragment inserted. One of the inserts that resulted was a Ribosomal RNA gene, though this was of little use as we were not looking for this gene. The most significant insert we found corresponded to one Bgl II fragment in the Tetrahymena genome.

IMSA ON WHEELS: AIR AND PRESSURE DVD

Presenters
Jessica Parr, Illinois Mathematics and Science Academy

Susan Pinto, Illinois Mathematics and Science Academy

Advisor
Mr. William McGrail, Illinois Mathematics and Science Academy

The *IMSA on Wheels* DVD Volume 2: "Air and Pressure" is based on the 2004 *IMSA on Wheels* elementary show, which was presented to thousands of students in twenty-five schools. The DVD covers air and pressure with a section on Bernoulli's principle and was created using valuable feedback from survey responses from the 2004 *IMSA on Wheels* program and volume I DVD. A "do it yourself" section was created, with additional activities that students, parents, and teachers could do themselves. Scripts were written for twenty-five demonstrations with cues for camera shots and actions included. The scripts were filmed using a Sony DV Camera in various locations including the new science wing, the Toyota Video Production Lab studio, and the Kid's Institute, and edited in Final Cut Pro and DVD Studio Pro. The DVD will be distributed to over 1200 schools, libraries, and museums, and cable TV stations across Illinois as a way to safely demonstrate science concepts and excite students about learning and IMSA as well as showing demonstrations students don't normally see in school.

ANALYZING DATA FROM COSMIC RAY DETECTORS

Presenter
Dobromir Rabovianski, Illinois Mathematics and Science Academy

Mentor
Mr. Tom Jordan, Fermi National Accelerator Laboratory

My research started in successfully designing code in PERL (the programming language) to manipulate data acquired from cosmic ray detectors. The data came in pairs that had to be sorted by the first number and the program that I created performed just that function. I used a hash-map to keep both values paired and sorted them by keys.

Currently, I am working on a code that includes some calculations. I need to alter it so that the arithmetic (in the code) restricts the emergence of floats and only integers are obtained. Floats can never yield an exact answer without error, and the use of integers can fix the problem in this particular situation.

DECREASED PHOSPHORYLATION OF THE MYOSIN LIGHT CHAIN 2V ISOFORM OCCURS WITH AGE AND PREDISPOSES THE HEART TO FAILURE

Presenter
Manjari Ranganathan, Illinois Mathematics and Science Academy

Mentor
Dr. Paul H. Goldspink, University of Illinois at Chicago

Cardiovascular decline associated with aging results from decreased intrinsic myocyte contractility is caused by one or more of three changes: altered adrenergic nervous system function, impaired delivery of calcium to contractile elements in the muscle cells, and reduced myosin-ATPase activity. However, all these changes converge at the level of the sarcomeric proteins and ultimately alter their functional interactions. We have noted aging changes the composition and the phosphorylation level of many important regulatory myofibrillar proteins. This baselines our examination of the mechanical and biochemical properties of these aging hearts in response to increased hemodynamic stress to investigate temporal events that mark progression of disease. Events at 3 and 6-months are associated with compensatory mechanisms whereas events at 9 and 12-months demonstrate signs of failure. Myofibrillar protein composition is altered due to the re-expression of the fetal myosin isoforms (MLCa and b-MHC) in the ventricles of aging mice. The expression of the atrial MLC isoforms is associated with a loss of MLC-2 phosphorylation at 12-months as determined by Western blotting and 2-D electrophoresis. These data suggest that the propagation of cardiac disease in the aging heart is due, in part, to changes in myofibrillar protein composition and/or phosphorylation. The altered expression of the myosin isoforms with age may be benign but when coupled with activation of protein kinases, the altered phosphorylation substrate appears to change the regulatory balance of the myofibrils to depress the contractile properties of the heart.

ARCHITECTURAL DESIGN AND DEVELOPMENT OF THE SPERTUS INSTITUTE OF JEWISH STUDIES

Presenter
Aria Reynolds, Illinois Mathematics and Science Academy

Mentor
Mr. Mark Sexton, Krueck and Sexton

Krueck and Sexton Architects is a firm in Chicago that is currently designing new facilities for the Spertus Institute of Jewish Studies, which are scheduled to be completed in 2007. The project was awarded to the firm after a competition phase, and has gone through many stages, ultimately becoming what we see today in the design documents. The Institute will house an auditorium, library, museum, classrooms, tenant space and a banquet hall. One striking aspect that has evolved with the building is the glass curtain wall that spans all ten stories. The modern façade is striking because of the folded plane geometries, and will be a noticeable symbol on Chicago's Michigan Avenue. Several aspects of the engineering, materials used, city codes and other design considerations are included. We have studied its progress, and the reasons behind each change to the geometries. Also, we have studied the effect of sunlight on the perception of the various glass planes. The design process and the developments will be discussed in a power point presentation.

ANALYSIS OF RISING PRESCRIPTION DRUGS COSTS

Presenter
Tulsi Roy, Illinois Mathematics and Science Academy

Advisor
Mr. Michael DeHaven, Illinois Mathematics and Science Academy

Since 1995, national spending on prescription drugs has reached a whopping total of $200 billion per year and the individual consumer, unfortunately, has little relief from these price hikes. Quite recently, American citizens and the government have taken an interest in slowing the rising expenses. In this inquiry, I will focus on the factors affecting rising prescription drug costs; the largest being the drug companies themselves, which raise the costs of "me-too" drugs to outlandish prices under the false claim of rising research and development costs. I will also investigate and predict some of the outcomes of implementing such pre-suggested solutions as Canadian drug reimportation and instituting price controls. While I found both answers to be too controversial and unpredictable to employ presently, I found that people should instead aim to shorten the twenty-year patent rights of medicine in order to get generic drugs on the market faster and reduce costs dramatically.

BUILDING A COMPUTER GENERATED HUMAN

Presenter
Tara Roys, Illinois Mathematics and Science Academy

Mentor
Dr. Peggy Connolly, Illinois Mathematics and Science Academy

From Pixar's the Incredibles to Dreamworks' Shrek 2, computer generated humans are fast becoming a staple of the animation industry. Off-the-shelf software like 3D Studio Max and Maya allow computer graphics artists to animate high quality computer generated humans on their home computers. This independent research project explores building a fully animated human character from scratch using the powerful modeling and animation tools of 3D Studio Max 7.

THE QUANTIFICATION OF ESCHERICHIA COLI IN WATER USING POLYMERASE CHAIN REACTION

Presenters
John Ruddy, Illinois Mathematics and Science Academy

Samantha Schneider, Illinois Mathematics and Science Academy

Advisors
Dr. Donald Dosch, Illinois Mathematics and Science Academy

Dr. Judith Scheppler, Illinois Mathematics and Science Academy

The goal of this inquiry project is to develop a polymerase chain reaction (PCR) procedure to quantify the amount of *Escherichia coli* in water. *E. coli* is a member of coliform bacteria and is the diagnostic organism to mark fecal contamination of water. During the inquiry, the most probable number (MPN) technique was used to detect lactose fermentation, indicating the presence of coliform bacteria in IMSA pond water. DNA was then isolated from the control *E. coli* samples and the negative control, *Pseudomonas fluorescens*, which is a non-coliform bacteria. UV light spectroscopy was utilized to detect protein contamination. The isolated DNA underwent PCR using primers to detect the lac-Z gene. Gel electrophoresis was used to validate the use of PCR by indicating the presence of replicated bands only in the *E. coli* sample. Currently, the PCR procedure has not yielded conclusive results. To optimize the PCR process, the conditions, such as the annealing temperatures, have been adjusted. To develop the PCR procedure, further testing is underway.

THE UNITED STATES' INFLUENCE ON THE NICARAGUAN SANDINISTAS

Presenter
John Ruddy, Illinois Mathematics and Science Academy

Advisor
Dr. Jim Victory, Illinois Mathematics and Science Academy

Throughout the twentieth century the United States intervened in Latin American politics. The US utilized both direct and indirect methods. The USA took a particularly active role in influencing the National Sandinista Liberation Front (FSLN), created in 1960 during the Cold War. The organization was formed by three Nicaraguan college students to overthrow the governing dictator, Anastasio Somoza. Throughout the FSLN's history, the USA's media, military, and economic power greatly affected the organization. The effect and goal of these forces was determined by studying newspaper articles, quantitative data, government legislation, and primary documents. The effect, scale, and goal of American influences changed drastically from the formation of the FSLN in 1960 until the end of the twentieth century. The role of the United States' was significantly altered after the election of Ronald Reagan, the assassination of ABC television correspondent Bill Stewart, and the Iran-Contra Scandal. The Sandinistas finally lost control of the Nicaraguan government in 1990 in a democratic election.

