



**PRESENTATION DAY 2002**  
ILLINOIS MATHEMATICS AND SCIENCE ACADEMY





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 21<sup>st</sup> 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 the Student Inquiry and Research Program contact IMSA Principal Eric McLaren at (630) 907-5053.

Sincerely,

Stephanie Pace Marshall, Ph.D.  
President



ILLINOIS MATHEMATICS AND SCIENCE ACADEMY  
"A Pioneering Educational Community"

**FOURTEENTH ANNUAL IMSA PRESENTATION DAY**  
**APRIL 24, 2002**

*Abstracts can be found attached in alphabetical order under the first presenter.*

**A-110**

- 8:30 - 8:45 JAPANESE FABLES  
Sarah Walter, Jonathan Besancon
- 8:55 - 9:10 WILD CANID OBSERVATIONS  
Bethany Kondiles, Linda Pinto, John Thompson
- 9:45 - 10:00 THE ESTABLISHMENT AND SUCCESS OF CHINESE AND MEXICAN  
IMMIGRANT ENTREPRENEURS  
Alicia Chan, Clarisol Avila
- 10:10 - 10:25 THE SUB-CONSCIOUS MIND'S INVOLVEMENT IN INTERPERSONAL  
ATTRACTION  
Nathaniel O'Bear, Nicholas Reinhart, John C. Sippy, Ph.D.
- 10:35 - 10:50 LARGE SCALE VIRTUAL WEB SERVER ADMINISTRATION  
Kevin He, Laura Mengel
- 11:00 - 11:15 BRUCE GOFF ARCHITECTURE IN CHICAGO: THE HELEN UNSETH HOUSE  
Nia Dukov, Mark Sexton
- 11:25 - 11:40 THE EFFECTS OF ANPLAG AND ITS METABOLITE ON PLATELET  
AGGREGATION / ACTIVATION  
Jessica Dy-Johnson, Pranay Patel, Jawed Fareed, Ph.D.,  
Debra A. Hoppensteadt-Moorman, Ph.D.

**A-112**

- 8:30 - 8:45 SONG OF SPIRIT, SONG OF STONE: CO-AUTHORING A FANTASY NOVEL  
Katy Dieber, Molly Punke, Julie Hipp, Ph.D.
- 8:55 - 9:10 MISCONCEPTIONS THAT ULTIMATELY LEAD TO WAR: PRECURSORS  
TO THE BIAFRA NIGERIA WAR  
Ola Nwabara, Christian Nokkentved, Ph.D.
- 9:20 - 9:35 RATIFICATION OF THE INTERNATIONAL CRIMINAL COURT: POTENTIAL  
WATERSHED EVENT OR FALSE PROMISE?  
Danny Yagan, Christian Nokkentved, Ph.D.
- 9:45 - 10:00 SYSTEMATIC APPROACHES TO ENGINEERING DESIGNS  
Ola Nwabara, Dr. Wei Chen
- 10:10 - 10:25 CREATING GRAPHICS FOR THE REAL SCIENCE CD  
Leon Wang, Britta McKenna, Clay Sewell
- 10:35 - 10:50 AN ANALYSIS OF THE PRELIMINARY HEARINGS UNIT AND RAP PROGRAM IN  
THE COOK COUNTY STATE'S ATTORNEY'S OFFICE, NARCOTICS PROSECUTIONS  
BUREAU  
Grace Wang, Anna Demacopoulos
- 11:00 - 11:15 ARCHITECTURAL DESIGN WITH AUTOCAD AND FENGSHUI PHILOSOPHY  
Leon Wang, Andrew Wang
- 11:25 - 11:40 ASIAN FINANCIAL STRUCTURES AND IMPLICATIONS FOR CAPITAL  
MOVEMENT AND INTERNATIONAL TRADE  
Arthur Wojtowicz, Howard J. Polk



**A-113**

- 8:30 - 8:45 MARTIN LUTHER AND THE RENAISSANCE TRADITION  
Paul Malina, Robert Kiely, Ph.D.
- 8:55 - 9:10 CUBAN REVOLUTIONARIES: A CONTRAST OF ACTIONS AND WORDS  
Alexandra Surasky-Ysasi, Jean Kadel, Ph.D.
- 9:20 - 9:35 LEGENDS OF THE SPANISH SPEAKING WORLD  
Emilie Dahod, Anupama Garla, Socorro Cintron, Jose Palos
- 9:45 - 10:00 DRINK IT FOR SCIENCE: A STUDY OF DIETARY SUPPLEMENTS  
Jennifer Mo, Amy Winans, Richard Dods, Ph.D.
- 10:10 - 10:25 DEVELOPMENT OF A WHOLE BLOOD FLOW CYTOMETRY METHOD  
FOR FUNCTIONAL ASSESSMENT OF PNEUMOCOCCAL PHAGOCYTOSIS  
Emilie Dahod, Shravani Pasupneti, William J. Kabat
- 10:35 - 10:50 VISUAL IMPAIRMENT AND BLINDNESS IN SCHOOLS: ASSESSING  
ACCOMMODATIONS AND ASSISTIVE TECHNOLOGIES IN PUBLIC  
SCHOOL DISTRICTS  
Margalit Faden, Qing (Janet) Wang, Leah Gerlach
- 11:00 - 11:15 STOCKS, BROKERS, AND EXCHANGES, OH MY! : WHAT YOU NEED TO  
KNOW ABOUT INVESTING IN THE STOCK MARKET  
Kristoffer Inton, Qing (Mary) Miao, James Meyerhoff
- 11:25 - 11:40 EXPLORING INTERACTIONS OF THE GENE TAP  
Kachiu Lee, Dr. John Crispino, Erica D. Smith

**A-114**

- 8:30 - 8:45 STAR TREK'S EFFECT ON TODAY'S PHYSICISTS  
Meghan Bannon, Claiborne Skinner, Ph.D.
- 8:55 - 9:10 ILLINOIS: IT'S MORE THAN JUST A CORNFIELD  
Rebecca Cooper, Jennifer Mo, Robert Quimby, Claiborne Skinner, Ph.D.
- 9:20 - 9:35 DETECTION OF D578H MUTATION OF THE LH RECEPTOR IN LEYDIG  
CELL TUMORS  
Anna Hang, Andrew Shenker M.D, Ph.D., Jason Monroe, Guoquan Liu, Ph.D.
- 9:45 - 10:00 FUZZY APPROACH TO MULTI-VARIABLE OPTIMIZATION  
Grace Woo, Peng-Yung Woo
- 10:10 - 10:25 SHAPE EFFECTS ON MAGNETIZATION REVERSAL IN NANO-PARTICLES  
Stephanie Yeh, Dr. Marcos Grimsditch, Dr. Johan Meersschaut
- 10:35 - 10:50 LISTENING TO THE AURORA  
Catherine Breckenridge, Robert Brazzle, Ph.D.
- 11:00 - 11:15 PROPOSAL FOR NOVEL RADIO ASTRONOMY TELESCOPE DESIGN  
Aaron Doukas, Robert Quimby, Donald Schmit, Robert Brazzle, Ph.D.

**A-115**

- 8:30 - 8:45 MODULATION OF SUBJECT RESPONSE TO AMPHETAMINE BY  
PERSONALITY TYPES  
Brendan Todt, Dr. Tara White, Dr. Harriet Dewitt
- 8:55 - 9:10 STREAMLINING OUR LEGAL SYSTEM UTILIZING MODERN TECHNOLOGY  
Henry Andoh, Joseph Sloan, Ronald E. Lang, Anne Lengle
- 9:20 - 9:35 GLUTATHIONE LEVELS IN ANTIGEN PRESENTING CELLS POLARIZE  
CD4+ TH0 IMMUNE RESPONSES  
Eric Szczesniak, Carl Waltenbaugh, Ph.D.
- 9:45 - 10:00 IDEAS OF THE EAST: HOW GANDHI'S PHILOSOPHIES AFFECTED THE WEST  
Puni Chennamaneni, Kavita Ramakrishnan, Christian Nokkentved, Ph.D.,  
James Victory, Ph.D.
- 10:10 - 10:25 PRILOSEC STUDIES: IMPROVING PATIENT CARE  
Vaibhav Upadhyay, Dr Archana Desai



**A-115 (continued)**

10:35 - 10:50

GAUGING THE EFFECTIVENESS OF THE SCIENCE EXPLORERS "CREEPY CRAWLERS" CURRICULUM

Matthew Getz, Mengyao Liang, Britta McKenna

11:00 - 11:15

SCIENCE EXPLORERS AMUSEMENT PARK PHYSICS

Amit Behal, Britta McKenna

**A-116**

8:30 - 8:45

AZTEC AND MAYAN INFLUENCE ON CONTEMPORARY MEXICO

Patricia Fonseca, Socorro Cintron, Jose Palos

8:55 - 9:10

WESTERN POLITICAL THEORY AND THE IDEAL STATE

Philip Stanton, Robert Kiely, Ph.D.

9:20 - 9:35

A SELF-INQUIRY INTO THE PHILOSOPHICAL STUDY OF LIFE AND ITS MEANING

Jennifer Wong, Robert Kiely, Ph.D.

9:45 - 10:00

GENDER AND WITCHCRAFT

Weiwei Tan, Claiborne Skinner, Ph.D.

10:10 - 10:25

THE NEAREST-NEIGHBOR REPRESENTATION OF BOOLEAN FUNCTIONS

Zhihao Liu, Gyorgy Turan

10:35 - 10:50

ARTIFICIAL INTELLIGENCE, EVOLUTION &amp; PHILOSOPHY

Justin Doran, Jennifer Huang, Elaine Khoong, Michael Osoosky

11:00 - 11:15

THE ROLE OF SANCHO PANZA

Nathan Walsh, Lisa Yung, Laura Carrillo-Barth, Beatriz M. Jacobo

11:25 - 11:40

DEVELOPMENTAL OUTCOMES OF PRETERM INFANTS WEIGHING LESS THAN 1000 GRAMS AT BIRTH, DURING THE PERIOD OF 1997-1998

Joanne Mathews, Dr. Monika Bhola

**A-117**

8:30 - 8:45

BASIC PROGRAMMING TECHNIQUES USING XML

Brian Choi, Matthew Katz, Manu Raam, Teodoro Alonso

8:55 - 9:10

"POLITICAL PARTY" AND "EXPRESS YOURSELF": YOUTH EMPOWERMENT AT COMMUNITY YOUTH CREATIVE LEARNING EXPERIENCE

Bernadette Contreras, Annie Dlugokecki, Rebecca Liu, Connie Van Brunt

9:20 - 9:35

WIZ KIDS ROCKIN' POWER

Jillian Jacobson, Jubilee Tan, Connie Van Brunt

9:45 - 10:00

"BIBLE VS. KORAN: THE WOMEN OF FAITH"

Rebecca Liu, Robert Kiely, Ph.D.

10:10 - 10:25

"ITS RHYMIN TIME" CYCLE POETRY CLASS

Chrystal Colbert, Jieun Kwak, Connie Van Brunt

10:35 - 10:50

TRADITION AND PHILOSOPHY IN ANCIENT CHINA

Samantha Chan, Robert Kiely, Ph.D.

11:00 - 11:15

PRESENT HUMAN CONDITION: HUMAN AND ANIMAL BEHAVIOR, CONTEMPORARY THEORIES AND STUDIES IN BIOLOGY, PSYCHOLOGY, AND NEUROLOGY WITHIN RECURRING PHILOSOPHICAL AND MORAL TRENDS

Kristina Govorovska, Robert Kiely, Ph.D., Clay Sewell, James Victory, Ph.D.

**A-119**

8:30 - 8:45

ANALYSIS OF MULTIGRID METHODS

David Xia, Dr. Paul Fischer

8:55 - 9:10

CHANGES IN GLUTAMATE TRANSPORTER EXPRESSION FOLLOWING LIGHT DAMAGE TO MOUSE RETINA

Neelima Vidula, Dr. Vijay Sarthy, V. Joseph Dudley

9:20 - 9:35

DISCRIMINATION IN SOUTH KOREAN POLITICS AND ECONOMY

Minji Ro, Dr. Kiseong Park



**A-119 (continued)**

- 9:45 - 10:00 SOLAR DESALINATION: HUMIDIFICATION-DEHUMIDIFICATION CYCLE  
Anna Peralta, Dr. Said Al-Hallaj
- 10:10 - 10:25 MUSIC COMPOSITION: WHAT GOES INTO THE MAKING OF A SONG?  
Minji Ro, Christopher F. Kuhl, Ph.D.
- 10:35 - 10:50 WHAT IT TAKES TO CO-WRITE A NOVEL  
Erica Sim, Amber Thompson, Christopher F. Kuhl, Ph.D.
- 11:00 - 11:15 ENKEPHALOS: BUILDING A COMPUTER ROLE-PLAYING GAME  
Justin Blanchard, Eric Bowden, Mallory Chua, Sharon David, Steven Lucy, Erica Sim, Erik Volkman, Jered Wierzbicki, Gene Skonicki
- 11:25 - 11:40 CLONING GENOMIC BREAKPOINTS OF *AML1* IN LEUKEMIA PATIENTS WITH t(3;21)  
Jennifer Li, Janet Rowley, M.D., Yanming Zhang, M.D.