THE CAMERA NEVER LIES: THE PORTRAYAL OF TRUTH IN REALITY CINEMA

Presenter
Patricia Ruiz, Illinois Mathematics and Science Academy

Advisor
Ms. Audrey Wells, Illinois Mathematics and Science Academy

Viewers watch popular reality television shows, and some accept the shows as reality, but others question their validity. With a series of short experimental documentaries and reality videos, this project explores the use of creative editing, natural soundtracks, superimposed music, narration, and other elements that affect the presentation of reality. Several similarly filmed reality shorts were edited using different combinations of these elements to demonstrate how their use can ultimately enhance or corrupt the context of the original video. Although it is possible to use creative editing and other post-production tools to emphasize reality, the ease with which the context of a video can be changed should discourage viewers to believe everything they see on television.

IMSA ON WHEELS: PRESENTATION SKILLS AND TRAINING TECHNIQUES

Presenter
Karla Schmidt, Illinois Mathematics and Science Academy

Advisor
Mr. Christopher Lin, Illinois Mathematics and Science Academy

IMSA on Wheels is a program sponsored by the IMSA Kids' Institute in which students travel to local elementary schools to present a fun and interactive science show. It was my task to train new presenters in order to help ensure program success. This incorporated researching proper techniques of teaching skills and how to retain information. I focused my research on public speaking in general. In order to teach these public speaking skills, I found games and activities that stressed voice projection, enthusiasm, eye contact, and hand motions. In order to test my training techniques, I designed and led the 2005 IMSA on Wheels Intersession. Throughout the week, a combination of fifteen sophomores and juniors practiced public speaking and presented at four shows. The group was even able to perform one show at the end of the week by only teaching with the other intersession students, and without the experienced teachers. At the end of the week, I assessed each student's progress. A majority of them improved their general skills and gained confidence in their abilities. Afterwards, I created a binder that incorporates all aspects of constructing a successful Intersession and how to effectively train new presenters.

EXHIBIT DESIGN: A RETURN TO CHILDHOOD

Presenters
Jessica Schmit, Illinois Mathematics and Science Academy

Valerie M. Simonis, Illinois Mathematics and Science Academy

Mentor
Ms. Jerre Henriksen, Scitech Museum

We started our mentorship by trying to learn and understand what makes a good exhibit by analyzing existing ones at Scitech Hands-on Museum and how children interacted with them. After defining what we think the optimum appearance and function of an exhibit is, we built our own. We also studied exhibit signs and worked on a couple of drafts for signs. During our mentorship, we designed two separate exhibits and set out to build them. One exhibit is an improvement on an existing one, "What's Behind the Wall." "What's Behind the Wall" helps children understand how an electrical circuit works by using everyday household elements in a circuit. The other exhibit "Let's Get Cellular" is a larger-than-life model comparing plant and animal cells and the functions of each organelle within. We encountered many set-backs in the creation of our masterpieces, including budgeting, human opposition, and logistic challenges. On Presentation Day, we hope to present a final product of "What's Behind the Wall," and a prototype of "Let's Get Cellular." We also hope to present signs for these exhibits.

BANKING ON EDUCATION: THE HONDURAN EXPERIENCE

Presenter
Margot Seigle, Illinois Mathematics and Science Academy

Advisor
Dr. Claiborne Skinner, Illinois Mathematics and Science Academy

The World Bank proudly announced in 2000 its goal of primary education for all children in ten countries by 2015, including Honduras. They received $178 million to spend on new teachers, schools, books and materials in order to increase enrollment and improve instruction. According to websites such as "The Whirled Bank," while 89% of Honduran children now attend primary school, only 21% go on to secondary schooling and few of these reach college. My project was to research this issue in depth and see what can be done to change it. I became interested in this after living in the village of Laura Abajo for six weeks last summer, where I saw the effects of poor education first hand. The village school lacked books, the teachers were constantly on strike, and the students proved hopeless in basic skills we take for granted. The World Bank needs to address this without discontinuing funding to secondary education. Only when these changes are made will the Third World have any chance of breaking the cycle of poverty. Currently, I am working on how this can be done, from private charity to teacher education.

THE JUVENILE DEATH PENALTY IN AMERICA

Presenter
Bansi N. Shah, Illinois Mathematics and Science Academy

Mentor
Mr. Robert Schultz, Amnesty International

On March 1, 2005 the United States Supreme Court abolished the juvenile death penalty. Before that date, America's continued endorsement of juvenile executions offended numerous international agreements including the United Nations Convention on the Rights of a Child. The reversal, undoubtedly, pushes America one step closer to abolishing the death penalty altogether. The oral arguments and Court's opinion in case that lead to the decision, Roper v. Simmons, were examined. Through the examination, how and why the Supreme Court abolished one of America's most controversial edicts was determined.

IN AND OUT OF THE HOT ZONE: A STUDY OF MORTALITY DISPLACEMENT

Presenter
Yuguan Bailey Shen, Illinois Mathematics and Science Academy

Mentor
Dr. Peggy Connolly, Illinois Mathematics and Science Academy

Despite the improvement of living conditions in the U.S., heat waves still kill in large numbers. Because many of the victims had low socioeconomic status, were elderly, and had preexisting medical conditions, it was hypothesized that these people would have died shortly afterwards even without a heat wave. Their accelerated deaths during the heat wave would therefore produce a period of decreased mortality following the heat wave known as mortality displacement. This study investigated the existence and magnitude of mortality displacement associated with the 1995 Chicago heat wave. Daily mortality numbers were compared with a baseline to estimate displacement at various time intervals. Mortality displacement was not found 3 months after the heat wave. In longer timeframes, however, significant displacement was evident. Eleven months after the heat wave, mortality displacement reached 52%, indicating that about 50 percent of all heat victims would have expired within a year. Mortality displacement was particularly high for elderly and cardiovascular disease deaths, but nonexistent for young deaths 11 months after the heat wave. The presence and magnitudes of mortality displacement after heat waves should be considered by public health when estimating the true impact of heat waves, allocating resources, and setting realistic goals for reducing the mortality caused by these natural disasters.

THE QUANTUM DOUBLE PENDULUM

Presenter
Rae Shih, Illinois Mathematics and Science Academy

Mentor
Dr. Mark Jackson, Fermi National Accelerator Laboratory

The classical pendulum is a well-studied system with a parallel, exactly solvable quantum mechanical analog. It is recognized that the simple classical pendulum displays chaotic behavior when another weight is attached. However, the quantum double case has not been fully considered yet, and it is this system that we study. We began our exploration by canonically defining the classical position and momentum and their equations of motion of the double pendulum. We then utilized the differential equation and plotting functions of *Mathematica* in order to observe the relationship between the initial conditions and the evolution of the system. Taking the next step, we simplified the Hamiltonian operator with the goal of calculating the time variations of the position and momentum operators.

MULTILOCUS DNA FINGERPRINTING OF WREATHED HORNBILLS

Presenter
Esther Shyu, Illinois Mathematics and Science Academy

Mentor
Dr. Jean Dubach, Brookfield Zoo

In many cases, modern conservation methods endeavor to preserve a maximum amount of genetic variation in each species. Because multilocus DNA fingerprinting can illuminate the genetic differences between animals and estimate relatedness between pairs of individuals, it is often used to further conservation. Over ten years ago, for instance, an American breeder produced four wreathed hornbills (Aceros undulates), now established as two separate mating pairs. Although the breeder asserted that all four birds were unrelated, the validity of this claim must be confirmed in order to organize an optimal breeding program. Studbook keepers for the wreathed hornbill Population Management Plan (PMP) collected DNA samples from the four founders, their offspring, and several unrelated birds for analysis. With the DNA of these birds, several DNA fingerprints were created. Band-sharing coefficients, a measure of genetic relatedness, were then calculated between first-order relatives and unrelated birds. Based on generated ranges, the relatedness of the four founder birds was evaluated.