**A-121**

- 8:30 - 8:45 USING PERL TO STUDY COSMIC RAYS IN THE HIGH SCHOOL CLASSROOM  
Samantha Chan, Thomas Jordan
- 8:55 - 9:10 BEHAVIORAL INVESTIGATIONS OF CAPTIVE RETICULATED GIRAFFES (*GIRAFFA CAMELOPARDALIS RETICULATA*) CONCERNING THE INTRODUCTION OF AN INFANT MALE  
David Hamman, Jennifer Stynoski, Sue Margulis, Ph.D.
- 9:20 - 9:35 MUTATED MYOCILIN'S (PROLINE 370 TO LEUCINE) EFFECTS ON MORPHOLOGY AND LOCALIZATION AS COMPARED TO NORMAL MYOCILIN  
Michael Hanes, Kelly Hunter, Ph.D., Beatrice Yue, Ph.D.
- 9:45 - 10:00 THE EFFECT OF PRACTICE ON ELBOW FLEXIONS  
Sarah Baker, Natalie Look, Dr. Daniel Corcos, Janey Wilding
- 10:10 - 10:25 SUPERCOOLING, OVERCLOCKING, AND PERFORMANCE BENCHMARKING THE INTEL® PENTIUM® 4 PROCESSOR  
Yousaf Malhance, Christopher M. Colburn
- 10:35 - 10:50 A STUDY OF THE EFFECTS OF PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR:  $\gamma$ (PPAR $\gamma$ ) AND TROGLITAZONE ON LIVER CELLS  
Vaishalee Yeldandi, Dr. Janardan K. Reddy, Dr. Songtao Yu

**A-147**

- 8:30 - 8:55 AN ANALYSIS OF CONSUMER AND COMMERCIAL CONFIDENCE IN THE WEB DEVELOPMENT INDUSTRY FOLLOWING THE "TECH WRECK" OF 2000-2001  
James Holmes, Sravisht Iyer, Alan Xiang, Michael DeHaven
- 8:55 - 9:10 PSYCHOLOGICAL INTERPRETATION OF HOW AND WHY TECHNICAL ANALYSIS INDICATORS PREDICT COMMODITY PRICE MOVEMENTS  
Mark Hoadley, David Jou, Michael DeHaven
- 9:20 - 9:35 THE HISTORY OF AUTOMOBILE ADVERTISING  
Alice Chang, Michael DeHaven
- 9:45 - 10:00 THE VOLATILITY OF THE TECHNOLOGY SECTOR THROUGH ANALYSIS OF THE INTERNET SUBSECTOR  
Yong Chen, Zheyang (Jenny) Chen, Andrew Friedl, Ying Shi, Michael DeHaven
- 10:10 - 10:25 HOW OIL PRICES AFFECT CAR DESIGNS IN THE UNITED STATES  
Dhaval Garg, Michael DeHaven
- 10:35 - 10:50 THE IMPACT OF MACROECONOMIC DATA ON EQUITY PRICE FLUCTUATION: COMPARATIVE EVALUATIONS WITHIN AND AMONG INDICES AND EQUITY GROUPS  
Niket Nathani, Michael DeHaven
- 11:00 - 11:15 PALEONTOLOGICAL DISCOVERIES THROUGH FOSSIL EXTRACTION, PRESERVATION, AND FAMILIARITY EXERCISES BASED ON DIG EXPERIENCES  
Vanessa Vardon, Kenneth J. Lacovara, Ph.D.
- 11:25 - 11:40 TECHNICAL ANALYSIS OF THE FINANCIAL MARKETS  
Heidi Grothaus, Michael DeHaven



**A-148**

- 8:30 - 8:45 THE FABRICATION OF BIODEGRADABLE NANOSPHERES  
Tiffany White, Cato Laurencin, Ph.D.
- 8:55 - 9:10 AFFERENT AND EFFERENT CONNECTIONS OF THE CAUDAL MEDIAL PREFRONTAL CORTEX IN RABBIT: A PROPOSED CIRCUIT MEDIATING EARLY ACQUISITION OF THE TRACE EYEBLINK CONDITIONED REFLEX  
Darrel J. Saldanha, Aldis Weible
- 9:20 - 9:35 FALL OUT OF THE GAP: AN ANALYSIS OF THE EDUCATIONAL OPPORTUNITY GAPS BETWEEN AFRICAN-AMERICAN, WHITE, AND ASIAN STUDENTS PRIOR TO THEIR IMSA CAREERS  
Mary Adekoya, Tiffany White, Karen Meyer, Steven Rogg, Ph.D.
- 9:45 - 10:00 PROLIFERATION AND DIFFERENTIATION OF SCHWANN CELLS STIMULATED BY AXOLEMMA-ENRICHED FRACTIONS FROM LARGE AND SMALL AXONS  
Sravisht Iyer, George H. DeVries, Ph.D.
- 10:10 - 10:25 MAXIMIZING THE SIGNAL TO NOISE RATIO OF NUCLEAR MAGNETIC RESONANCE (NMR) RADIO FREQUENCY (RF) COILS IN SAMPLES OF MICROSCOPIC SIZE  
Mark Hoadley, Alan Feinerman, Ph.D.
- 10:35 - 10:50 THE ROLE OF HOSPICE AND PALLIATIVE CARE CENTERS IN THE TREATMENT OF TERMINALLY ILL PATIENTS AND IN THE CLINICAL STUDY OF DNR  
Pranjal Patel, Michael Saphavee, Dr. Martha Twaddle
- 11:00 - 11:15 COMPARING THE NEONATAL NURSE PRACTITIONER (NNP) ROLE TO THE RESIDENT ROLE IN THE NEONATAL INTENSIVE CARE UNIT (NICU)  
Rabeah Sabri, Jonathon K. Muraskas, M.D.

**A-149**

- 8:30 - 8:45 KEY FACTORS THAT CONTRIBUTE TO THE PREVALENCE OF PSEUDOSCIENTIFIC INTELLECTUAL SYSTEMS AND THE INFLUENCE OF ILLEGITIMATE SCIENTIFIC CLAIMS ON AMERICAN SOCIETY  
Di Shui, Leon Lederman, Ph.D., Judith Scheppler, Ph.D., Joanne Wallmuth
- 8:55 - 9:10 THE ORIGIN AND TRADE ROUTES OF MAJOR SNUFF BOTTLE MINERALS IMPORTED INTO CHINA DURING QING DYNASTY (1644-1912)  
Ying Shi, Bennet Bronson
- 9:20 - 9:35 CAPSAICIN AS AN ANTI-BACTERIAL AGENT  
James Holmes, Judith Scheppler, Ph.D.
- 9:45 - 10:00 THE EFFECT OF NAZI POLITICS ON THE GERMAN MEDICAL PROFESSION DURING WORLD WAR II  
David Jou, Leon Lederman, Ph.D., Judith Scheppler, Ph.D., Joanne Wallmuth
- 10:10 - 10:25 KINETICS OF CYTOKINE EXPRESSION AFTER COMPLETE FACIAL MOTONEURON TRANSECTION  
James Holmes, Kathryn Jones, Ph.D., Craig Serpe, Cynthia DeBoy
- 10:35 - 10:50 PHYSICOCHEMICAL ANALYSIS OF CHINESE LIGHT PENETRATION MIRRORS  
Zheyang Chen, Philip Nash, Ph.D.
- 11:00 - 11:15 FORENSICS FOR BEGINNERS: IDENTIFYING DNA USING THE PCR METHOD  
Brytne Winfrey, Judith Scheppler, Ph.D., Susan Styer, Ph.D.
- 11:25 - 11:40 DROPLET CAPILLARY WAVES AND OSCILLATIONS  
Casey Liang, Dr. Constantine Megaridis



**A-150**

- 8:30 - 8:45 EXPLORATION AND EXPANSION OF THE SAM DATA HANDLING SYSTEM AT FERMIONATIONAL ACCELERATOR LABORATORY  
Dmitry Goldin, Gabriele Garzoglio
- 8:55 - 9:10 THE IMPLICATIONS OF GENETICALLY MODIFIED ORGANISMS IN OUR SOCIETY AND ENVIRONMENT  
Yao Bian, Joyce Hwu, Heidi Lu, Qing (Mary) Miao, Qing (Janet) Wang, Donald Dosch, Ph.D., Judith Scheppler, Ph.D., Susan Styer, Ph.D.
- 9:20 - 9:35 ACOUSTIC QUALIFICATION OF AN ANECHOIC CHAMBER  
Tracy Llenos, Ganesh Raman, Ph.D.
- 9:45 - 10:00 HOW DO WE TALK? A STUDY ON DIFFERENT DIALECTS AND THEIR AFFECTS IN ILLINOIS  
Julie Lauffenburger, Urvi Purohit, Dennis Czerny, Ph.D.
- 10:10 - 10:25 MORPHOLOGICAL RESPONSES EXHIBITED IN *HYDRA* DUE TO EXTRACELLULAR ATP EXPOSURE  
Heather FitzHenry, Vicki Burgholzer
- 10:35 - 10:50 A LOOK INTO BRAIN DEVELOPMENT AND ITS IMPLICATIONS  
Sandra Garcia, Keisha Williams, John Eggebrecht, Ph.D.
- 11:00 - 11:15 MECHANISM OF DUCTILE REGIME MACHINING OF SILICON  
Michelle Meneses, Dr. Yury Gogotsi, Thomas Juliano

**A-151**

- 9:20 - 9:35 THE EFFECTS OF RNA INTERFERENCE ON THE DIFFERENTIATION, TOWARD MYELOID HEMATOPOIESIS, OF MOUSE EMBRYONIC STEM CELLS  
Jean Park, Gang M Zou, M.D., Ph.D.
- 9:45 - 10:00 INVESTIGATIONS INTO THE PROBLEM OF REGIOCHEMISTRY DURING PHARMACEUTICAL DESIGN OF HIV-INHIBITORS RELATED TO CONOCURVONE  
Keisha Williams, Kenneth W. Stagliano, Ph.D.

**A-152 / A-154**

- 8:30 - 8:45 VIRTUAL ONLINE CHEMISTRY LAB  
Yong Chen, Caleb Harper, Alex Lyle, Mark Quinn, Matthew Traverso, David Gossman
- 8:55 - 9:10 APPLICATIONS OF JAVASCRIPT IN SCIENCE EDUCATION  
Yong Chen, Caleb Harper, Alex Lyle, Mark Quinn, Matthew Traverso, David Gossman
- 9:20 - 9:35 CREATION OF A COMPREHENSIVE MAP OF THE GOSSMAN FARM IN ZWINGLE, IOWA  
Kyle Buchman, Jessica D'Souza, Erin Leindecker, Chelsea Lynn, Annie Park, Jennifer Poulsen, Molly Punke, Soumya Venkiteswaran, David Gossman
- 9:45 - 10:00 ANALYSIS OF ARCHAEOLOGICAL ARTIFACTS FROM THE GOSSMAN FARM IN ZWINGLE, IOWA  
Emily Rice, Cecilia Westbrook, David Gossman
- 10:10 - 10:25 HISTORY IGNITED: REFURBISHMENT AND ANALYSIS OF A 19TH CENTURY LIME KILN IN MAQUOKETA, IOWA  
Sarah Howe, Joseph Langan, Julie Lauffenburger, David Gossman
- 10:35 - 10:50 INVENTORY AND ANALYSIS OF HUMAN REMAINS FROM THURSTON GRAVEYARD  
Cecilia Westbrook, Dr. Anne Grauer
- 11:00 - 11:15 A BOTANICAL SURVEY OF THE GOSSMAN FARM IN ZWINGLE, IOWA  
Rebecca Arundale, Meghan Bannon, Heather FitzHenry, Anna Gembis, Kathleen Kelly, Andrew Langan, Amanda Murphy, Sydney Null, Kevin Schlee, Tori Walters, Jonathan Warnock, David Gossman, Elizabeth Neese, Ph.D.



**A-155**

- 8:30 - 8:45 EXAMINATION OF ALSIN DISTRIBUTION IN ORGANS  
Abdullah Abdussalam, Jalila Bouchareb, Teepu Siddique, M.D.
- 8:55 - 9:10 RECURRENCE QUANTIFICATION ANALYSIS (RQA) OF PROTEIN SECONDARY  
STRUCTURE  
Yinin Hu, Charles Webber, Jr, Ph.D.
- 9:20 - 9:35 EXAMINATION OF A PURPORTED LINK BETWEEN ABORTION AND LATER  
DEVELOPMENT OF BREAST CANCER  
Catherine Kim, Senator Chris Lauzen
- 9:45 - 10:00 INVESTIGATING HYPERCOAGULABLE STATE AND INFLAMMATORY  
RESPONSE OF VASCULAR ENDOTHELIA FOLLOWING CORONARY VESSEL  
REVASCLARIZATION WITH POST-PTCA BRACHYTHERAPY  
Vinaya Puppala, Angel Qin, Jeanine M. Walenga, Ph.D., Walter P. Jeske, Ph.D.,  
M. Margaret Prechel, Ph.D., Amanda F. Drenth
- 10:10 - 10:25 PROTEASOME PRODUCTION IN HUMAN MUSCLE DURING NUTRITIONAL  
INHIBITION OF MYOFIBILLAR PROTEIN DEGRADATION  
Sean Pitroda, Irwin Brodsky, M.D., Paul Goldspink, Ph.D.
- 10:35 - 10:50 PROACTIVELY SEARCHING THE WEB: CAN WE AGREE ON WHAT'S  
RELEVANT?  
Harrison Stein, Michael Ruberry, New Trier High School, Jerome Budzik
- 11:00 - 11:15 A STUDY OF THE DIPLOMATIC INFLUENCE OF URUGUAY ON INTERNATIONAL  
ISSUES DURING THE 20TH CENTURY  
Ana Tellez, Dr. Graziella Reyes
- 11:25 - 11:40 IDENTIFICATION AND CHARACTERIZATION OF MULTICOPY SUPPRESSORS OF  
VPR-INDUCED CELL DEATH  
Pyong Wha (Hannah) Koh, Dr. Yuqi Zhao

**B-108**

- 8:30 - 8:45 COMPUTER EXPLORATIONS OF FRACTALS  
Daniel Gulotta, Steven Condie, Ph.D.
- 8:55 - 9:10 GENOMIC ANALYSIS OF NMDA-RECEPTORS IN ATTENTION-DEFICIT  
HYPERACTIVITY DISORDER  
Adebosola Oladeinde, Donna Kersey, Dr. Roger A. Kroes, Nigel Otto, Jennifer Perez
- 9:20 - 9:35 HEADACHE: WHY, WHAT, AND HOW TO MANAGE IT  
Amy Orsborn, Dr. Fredrick G. Freitag
- 9:45 - 10:00 VMODEL QUALITATIVE CONCEPT MODELING FOR MIDDLE-SCHOOL  
STUDENTS  
Christopher Fanning, Karen Carney, Leo Ureel
- 10:10 - 10:25 COOPERATION BETWEEN ANGIOGENESIS INHIBITOR TSP-1 AND GENTOXIC  
AGENT DOXRUBICIN  
Laura Foote, Olga V. Volpert, Ph.D.
- 10:35 - 10:50 EYEBLINK CONDITIONING IN THE MOUSE: EFFECTS OF THE TRACE  
INTERVAL ON LEARNING RATE  
Rui Guan, Craig Weiss, Ph.D.
- 11:00 - 11:15 STUDY OF THE TRANSFORMATION OF NON-HODGKIN'S LYMPHOMA  
Lucy Guo, Dr. Lionel J. Coignet
- 11:25 - 11:40 ANALYSIS OF CARBON NANOTUBE SYNTHESIS USING PLASMA ARC  
DISCHARGES  
James Koo, Shaun Doherty, R.P.H. Chang



**B112**

- 8:30 - 8:45 THE EFFECTS OF PHYTOREMEDIATION ON AN INDUSTRIAL SITE  
Holly Bybee, Zheyang (Jenny) Chen, Emma Goodman, Anna Hang, Lynn Peng, Diana Tung, Tori Walters, Yun Wu, David Workman, Ph.D.
- 8:55 - 9:10 DYNAMICS OF THE MORRIS GREAT BLUE HERON ROOKERY  
Jonathan Warnock, David Workman, Ph.D.
- 9:20 - 9:35 PHYSICS PROBLEM SOLVING TECHNIQUES  
Daniel Gulotta, Laura Nickerson, David Workman, Ph.D.
- 9:45 - 10:00 AN ANALYSIS ON THE REACTION OF CYTOCHROME C PEROXIDASE WITH VARIOUS REACTANTS  
Nicholas Kim, Dr. James E. Erman
- 10:10 - 10:25 ION PROPULSION DESIGN AND EFFICIENCY  
Vladimir Krastev, Christopher McLaughlin, Robert Quimby, Christopher Szucko, Michael Lindenmeyer, David Workman, Ph.D.
- 10:35 - 10:50 BACKSCATTERED REFLECTOMETRY USING POLARIZATION MAINTAINING OPTICAL FIBERS  
Nicholas Moryl, Dr. William A. Ellingson
- 11:00 - 11:15 CHARACTERIZATION OF CELL ADHESION IN *DICTYOSTELIUM DISCOIDEUM*  
Lina Nayak, Rex L. Chisholm, Ph.D., Petra Fey

**B-133**

- 8:30 - 8:45 EVEN THE BEAUTIFUL ONES DIE: THE CORRELATION BETWEEN LETHAL WHITE FOAL SYNDROME AND HIRSCHSPRUNG'S DISEASE  
Puni Chennamaneni, Emily McCord, Urvi Purohit, Donald Dosch, Ph.D., Susan Styer, Ph.D.
- 8:55 - 9:10 NATURAL HABITAT: ARTIFICIAL POND  
Sharda Thakral, Donald Dosch, Ph.D.
- 9:20 - 9:35 THE EFFECTIVENESS OF HANDS-ON LEARNING FOR MIDDLE SCHOOL STUDENTS  
Chandana Jasti, Samantha Narayanan, Donald Dosch, Ph.D.
- 9:45 - 10:00 MUTAGENESIS AND E. COLI RESISTANCE TO STREPTOMYCIN  
Jo Nelson, Donald Dosch, Ph.D.
- 10:10 - 10:25 A QUANTITATIVE MODEL OF ELECTROPHORETIC MOBILITY OF OLIGOMERIC B-DNA  
Kevin Yang, Dr. Udayan Mohanty
- 10:35 - 10:50 *ECHINACEA PURPUREA* TEA EXTRACT EFFECTS ON U937 AND CEM CELL LINES  
Yao Bian, Min Jung (Jenny) Jun, Jieun Kwak, Jean Park, Donald Dosch, Ph.D., Judith Scheppler, Ph.D.
- 11:00 - 11:15 ROBOTICS: THE FIELD OF THE FUTURE  
Jason Chang, Caleb Harper, James Sanders, Daniel Sun, Donald Dosch, Ph.D., Michael Lindenmeyer
- 11:25 - 11:40 A HOUSE FOR MY PARENTS  
Vivian Lau, Grace Whang, Joy Meek

**B-148**

- 8:30 - 8:45 A KINETICS EXPERIMENT INVOLVING THE REACTION OF METHANOL WITH TRIFLUOROACETIC ACID  
Emilie Dahod, Yuan Gong, Elizabeth Lampe, Dr. Joseph Ray, Mary VanVerst
- 8:55 - 9:10 HARDNESS OF EXTRUDED AND WELDED 6061 ALUMINUM ALLOY AFTER PROCESSING AND HEAT TREATMENT  
Sang Oh, Dr. Joseph Benedyk
- 9:20 - 9:35 IDENTIFICATION OF UNKNOWN ORGANIC COMPOUNDS THROUGH NUCLEAR MAGNETIC RESONANCE AND INFRARED SPECTROSCOPY  
Matthew Traverso, Kevin Yang, Dr. Joseph Ray, Mary VanVerst
- 9:45 - 10:00 MOLECULAR CLONING OF NOVEL GENES FROM HEMATOPOIETIC STEM CELLS  
Yuan Gong, San Ming Wang M.D., Guolin Zhou, M.D.



**B-148 (continued)**

- 10:10 - 10:25 VERBAL MEMORY PERFORMANCE: ARE FEMALES REALLY SUPERIOR TO MALES?  
Elizabeth Lampe, Christopher Randolph, Ph.D., Catherine Zaweski
- 10:35 - 10:50 THE FIRST FILIPINO: THE LIFE AND LEGACY OF DR. JOSE RIZAL  
Bernadette Contreras, Socorro Cintron, Jose Palos
- 11:00 - 11:15 WOLLSTONECRAFT: PAST AND PRESENT PERSPECTIVES  
Elizabeth Lampe, Julie Hipp, Ph.D.

**E-115**

- 8:30 - 8:45 REAL SCIENCE  
Kevin Yang, Rosalind Yang, Britta McKenna
- 8:55 - 9:10 KIDS INSTITUTE TAKES SCIENCE EXPLORERS TO BILINGUAL CLASSROOMS  
Sandra Garcia, Socorro Cintron, Britta McKenna
- 9:20 - 9:35 ONLINE TECHNOLOGY IN SCIENCE EDUCATION: STREAMING  
Eric Bowden, Britta McKenna
- 9:45 - 10:00 CREATING AN EFFECTIVE SCIENCE CURRICULUM FOR THIRD AND FOURTH GRADE STUDENTS  
Stephanie Lewis, Britta McKenna
- 10:10 - 10:25 WORKING TO DEVELOP AN IMSA MOBILE EDUCATION UNIT  
Linda Pinto, Britta McKenna
- 10:35 - 10:50 "IMSA ON WHEELS"  
Sarah Walter, Britta McKenna
- 11:00 - 11:15 SCIENCE EXPLORERS: SPACE EXPLORATION  
Jeanne Lee, Britta McKenna
- 11:25 - 11:40 EXPANDING IMSA KIDS INSTITUTE ENRICHMENT OPPORTUNITIES  
Paul Malina, Christopher Young, Britta McKenna

**E-117**

- 9:20 - 9:35 REALIZING A SCULPTURE  
Rosalind Yang, Clay Sewell

**Lecture Hall**

- 9:20 - 10:25 "FLIPPOVISION: THE LEGACY" STUDENT PRODUCED STOP-ACTION ANIMATION  
Dan Adamo, Amit Behal, Reginald Champagne, Dmitry Goldin, Matthew Getz, Thomas Han, Jeanne Lee, Mengyao Liang, David Lu, Zouyan (Jared) Lu, Christopher Young, David Xia, Brian Thornburg

**Garage**

- 9:45 - 10:00 TURBINE ENGINE THEORY- FROM CONCEPTION TO REALITY  
Joe Abruscato, Shaun Currier, Timothy Johnson, Timothy Roderick, Michael Lindenmeyer, David Workman, Ph.D.

**Auditorium**

- 10:10 - 10:25 FROM THE SAVOY TO THE RAVE: A COMPARISON OF 2 DIFFERENT ERAS OF DANCE CLUB MUSIC  
Martin McCrory, Jennifer Poulsen, David Deitemyer



## **EXAMINATION OF ALSIN DISTRIBUTION IN ORGANS**

### Presenters

Abdullah Abdussalam, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
aze23@imsa.edu

Jalila Bouchareb, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jalilab@imsa.edu

### Mentor

Teepu Siddique, M.D., Northwestern University Medical School, Cell and Molecular Biology, 303 East Chicago Avenue,  
Chicago, IL 60611-3008; t-siddique@northwestern.edu; 312-503-4737; 312-908-0865

Amyotrophic Lateral Sclerosis, more commonly known as Lou Gehrig's Disease, is a disorder causing progressive loss of control of voluntary muscles due to destruction of nerve cells in the brain and spinal cord. Alsin is a protein; its basic distinction is that it has three guanine-nucleotide exchange factor domains. The first thing we did was extract DNA from the blood. Through a process called PCR, otherwise known as Polymerase Chain Reaction, we produced relatively large quantities of replicated DNA from the minimal samples we had extracted. We then did experiments on that DNA in attempt to detect possible mutations in mitochondrial DNA, which is maternal. Huge pieces of DNA can be easily replicated using BACS. DNA sequencing reactions are just like the PCR reactions for replicating DNA. The reaction mix includes the template DNA, free nucleotides, an enzyme (usually Taq polymerase) and a primer. Although two individuals of the same species have almost identical genomes, they will always differ at a few nucleotides. The less related the individuals, the more divergent their DNA sequences are and the more likely you are to find a restriction fragment length polymorphism.

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## **TURBINE ENGINE THEORY- FROM CONCEPTION TO REALITY**

### Presenters

Joe Abruscato, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mantis@imsa.edu

Shaun Currier, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; scurrier@imsa.edu

Timothy Johnson, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;

tjohnson@imsa.edu

Timothy Roderick, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;

ymmit@imsa.edu

### Advisors

David Workman, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;

workman@imsa.edu; 630-907-5915

Michael Lindenmeyer, Grainger Workshop, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,

Aurora, IL 60506; tfilm@imsa.edu; 630-907-5959

Ever since man has taken to the air using jet engines, the race has been on to get the engines working faster, more reliably, quieter, and more efficiently. The trick to this is to successfully balance the key characteristics of an engine. To aid us in finding out which characteristics of the engine were key in its functioning, we set out to build a turbine engine from a basic automobile turbocharger. This provided the essential compression/power transfer stages that are indispensable to a turbine engine. In addition to this, a combustion chamber was built, flame tubes were designed, and fuel injectors were thought of. Perhaps the most important aspect of the combustion chamber is the flame tube. We came up with different designs for flame tubes that theoretically accomplished different effects and set about to find one that would work for us. One design involved the use of primary air/fuel mixing holes followed by secondary air cooling holes. We also came up with ideas for fuel injectors. One design that was thought up involved an orifice from a propane torch and copper tubing regulated by a regulator. Overall, the project teaches the workings of a real turbine engine, the features of a turbine engine, and a connection between concepts in the mind and their projections into reality. The design is being brought together into a working turbine engine to be displayed on presentation day.

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## "FLIPPOVISION: THE LEGACY" STUDENT PRODUCED STOP-ACTION ANIMATION

### Presenters

Dan Adamo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; daa84@imsa.edu  
Amit Behal, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amitb@imsa.edu  
Reginald Champagne, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
rchamp@imsa.edu

Matthew Getz, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; getz@imsa.edu  
Dmitry Goldin, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dgtal@imsa.edu  
Thomas C. Han, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
tomhan@imsa.edu

Jeanne Lee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jeanne@imsa.edu  
Mengyao Liang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
paladin@imsa.edu

David Lu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dlu@imsa.edu  
Zouyan (Jared) Lu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
zouyan@imsa.edu

David Xia, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dxia@imsa.edu  
Christopher Young, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
cyoung@imsa.edu

### Advisor

Brian Thornburg, IITL/TVPL, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
briant@imsa.edu; 630-907-5978

The art of stop-action animation has been a powerful form of expression in the film industry for the past century ever since it was popularized in the early 1900's. Even today when computer generated animation dominate the special effects industry, stop-action animation is still a form of art that reminds us of the simplistic beauty of a obsolete craft. This inquiry explores the process behind producing the special effects seen in popular movies such as *Chicken Run* (2000) or *Tim Burton's The Nightmare Before Christmas* (1993) in order to create SAA films. The goal for this inquiry was to streamline the process of script writing, set design, animation, sound editing, and digital manipulation that was touched upon in the last two years of Flippovision's existence. Specifically, we will discuss what we learned in the process of creating our movies such as using props to fake the appearance of motion, digitally re-mapping images to remove errors in filming, and the art of changing action speeds. From arranging storyboards, script writing, and the details of our set design, we will overview modern SAA techniques and how they influenced our films. Our Inquiry presentation will include SAA examples as well as a discussion of various techniques employed to improve the quality of SAA films.

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## FALL OUT OF THE GAP: AN ANALYSIS OF THE EDUCATIONAL OPPORTUNITY GAPS BETWEEN AFRICAN-AMERICAN, WHITE, AND ASIAN STUDENTS PRIOR TO THEIR IMSA CAREERS

### Presenters

Mary Adekoya, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
madekoya@imsa.edu

Tiffany White, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bugeyes@imsa.edu

### Advisors

Steven Rogg, Ph.D., Philosophy, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
rogg@imsa.edu; 630-907-5069

Karen Meyer, Research and Design, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; klmeyer@imsa.edu; 630-907-5069

*Evidence points to the fact that inequalities exist in education. We were interested in this particular inquiry after noticing that the average White or Asian incoming sophomore began in a higher math class than the average African-American incoming sophomore. This observation led to the following question: In what ways has the achievement gap between African-American, White, and Asian students been affected by the opportunity gap of these students before enrolling at IMSA? Illinois State Board of Education (ISBE) report card data was utilized to gauge the opportunities at home schools such as: mathematics courses offered, per capita student spending, teacher experience, percentage of student body matriculation to college, etc. From our analysis of ISBE report card data we expected to find a trend in the relationship between the opportunity gap and the achievement gap. This information could help IMSA students, IMSA programs, and the state of Illinois to better understand the causes of the achievement gap in order to strengthen education in Illinois.*



## **STREAMLINING OUR LEGAL SYSTEM UTILIZING MODERN TECHNOLOGY**

### Presenters

Henry M. Andoh, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
hmandohl@imsa.edu

Joseph Sloan, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jascool@imsa.edu

### Mentors

Ronald E. Lang, Attorney at Law, Call-my-Lawyer.com, 16 South Locust, Aurora, IL 60506; 630-859-3230

Anne Lengle, 16 South Locust, Aurora, IL 60506; 815-498-4361; amLengle@aol.com

There are many areas of our legal system that are very inefficient. It is paramount that these ineffective areas be addressed. It is not always only money at stake, but often the lives of human beings are in the balance. Each of the counties in Illinois has different clerk and recorder of deeds; because of this all the counties have different, organizational methods for legal documents. Multiple platforms and piles of paperwork have hindered the legal system. Technology has made great leaps over the past couple decades; however, the legal system has failed to utilize the most recent technology. Our specific area of work was with divorce and its components; Order of Protection and Divorce Financial Statement. Both the front and back end of the dynamic databases and platforms will be discussed. Front end: Form Flow, FrontPage, and Microsoft Excel. Back end: Microsoft access, Visual Basic Script and SQL server. Security issues will also be addressed; password finger identification, digital signatures, and encryption. Conceptions for application of current technology (hand held wireless devices, digital cameras, etc. will also be discussed and as well as future for the call-my-lawyer website.

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## **A BOTANICAL SURVEY OF THE GOSSMAN FARM IN ZWINGLE, IOWA**

### Presenters

Rebecca Arundale, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
arundale@imsa.edu

Meghan Bannon, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
mb33doc@imsa.edu

Heather FitzHenry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
mew3@imsa.edu

Anna Gembis, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; agem14@imsa.edu

Kathleen Kelly, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; heoscar@imsa.edu

Andrew Langan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; langan@imsa.edu

Amanda Murphy, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
smurph@imsa.edu

Sydney Null, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; squit@imsa.edu

Kevin Schlee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; schlee@imsa.edu

Tori Walters, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; tjw@imsa.edu

Jonathan Warnock, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; onw@imsa.edu

### Mentors

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; dgossman@gcisolutions.com;  
847-683-4188

Elizabeth Neese, Ph.D., University of California at Berkeley, 2180 La Mirada Drive, Richmond, CA 94803; 501-758-7918;  
lizneese@msn.com

A botanical survey is the process of collecting evidence as to the species composition of the flora of a specific area. This survey focuses on the plants at the Gossman farm in Maquoketa, Iowa, and uses mounted plant specimens and digital pictures. This survey currently focuses on the plants at the Gossman farm in Maquoketa, Iowa. The area is covered in cultivated fields, prairie, limestone bluffs, and wooded areas. Plant specimens are collected, pressed, mounted, identified, and then placed in an herbarium. This documents the plant-life in the area. As the identification process continues the diversity of plant life is evident. Soil analysis has begun throughout the farm to chemically identify different floral communities. This includes taking the pH level and the nitrogen, phosphorous, and potassium content of the soils. As survey progresses, more species are cataloged and the overall ecological picture at this site becomes clearer.