THE EFFECTS OF PHEROMONE TREATMENTS ON STREPTOCOCCUS PNEUMONIAE AUTOLYSIS

Presenter
Charles C. Song, Illinois Mathematics and Science Academy

Mentor
Dr. Donald Morrison, University of Illinois at Chicago

The ability of Streptococcus pneumoniae, a major disease causing bacterium in humans, to regulate competence for genetic transformation is triggered naturally via a quorum-sensing mechanism in the presence of a pheromone called CSP (competence-stimulating peptide). When competence is induced, a portion of the population undergoes autolysis. This autolysis is accompanied by a release of pneumolysin, the toxin responsible for much of Streptococcus pneumoniae's virulence. Recently, the treatment of mice by CSP has been demonstrated to produce a significant increase in survival rates of the mice and reduced survival of Streptococcus pneumoniae bacteria. Thus, CSP is able to block disease in mice. Through a B-Galactosidase enzyme assay, we were able to model the effects of CSP treatments on cell autolysis. A sudden dose of CSP produced a transitory inhibition of growth. In addition, chronic CSP treatment resulted in lower lysis than the lysis activity associated with a sudden inoculation of CSP. Less autolysis presumably would correlate to a lower level of pneumolysin released. Therefore, the therapeutic effects of CSP in treating Streptococcus pneumoniae infections can be a novel innovation as the prevalence of antimicrobial drug resistant strains of the bacterium increases.

THE EFFECTS OF FUNDAMENTAL FREQUENCY AND/OR THIRD FORMANT REMOVAL IN TALKER NORMALIZATION IN PATIENTS WITH AUDITORY PROCESSING DISORDERS

Presenter
Arth K. Srivastava, Illinois Mathematics and Science Academy

Mentor
Dr. Patrick Wong, Northwestern University

In auditory perception, the human brain uses the fundamental frequency (F0) and the third vocal tract resonance (also known as the third formant or F3), which are both essential in vowel perception (Syrdal and Gopal, 1986); (Nusbaum and Morin, 1992). The absence of F0 correlates to minimal vocal fold motion, resulting in whispers. Nusbaum and Morin (1992) tested normal subjects in two different types of talker scenarios, and used 2 different sets of synthesized stimuli. The first set of stimuli lacked both F0 and F3 (whispered-filtered stimuli), and the second set had all components present. In our lab, we tested these two sets of stimuli on patients with auditory processing disorders (APD) to observe how this group differentiates between the manipulated stimuli. APD individuals are defined as a group with limited auditory perception abilities, including worsened auditory performance in response to degraded acoustic signals similar to our stimuli that lacked F0 and F3 (Bellis, 2003). It is hypothesized that in the set of stimuli possessing all acoustic components, both normal hearing subjects and APD subjects will perform better than in the set lacking both F0 and F3; however, the APD group will perform even more poorly in the latter set.

INVESTIGATION OF THE EFFICIENCY OF AUTOMOBILES: BUILDING A REGENERATIVE BRAKING SYSTEM IN A MODEL CAR

Presenter
Peter Stynoski, Illinois Mathematics and Science Academy

Advisor
Dr. David Workman, Illinois Mathematics and Science Academy

Hybrid automobiles are becoming increasingly popular in our world. The combination of an electric motor and an internal combustion engine increases gas mileage, thereby decreasing exhaust emissions. However, there are many other new systems within these cars such as regenerative braking and Chrysler's Multi-Displacement System that contribute to efficiency and cleanliness. In this inquiry, I sought out these systems and developed an understanding of the physics and engineering upon which they rely with hope that I would be inspired to come up with a new system. Each new idea I came up with either could not be feasibly implemented or was already in use. Some of these ideas were turning off the engine at stoplights, using windmill generators, and running the accessories off of the electric motor's batteries instead of the serpentine belt. Since I could not find anything new to make, I decided to model the regenerative braking system using a radio-controlled car. This system works by using an electric motor to produce a current that recharges the batteries when a revolving axle turns it. Throughout the duration of this project, I have developed a thorough understanding of the workings of a hybrid automobile including the drivetrain, weight distribution, electrical system, and brakes, among other things. In the presentation, I will demonstrate my environmentally friendly model and convey my new knowledge to those who are interested.

FACTORS THAT AFFECT SLEEP DEPRIVATION: A STATISTICAL ANALYSIS

Presenter
Frank Sun, Illinois Mathematics and Science Academy

Mentor
Dr. Bala Hosmane, Northern Illinois University

Sleep deprivation afflicts many students at IMSA. What can possibly influence the sleeping habits of IMSA students? Classes? Extracurricular activities? Caffeine intake? For this study, a questionnaire was designed and sent out to students, asking them about their living habits. Using a statistical tool called a multiple linear logistic regression, the responses from these questionnaires can be analyzed to determine what influences sleep deprivation. This information can then be used to determine ways to help prevent this disorder. (As of the time this abstract was written, not enough data has come in to make any conclusions.)

MECHANISMS FOR NON-MITOGENIC ANTI-CD3 MAB REVERSAL OF EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS

Presenter
Yi-Meng Tan, Illinois Mathematics and Science Academy

Mentors
Dr. Adam Kohm, Northwestern University Medical School

Dr. Stephen Miller, Northwestern University Medical School

Previous research has shown that non-mitogenic (NM) antibodies confer protection against experimental autoimmune encephalomyelitis (EAE), an animal model of multiple sclerosis (MS). Of the possible mechanisms by which NM Abs are stymieing EAE progression, I am focusing on T-cell anergy and cell homing. It is known that NM Abs cross-link the TCR complex in the absence of co-stimulatory molecule binding, sending a weak signal to the T-cell and inducing a state of unresponsiveness. I am investigating key molecules within the signaling cascade for any expression level disparities between non-mitogenic and mitogenic (M) Ab treated cells would point to a protein that could be affecting cell tolerance. Furthermore, it has been observed that NM treated cells leave the circulation, hence preventing CD4+ cells from entering the CNS and harming the myelin. Surface adhesion molecules are probable contributors to this migration, and expression levels of these proteins may point to a mechanism by which NM Abs may be altering cell trafficking. Thus, by identifying the major proteins contributing to disease amelioration in NM Ab treated mice, we hope to uncover the means by which this treatment is conferring disease protection and find targets for future MS therapies in humans.

COLLAGEN FIBRIL FORMATION: A 1-D COMPUTER SIMULATION

Presenter
Yi-Meng Tan, Illinois Mathematics and Science Academy

Mentor
Dr. Bradley Layton, Drexel University

Collagen is the most ubiquitous protein in the body, comprising approximately 30-50% of all protein and over 5% of body mass. It is mostly found in connective tissue, such as bone, skin, tendon, cornea, and other structural elements. Its unique structure includes a 300nm long triple helix of tropocollagen strands that self-assemble into fibrils with diameters of 20-500nm and indeterminant length through a self-controlled process. The details for fibril size limitation is influenced by many factors, including curvature and stiffness of the strands, as well as energies of formation and deformation. We created a computer model to simulate this process that would allow for experimentation with the variables of bending stiffness and intramolecular binding energies to lead to more knowledge about the mechanics of collagen formation. Eventually, tissue engineers may then use this knowledge of the optimal conditions for synthesizing collagen molecules to design tissues on the nanoscale level.

IMPLEMENTATION OF THE CHILE-US FREE TRADE AGREEMENT IN ILLINOIS: PROMOTING CHILEAN EXPORTS

Presenter
Harry Thompson, Illinois Mathematics and Science Academy

Mentors

Sr. Consul Alejandro Rogers, Consulate General of Chile

Mr. Jaime Melendez, Consulate General of Chile

On June 6th, 2003 representatives from both the United States and Chile were brought together in Miami to formally sign a bilateral free trade agreement that reduced tariffs and opened the way for new trade between many businesses. With a growing economy, Chile continues to lead Latin America in many sectors, such as copper, fresh produce, wine, and fish/seafood. We assessed each of these sectors to see which ones we would hypothesize to have the greatest potential for businesses and consumers in Chicago. We decided to look at the fish and seafood industry, which has full tariff reduction in effect. After contact with more than twenty different importers and distributors, we have seen that the industry is maturing. Direct importation to the Chicago area, instead of relying on East Coast distributors, has been another option.

We have found that many businesses are continuing to import directly from Chile in large quantities and have found working with Chile to be a high potential source of fish and seafood products. They have noted that the FTA has made importing and customs easier and less expensive. We believe that importers and distributors will in the future use Chile as a gateway to Latin American trade.