## **THE EFFECT OF PRACTICE ON ELBOW FLEXIONS**

### Presenters

Sarah Baker, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; zaharia@imsa.edu  
Natalie Look, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; abnjl@imsa.edu

### Mentors

Dr. Daniel Corcos, University of Illinois at Chicago, Kinesiology, 1919 W. Taylor St., Chicago, IL 60607; dcorcos@uic.edu;  
312-355-1708

Janey Wilding, University of Illinois at Chicago, 1919 W. Taylor St., Chicago, IL 60607; jwildi1@uic.edu

In this research, we performed two experiments. The first examined the effect of practice on peak movement velocity of elbow flexions performed from different starting elbow angles. The second explored the effect of practicing at one starting angle on movements performed at each of the other starting angles. The hypothesis for experiment one was that the relationship between velocity and starting angle would be retained across practice, and for experiment two, that practice at the slowest angle would not affect the relationship between velocity and starting joint angle. In experiment one, nine subjects practiced three blocks of movements within one session starting from four different elbow angles. In experiment two, one subject practiced 45 blocks of movements over three experimental sessions at the slowest starting joint angle, determined from the results of experiment one. Results from experiment one revealed that movements made from the most extended arm position were significantly slower than movements made from more flexed positions, and that practice at each of the angles did not change this velocity-angle relationship. Results from experiment two are still pending. In conclusion, it appears that short amounts of practice can affect movement speed but cannot overcome the velocity-angle relationship. Results from experiment two will allow us to see if extended practice can affect this relationship:

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## **STAR TREK'S EFFECT ON TODAY'S PHYSICISTS**

### Presenter

Meghan Bannon, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
mb33doc@imsa.edu

### Advisor

Claiborne Skinner, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; skinner@imsa.edu; 630-907-5021

There have been few science fiction shows on TV, and none as popular as the Star Trek series. Assuming TV affects young people, as numerous studies have indicated, what effect has Star Trek had. If violent TV makes violent children, logically science TV would make science children. Folk wisdom holds that most physicists are previous Trekkies. To test this assumption, a survey was sent out to approximately 150 leading scientists in the Illinois state area. The survey's goal was to assess the relationship between science, education, and Star Trek.

Though the surveys did not yield as positive a correlation as was hypothesized, it did produce a number of interesting statistics. First, a higher number of scientists watched Star Trek than the general population. Second, if the generally weak correlation is broken down by specific age cohorts of Star Trek watchers, an interesting correlation emerges. The thirty-year-old cohort was twice as likely to have been influenced out of all ages surveyed. Cohorts on either side of thirty showed very little impact with fifty to seventy-year-olds exhibiting similar responses to twenty-year-olds. However, there was anecdotal data that suggested that Star Trek had a larger physics audience the data sample may have been too small to find.

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## **SCIENCE EXPLORERS: AMUSEMENT PARK PHYSICS**

### Presenter

Amit Behal, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amitb@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

An amusement park has traditionally been a symbol of fun for children. Furthermore, understanding what goes on behind the



scenes of rides in amusement parks requires knowledge of physics. This inquiry, targeted to 3rd and 4th graders, will explore the many aspects of physics through amusement park rides. By doing so, kids will enjoy learning complex physics concepts that might otherwise be difficult or boring. The Science Explorers Jr. "Amusement Park Physics" starts with the kids learning about physics principles such as gravity, friction, momentum, centripetal force, and kinetic and potential energies using marbles, hot wheels, and other "fun" and educational tools. The kids will discover the principles by themselves with the help of IMSA students by performing hands-on lab experiments and exploring roller coaster computer simulations. The kids will then design and build their own amusement park ride by utilizing skills learned throughout the day. The work of this inquiry will be tested when IMSA students teach two hours of the curriculum at the April 3rd "Fieldtrip to IMSA" for two 3rd grade classes. The culmination of "Amusement Park Physics" takes place at the Science Explorers summer camp on the week of June 17-20, 2001 with 72 students.

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## ***ECHINACEA PURPUREA* TEA EXTRACT EFFECTS ON U937 AND CEM CELL LINES**

### Presenters

Yao Bian, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yaoyao@imsa.edu

Min Jung (Jenny) Jun, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
lilstarz@imsa.edu

Jieun Kwak, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lilkwak@imsa.edu

Jean Park, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; genie123@imsa.edu

### Advisors

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987

Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy,  
1500 West Sullivan Road, Aurora, IL 60506; quella@imsa.edu; 630-907-5899

*Echinacea purpurea*, a member of the Compositae family, is a plant used by the Native Americans for healing purposes. Currently, *Echinacea* is used to treat several ailments such as the common cold, syphilis, and the flu to speed healing processes. Our inquiry tested the effects of extracts of *E. purpurea* on the growth and viability of two immune system cell lines: U937's (macrophages) and CEM's (T-cells). A 5.3% stock concentration (weight/volume) of *E. purpurea* tea extract in water was prepared of *E. purpurea*. The effect on the two cell lines was tested using different percentages of the extract in the cell culture medium. Our daily viability counts show that the CEM's are killed after 24 hours in concentrations greater than 0.5% extract. Future experiments for CEM's will determine if lower concentrations have the same effect. However, our results show that extracts greater than 5% are needed to kill the U937's. Preliminary data shows that the growth rate for U937's is not significantly increased with the addition of tea extract in cell medium. Further experiments of different percentages are underway to determine if the claims of *Echinacea*'s ability to boost immunity are scientifically valid.

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## **THE IMPLICATIONS OF GENETICALLY MODIFIED ORGANISMS IN OUR SOCIETY AND ENVIRONMENT**

### Presenters

Yao Bian, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yaoyao@imsa.edu

Joyce Hwu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jawho@imsa.edu

Heidi Lu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; popita@imsa.edu

Qing (Mary) Miao, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
kittykas@imsa.edu

Qing (Janet) Wang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jan03@imsa.edu

### Advisors

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987

Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 West Sullivan  
Road, Aurora, IL 60506; quella@imsa.edu; 630-907-5899

Susan Styer, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
sstyer@imsa.edu; 630-907-5987

Genetically modified organisms (GMOs) have an altered genetic code that expresses a desirable trait not native to the



organism. In the US, no FDA requirements exist for the labeling of GMO products. Therefore, the general public does not know the full range of consequences caused by ingesting such foods. US scientists, businessmen, and we as a society must probe deeper into the implications of GMOs, looking at the negative as well as the positive effects of commercial crops in particular. Different commercial GMO crops include "Golden" Rice, with its nutritional value, pest-resistant Bt-Corn, and Roundup Soybeans, with its built in insecticide. These crops, developed by multi-billion dollar companies such as Monsanto, are widely used across the world. However, intentions for creating these GMOs are questionable. Are scientists creating GMOs for society or for their own personal profit? GMOs are costly and hard to maintain since superweeds, which are resistant to crops such as Roundup Soybeans, are likely to develop. Even so, some farmers use these modified seeds to reduce crop loss (up to five percent per year). With the increasing popularity of GMOs, it is important that we acquire a full understanding of their importance.

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## **ENKEPHALOS: BUILDING A COMPUTER ROLE-PLAYING GAME**

### Presenters

Justin Blanchard, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
justinb@imsa.edu

Eric Bowden, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ericb@imsa.edu  
Mallory Chua, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
bookme13@imsa.edu

Sharon David, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
pngwnpwr@imsa.edu

Steven Lucy, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; stevenl@imsa.edu  
Erica Sim, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ladymute@imsa.edu  
Erik Volkman, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; eryanv@imsa.edu  
Jered Wierzbicki, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jered@imsa.edu

### Advisor

Gene Skonicki, On-Line Learning, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
gene@imsa.edu; 630-907-5909

Interactive video games are massive artistic projects at the forefront of technological innovation in the consumer market. What goes in to the construction of a non-trivial computer game? First we imagined the game: Seth, an unassuming teen male living in the middle of a cornfield, finds a book, chaos, which is his passport into the fantastic dimension of a world similar to ours. Seth leaves the farm to find his fortune. Along the way, he must decide whom to trust at each stage in the game, and his own powers and identity develop accordingly as he chooses to side with the forces of good, evil, or neither. The player travels through old neighborhoods, cellars and pawnshops, antique book stores and back alleys, hospital wards, monasteries, underground night spots and back again to discover the truth of their own character, bringing about one of several unique endings. To realize this vision, our programmers built a large technological framework including an isometric tile map editor and scripting system; our designer laid out game systems in detail; our artist drew concept art, tiles, and character sprites; the writers designed the game world, wrote character and scenario sketches and dialogue, and made them believable; and finally, we struggled to pull it all together into a playable demo by April.

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## **ONLINE TECHNOLOGY IN SCIENCE EDUCATION: STREAMING**

### Presenter

Eric Bowden, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ericb@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

The future of science education includes streaming multimedia and classroom lessons over the Internet. Streaming presentations of educational content allow for a global student audience with minimal institutional expense. This project created IMSA's first-ever publicly available streaming content, and a web site to distribute it using existing technologies and resources. To kick off the streaming initiative, the contents of the Real Science 2001 CD (a yearly student-produced educational science CD-ROM, distributed at no charge to ILLINOIS schools) were made available in streaming form from the IMSA Kids Institute web site. Initial feedback from online quality-of-service surveys submitted during public testing of



the streaming content by teachers and other interested parties has been positive, and indicates a quality end-user experience on a variety of Internet connection speeds. The results of this research project show that useful, high-quality streaming content is now easier than ever to produce, and that it will soon become a very practical alternative to videos or CD-ROMs in the classroom.

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## **LISTENING TO THE AURORA**

### Presenter

Catherine Breckenridge, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
reader@imsa.edu

### Advisor

Robert Brazzle, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
brazzle@imsa.edu; 630-907-5942

On August 12th, 2000, there was a display of the Northern Lights seen from Alaska to Texas, sweeping across Canada and the United States, including the town of Union Pier, Michigan where I saw it as an arc of white light. Union Pier is at roughly the same latitude as our city of Aurora, but as a rule, it is almost impossible to see the Northern Lights, or aurora borealis, at our latitude. Displays, like those seen on August 12th, usually happen once a decade. That does not mean, however, that studying the aurora, or rather one of its generators, the magnetic storm, is impossible to do from here. Magnetic storms are the interactions between the earth's magnetic lines and the millions of ionized particles from the solar wind that impact the earth's atmosphere every minute. Some of these ionized particles are captured by the magnetic lines during a storm, sending the particles on a spiral journey between the magnetic poles of the earth, and also causing the captured particles to emit at radio frequencies. By determining the dominant chemical element and range of energy within these masses of particles, we might be able to determine a specific frequency at which most captured particles emit. Instead of observing the aurora by sight, it is possible that it can be observed by its radio emissions.

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## **THE CREATION OF A COMPREHENSIVE MAP OF THE GOSSMAN FARM IN ZWINGLE, IOWA**

### Presenters

R. Kyle Buchman, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
kyleman@imsa.edu

Jessica D'Souza, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506; jessica@imsa.edu

Erin Leindecker, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506; nire@imsa.edu

Chelsea Lynn, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; drlynn@imsa.edu

Annie Park, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; blurgrrl@imsa.edu

Jennifer Poulsen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;

baobob@imsa.edu

Molly Punke, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; safie@imsa.edu

Soumya Venkiteswaran, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; toum@imsa.edu

### Mentor

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; dgossman@gcisolutions.com;  
847-683-4188

The purpose of this project has been to create a comprehensive map of the Gossman farm in Zwingle, Iowa, to allow future students of this mentorship to familiarize themselves with the geographic and historical features of the farm. The information we used has been taken from historical maps, topographical maps, and aerial photos. We also survey the farm to map locations of archaeological sites and historical features by comparisons with other known locations as well as Global Positioning System coordinates. Compiling this information will provide a means for locating areas requiring further investigation as well as future archaeological dig sites.

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## THE EFFECTS OF PHYTOREMEDIATION ON AN INDUSTRIAL SITE

### Presenters

Holly Bybee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; grvychic@imsa.edu  
Zheyang (Jenny) Chen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jennyc@imsa.edu

Emma Goodman, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
peacocki@imsa.edu

Anna Hang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lucky3@imsa.edu

Lynn Peng, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; evex101@imsa.edu

Diana Tung, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; iluvya@imsa.edu

Tori Walters, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; tjw@imsa.edu

Yun Wu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; meese923@imsa.edu

### Advisor

David Workman, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
workman@imsa.edu; 630-907-5049

Phytoremediation is being used by Rafson Engineering to clean up an industrial site contaminated by organic solvents and their derivatives, mainly TCE, PCE, DCE, and vinyl chloride. Poplar trees were planted at the contaminated site in the spring of 2000 because their deep root systems are able to reach the water table and absorb the pollutants. We have completed a detailed site map and have monitored the growth of the trees for two years in order to track the correlation between the growth of the trees and the decrease of TCE. The first water samples were taken from the ten test wells at the site in March 2001. We plan to extract the volatile organic solvents from the water samples and use a gas chromatograph to measure the concentration of the contaminants. The objective is to bring the contamination levels in the groundwater to 0.001 parts/million, which is approximately equivalent to the quality of drinking water. Using the data that we will obtain, we will see if phytoremediation truly has an effect on the decontamination of ground water. We will continue to monitor the evolution of the site until it is determined to be clean and useable for commercial purposes.

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## THE ESTABLISHMENT AND SUCCESS OF CHINESE AND MEXICAN IMMIGRANT ENTREPRENEURS

### Presenter

Alicia Chan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; achan@imsa.edu

### Mentor

Clarisol Avila, Office of United States Senator Richard J. Durbin, 230 South Dearborn, Suite 3892, Chicago, IL 60604;  
clarisol\_avila@durbin.senate.gov; 312-353-4952

As two of the fastest growing immigrant groups in the nation, Chinese and Mexican immigrants have come to the United States in pursuit of the American Dream. Chicago is a major destination of these two immigrant groups, and has strong immigrant communities such as Chinatown and Little Village. These immigrants often find success in many sectors, though they seem to be most successful in establishing small businesses and in becoming immigrant entrepreneurs. This research addresses the types of business that these immigrant groups find and establish, their respective rates of success, cultural states of mind that drive them to establish small business, and immigration trends that may account for the rise and success of immigrant businesses. Immigrant small businesses help an ethnic community succeed economically, provide support and create niche markets for immigrants and others, provide close social and business relationships, and also allow for an efficient division of labor. The ultimate goal of this research is to suggest legislation that can help such immigrant businesses to succeed and further enhance their positive effects on their communities.

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## TRADITION AND PHILOSOPHY IN ANCIENT CHINA

### Presenter

Samantha Chan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sukino@imsa.edu

### Advisor

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

Before the arrival of Buddhism in China, the region had two major philosophies: Taoism and Confucianism. These religions developed from deep cultural beliefs and were largely influenced by ancient views of nature and the afterlife. The founders of Taoism and Confucianism, Lao Tzu and Confucius respectively, were said to have met once. If such a meeting actually took place, they would have been at odds with each other. Taoism, which propounds that everything is constantly changing, is the exact opposite of Confucianism, which declares that there are set ways to behave and act in accord with tradition. The ideas of the Tao are abstract and open to individual interpretation whereas the stances of Confucianism are systematic, predictable, and based on the propriety and rites of the ancestors. Traditional or mythological ideas about the birth of the cosmos, the operations of nature, and the development of social hierarchy are important clues in discovering the origin of various ideas in Taoism and Confucianism. I studied these areas along with the theories of Lao Tzu and Confucius. I discovered that the mythology and the philosophies coincided, especially where main doctrines of Taoism and Confucianism are concerned.