A NOVEL METHOD OF IRON REGULATORY PROTEIN STUDY IN SACCHAROMYCES CEREVISIAE

Presenter
Jennifer L. Townsend, Illinois Mathematics and Science Academy

Mentors
Ms. Sara Powell, University of Illinois at Chicago

Dr. William Walden, University of Illinois at Chicago

Iron regulatory proteins (IRP) are sequence-specific regulators of mRNA, which act through iron responsive elements (IRE) in animals. The precise stages of regulation by IRP are not known in great detail. Use of yeast as a model system for studying IRP in action offers information about the role of IRP in animal systems through the following procedure. Ligation of a pMet3.1 vector under methionine regulation with pNFkB-d2EGFP and pCMV-DsRed-Express, genes that code for green and red florescence proteins respectively, using several restriction enzymes creates a viable plasmid for transformation with DH5α E.coli in order to speedily replicate the recombinant DNA. Insertion into Saccharomyces cerevisiae, where pMet3.1 becomes active, would establish a viable method of studying the effects of IRP in live cells. If completed, the method will allow green florescence to be monitored through an iron- responsive protein, while the red florescence will link to a normal gene that does not fluxuate with iron restriction, in order to establish a means of comparison. This method will assist in further research of IRP and either confirm or realign current hypothesis over the methodology of IRP activities.

SIGNIFICANCE OF HERPES SIMPLEX VIRUS ENVELOPE GLYCOPROTEIN D (GD) IN VIRAL INFECTION

Presenter
Caitlin M. Tribout, Illinois Mathematics and Science Academy

Mentor
Dr. Deepak Shukla, University of Chicago

Once acquired, Herpes Simplex Virus (HSV) infections persist for a lifetime in individuals. Four HSV envelope glycoproteins, gB, gD, gH and gL, are required for invasion or entry of the virus into susceptible cells. The goal of this project is to study gD, a potentially multifunctional viral protein. It is already known to mediate virus attachment, membrane fusion for entry of genetic material into host cytoplasm and prevention of apoptosis upon viral entry. Apart from the known functions, gD potentially has the ability to affect viral infectivity in additional ways. One way to study gD is to design and express a recombinant fluorescent form of the protein in host cells. That way gD can be studied in the absence of other viral proteins and it can be easily distinguished from other cellular proteins. In addition, the fluorescent tag could be used to localize and observe cellular gD, using fluorescent microscopy. Thus, the focus of our study was to generate by polymerase chain reaction (PCR) a DNA expression construct that expresses a chimeric protein that contains gD fused in-frame with a red or green fluorescent protein. The chimeric protein was transiently expressed in mammalian cells and its expression was studied by fluorescent microscopy.

DEVELOPING A SCIENTIFIC MODEL: THE HISTORY OF ACTIVE GALACTIC NUCLEI

Presenter
Christopher Trigg, Illinois Mathematics and Science Academy

Advisor
Dr. Robert Brazzle, Illinois Mathematics and Science Academy

Active Galactic Nuclei are found in only 7% of all galaxies, but are objects commonly studied by modern astrophysicists. Like any object in nature, our understanding of them comes from information collected over a long period of time. This Inquiry looked at the history of the AGN model, from its very beginnings in the early 1930's with the creation of radio astronomy, to the newest discoveries on variability in energy emissions. Research was conducted at IMSA and Chicago's Adler Planetarium. The result is a history of the AGN model which shows such things as the progression of information on AGNs' location and orientation in the sky, the misconception of some scientists that some AGN were actually stars and how this was overcome by considering the sources' redshift, and the need for better information regarding the power sources of AGN. Together, the progression of information, misconceptions and they ways they were overcome, and unanswered questions about AGN show the interesting process that goes into forming what is currently understood about such celestial objects.

IMMIGRATION IN THE 21ST CENTURY

Presenter
Christopher Trigg, Illinois Mathematics and Science Academy

Advisor
Ms. Socorro Cintron, Illinois Mathematics and Science Academy

Immigration to the United States has been an issue of growing importance in both politics and local communities during recent decades. Unfortunately, racial tensions, often fueled by stereotypes, have affected many peoples' views on the subject. This independent study wanted to learn the facts of immigration by studying both the legal aspects, such as green cards, visas, and the process of United States citizenship, and illegal aspects of immigration, like smugglers, methods of border patrol, and the increase in civilian border police. Research was done using on-line government sources, scholarly articles, and first hand accounts to produce a report aimed at elucidating the hardships immigrants face, the problems immigration can cause, as well as the important role immigrants play in today's society. It was learned that immigrants, especially those who are unable to speak English, can face a very difficult and expensive challenge in working their way through the legal system of immigration, but that there are also extreme dangers to be faced in using illegal methods of immigration. What is more, while illegal immigrants can cost the government millions in lost taxes and border patrol, they provide labor that is essential to our economy.

5ASA SUPPRESSED INDUCTION OF DYSPLASIA ON AOM/DSS MODEL: CORRELATION WITH INHIBITION OF WNT/BETA-CATENIN TRANSCRIPTIONAL ACTIVITY

Presenter
Vyas Viswanathan, Illinois Mathematics and Science Academy

Mentor
Mr. Gery Grimm, Northwestern University Medical Center

Patients with ulcerative colitis (UC), a form of inflammatory bowel disease (IBD), have increased risks of developing colorectal cancer (CRC). 5-aminosalicyilic acid (5ASA) is hypothesized to lower risks of developing CRC in IBD patients. This study shows the effects of high dose (HD) and low dose (LD) 5ASA in mice induced with CRC using the DSS/AOM model. After 3 cycles of DSS, 66% of the mice were observed to have high grade dysplasia, which was reduced by 14% subsequent to treatment with LD (100 mg/kg/d) 5ASA chow, while HD 5ASA (300mg/kg/d) reduced the instance of dysplasia in mice by 55%. Staining for epithelial BrdU incorporation (2h label) and Ki67 (cell cycle marker) within 3 days of DSS cessation showed that crypt cell proliferation increased by 200-300% compared to control groups without inflammation. Inflammation went down (7–14 days after DSS) with epithelial proliferation decreasing by >80% and the appearance of dysplastic crypts increasing. Isolation of colonic crypt epithelial cells 10 days after DSS showed significant increases (mRNA fold induction) in Wnt/ß-catenin target genes: cMyc and cyclin D1. Experiments showed a 70% reduction in cMyc induction and no effect for cyclin D1 using LD 5ASA, but experiments with HD 5ASA revealed a complete recession in cMyc and 82% reduction in cyclin D1. In conclusion, the data suggests that 5ASA reduces dysplastic transformation by inhibiting proximal signaling events needed for induction of inflammation-induced Wnt/ß-catenin transcriptional activity.

CHLOROACETALDEHYDE (CAA) AND THE FORMATION OF ADDUCTS AT THE O6-POSITION OF GUANINE

Presenter
Xin (Cindy) Wang, Illinois Mathematics and Science Academy

Mentor
Dr. Eileen Dolan, University of Chicago

Despite potentially damaging side effects, cyclophosphamide is widely used in cancer cell chemotherapy. Cyclophosphamide forms several metabolites, some of which react with DNA and inhibit further cell replication, resulting in anticancer activity. Unfortunately, unwanted side effects, including bladder carcinogenesis and neurotoxicity, are produced by other metabolites formed from cyclophosphamide, namely chloroacetaldehyde (CAA). This research seeks to determine the structure of the adducts on DNA formed by CAA and whether the DNA repair protein, O6-alkylguanine-DNA alkyltransferase (AGT), repairs adducts formed on DNA by CAA. Using high performance liquid chromatography (HPLC), the DNA adducts formed after reaction of CAA with DNA were measured in the presence and absence of AGT. Preliminary results show that AGT alters the concentrations of various adducts found in the CAA-reacted DNA, although the exact composition and identification of the compounds remain unknown.

RHIZOCTONIA SEEDLING DAMPING-OFF IN SUGAR BEETS

Presenter
Xin (Cindy) Wang, Illinois Mathematics and Science Academy

Mentor
Dr. J. Mitchell McGrath, Michigan State University

The fungal pathogen Rhizoctonia solani infects over 2,000 types of crop plants, including the sugar beet (Beta vulgaris L.), which provides up to a third of the world's sugar supply. The sugar beet is prone to two main Rhizoctonia diseases, one of which is seedling damping-off. In this project, the host-pathogen interactions were noted between a resistant and susceptible variety of sugar beet inoculated with either a virulent or hypovirulent strain of the fungus. All plants were penetrated, but plant death only occurred in the susceptible variety inoculated with the virulent strain of fungus. The hypothesis of stele penetration was tested both directly by microscopy and indirectly through water potential. The methods used all suggest against stele penetration as a pathogenic mechanism. Genomic analysis was also done with cDNA-AFLP analysis, and isolated sequence clones were sent to a sequencing facility for analysis.

THE EFFECTS OF ALCOHOL ON THE COGNITIVE-MOTOR SKILLS OF LIGHT VERSUS HEAVY DRINKERS

Presenter
Yingjia Wang, Illinois Mathematics and Science Academy

Mentor
Dr. Andrea King, University of Chicago

Awareness among the general public of the degree of cognitive-motor impairment resulting from alcohol consumption is key in preventing harmful and potentially fatal accidents. While some studies have shown heavy drinkers to be more tolerant towards alcohol than their light-drinking counterparts, others have argued that a marked difference does not exist. To further explore this issue, 52 nonalcoholic drinkers aged 21-35 years were examined. Thirty-eight heavy drinkers and fourteen light drinkers participated in three early evening test sessions where they consumed a placebo, 0.4g/kg alcoholic, or 0.8g/kg alcoholic beverage. Cognitive-motor impairment was assessed by the grooved pegboard task and the Digit Symbol Substitution Test (DSST). Alcohol at the 0.8g/kg dose diminished performance on the pegboard with deterioration peaking at 15 minutes after consumption (Dose x Time, $F(8,408)=8.33$, $p<.001$). Light and heavy drinkers were equally impaired on the pegboard. DSST performance was also worsened by alcohol, especially at the high dose and also peaking 15 minutes after consumption (Dose x Time, $F(8,400)=14.36$, $p<.001$). Alcohol caused the same relative decrements on the DSST between light and heavy drinkers. These results suggest that light and heavy drinkers are similarly susceptible to alcohol's cognitive-motor decrements.

TRAFFIC MODELING: THE MECHANICS OF THE DELAY

Presenter
Daniel T. Wheeler, Illinois Mathematics and Science Academy

Advisors
Dr. Mark Horrell, Illinois Mathematics and Science Academy

Mr. Ronald Hurlbut, Illinois Mathematics and Science Academy

Unnecessary slowdowns in highway traffic flow occur frequently due to bottlenecks in the progression of vehicles, or simple driver error. Of course, initial disruptions in traffic flow often cause a progression of delays, resulting in a traffic wave that persists for a much longer period of time than the actual cause for delay itself. The goal of this project was to produce a model which would effectively mimic driver behavior, with a simple set of instructions. Various studies of traffic flow were first used to identify the necessary components for effectively reproducing certain traffic situations. Using a spreadsheet program, a model was developed that included numerous variables that determine vehicle behavior, such as driver reaction time, following distance, and situations that cause slowdowns. This model may be used to predict how a typical roadway, with a given number of vehicles and a logic system for determining their behavior, will experience interference in traffic flow. By using this model, it is possible to test the individual effects of each variable, leading to a better understanding of the parameters influencing traffic flow anomalies.

MY ADVICE TO THE PLAYERS: AN ACTING EXPERIENCE THROUGH THE MIND OF KURT VONNEGUT JR.

Presenter
Camilla White, Illinois Mathematics and Science Academy

Advisor
Dr. Dennis Czerny, Illinois Mathematics and Science Academy

Acting is an art form that we do not see much of here at IMSA. This inquiry focused on gaining a deeper understanding of acting and the processes that actors have to go through to be successful. An actor needs more than just a script handed to him and a director calling out directions. He researches a role, uses vocal training, learns improvisation techniques, and interacts with the materials around him. Most people also don't consciously realize that there is a huge difference between actors in theatre and actors in film. For example, actors in film can make mistakes and re-do scenes until they are "perfect," theatre actors only have one shot until the next show. There are various important aspects of acting, such as scenery and lighting. If the scenery is too detailed, the audience might spend more time focusing on the scenery than on the actors. Makeup can turn a beautiful woman into an ugly, villainous, and decrepit creature, such as when Charlize Theron played Aileen Wuornos in *Monster*. This presentation will address the previously mentioned issues and more through a performance of the play *Happy Birthday Wanda June* by Kurt Vonnegut Jr., followed by a small presentation on an actor's primer.

HOW TO PREPARE A BRANTA CANADENSIS SKELETON FOR A DISPLAY

Presenter
Anna Wilewska, Illinois Mathematics and Science Academy

Advisors
Ms. Vicki Burgholzer, Illinois Mathematics and Science Academy

Dr. David Workman, Illinois Mathematics and Science Academy

The body of a dead Canada Goose was discovered next to the IMSA pond. Since examining skeletal remains is a valuable learning experience, we decided to mount the skeleton for an IMSA display. We tried various methods for removing the remaining tissue and the feathers: scalpels, Dermestid beetles, and boiling the bones. All of these methods had their disadvantages. After trying all of these techniques it took the majority of the first year to get the bones mostly clean. This year's project investigated procedures to whiten the bones, and then mount them for a display. Many of the procedures used hydrogen peroxide to whiten the bones. I discovered that dipping the bones in hydrogen peroxide for whitening also helped with removing the remains of the muscles and cartilage. This method was better than others attempted, including applying whitening strips, peroxide cream, or whitening toothpastes and dipping the bones in baking soda, acetone, or bleach. I decided to mount the skeleton in a flying position rather than in a typical standing pose to create variation. This involved suspending the backbone with strings and attaching the other bones to it progressively. The result is a unique display of the skeleton of a bird in a flight.

PRESENCE OF SOME PRE-MIRNAS AND DICER MRNA IN MOUSE SYNAPTONEUROSOMES

Presenter
Kinga Wilewska, Illinois Mathematics and Science Academy

Mentor
Dr. Neil Smalheiser, University of Illinois at Chicago

RNA Interference (RNAi) starts when miRNAs are transcribed in the nucleus of a cell, processed by Drosha, and turned into pre-miRNA (55-110 nucleotides). Then it's exported into the cytoplasm and processed by an enzyme, Dicer, which generates 20-22 nucleotides double-stranded fragments. The active miRNAs are still attached to Dicer, which transports them to RISC, which in turn recognizes cognate mRNAs and leads to their accelerated destruction or suppression. We hypothesized that after thirty minutes of hippocampus stimulation, Dicer and EIF2c, mRNAs and proteins, and some of the miRNA precursors' levels will be modified. Because previous studies have shown that Dicer and RISC are expressed at the post synaptic site and PSD, we want to test whether miRNA precursors do as well. To evaluate our hypothesis, mice were used and treated with a brain stimulator. Hippocampi were removed from their brains and RNA and protein were extracted. The proteins were assessed by Western blotting technique, and RNA with qRT-PCR. We also tested their relative concentration in synaptoneurosomes compared to the total cell body RNA. We are the first ones to show the presence of Dicer mRNA and some pre-miRNAs in the synaptoneurosomes of the mouse.

CHROMOSOME TRANSLOCATION OF THE C-MYC GENE IN BREAST CANCER CELLS

Presenter
Tingting Wu, Illinois Mathematics and Science Academy

Advisors
Dr. Donald Dosch, Illinois Mathematics and Science Academy

Dr. Judith Scheppler, Illinois Mathematics and Science Academy

The proto-oncogene *c-myc* codes for a transcription factor that regulates the expression of other genes. Through mutational change, the c-myc oncogene becomes overproduced, causing the cell to repeatedly initiate mitosis even without the presence of growth factors. It has been shown that the DNA in some breast cancers has been rearranged to boost the frequency of c-myc transcription. I asked if the over-expression of the c-myc gene in the breast cancer cell line, MCF7, was the result of chromosome translocation. I tracked the sequence-length variations of the c-myc gene in breast cancer cells using Southern blotting; a T-cell line and a monocytic cell line were used as the controls. Having already run the isolated DNA samples through the electrophoresis gel, I now need to probe the membrane to identify c-myc from the other genetic material. And from there on, I hope to determine the effect of gene juxtaposition on cancer.

A JOURNEY INTO SABERMETRICS: UTILIZING BASEBALL STATISTICS INTO PERFORMANCE AND TALENT EVALUATION

Presenters
Kwin Xie, Illinois Mathematics and Science Academy

Di Zhuang, Illinois Mathematics and Science Academy

Advisor
Dr. Don Porzio, Illinois Mathematics and Science Academy

This inquiry's purpose is to find more effective ways to evaluate talent and performance in Major League Baseball by utilizing historical, numerical statistics. This research was conducted through using regression analysis on statistical categories, to determine which ones were useful and which were not. The following conclusions proved to be the most revealing and significant. The most effective tool of evaluating the number of runs a team scores is by its on-base plus slugging percentage (OPS). Thus, the most effective way to judge a player's batting contribution to a team is by his OPS. There is no significant difference in recent years of batting or pitching statistics between the American and National Leagues. Despite the disparity in quantity, there is almost an equal amount of talent batting-wise between left-handed and right-handed hitters near the top of the OPS rankings. The number of games a team wins during a season can be accurately and consistently predicted by the difference in runs scored and runs given up in a linear relationship. Due to this, we can also conclude that pitching and hitting take nearly equal importance in a game. Defense can be measured more effectively by counting the number of successful plays made rather than with errors.