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## USING PERL TO STUDY COSMIC RAYS IN THE HIGH SCHOOL CLASSROOM

### Presenter

Samantha Chan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; tsukino@imsa.edu

### Mentor

Thomas Jordan, Fermi National Accelerator Laboratory, Education Office, P.O. Box 500, Batavia, IL 60510; jordant@fnal.gov; 630-840-4035; 630-840-8248

Cosmic Rays are extremely energetic, charged particles that strike earth's upper atmosphere and collide with the nuclei of atmospheric gases. These collisions create more particles, many of which are unstable and can further decay into either stable or unstable particles. The most interesting cosmic rays deposit huge amounts of energy ( $>10^{15}$  eV) and the resulting particle shower covers huge areas of earth's surface. One product of the collisions is the muon, an unstable subatomic particle that is ~1000 times heavier than the electron and has a lifetime of  $2.2 \times 10^{-6}$  seconds. By observing these muons as they appear regularly in the atmosphere, we have an opportunity to study cosmic rays. We constructed a device to detect these cosmic ray muons. The device will be accessible via the World Wide Web so that students can access the data for independent analysis. Throughout the year, I wrote programs with PERL to parse the data and write more student-friendly data files. Simple analysis can lead to a measurement of the muon's lifetime and changes in the muon flux. Future plans include the ability to synchronize the measurements from a large array of detectors in many North American high schools.

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## THE HISTORY OF AUTOMOBILE ADVERTISING

### Presenter

Alice Chang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; alice@imsa.edu

### Mentor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5605

In the past century, automobiles have proved to be a significant part of American culture. 1996 marked the 100-year anniversary of the automobile itself, and this Inquiry explores the changes that automobile advertisements went through as the industry was affected by changes and improvements in vehicles, television and the Internet, and revolutionary advertising techniques. When the number of automobiles in the world could be counted with two hands, the best way to advertise vehicles was by promoting them in public races. As more manufacturers appeared and the amount of customers increased, companies competed to become a big name in the automobile industry. After the definition of an automobile stabilized, companies were able to advertise aspects such as appearance, style, luxury, social status, and self-expression. As society and lifestyles evolved in the United States, the automobile ads evolved to accommodate Americans' interests and vulnerabilities.



In the sixties era, Americans enjoyed the golden age of advertising, from when many ads that could be recognized decades later were born. Today, Americans are being targeted in innovative ways, using personalization and customization techniques that are available through the Internet.

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## **ROBOTICS: THE FIELD OF THE FUTURE**

### Presenters

Jason Chang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dejay703@imsa.edu  
Caleb Harper, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; capbob@imsa.edu  
James Sanders, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jsanders@imsa.edu  
Daniel Sun, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; xdansolo@imsa.edu

### Advisors

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987  
Michael Lindenmeyer, Grainger Workshop, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora,  
IL 60506; tfilm@imsa.edu; 630-907-5959

The purpose of our inquiry is to construct a robot that will navigate its way through a maze using its pre-programmed logic. We see this robot has a practical application in the world in that it can act as a mechanical seeing-eye dog. The procedure required that we derive a table of digital logic for the robot to determine what direction it would move when encountering an obstacle. The other main complication was determining the circuitry of the robot. The biggest problem that confronted us was the differential in the voltages between the different components. For instance, the logic (brain of the robot, if you will) required a five-volt circuit. The optic sensors, on the other hand, required a minimum of ten volts. A few fried logic circuits later, and we finally constructed a circuit that would reduce the voltage down to five volts, then increase it to twelve volts, and, depending on the output of our logic, power the motors. The construction of the digital logic has, by far, been the most difficult of our tasks. The success of this project will be proven on presentation day when the robot is tested in maze to simulate a real-life situation.

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## **APPLICATIONS OF JAVASCRIPT IN SCIENCE EDUCATION**

### Presenters

Yong Chen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ychen88@imsa.edu  
Caleb Harper, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; capbob@imsa.edu  
Alex Lyle, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; galen@imsa.edu  
Mark Quinn, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mmq@imsa.edu  
Matthew Traverso, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jobobs@imsa.edu

### Mentor

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; 847-683-4188

This past year, the group has continued to expand the capabilities and horizons of the online JavaScript units converter begun in 1998 by Matthew Stanislawski and David Stears, and carried over for four years. Appearing to be the first and only units converter on the Internet that provides the user with detailed histories and explanations for most units, it is accessed by thousands of users from around the globe each month, despite the lack of advertisement. Currently, the converter sports over 200 units in 22 different categories, ranging from length and viscosity to capacitance and energy per mass units. This units converter remains a continuing project, with plans to add new units yearly.

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## **VIRTUAL ONLINE CHEMISTRY LAB**

### Presenters

Yong Chen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ychen88@imsa.edu  
Caleb Harper, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; capbob@imsa.edu  
Alex Lyle, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; galen@imsa.edu  
Mark Quinn, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mmq@imsa.edu  
Matthew Traverso, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jobobs@imsa.edu

### Mentor

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; 847-683-4188

Over the course of the year, the group began work on an online chemistry lab. When completed, the user will log in to the site and be given an unnamed compound on which they will be able to run tests to attempt to identify the compound. The qualitative organic lab simulation will provide the capabilities to use both bench and instrumental tests. This will allow any student with Internet access to learn about chemistry and various tests used in the lab environment without expensive equipment. The site is being built using a combination of client-side JavaScript and server-side Perl scripts, using a database to allow for dynamically generated graphs which account for real-life error and other factors. The chemistry site is a work-in-progress that will continue in future years.

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## **THE VOLATILITY OF THE TECHNOLOGY SECTOR THROUGH ANALYSIS OF THE INTERNET SUBSECTOR**

### Presenters

Yong Chen, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ychen88@imsa.edu  
Zheyang Chen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jennyc@imsa.edu  
Andrew Friedl, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; legal@imsa.edu  
Ying Shi, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yihi852@imsa.edu

### Advisor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu, 630-907-5960

The various things that we have learned throughout the course of this year centers around the volatility of the technology sector on the stock market. For each sector, there are various indicators—such as interest rates, monetary policies, and valuations—that may predict the vacillations of its growth and decline. For instance, spikes in interest rates, in most cases, discourage spending and prevents inflation while drops in interest rates usually lead to encourage consumer spending,

increase cash flow, and prevent possible recession. We discovered in the incipient stages of our research that the technology sector was too general to do a thorough analysis, for it can be broken into 4 subsectors: computers, electronics, internet, and telecom. So we narrowed our focus down to the Internet subsector. We felt that it best modeled the fluctuations of the stock market. There are 6 companies who show the bulk of the fluctuation in the internet subsector: AOL Time-Warner, Cisco Systems, Sun Microsystems, Ebay, Amazon, and Oracle Corporations. We found that Internet stocks are very unstable, and usually have no real earnings while having high projections. Investors are taken in with promises of high capital gain without any foundation for assets.

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## **PHYSICOCHEMICAL ANALYSIS OF CHINESE LIGHT PENETRATION MIRRORS**

### Presenter

Zheyang Chen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jennyc@imsa.edu

### Mentor

Philip Nash, Ph.D., Illinois Institute of Technology, 10 West 32<sup>nd</sup> Street, Chicago IL 60616; nash@iit.edu;  
312-567 3056; 312-567 8875

In ancient China, mirrors were bronze disks whose surfaces were polished to such a degree that one could see reflections clearly. One such variety of bronze mirrors has the mysterious property of creating an image in its reflection. Two types of



mirrors were selected in this project. Type A mirrors reflect the image that is cast onto the back, while Type B mirrors reflect a completely different image. The purpose of this study was to examine one mirror of each type and develop explanations of their manufacturing processes. SEM (Scanning Electron Microscope) and EDS (Energy Dispersive Spectrometer) techniques were used to understand physicochemical properties of intermetallic phases found on mirror surfaces to obtain analysis of the compositions in the mirrors quantitatively. In Mirror A, the casting dendrites were apparent, and the three combinations of materials were easily distinguishable. In Mirror B, a more eutectic pattern was observed, and its microstructure was shown to be clearly different from Mirror A. Because the cooling rates of materials depend on their thickness, varying hard and soft areas develop on the mirrors during the cooling process. The soft areas tend to deform, but are constrained by the hard areas. When the mirrors are polished, they become thinner and release the residual stresses produced by the casting. Laser profilometry was used to characterize surface profile for curvature, and indeed, the mirrors do have curved surfaces.

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## **IDEAS OF THE EAST: HOW GANDHI'S PHILOSOPHIES AFFECTED THE WEST**

### Presenters

Puni Chennamaneni, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
pc03@imsa.edu

Kavita Ramakrishnan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
kavita@imsa.edu

### Advisors

James Victory, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jvictory@imsa.edu; 630-907-5977

Christian Nokkentved, Ph.D., History and Social Science, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; drnok@imsa.edu; 630-907-5961

A key thinker of his time, Mahatma Gandhi's philosophies on nonviolence helped to gain India's independence from Britain. Stressing equality for all, his struggle for freedom garnered attention around the world. As the civil rights movement became a national platform in the 40's in America, black civil rights leaders followed Gandhi's system and evolved his ideas to further their cause. Three key figures that implemented and adapted Gandhi's ideas were James Farmer, A.J. Muste, and Martin Luther King Jr. Affectionately referred to as the "little brown Indian man in a loincloth" Gandhi proved that masses of people could come together and channel their passion into nonviolent action, thus reaping better outcomes than violence. Interestingly enough, Chicago played an important role in the civil rights movement, creating a solid base for the leaders to organize plans of action. The establishment of C.O.R.E. (Congress of Racial Equality) by James Farmer made Chicago a national player in the struggle for equality. Ideas that originated in the East crossed oceans and continents to radically change an entirely different culture and time period.

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## **EVEN THE BEAUTIFUL ONES DIE: THE CORRELATION BETWEEN LETHAL WHITE FOAL SYNDROME AND HIRSCHSPRUNG'S DISEASE**

### Presenters

Puni Chennamaneni, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
pc03@imsa.edu

Emily McCord, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; gc34@imsa.edu

Urvi Purohit, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; urvs9@imsa.edu

### Advisors

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987

Susan Styer, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
sstyer@imsa.edu; 630-907-5943

Lethal White Foal Syndrome is a condition in horses similar to Hirschsprung's disease in humans. Both diseases are caused by mutations of the endothelin-B receptor gene (EDNRB) that prevent the absorption of food in the intestinal tract, and are also characterized by an all white coat pattern in horses and a white forelock in humans, which is caused by an absence of melanocytes in the skin. Lethal White Foal Syndrome occurs in foals bred from two frame overo horses sometimes have the condition and generally die within twelve hours from lack of nutrition. Hirschsprung's disease is a rare congenital



abnormality found in 1/5000 children that results in obstruction of the bowel movements because the intestines do not work normally. It can be life threatening or a chronic disorder. Lethal White Foal Syndrome carriers can be detected by using PCR on DNA samples isolated from horsehair. We used the same technique used to test for LWFS, but instead of testing for EDNRB, we examined two regions that are known to be variable in humans, TPA25, an Alu element, and D1S80, a VNTR DNA polymorphism. By doing this experiment we can determine whether the horse is heterozygous or homozygous for trait in the regions tested.

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## **BASIC PROGRAMMING TECHNIQUES USING XML**

### Presenters

Brian Choi, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bc@imsa.edu

Matthew Katz, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
dragon53@imsa.edu

Manu Raam, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; manuraam@imsa.edu

### Mentor

Teodoro Alonso, Motorola Corporation, Personal Networking Group, 1411 Opus Place, Downers Grove, IL 60515;  
teodoro.alonso@motorola.com; 630-353-8279; 630-353-8301

After having lived at IMSA a full year, even the sophomores know that the lifeblood of this place is its cafeteria, Arbor. Unfortunately, students have difficulty easily accessing accurate menu information, which is where XML comes in. XML, or extensible markup language, allows users to enter data, then converts that data to fit specifications, using a style sheet to transform the data to an HTML web page. The project also is an example of achieving an effective graphical user interface (GUI) design. The way the project achieves an effective GUI design is to get feedback from both Arbor staff and IMSA students, to ensure both that the software fulfills their needs in a fluid and accessible program, and also works effectively.

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## **“IT’S RHYMIN’ TIME!” CYCLE POETRY CLASS**

### Presenters

Chrystal Colbert, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
chrystal@imsa.edu

Jieun Kwak, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lilkwak@imsa.edu

### Mentor

Connie Van Brunt, Community Youth Creative Learning Experience, 1111 North Wells, Chicago, IL 60610;  
312-573-8920; 312-573-8879

Starting on September 19, 2001, we designed a poetry class called “It’s Rhymin’ Time!” that we began on October 10, 2001 and continued for fourteen sessions until March 20, 2002. The class consisted of six third through fifth-grade girls who transported to the Cycle Building in Chicago, the site of the class. The class met weekly for an hour at a time. Because the girls had little or no knowledge about poetry, we decided to teach them basic rhyming like single-syllable rhyming, about the different forms of poetry, and how to write poetry on various subjects. In order to reach these goals, we had our students read well-known classics, and write poetry individually and as a group. Some of the poems that the students wrote were acrostic, holiday, and picture poems. The student’s final projects, their poetry collections, were drafted and completed on March 6 and March 13. Each project was a compilation of one student’s poetry. Each collection consisted of a title, dedication, author’s page, poems, and pictures. We also created a class poetry collection by compiling individually written poems with the class’s group poems. These final projects express our class’s success because they meet our goals for the class.

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## **"POLITICAL PARTY" AND "EXPRESS YOURSELF": YOUTH EMPOWERMENT AT COMMUNITY YOUTH CREATIVE LEARNING EXPERIENCE**

### Presenters

Bernadette Contreras, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; adette14@imsa.edu

Annie Dlugokecki, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; annied@imsa.edu

Rebecca Liu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; rebelulu@imsa.edu

### Mentor

Connie Van Brunt, Community Youth Creative Learning Experience, 1111 North Wells, Chicago, IL 60610; 312-573-8920

Empowering the sixth-grade through eighth-grade girls at the Community Youth Creative Learning Experience (CYCLE) was the goal of all our labs. We created two labs in order to accomplish our goal over the span of the year. The first lab, Political Party, focused on the structure of American government, recent global issues, and their direct effects on our daily lives. We facilitated interactive learning experiences such as acting out a mock trial, writing a bill, and campaigning for a fictitious election. At the conclusion of this semester long curriculum, we allowed the girls to decide on the next topic of exploration. They expressed a strong desire to pursue the multi-faceted art of communication. Thus, we created a lab entitled, Express Yourself. This lab entailed an introduction to foreign languages, sign language, written odes, and various communication exercises. Ultimately, we hope that the girls have benefited from our efforts because, undoubtedly, we have learned many important lessons from them.