SORTING NEXIN 5 AND ITS EFFECTS ON POLYAMINE SYNTHESIS AND TRANSPORT

Presenter
Allen Ye, Illinois Mathematics and Science Academy

Advisors
Dr. John L.A. Mitchell, Northern Illinois University

Dr. Susan Styer, Illinois Mathematics and Science Academy

Polyamines are essential cations in the body that help induce cell growth. Antizyme (AZ), which degrades polyamines, can be inactivated by antizyme inhibitor (AZI). Our goal was to discover more about AZI function. We used an analogue of AZI, sorting nexin 5 (SNX-5) and transfected Chinese hamster ovary cells (CHO) with a plasmid containing SNX-5. We hoped for a greatly increased level of SNX-5 within our cells. We used a western blot that detected proteins attached to the polyamines, looking for elevated levels of polyamines. However, the first result came out inconclusive and we are still examining the causes and problems involved in our western blot. We also looked at passage times of the CHO cells and did not notice a difference in growth times.

MUON CHARGE RATIO FOR DATA FROM THE MINOS FAR DETECTOR

Presenter
Junwei Ye, Illinois Mathematics and Science Academy

Mentor
Dr. Maury Goodman, Argonne National Laboratory

Neutrinos are different from other subatomic particles in that they rarely interact with their surroundings. They carry no charge, have very little mass and travel at near the speed of light. There are three types of neutrinos to correspond to the three leptons: electron, tau and muon. Previous neutrino experiments such as those conducted by Super-Kamiokande and the Sudbury Neutrino Observatory showed that even though the sun only produces electron-type neutrinos, the actual count of electron-type neutrinos that reach the detectors is not as expected. An explanation for this phenomenon is that neutrinos can oscillate between the three different types. In spring of 2005, the MINOS project will send a beam of neutrinos from the Main Injector at Fermilab through a near detector at Fermilab to a Far Detector in the Soudan mine in Minnesota. Before the results can be understood, the acceptance of the Far Detector must first be understood. My contribution to the project will be a ROOT program that will interpolate NASA's data for the moon's shadow's right ascension and declination as a function of time, because the shadow of the moon on Earth affects the number of muons that reach the detector.

BEHAVIORAL EFFECTS OF CAFFEINATED COLA CONSUMPTION ON FIRST GRADERS

Presenter
Ying Ye, Illinois Mathematics and Science Academy

Mentor
Dr. Alan Hirsch, Smell & Taste Treatment and Research Foundation, Ltd.

Introduction: Use of caffeinated cola by children is ubiquitous in our society. The potential psychological effects of this include DSM-IV caffeine induced anxiety and sleeping disorders, and withdrawal symptoms. Manufactures continue to add caffeine to cola and target young children for marketing despite that the effects of caffeinated cola in this age group have not been explored.

Methods: In a double blinded fashion, twenty 1st graders (ten of each gender) were presented with caffeine free cola and caffeinated cola for ad lib consumption in three hour epochs sequentially over two weeks. Average consumption of caffeine free cola and of caffeinated cola was 7.55 oz (2 to 12) and 9.45 oz (2 to 12), respectively. After completion of each session, teachers rated each student with a six question modified Connors test.

Results: The modified Connors score was an average of 5.45 points higher for caffeine than for caffeine-free cola. ($p=.017$, 2-tailed t-test) In response to caffeine intake, 60% (12) students' scores increased compared to 12% (3) whose scores decreased ($p=.079$). Even after adjusting for number of ounces, there is still a significant increase in the Connor score comparing caffeine to caffeine-free soda. ($t= 2.69$, $p= 0.0151$)

Conclusion: First graders manifested behavioral problems when presented with caffeinated cola, suggesting that consumption of this should be minimized.

EPICARDIAL CELL DIFFERENTIATION IN VITRO

Presenter
Emilie T. Yeh, Illinois Mathematics and Science Academy

Mentor
Dr. Robert Dettman, Northwestern Feinberg School of Medicine

In humans plus other birds and mammals, epicardial cells develop into smooth muscle cells that surround coronary vessels. It has been proposed that these cells also produce the layer of endothelial cells that line the inside of the lumen. Our experiment was designed to test if we could culture epicardial cells to differentiate into endothelial cells. In this experiment, we tried to imitate the formation of blood vessels in a dish. We formed rat epicardial mesothelial cells (rEMCs) into small clusters of attached cells (spheroids) then embedded them in collagen or Matrigel to observe the growth of cellular networks. To discover the best method to set the Matrigel, we tested many procedures. Afterwards, we stained the growths with varying antibodies to assay differentiation. Our results show that cultured rEMCs express some markers of endothelial cells and smooth muscle cells. After one day of culture, spheroids spread on thin layers of either Matrigel or collagen. However, spheroids only spread on thick layers of Matrigel, not collagen. After three days, cells grown on thick Matrigel formed networks that appeared mesenchymal, but still maintained adherens junctions. In conclusion, while REC cells form networks that maintain cell-to-cell contact, they don't express endothelial specific antigens.

TIME SERIES ANALYSIS IN MACROECONOMICS

Presenter
MengFei S. Yin, Illinois Mathematics and Science Academy

Mentor
Dr. Lars Hansen, University of Chicago

Time series analysis integrates economic data to construct models that represent the current economy. This study uses the matlab software to simulate and analyze certain dynamics with the purpose of finding an economic model, or a series of models, that fits the given data and renders meaningful interpretations. The models are estimated from economic time series data using least squares regression methods, and can be used to assess the importance of alternative economic shocks, the responses of economic time series to those shocks, and the underlying macroeconomic risk factors. Matlab simulations include counterfactual impulses that isolate the many dynamic ingredients in the fundamental economic model. In our analysis, my mentor and I work with quarterly data on consumption, corporal earnings, wealth, price deflator, and portfolio dividends. Given sufficient information, time series can be employed to fit and represent all kinds of data in order to characterize macroeconomic trends and risk factors.

DEVELOPING A THEORY OF SERVANT LEADERSHIP

Presenter
Binglei Yu, Illinois Mathematics and Science Academy

Mentor
Dr. Robert Liden, University of Illinois at Chicago

Servant leadership is a type of leadership that stresses personal integrity and is defined as the act of a leader catering to the needs of the subordinate, community and customer before his own. Although there has been literature regarding the subject, there has been little sufficient scientific research. The object of this project was, then, to develop a framework and working model for this type of leadership.

The research began with a survey given to 298 students, which tested the nine dimensions of servant leadership that we had previously determined from relevant literature. Through this, we determined that a 7-factor model was most appropriate. We used this model in an organization of 174 employees. We further validated the 28-item servant leadership scale by controlling for transformational leadership, accounting for a variance in employee commitment, community citizenship behavior, and innovation beyond transformational leadership.

INVESTIGATION OF HISTAMINE PRODUCTION DUE TO VARYING ANTIGEN CONCENTRATION

Presenter
Rishi Zaveri, Illinois Mathematics and Science Academy

Advisor
Dr. Donald Dosch, Illinois Mathematics and Science Academy

In 1966, the antibody IgE was discovered to be primarily accountable for allergies. Allergies appear when the immune system malfunctions and produces IgE antibodies for a typically harmless foreign antigen. During an allergic reaction people sometimes have ten times more IgE in their blood stream than normal. IgE antibodies bind to mast cells causing the cells to produce a variety of chemicals including histamines, which instigate the majority of allergic reactions. The focus of this investigation is to find how the amount of histamine produced by mast cells varies as the amount of antigen is modified. This goal is being accomplished by maintaining a mouse mast cell line, and then sensitizing the line to IgE which serves as the antigen. After the sensitization of the cell line, the amounts of histamine produced can be tested by performing an ELISA. The amount of histamine is then determined by comparison with a standard curve. Cell growth and ELISA conditions have been optimized. Experiments are underway to examine antigen induced histamine production.