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## **THE FIRST FILIPINO: THE LIFE AND LEGACY OF DR. JOSE RIZAL**

### Presenter

Bernadette Contreras, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; adette14@imsa.edu

### Advisors

Socorro Cintron, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cintron@imsa.edu; 630-907-5901

Jose Palos, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jpalos@imsa.edu; 630-907-5085

Within the lines and rhymes of his poems lies the history of a man and a nation. Dr. Jose Rizal proved the pen is truly mightier than the sword. He lived during a time when the Philippines was held under Spanish rule, and he stirred patriotism and courage in the hearts of many native Filipinos. Because of his controversial poems and novels, he was accused of inciting a revolution, and was later executed for such allegations. A man of many talents, (a physician, a poet, and a linguist, among other things), he was to become the martyr and national hero of the Filipino people. His life and legacy tell the tale of a country in turmoil, a persecuted people, and the lessons and observations of a genius. A brief historical overview, an explication of his poetry, and a detailed biography will be presented in Spanish.

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## **ILLINOIS: IT'S MORE THAN JUST A CORNFIELD**

### Presenters

Rebecca Cooper, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; posy@imsa.edu

Jennifer Mo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jmo@imsa.edu

Robert Quimby, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bobq@imsa.edu

### Advisor

Claiborne Skinner, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; skinner@imsa.edu; 630-907-5021

For our inquiry, we wanted to widen knowledge of Illinois history, and we decided it would be most effective to make use of modern technology, incorporating the Internet and developing methods of learning. We believe that by making a wide variety of primary sources available electronically, we can provide a better learning experience for people all over the state.



The eventual goal is to create a curriculum guide for teachers throughout the state to use them in their classrooms. So far we have amassed a formidable collection of sources, including well-known documents, like the speeches of Abraham Lincoln, lesser-known documents, such as the Degannes memoir, and much less known items as The Engagement of Beauvais to Tonti. Among these sources are letters written to De La Barre. These letters were translated from the original French for the purpose of spreading awareness about them. Odds are reasonably few people are familiar with even George Rogers Clark's report, which details the fighting in Illinois in the American Revolution, as well as the period of time in which Illinois was a territory of Virginia. This is one demonstration of the lack of knowledge about our own history that we would like to remedy.

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## **A KINETICS EXPERIMENT INVOLVING THE REACTION OF METHANOL WITH TRIFLUOROACETIC ACID**

### Presenters

Emilie Dahod, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
dahodo16@imsa.edu

Yuan Gong, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yugo@imsa.edu  
Elizabeth Lampe, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; air@imsa.edu

### Advisors

Mary VanVerst, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
vanverst@imsa.edu; 630-907-5047

Dr. Joseph Ray, Consultant, Baxter Lab and Northwestern Graduate School of Chemistry; ray67@msn.com

A Kinetics investigation was done of a reaction between methanol and trifluoroacetic acid using the Fourier Transform Nuclear Magnetic Resonance Spectrometer (NMR). Preliminary work has focused on familiarity with the NMR instrument and understanding basic concepts. The experiment was patterned after a modification of the standard method. Instead of scanning a sample using time intervals determined by an exponential equation based on the half-life of the reaction, the instrument was set to scan at one-hour intervals. A total of 16 scans per sample were taken. Three different samples were prepared, all containing different ratios of the methanol and trifluoroacetic acid. There was a 10:1 (methanol, trifluoroacetic acid), 1:1, and a 1:10 ration used. The concentration was varied in order to determine what effect the trifluoroacetic acid's concentration had on the rate of the experiment. The results and conclusions from this experiment will be presented.

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## **DEVELOPMENT OF A WHOLE BLOOD FLOW CYTOMETRY METHOD FOR FUNCTIONAL ASSESSMENT OF PNEUMOCOCCAL PHAGOCYTOSIS**

### Presenters

Emilie Dahod, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
dahodo16@imsa.edu

Shravani Pasupneti, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
shravani@imsa.edu

### Mentor

William Kabat, Children's Memorial Hospital, Infectious Diseases, 2300 Children's Plaza, Chicago, IL 60614;  
bkabat@childrensmemorial.org; 773-880-4907; 773-975-8795

A large population of patients suffers from infection by *Streptococcus pneumoniae*. The process of developing a vaccine to prevent infection has been hindered by the different capsule types of pneumococci. A vaccine that provokes the development of antibodies that recognize all of the over one hundred different capsule types has not yet been produced. The best assessment of newly developed vaccines is the evaluation of functional antibodies. These assays evaluate the presence as well as the effectiveness of the antibody. The goal of this research is to develop a single tube, whole blood procedure to simultaneously observe opsonisation and phagocytosis by monocytes and granulocytes of *Streptococcus pneumoniae* by flow cytometric evaluation. This research team has made considerable progress toward the development of such an assay using FITC (Fluorescein-isothiocyanate) stained bacteria of different capsule types and flow cytometric analysis. At present, the basic procedures and conditions for the assay as well as the gating parameters for the flow assessment have been established. Monoclonal antibodies, including PE-conjugated anti-human IgG and CD14-PC5 have been evaluated. These developments have allowed us to simultaneously measure monocyte and granulocyte uptake of labeled bacteria. A presentation of future plans will follow.



## LEGENDS OF THE SPANISH SPEAKING WORLD

### Presenters

Emilie Dahod, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
dahodo16@imsa.edu

Anupama Garla, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
prezabu@imsa.edu

### Advisors

Socorro Cintron, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; cintron@imsa.edu; 630-907-5901

Jose Palos, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jpalos@imsa.edu; 630-907-5085

Throughout history, different cultures around the world have grown and developed within the context of legends and fairy tales. In studying legends that are passed on from generation to generation of Spanish speakers, we have gained a better understanding of the lifestyles in their areas. We have examined legends such as "La Llorona (The Crying Woman)", and "Chupacabra (The Alien Creature)" and how they have transformed over time. In order to paint a complete picture of these intricate stories and their effect on society, we also analyzed stories of other nations and researched the significance of childhood tales in general. As a result of our studies, we identified countless aspects of each legend that were emphasized in the everyday ideas of its respective society. For instance, in the Mayan rabbit story, children are taught the importance of assimilating to western culture while also retaining the ideas of their traditions. They learn that power, greed, and conceit corrupt, and that there is still hope for the Mayan people. This story embodies many of the Mayan values while also entertaining its audience. We concluded that traditional stories both reflect upon and impact the cultures that they spring from.

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## SONG OF SPIRIT, SONG OF STONE: CO-AUTHORING A FANTASY NOVEL

### Presenters

Katherine Dieber, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
froggish@imsa.edu

Molly Punke, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; safie@imsa.edu

### Advisor

Julie Hipp, Ph.D., English, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jhipp@imsa.edu; 630-907-5981

Our novel began with the idea of a world formed of two energies - one non-living matter, and one life: element and spirit, respectively. As the idea became more concrete, we wondered about the people who would exist in such a world. The story would inevitably unfold from here as we attempted to weave the themes of betrayal, obsession, love, science, art, and balance into our new world. This year, we discovered there is more to writing a novel than gathering ideas. The process is long and tedious, though satisfying. To help flesh out our world and make the writing more complete and consistent, we mapped the main centers of action and used many pre-writing techniques to help us more fully understand the minds of the characters. And, of course, we wrote. We have more than 30 pages (in MS Word, single-spaced) written, all of which has been edited and is still being edited for elegance and continuity. In co-authoring a novel, we also are learning vital lessons about compromise. We intend to chase this tale to completion, though as we have come to realize, producing a quality novel may take longer than expected.

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## **ARTIFICIAL INTELLIGENCE, EVOLUTION AND PHILOSOPHY**

### Presenters

Justin Doran, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; beesting@imsa.edu  
Jennifer Huang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jen5720@imsa.edu  
Elaine Khoong, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
soccagrl@imsa.edu

### Mentor

Michael Ososky, President, Applied Computer Technology, 69 South LaSalle Street, Aurora, IL 60505;  
mike@zenmountain.org; 630-896-2281

Evolutionary processes have existed since a point in time beyond our comprehension. Only recently (circa 3,000,000 B.C.E.), has evolution produced an organism capable of creating an intelligence parallel to itself. Homo sapiens is the organism, and the new life form -its brainchild- is Artificial Intelligence (AI). The goal of our mentorship is to explore the past and future impacts this profound revolution will have on the universe and our worldviews. In the past, biological evolution has reigned over earth, but now memetic (memes are like genes in that they propagate information, but unlike genes the information contained are ideas) evolution is increasing in strength and influence. Through in-depth discussions analyzing books in these fields, we are better understanding society's idea of self in the present and how it will be affected by technology in the future.

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## **PROPOSAL FOR NOVEL RADIO ASTRONOMY TELESCOPE DESIGN**

### Presenters

Aaron Doukas, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mrpopo@imsa.edu  
Robert Quimby, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bobq@imsa.edu  
Donald Schmit, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
donjuan1@imsa.edu

### Advisor

Robert Brazzle, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
brazzle@imsa.edu; 630-907-5942

Radio astronomy is limited in the fact that a large parabolic dish is necessary for astute study. Our main goal is to implement a prototype design, which can accurately receive signals without the expense of a parabolic dish, through the use of dual cylindrical reflectors. The advantage behind this design is that it cuts down on the amount of technical engineering necessary. The first phase of our inquiry has been the construction of a radio receiver meant to observe cyclotron radiation between Jupiter and its moon Io. Electrons from Io cause this radiation by traveling across Jupiter's magnetic field lines. This distorts their path, causing them to give off radiation over a broad range, which includes the frequency of 22.2 MHz. This receiver is a dual-dipole receiver, and we used it to pick-up radiation from Jupiter. Using this receiver we then observed this radiation. The next phase, which we plan on carrying through next year, is the creation of our prototype. Using the knowledge we gained from the receiver we built this year we will be able to continue with our plans of the construction of our prototype.

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## **BRUCE GOFF'S ARCHITECTURE IN CHICAGO: THE HELEN UNSETH HOUSE**

### Presenter

Nia Dukov, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; nia@imsa.edu

### Mentor

Mark Sexton, Executive Director, Krueck and Sexton Architects, 2160 South First Avenue, Chicago, IL 60610;  
312-787-0056; marksexton@ksarch.com

Bruce Goff was a visionary American architect whose highly individualistic style was characterized by free form and the innovative use of materials. Intimate relationships with clients were at the core of his architecture. In a few unconventional projects, Goff was able to explore his idea of "absolute architecture" and the "continuous present." His unusual style led the prominent architect Mies van der Rohe to exclaim "Goff is a good architect, but he shouldn't be imitated." Goff spent 8 years



practicing in Chicago during the 1930s and early 1940s, and one of the residences he produced, the Helen Unseth House, is a perfect vehicle for analyzing his architecture. The original plans and most of Goff's drawings and models for this house have been lost, but were reproduced during the mentorship. Their regeneration brought a greater appreciation of Goff's methodology. Producing plans, elevations, and sections led to a richer understanding of what Goff meant by "absolute architecture."

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## **THE EFFECTS OF ANPLAG AND ITS METABOLITE ON PLATELET AGGREGATION / ACTIVATION**

### Presenters

Jessica Dy-Johnson, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jessica8@imsa.edu

Pranay Patel, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; pranay7@imsa.edu

### Mentors

Jawed Fareed, Ph.D., Loyola University Medical Center, Pathology, 2160 South First Avenue, Maywood, IL 60153;  
jfareed@lumc.edu; 708-216-3262; 708-216-6660

Debra Hoppensteadt-Moorman, Ph.D., Loyola University Medical Center, Pathology, 2160 South First Avenue, Maywood, IL 60153; 708-216-4625; dhoppen@luc.edu

Platelet activation/aggregation is a common abnormality observed in blood vessels. Several new agents to inhibit platelet activation/aggregation have recently been under investigation. A new compound, Sarpogrelate (ANPLAG) was recently synthesized and shown to be a serotonin receptor antagonist. In our study, we supplemented ANPLAG and its metabolite (BPM) to platelet rich plasma (PRP) and to whole blood at varying concentrations, and we measured the effects of these two agents on platelet aggregation and platelet function in normal healthy volunteers. We found that ANPLAG did not inhibit platelet aggregation significantly when added to PRP; however, its metabolite showed a concentration-dependent inhibition. When we studied the effects of both ANPLAG and BPM in whole blood aggregation, we found that ANPLAG had only a slight inhibitory effect on ADP-induced whole blood aggregation; however the metabolite produced concentration-dependent inhibition similar to that observed in the platelet-rich plasma. Our studies demonstrate the anti-platelet effects of ANPLAG and its metabolite, BPM, in invitro-supplemented systems. These results suggest that ANPLAG may be a useful drug to inhibit platelet activation/aggregation in clinical settings.

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## **VISUAL IMPAIRMENT AND BLINDNESS IN SCHOOLS: ASSESSING ACCOMMODATIONS AND ASSISTIVE TECHNOLOGIES IN PUBLIC SCHOOL DISTRICTS**

### Presenters

Margalit Faden, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
margalit@imsa.edu

Qing (Janet) Wang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jan03@imsa.edu

### Mentor

Leah Gerlach, Deicke Center for Visual Rehabilitation, Eye Tec Program, 219 East Cole Ave., Wheaton, IL 60187;  
leah@deicke.org; 630-690-5966

Visual impairment and blindness encompasses a wide range of visual conditions, including no light perception, some perception of images, and restricted fields of vision. These visual conditions are caused by a variety of diseases and/or developmental events, thus accounting for the diversity of needs found among students who are visually impaired or blind. Students with visual impairments must face many difficulties in our society that a person with normal (20/20) vision does not have to experience. Some of the most prominent difficulties facing these students exist in the area of academics, including access to information. A research survey was conducted in which over 300 school districts were mailed questionnaires about accommodations and assistive technologies for visually impaired and blind students at their schools. The data collected from the answers on these questionnaires offers interesting insight into the level of knowledge displayed by school districts about assistive technology and accommodations. Furthermore, this data provides a look into the options offered to a blind or visually impaired student in the mainstream classroom of today, and identifies areas of need within school districts. Together with the Deicke Center for Visual Rehabilitation, we are analyzing the data extracted from this survey, and hoping to use this information to create services beneficial to school districts and visually impaired students.



## **VMODEL - QUALITATIVE CONCEPT MODELING FOR MIDDLE SCHOOL STUDENTS**

### Presenter

Christopher Fanning, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
imajedi@imsa.edu

### Mentors

Karen Carney, Northwestern University, Qualitative Reasoning Group, 1890 Maple Avenue, Evanston, IL 60201;  
k-carney@northwestern.edu; 847-467-1869

Leo Ureel, Northwestern University, Qualitative Reasoning Group, 1890 Maple Avenue, Evanston, IL 60201; 847-491-4790;  
ureel@cs.northwestern.edu

Learning to create, test, and revise models of phenomena is a central skill in scientific reasoning. Vmodel is a software program and curriculum that provides a graphical representation for concept modeling, which allows students to hone their modeling skills by building connections not only between parts of the same phenomenon, but also between corresponding structures in different phenomena that would have otherwise had no connection to each other in the eyes of the students. Vmodel uses a very specific modeling ontology that can be easily applied to phenomena in a wide range of scientific fields. This limited ontology helps students see corresponding concepts within different models that a specified ontology wouldn't allow. This is because its ontology is composed of very basic relationships and entities that can apply to the entire spectrum of scientific understanding, rather than subject-specific terms that only apply to a particular field. Vmodel's ontology is constantly being tested and revised by the project, becoming simpler and more universal. As a result, the ontology in Vmodel is quickly evolving, using feedback from pilot tests to improve the ontology. The work done on Vmodel's ontology not only pertains to education, but also cognitive science and artificial intelligence.