MONITORING AND RECORDING THE STATUS OF RADIOLOGY STUDIES IN HOSPITAL INFORMATION SYSTEMS

Presenters
Wang (Jennifer) Zhan, Illinois Mathematics and Science Academy

Richard Zhang, Illinois Mathematics and Science Academy

Mentors
Dr. David Channin, Northwestern University Medical School

Dr. Pattanasak Mongkolwat, Northwestern University Medical School

The purpose of this project is to design a software system that monitors and records the status of radiology studies as they pass through the radiology order status life cycle. Using Health Level Seven (HL7) message traffic between multiple information systems, the system monitors every order for radiology service. Radiology studies typically pass through a series of defined states, beginning with ordered, started, completed, dictated, transcribed, and final. Our system is designed to store the relevant HL7 order and status messages, allowing authorized personnel to monitor this information in real-time. Created by the programming tools Eclipse, Java, and Symphonia, this system obtains messages from the Quovadx Cloverleaf message passing engine in use at the facility. Messages are stored in a database for easy access. The benefits of this system lie in allowing management of real-time information and to distinguish the statuses of studies. Our project demonstrates, among other things, how HL7 information remains a powerful tool within an institution and when used for purposes which it was not intentionally designed for, can benefit the healthcare enterprise in numerous ways.

COUNTING NUMBER OF LATTICE POINTS INSIDE A 3-D TETRAHEDRON

Presenter
Letian Zhang, Illinois Mathematics and Science Academy

Mentor
Dr. Stephen Yau, University of Illinois at Chicago

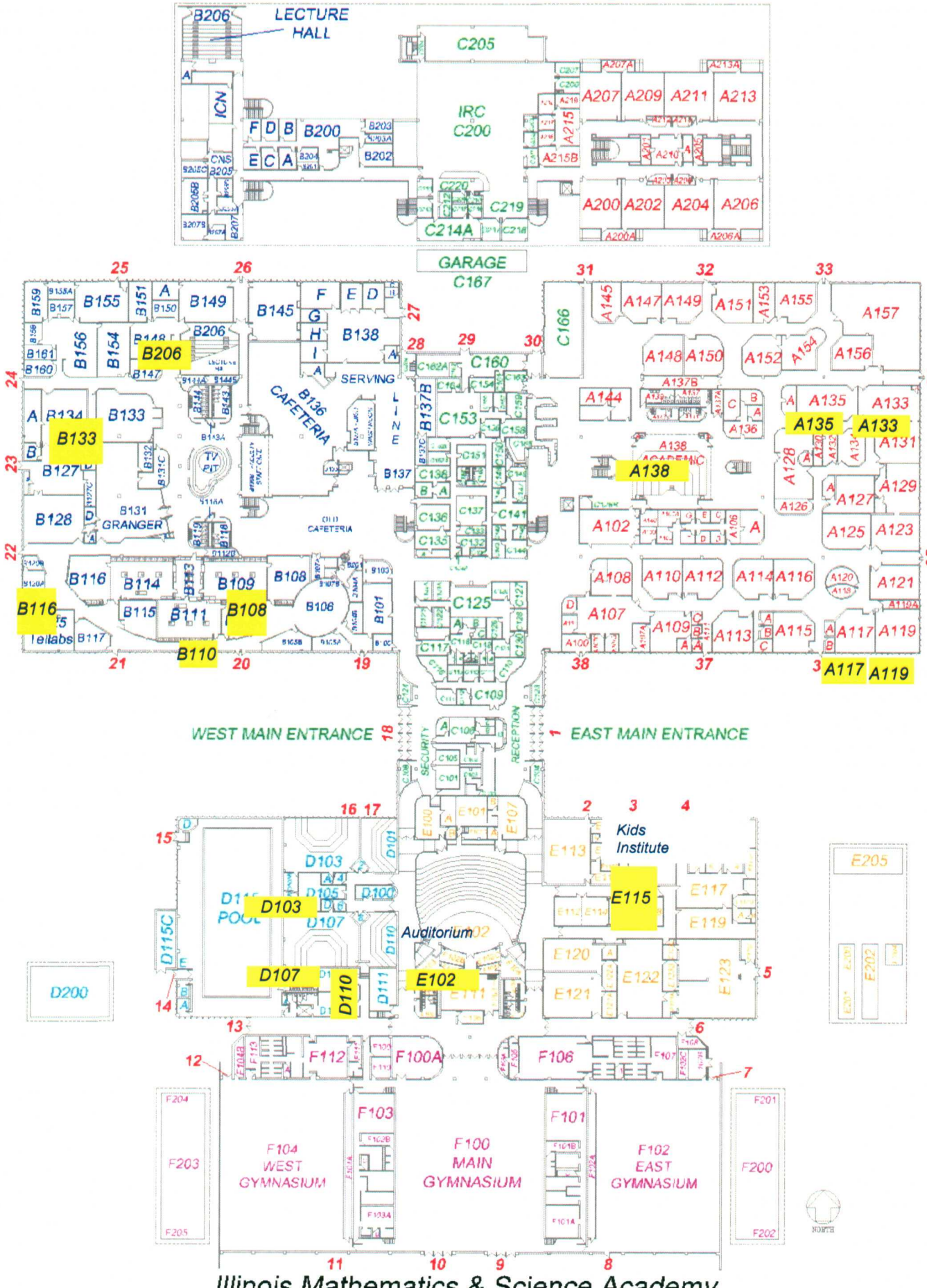
The counting of lattice points inside a 3-dimensional tetrahedron has been an intriguing problem for years. For the tetrahedrons with integer coordinates, Erhart has found a polynomial that corresponds to the number of lattice points inside a n-dimensional tetrahedron. However after n>2, Ehrhart's polynomial cannot be expressed explicitly. The goal of our mentorship is to find explicit bounds for the number of lattice points inside a 3-dimensional tetrahedron.

Name	Time/Room	Time/Room	Time/Room	Time/Room
Ivy Abraham	10:00 / B110			
Oluwemimo Adeyanju	1:20 / A-119			
Eunho (Joyce) Ahn	12:55 / D110	1:20 / D110		
Alisa Albrecht	9:35 / Lecture Hall			
Sarah Alef	10:50 / B-108			
Kavin Arasi	10:25 / B-108			
Cici Bai	9:35 / B110			
Joseph Baker	10:25 / Lecture Hall			
Rashi Bamzai	1:45 / B-116			
Grant Barbosa	12:30 / A-119			
Kathleen Barnes	12:30 / D107			
Chelsey Bayer	9:35 / B-108			
Paras Bhayani	1:45 / A-133			
Rohan Bhobe	Not Presenting			
Tracey Blasingame	1:20 / Academic Pit A-138			
Aravind Bommiasamy	2:35 / B-116			
Jessica Bubert	1:20 / Academic Pit A-138			
Raymond Buhr	2:35 / B-133			
Jordan Burdinie	2:35 / Lecture Hall			
Meghan Carroll	1:45 / Academic Pit A-138			
Aaron Caveglia	2:35 / A-133			
Manisha Chandar	2:35 / Kids Institute E-115			
Grady Chang	11:15 / A-135			
Kevin Chang	12:55 / Lecture Hall			
Jason Chen	2:10 / B110			
Mi (Amy) Chen	1:20 / B110			
Jenny Cheng	1:20 / A-133			
Nathan Cheng	12:30 / A-135			
Yishan Cheng	1:45 / A-135			
Karen Chien	1:45 / A-135			
Justin Chiou	12:30 / Kids Institute E-115	12:55 / Kids Institute E-115		
Connie Choi	12:30 / A-133			
Jonathan Chou	2:35 / B-133			
Laura Cladek	9:10 / D103			
Raymond Colletti	1:20 / Academic Pit A-138			
Timothy Credo	10:25 / Academic Pit A-138			
Sandra Diaz de Leon	12:55 / A-133			
Matthew Drake	12:55 / A-117			
Danny Duong	12:55 / A-119			
Grace Dwyer	12:55 / Academic Pit A-138			
Jason Edes	1:20 / Academic Pit A-138			
Alyse Eggertsen	10:50 / Academic Pit A-138			
Justin Eusebio	10:25 / B110			
Nida Faheem	12:30 / B-116			
John Forbes	10:00 / A-133			
Robert Forler	9:10 / A-135			
Christine Foster	9:10 / Kids Institute E-115			
Rakesh Gadde	10:25 / A-135			
Pooja Gala	11:15 / A-119			
Raj Gala	2:35 / D101			
Khadijat Gbenro	12:55 / Academic Pit A-138			
Christine Gebler	12:30 / Aud. E102	12:55 / Aud. E102		
Sara Goek	10:25 / D107	10:50 / D107		
Vijay Govind-Thomas	1:20 / Kids Institute E-115			