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## **MORPHOLOGICAL RESPONSES EXHIBITED IN *HYDRA* DUE TO EXTRACELLULAR ATP EXPOSURE**

### Presenter

Heather FitzHenry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
hrfitz@imsa.edu

### Advisor

Vicki Burgholzer, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
vicki@imsa.edu; 630-907-5986

Stuart Newman (1973) observed a morphological response in *Hydra attenuata* when exposed to extracellular metabolites through their environment. This response was noted by a drastic change towards the extreme ends of the body and a loss of tentacles. Further experiments with ATP were performed on *Hydra oligactis* to see if they could become accustomed to the metabolite solution; signaled by their ability to bud. Using varying dilutions of Newman's original concentration of ATP, it was noted that their body "stretched" (got longer and thinner), but seemed to do so disproportionately. The budding region was used as an arbitrary point to divide the hydra in half. The gastric (top) and peduncle (bottom) regions were measured using Image Pro analysis software. The disproportionate "stretching" of the hydra was quantified through the results of a MANOVA. Disproportionate changes between the two regions is thought to occur because of elevated levels of a purine triphosphate, disrupting the "normal" metabolic gradients found throughout the hydra's body.

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## **AZTEC AND MAYAN INFLUENCE ON CONTEMPORARY MEXICO**

### Presenter

Patricia Fonseca, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
snoopy42@imsa.edu

### Advisors

Socorro Cintron, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cintron@imsa.edu; 630-907-5901

Jose Palos, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jpalos@imsa.edu; 630-907-5085

The Aztecs and the Mayans, the two most recognizable ancient cultures of Mexico, influenced many of the contemporary



beliefs of Mexico. The Aztec and the Mayan creeds depict many of the values that still maintain a significant part in the culture. I focused on the motives behind the ceremonies in order to comprehend how these ideals/rituals began. Even though these ancient civilizations lacked the understanding of many natural phenomena they explained them through their religions. After giving birth, a woman took steam baths every third day for fifteen days to preserve her tonalli or life heat. This belief, though somewhat altered by science, still emerges in modern Mexico. The similarities between the archaic beliefs of these civilizations and contemporary Mexican culture emerge incessantly. For example, women and men were encouraged to wait until marriage to perform sex. The Mexicans enforced this for they believed it killed their "tonalli" or soul. A proverb relating to this theme stated, "not too ruin thyself impetuously as if thou wert a dog." Studying the values, and proverbs of the Aztecs, the Mayans, and contemporary Mexico I concluded that many derived from the ancient peoples. The intricate creeds the Aztecs and Mayans exercised allowed their customs to transcend and continue to exist.

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## **COOPERATION BETWEEN ANGIOGENESIS INHIBITOR TSP-1 AND GENTOXIC AGENT DOXRUBICIN**

### Presenter

Laura Foote, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; chanter@imsa.edu

### Mentor

Olga V. Volpert, Ph.D., Executive Director, R.H. Lurie Comprehensive Cancer Center, Northwestern University Medical School, 710 North Fairbanks Court, Olson Pavilion #8416, Chicago, IL 60611; olgavolp@northwestern.edu; 312-503-5934

Cancer masses require angiogenesis, the sprouting of new blood vessels, to exceed microscopic size. Tumor size can be restricted if angiogenesis is blocked, so it is essential to understand its regulatory mechanisms. A molecule that inhibits angiogenesis, TSP1, prevents or even terminates the microvascular network recruited by tumors. To block angiogenesis TSP1 utilizes Fas receptor and Fas ligand, a cascade leading to cell death. Fas receptor is expressed low on resting vascular cells and stable vessels, but much increased in cells activated by angiogenesis inducers and on new vessels. This way inducers make stimulated cells in growing capillaries sensitive to killing by inhibitor-generated Fas ligand. Chemotherapies, such as Doxorubicin, traditionally used in cancer treatments, are highly toxic at high doses, while low doses are ineffective. Recently Doxorubicin has been discovered to induce Fas receptor on proliferating vascular cells. We tested Doxorubicin and DI-TSP, a derivative of TSP1. At low doses, neither delayed angiogenesis or tumor growth when tested alone. In concert, they caused strong reduction of angiogenesis and tumor growth. Such combinations of low TSP-1 and Doxorubicin are significantly less toxic than conventional treatments with high doses of Doxorubicin and may in due time replace more traditional cancer therapies.

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## **KIDS INSTITUTE TAKES SCIENCE EXPLORERS TO BILINGUAL CLASSROOMS**

### Presenter

Sandra Garcia, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sandrag@imsa.edu

### Advisors

Socorro Cintron, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cintron@imsa.edu; 630-907-5901

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

IMSA's Kids Institute is able to reach into the community and spark kids imaginations through school visits, summer camps, and virtual publications. Unfortunately due to a language barrier, many kids in the Chicagoland area have not been able to take full advantage of the programs offered by the Kids Institute. How can we expand the Kids Institute to benefit bilingual classrooms? After surveying bilingual classroom teachers in the Chicagoland and Aurora areas, the best of the Science Explorers curricula was chosen according to the needs described by the surveys. From a list of physics, biology, earth science and chemistry, teachers chose physics, biology, and earth science as a priority. The best of the curricula has been translated into Spanish and compiled into a binder that will compliment classroom lessons. This compilation of "the best of Science Explorers" underwent several revisions to ensure appropriate translations of the lessons. Each lesson includes hands-on activities as well as a vocabulary section to strengthen the concepts learned. Originally, the purpose of this inquiry was to translate the curricula as it stood for classroom teachers to use as a resource. This idea evolved and a more efficient concept emerged. The material was rewritten in "kid-friendly" terms allowing both students and teachers to benefit from it. The binder will be distributed to classrooms in the community.



## **A LOOK INTO BRAIN DEVELOPMENT AND ITS IMPLICATIONS**

### Presenters

Sandra Garcia, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sandrag@imsa.edu  
Keisha Williams, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; marie@imsa.edu

### Advisor

John Eggebrecht, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
egge@imsa.edu; 630-907-5941

Cognitive Science, in the past two decades has made incredible advances in understanding brain activity. This inquiry project seeks to understand the nature of learning in light of the recent discoveries in cognitive science, and their applications in the current elementary schools of Illinois. Drawing on literature from various sources, this project synthesizes and highlights the major implications of what the past two decades have taught us about learning and public policy: How can we assess learning properly? Are the Illinois Learning Standards appropriate goals for the classroom? How can we compensate for biological learning deficiencies through curricula? How can we build a bridge in the classroom that allows students to take abstract concepts and apply them to real life problems? Data shows that learning standards applications should be redirected so that they correlate with the brain activity of a group of individuals at a certain age. The solution lies in building a bridge from abstract concepts learned in the classroom to real world applications. This involves a large investment in hands-on learning and a better selection of classroom resources. Those directly benefited would be elementary school aged children, as it is at this age that the gap in learning begins.

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## **HOW OIL PRICES AFFECT CAR DESIGNS IN THE UNITED STATES**

### Presenter

Dhaval Garg, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dhaval@imsa.edu

### Advisor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5889

The time when big bulky cars dominated the road is long gone. SUVs rule the road now. These changes can be attributed to several factors. During the course of history, customers' preferences for cars changed, as technology improved, car designs changed and automobile companies wanted to create a fashion statement through cars. Another key factor is world politics. World politics greatly influences the design of the cars in the United States. World politics invariably affects the oil prices which in turn affect the car designs. One example of this is the difference in cars in the 70's and the 90's. In the early 70's, heavy gas guzzlers were popular, on the contrary, in the 90's, compact fuel efficient cars were more prevalent. This change can largely be attributed to the change in oil prices over a long period of time. High oil prices meant there was a shortage of oil and therefore automobile companies had to make their cars more fuel efficient. Conversely, low oil prices meant there was a surplus of oil and automobile companies made gas guzzlers. But when there is a major change in oil prices, the designs of cars do not change immediately. There is a lag period to it. This inquiry looks at how the changes in oil prices affected the cars in the United States and how long it took to make the changes.

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## **GAUGING THE EFFECTIVENESS OF THE SCIENCE EXPLORERS "CREEPY CRAWLERS" CURRICULUM**

### Presenters

Matthew Getz, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; getz@imsa.edu  
Mengyao Liang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
paladin@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

"Eew, Yuck!" is a probable reaction when kids think about all the microbes crawling around the room, on their pencils and pens, and even their skin. The Science Explorers "Creepy Crawlers" group explored the insects and microbiology that cause



this response. The four hours of curriculum developed by the "Creepy Crawlers" group deal with bugs and microbiology. Two of these hours deal with microbes and the spread of communicable diseases, while the other two hours deal with insects and their unique structures. This year in addition to teaching the material, the effectiveness of the curriculum, in both teaching and generating interest, will be gauged. Two surveys were developed to analyze the elementary students' knowledge in the topics that will be presented. The first survey measured preliminary interest and the students' knowledge of bugs and microbiology before the students' "Fieldtrip to IMSA" on May 8, 2002. The second survey will be used as a more subject specific sample of knowledge at the conclusion of their fieldtrip. The data from these surveys will reveal the effectiveness of the curriculum and student teacher delivery methods. The full measure of success of this inquiry will be realized during the Science Explorers, Jr. "Creepy Crawlers" day the week of June 17-21, 2002.

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## **EXPLORATION AND EXPANSION OF THE SAM DATA HANDLING SYSTEM AT FERMI NATIONAL ACCELERATOR LABORATORY**

### Presenter

Dmitry Goldin, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dgtal@imsa.edu

### Mentor

Gabriele Garzoglio, Fermi National Accelerator Laboratory, Computing Division, P.O. Box 500, MS 114, Batavia, IL 60510; garzogli@fnal.gov; 630-840-6470; 630-840-3867

In modern day, there are important physics questions that can only be answered by building new particle accelerators that can reach higher energy levels. However these facilities will require world-wide collaboration and computing is a critical element in making this collaboration work. Creating computer tools that will allow physicists to work at their home base and simultaneously receive data from sources anywhere in the world, is rather new in the scientific community but it will further physics research well beyond what it was before. At my mentorship, I have been involved in a project dealing with a computing grid called SAM, established for Fermilab's DZero experiment and used to offer access for experiment collaborators at six sites in Europe. I have also helped expand capabilities of SAM using the Globus Project technology, which is needed to build computational grids. Through my research and work I have acquired some familiarity with programming in JAVA, HTML, and SQL, yet I have also learned theory on topics such as client-server relationships as well as learning to operate in Linux. In my mentorship presentation I will include theory and structure of the SAM data handling system in addition to the computer topics I've learned.

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## **MOLECULAR CLONING OF NOVEL GENES FROM HEMATOPOIETIC STEM CELLS**

### Presenter

Yuan Gong, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yugo@imsa.edu

### Mentors

San Ming Wang, M.D., University of Chicago Medical Center, Section of Hematology/Oncology, 5841 S. Maryland MC2115, Chicago, IL 60637; swang1@midway.uchicago.edu; 773-702-6788

Guolin Zhou, M.D., University of Chicago Medical Center, Section of Hematology/Oncology, 5841 S. Maryland MC2115, Chicago, IL 60637; gzhau@mcis.bsd.uchicago.edu; 773-702-6788

Data generated from Dr. Wang's laboratory in University of Chicago indicate that the genes in human genome are far more than 30,000 or so predicted by Human Genome Project. They analyzed the genes expressed hematopoietic stem cells (HSC), and observed that nearly 50% of the genes identified do not match the existing databases containing known genes. I participated in a project on molecular cloning of novel genes expressed in hematopoietic stem cells under the guide of Dr. Zhou in the laboratory. Using a forward and reverse primer, I performed PCR (Polymerase Chain Reaction) to amplify the complementary DNA (cDNA) from a novel gene found in the stem cell, which was cloned in a vector. I then cloned the amplified cDNA into the pCR4-TOPO vector using T4 ligase which were transformed into bacteria cells through electroporation. I then selectively grew the transformants overnight using antibiotics. I further purified the plasmid containing the correct cDNA and performed sequencing reaction. I matched this sequence in the NIH GenBank. Of the 33 sequences checked, one was proved as a novel gene. Using the sequences generated from this experiment, we can start to analyze the function of this gene.



## **PRESENT HUMAN CONDITION. HUMAN AND ANIMAL BEHAVIOR. CONTEMPORARY THEORIES AND STUDIES IN BIOLOGY, PSYCHOLOGY AND NEUROLOGY WITHIN RECURRING PHILOSOPHICAL AND MORAL TRENDS**

### Presenter

Kristina Govorovska, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ruric28@imsa.edu

### Advisors

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

Clay Sewell, Fine Arts, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
clay@imsa.edu; 630-907-5054

James Victory, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jvictory@imsa.edu; 630-907-5977

This inquiry investigates a variety of viewpoints on the relationship between genetic human behavior and social institutions. It explores to what extent human behavior is genetically determined, what is the relationship between the physical architecture of the brain and the nature of human thought and culture. Prior to religion, civilization, and government, humans, as a species, evolved over 50,000,000 years within biologically entrained environments. Modern humans are markedly most isolated from nature, living within artificially mediated life cycles and cultural institutions. In primate field studies, subjects, deliberately removed from their natural environments, display a fixated need to replace nature with objects, which entrain the expression of specific natural behaviors and biochemical responses previously mediated through biological events. This inquiry shows the development of Freudian psychology as an attempt to explain these parasitic consequences of environmental isolation, through E.O. Wilson's Biophilia hypothesis and Richard Dawkin's studies on the Selfish Gene. The study exposes the powerful function of genetic interactions within the human condition, the mind vs. body dilemma, the ethical implications of genetic manipulation, and the meaning of life in general by combining the newest scientific studies and theories with recurring philosophical trends.

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## **TECHNICAL ANALYSIS OF THE FINANCIAL MARKETS**

### Presenter

Heidi Grothaus, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
heidelin@imsa.edu

### Mentor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5960

My objective was to see how closely technical analysis correlates with fundamental analysis. Technical analysis is based on the principles of market action, while fundamental analysis is based on the study of supply and demand factors that cause market prices to rise or fall (Murphy, John, *John Murphy on Chart Analysis*, Ellicott City, MD: Marketplace Books, 1999). Factors that are figured into technical analysis are the Dow Jones Industrial Average, the Value Line Composite Index, inflation indexes, employment, interest rates, and countless indicators. OmniTrader, by Nirvana Systems, Inc. is an automated technical analysis program that was used to chart the trading instruments that this mentorship was tracking. A fundamental analyst uses price-to-earning ratios, dividend yields, liquidity, profitability, free cash flow, and many other components to determine the decisions. Does technical analysis foreshadow events that factor into fundamental analyst's conclusions? Which method is more accurate? These questions and many others that arose throughout the time frame will be confronted in this presentation.