Name	Time/Room	Time/Room	Time/Room	Time/Room
Tatiana Green	2:35 / A-119			
Rishi Gupta	2:10 / D101			
Lyra Haas	12:30 / Academic Pit A-138			
William Hahm	1:20 / Academic Pit A-138			
Neil Halmagyi	10:00 / B-133			
Jing Han	10:25 / B-133	1:20 / B-133		
Nicholas Harker	10:00 / B-133			
Laura Hawkes	12:55 / B-133			
Sarah Heaney	1:45 / D103			
Amanda Heikes	1:20 / Academic Pit A-138			
Ovidiu Hentea	2:10 / D107			
Carl Herrmann	2:10 / D103			
Jamison Hill	11:15 / B-116			
Nicholas Hinton	10:25 / A-133			
Sharon Hong	12:30 / B-133			
Thomas Houlahan	10:00 / Academic Pit A-138			
Aiva Ievins	12:30 / D110			
Swetha Jalli	1:20 / B-116			
Akta Jantrania	12:30 / D103			
Elizabeth Janusick	1:45 / A-117			
Hemanth Jasti	10:00 / A-135			
Dana Jensen	12:55 / A-133			
Sarah Jeong	10:50 / A-135			
Abigail Johnson	12:30 / B-108			
Jennifer Jones	12:55 / B110			
Jennifer Kang	9:10 / B110			
Arielle Kanters	2:35 / B-108			
Charles Keaton	9:10 / A-119			
Andrew Keller	11:15 / D107			
John Kenealy	11:15 / Kids Institute E-115			
Christopher Kervick	1:20 / Academic Pit A-138			
Navin Kesari	9:10 / D101			
Nahree Ki	12:55 / Academic Pit A-138			
Joshua Kinder	12:55 / Academic Pit A-138			
Heidi Knappenberger	10:00 / D103			
Anastasia Knasiak	9:35 / D103			
William Konrad	10:00 / Lecture Hall			
Jakob Kotas	2:10 / A-119			
John Koval	2:10 / D101			
Aud.ra Kramer	12:55 / A-133			
Rebecca Krock	2:10 / D110			
Codi Kuhlemeier	2:10 / Lecture Hall			
Sharad Kumar	9:10 / Lecture Hall			
Michael Kuo	10:00 / D107			
Shang-Pin (Anne) Kwei	12:55 / B-116			
Azmina Lakhani	12:55 / B-133			
Daniel Lee	1:45 / B-133			
Stephanie Lee	2:35 / D110			
Melanie Leung	10:25 / A-117			
Stephanie Leung	10:25 / A-117			
Ashley Levato	12:30 / D107			
Casey Lewis	2:35 / Academic Pit A-138			
Sylvia Li	12:30 / A-135			
Yang Li	1:45 / B110			
Kyung-gun (Sam) Lim	11:15 / Academic Pit A-138			

Name	Time/Room	Time/Room	Time/Room	Time/Room
Natnari Linwong	1:20 / A-117			
Conan Liu	12:30 / D103			
David Liu	9:35 / A-133			
Jessica Liu	2:10 / Academic Pit A-138			
Yuan Liu	9:35 / Academic Pit A-138			
Mary Logue	1:45 / Academic Pit A-138			
Robert Main	10:00 / Lecture Hall			
Martha Malin	9:10 / B-133			
Sriniwasan (Balaji) Mani	10:50 / A-133			
Kevin McHugh	2:10 / B-116			
Yugarshi Mondal	10:50 / Kids Institute E-115			
Daniel Montgomery	11:15 / Academic Pit A-138			
Daniel Moorehead	2:10 / D107			
Kate Moss	2:10 / B-108			
Thomas Mullins	9:35 / A-135			
Heena K. Mutha	1:20/ B116			
Lucy Na	12:55 / A-135			
Puskar Naha	9:10 / Academic Pit A-138			
Rajeev Nayak	10:50 / B110			
Varun Nayini	10:00 / B-116			
Edward Nepomuceno	2:35 / B110			
Helene Nguyen	1:45 / Kids Institute E-115			
Raman Nohria	1:20 / B-108			
Simileoluwa Odueyungbo	12:30 / A-119			
Brittany Oleson	12:30 / D107			
William Pan	10:00 / D107			
Neel Pancholi	9:35 / D101			
Jessica Parr	10:50 / Lecture Hall	11:15 / Lecture Hall		
Rachael Parrish	9:35 / Lecture Hall			
Jason Petsod	2:35 / A-133			
Joseph Phan	9:35 / A-133			
Susan Pinto	10:50 / Lecture Hall	11:15 / Lecture Hall		
Michael Plachta	12:55 / Academic Pit A-138			
John Powers	1:45 / B110			
David Qasem	9:10 / A-135			
Dobromir Rabovianski	12:30 / D101			
Manjari Ranganathan	11:15 / B110			
Aria Reynolds	9:10 / B-116			
Wit Riewrangboonya	10:00 / B-133			
Kaleigh Roberts	2:10/ D101			
Clement Robinson	1:20 / Academic Pit A-138			
Michelle Rogers	10:25 / A-117			
Isabella Rossi	2:35 / D110			
Whitney Rossmiller	2:10 / B-108			
Tulsi Roy	12:30 / Lecture Hall			
Tara Roys	1:45 / D107			
John Ruddy	11:15 / B-108	12:55 / B-108		
Angela Rudolph	10:50 / Academic Pit A-138			
Patricia Ruiz	1:20 / Lecture Hall			
Trisha Salkas	12:30 / B-133			
Brian Sawicki	2:10 / D107			
Karla Schmidt	10:00 / Kids Institute E-115			
Jessica Schmit	11:15 / A-117			
Samantha Schneider	12:55 / B-108			
Margot Seigle	2:10 / A-117			

Name	Time/Room	Time/Room	Time/Room	Time/Room
Bansi Shah	2:35 / D103			
Viral Shah	10:25 / B110			
Yuguan Bailey Shen	9:35 / A-117			
Rae Shih	1:45 / D101			
Esther Shyu	2:35 / A-117			
Max Silvestre	1:45 / Academic Pit A-138			
Valerie Simonis	11:15 / A-117			
Scott Smedinghoff	2:10 / A-119			
Charles Song	10:25 / B-116			
Stephanie Song	12:30 / Kids Institute E-115	12:55 / Kids Institute E-115		
Arth Srivastava	11:15 / A-133			
Peter Stynoski	11:15 / B-133			
Frank Sun	1:45 / A-119			
Yifan Sun	2:10 / Academic Pit A-138			
Yi-Meng Tan	2:10 / B-133	10:50 / B-133		
Terry Tao	12:30 / Kids Institute E-115	12:55 / Kids Institute E-115		
Harry Thompson	1:20 / A-135			
Dawn Tian	1:45 / Kids Institute E-115			
Tiffany Todd	1:45 / Academic Pit A-138			
Jennifer Townsend	9:35 / B-116			
Caitlin Tribout	1:45 / D110			
Christopher Trigg	9:35 / A-119	10:25 / A-119	12:30 / Aud. E102	12:55 / Aud. E102
Vyas Viswanathan	2:10 / Kids Institute E-115			
Xin (Cindy) Wang	10:00 / A-119	10:50 / A-119	12:30 / Aud. E102	12:55 / Aud. E102
Yingjia Wang	2:10 / A-135			
Anthony Waymire	2:35 / Academic Pit A-138			
Daniel Wheeler	1:45 / Lecture Hall			
Camilla White	11:15 / Aud. E102			
Anna Wilewska	9:35 / B-133			
Kinga Wilewska	10:00 / D101			
Anna Wu	2:35 / Lecture Hall			
Tingting Wu	1:45 / B-108			
Catherine Xiao	1:45 / D103			
Kwin Xie	9:10 / A-133			
Allen Ye	10:00 / B-108			
Junwei Ye	9:10 / D107			
Xi Ye	1:20 / A-119			
Ying Ye	10:50 / A-117			
Emilie Yeh	12:30 / B110			
MengFei Yin	2:35 / D107			
Binglei Yu	10:50 / B-116			
Rishi Zaveri	9:10 / B-108			
Joseph Zearing	2:35 / Academic Pit A-138			
Wang (Jennifer) Zhan	12:30 / A-117			
Letian Zhang	10:00 / A-117			
Richard Zhang	12:30 / A-117			
Di Zhuang	9:10 / A-133			



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