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## EYEBLINK CONDITIONING IN THE MOUSE: EFFECTS OF THE TRACE INTERVAL ON LEARNING RATE

### Presenter

Rui Guan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; quanine@imsa.edu

### Mentor

Craig Weiss, Ph.D., Northwestern University Medical School, Department of Physiology, 303 E. Chicago Ave, Chicago, IL 60611; cweiss@northwestern.edu; 312-503-0529

Wildtype C57Bl/6 mice were examined for learning with eyeblink conditioning. Mice (3-8 m of age) were conditioned to blink by pairing a 250 ms tone with a 100 ms periorbital shock. The two stimuli were separated by a "trace" interval of either 0, 250, or 500 ms. Mice were trained for 5 days (30 trials/session, 2 sessions/day). A significant increase in eyelid EMG activity prior to the shock defined a conditioned response (CR). Mice that exhibited at least 60% CRs in any session were considered learners. The results indicate mice conditioned with a trace interval of 500 ms (trace 500) were not able to learn, while 75% of trace 0 mice and 87.5% of trace 250 mice learned the paradigm by day 5. Trace 500 mice learned to only 37.5% by day 5 which was not significantly different than the percentage of CRs expressed by control mice. These results indicate that the trace interval greatly affects acquisition of eyeblink conditioning, and that a trace interval of ~250ms may be short enough for the mouse to learn, but too long for the cerebellar system to mediate learning without hippocampal support.

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## PHYSICS PROBLEM SOLVING TECHNIQUES

### Presenter

Daniel Gulotta, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dgulotta@imsa.edu

### Advisors

Laura Nickerson, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; physnicks@imsa.edu; 630-907-5915

David Workman, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; workman@imsa.edu; 630-907-5915

There are often many ways to solve a physics problem. Solutions may be valued for elegance, clarity, and ability to generalize. The use of Lagrangian and Hamiltonian mechanics can often simplify problems and lead to advanced theorems. Often, techniques such as the superposition principle and change of variables prove useful. While there is no approach that is always effective, familiarity with these techniques is extremely beneficial. They often lead to beautiful, relatively simple solutions that are not readily apparent. This presentation will give examples of elegant solutions that come from these techniques. The focus will be on mechanics, although other areas of physics will be included. Many problems will involve mathematical tricks that make calculations much simpler. The goal of this presentation is to convey unique ways of looking at physics that are both practical and intriguing.

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## COMPUTER EXPLORATIONS OF FRACTALS

### Presenter

Daniel Gulotta, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dgulotta@imsa.edu

### Advisor

Steven Condie, Ph.D., Mathematics, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; scondie@imsa.edu; 630-907-5967

Fractals are everywhere. Clouds, trees, coastlines, mountains, capillaries, and galaxies exhibit self-similar structures. Despite their great complexity, these structures can be understood and recreated using mathematics. Many fractal phenomena appear in simple equations that lend themselves to computer experiments. Such experiments can lend crucial insight into the nature of fractals. In this presentation, we will discuss the iterative processes that give rise to fractals. We will examine the recursive functions that correspond to different types of fractals and look at how a computer can use them to quickly and accurately generate fractal images. We will observe some images to see what information they convey about the structure of fractals. This will allow us to make conjectures about these structures.



## **STUDY OF THE TRANSFORMATION OF NON-HODGKIN'S LYMPHOMA**

### Presenter

Lucy Guo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; tkd1@imsa.edu

### Mentor

Dr. Lionel J. Coignet, Loyola University Medical Center, Oncology Institute, 2160 South First Ave., Maywood, IL 60153; 708-327-3298; lcoignet@lumc.edu

Non-Hodgkin's Lymphoma (NHL) is a disease that affects mainly the lymph nodes. Although usually an indolent disease, 25-40% of all cases will transform into aggressive disease, resulting in reduced life expectancy. Until now, the poor morphology of chromosomes in NHL samples has not allowed a specific deletion to be associated with this transformation into aggressive disease. Using established transformed NHL cell lines, Dr. Coignet and his lab have discovered that SMRT, a transcription repressor localized on chromosome 12q24, is a recurrent abnormality. Moreover, a fragile site has been localized on 12q24. One mechanistic explanation for the SMRT alteration in these tumors could be an activation of this fragile site. Therefore, Dr. Coignet predicted that this fragile site would be found to be located within the SMRT gene. To test this prediction, normal lymphocytes have been treated with different doses of caffeine and aphidicolin in order to induce fragile sites. Then, FISH (fluorescence in situ hybridization) experiments have then been performed with SMRT specific probe. It appears that 5% of the metaphases showed a disrupted FISH signal, which is compatible with what was expected with our hypothesis. Similar experiments are ongoing, using blood samples from patients with transformed lymphoma. If our hypothesis is correct, these samples should show a higher incidence of signal disruption.

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## **BEHAVIORAL INVESTIGATIONS OF CAPTIVE RETICULATED GIRAFFES (GIRAFFA CAMELOPARDALIS RETICULATA) CONCERNING THE INTRODUCTION OF AN INFANT MALE**

### Presenters

David Hamman, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dhamman@imsa.edu

Jennifer Stynoski, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; srrulz@imsa.edu

### Mentor

Sue Margulis, Ph.D., Brookfield Zoo, Animal Collection/Conservation, Brookfield, IL 60513; sumargul@brookfieldzoo.org; 708-485-0263 x438; 708-485-6048

Since behavior is a visual indicator of an animal's internal and external environment, monitoring behavior reveals variation within that environment without direct human interaction. Through observations, the impact of planned changes can be documented. The birth of Mashama, a reticulated giraffe, provided an opportunity to examine the effects on one such change. The purpose of our study included tracking changes in the behavior of the mother and calf, and also of the five giraffes before and after the birth of the calf. The observational sampling methods described in Altmann '74 were utilized to obtain a time budget for each animal as well as the social interactions between individuals, with emphasis on the mother and calf. Data previously collected by keepers formed a baseline for the comparison of the behaviors observed over a six-month duration. Preliminary analyses show that trends went in the expected direction. One indication of impact as a result of the calf's introduction is a dramatic difference in the time budget of the mother, possibly due to the stress of raising a calf. Additional conclusions will be discussed in depth.



## MUTATED MYOCILIN'S (PROLINE 370 TO LEUCINE) EFFECTS ON MORPHOLOGY AND LOCALIZATION AS COMPARED TO NORMAL MYOCILIN

### Presenter

Michael Hanes, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amko@imsa.edu

### Mentors

Kelly Hunter, Ph.D., University of Illinois Chicago College of Medicine, Department of Ophthalmology and Visual Sciences, 1855 W. Taylor Street, Chicago, IL 60612; kkwhphd@uic.edu; 312-996-6125

Beatrice Yue, Ph.D., University of Illinois Chicago College of Medicine, Department of Ophthalmology and Visual Sciences, 1855 W. Taylor Street, Chicago, IL 60612; beatyue@uic.edu; 312-996-6125

Glaucoma is one of the leading causes of blindness in the United States. It is caused by an elevation of the intraocular pressure. This excess pressure leads to the damage of the optic nerve head, which eventually results in blindness. The most common form of glaucoma is primary open angle glaucoma (POAG), and the presence of mutated forms of myocilin, also called trabecular meshwork-inducible glucocorticoid response protein (TIGR), in mammalian trabecular meshwork (TM) cells has been directly linked to POAG. The functions of myocilin in mammalian TM cells are not yet well defined, and the objective of my research was to study the function of a mutated form of the protein. I specifically studied a common point mutation of myocilin, Proline 370 to Leucine. I mutated the myocilin gene through site directed mutagenesis. The mutated myocilin gene was transfected into mammalian TM cell cultures, and its effects on morphology and localization as compared to normal myocilin were determined. However, this does not imitate actual conditions that are present *in vivo*, and therefore conclusions made through this study of the mutant gene cannot be verified until tested *in vivo*.

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## DETECTION OF D578H MUTATION OF THE LH RECEPTOR IN LEYDIG CELL TUMORS

### Presenter

Anna Hang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lucky3@imsa.edu

### Mentors

Andrew Shenker, M.D., Ph.D., Children's Memorial Hospital, 2300 Children's Plaza, M/C 225, Chicago, IL 60614; ashenker@northwestern.edu; 773-880-8297

Jason Monroe, Children's Memorial Hospital, 2300 Children's Plaza, M/C 225, Chicago, IL 60614; jmonroe@nwu.edu; 773-880-8345

Guoquan Liu, Ph.D., Children's Memorial Hospital, 2300 Children's Plaza, M/C 225, Chicago, IL 60614; gliu@nwu.edu; 773-880-8340

The human luteinizing hormone receptor (LHR) is G-protein coupled receptor located on Leydig cells (LC) of the testis. This transmembrane receptor, normally activated by LH activates pathways in LC inducing testosterone production and cell proliferation. Activating mutations, which lock the LHR in the active state, can cause abnormal growth of the LC and precocious puberty. An activating mutation, encoding the substitution of aspartate 578 with histidine (D578H) has been found in a high proportion of LC tumors from boys, but much less frequently in adult tumors. Fifteen new anonymous samples in the form of paraffin blocks were thinly sliced and mounted on glass slides. Tumor sections were isolated from normal cell sections by microdissection and DNA is extracted. A region of the LHR gene was amplified by PCR, digested, and sequenced to detect D578H. In sequence specific PCR digest, restriction enzyme BsrI would cut the fragment, creating a second band in the electrophoresis gel, if the mutation was present. One adult sample tested positive for D578H. In total, 50% of pediatric tumor samples tested positive versus 6% of adult samples. LC tumors that tested negative may be associated with factors other than D578H.

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## **LARGE SCALE VIRTUAL WEB SERVER ADMINISTRATION**

### Presenter

Kevin He, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kevinh@imsa.edu

### Mentor

Laura Mengel, Fermi National Accelerator Laboratory, Computing Division, MS 120 Box 500, Batavia, IL 60510; lauram@fnal.gov; 630-840-8107

It takes a lot of planning and automation to manage over fifty virtual web servers on multiple machines. An overview of some of the challenges involved is: (1) administrating a single web server; many tasks need to be done in order to maintain just one web server. For this area, I learned about CGI security and checked scripts residing on these servers for security vulnerabilities. (2) administrating multiple web servers; many management and maintenance problems can arise when a web server is running on multiple machines. I wrote a log file browser to merge a server's log files from multiple machines so web authors could browse log files from their server. (3) porting web server between platforms: Things become more complicated when there are web servers running on different platforms. Different scripts and techniques are required for each platform. I wrote a log file converter, which is designed to convert log files to the same format so that they would be compatible with each other and the scripts designed to manage them.

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## **MAXIMIZING THE SIGNAL TO NOISE RATIO OF NUCLEAR MAGNETIC RESONANCE (NMR) RADIO FREQUENCY (RF) COILS IN SAMPLES OF MICROSCOPIC SIZE**

### Presenter

Mark Hoadley, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; hoadley@imsa.edu

### Mentor

Alan Feinerman, Ph.D., Professor and Director MAL Laboratory, University of Illinois at Chicago, 221 W. Erie St., Chicago, IL 60607; feinerman@uic.edu; 312-996-2313; 312-413-0447

Current NMR techniques analyze samples of microscopic size with less precision than desired. I am attempting to maximize the signal-to-noise ratio (SNR), which corresponds to an improvement in precision for RF coils designed especially for the analysis of very small samples. Coils of 1000 microns in length were designed to spiral very tightly around a given sample, imitating the behavior of concentric circles and theoretically maximizing the SNR. Several such coils are being microfabricated to test and optimize several variables determining the lengths and specifications of the coils' various facets. An optimal production method has been empirically determined, and the research continues with the process of inserting the coils into liquid-samples for NMR analysis and testing.

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## **PSYCHOLOGICAL INTERPRETATION OF HOW AND WHY TECHNICAL ANALYSIS INDICATORS PREDICT COMMODITY PRICE MOVEMENTS**

### Presenters

Mark Hoadley, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; hoadley@imsa.edu

David Jou, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dsjou@imsa.edu

### Advisor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5889

Financial markets are discounters of all known information. All fundamental news or micro- and macro-economic indicators that become known to investors, both long and short term, will immediately be absorbed into market prices and factored into the price movement of the various commodities before any profits can be made. Market pricing, however, innately harbors all the necessary information to predict a trend and its future direction. In order to profit above a market's average, the equity-holder must interpret available information differently than the average investor or trader. The behaviors of investors of all timeframes, including hedgers, speculators, and strategists, can be predicted by means of price movements. Some of the indicators studied in this inquiry that predict market direction include moving averages, oscillators, contrary opinion, Elliot Wave Theory, Japanese Candlesticks, and trendline analyses. These technical analysis indicators, when combined meticulously and carefully, can readily recognize the predictable patterns of the investment public.



## CAPSAICIN AS AN ANTI-BACTERIAL AGENT

### Presenter

James Holmes, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
onerib18@imsa.edu

### Advisor

Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; quella@imsa.edu; 630-907-5899

People in warmer climates-where bacteria can thrive when food is not refrigerated-tend to eat hotter, spicier foods. It is possible then that herbs and spices do more than just season food, but kill bacteria as well. Using habañero hot sauce in the Kirby-Bauer, assay zones of bacterial inhibition were measured. It was found that habañero hot sauce killed *B. cereus*, *E. coli*, *S. capitus*, and *S. arizonae*. With this in mind it was then thought that capsaicin-the molecule that makes hot peppers hot-could be the molecule acting as an anti-bacterial agent. It was found that at relatively high concentrations, capsaicin only killed *B. cereus*, not the other three bacteria. A simple explanation would be that at higher concentrations, capsaicin would kill the other three bacteria. It is also possible and more probable that there are some subtle activities going on that make *B. cereus* more susceptible to capsaicin. Finally, it is even possible that the vinegar present in hot sauce was able to kill some of the bacteria. With all this in mind, determining the method by which capsaicin was able to kill bacteria will be the aim of further experiments.

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## KINETICS OF CYTOKINE EXPRESSION AFTER COMPLETE FACIAL MOTONEURON TRANSECTION

### Presenter

James Holmes, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
onerib18@imsa.edu

### Mentors

Kathryn Jones, Ph.D., Hines VA Hospital, Department of Rehabilitation, Research and Development, Hines, IL 60141;  
kjones1@lumc.edu; 708-202-5786

Craig Serpe, B.S., Hines VA Hospital, Department of Rehabilitation, Research and Development, Hines, IL 60141;  
cserpe@lumc.edu; 708-202-5786

Cynthia DeBoy, B.S., Hines VA Hospital, Department of Rehabilitation, Research, and Development, Hines, IL 60141;  
cdeboy@lumc.edu; 708-202-5786

In order to regenerate an injured nerve, it is first necessary to preserve the life of its neuron body. It has been shown that T cells, specifically CD4+ T cells, but not B cells are necessary for this survival. However it is not known which subset of CD4+ T cells-T helper 1 (Th1) or T helper 2 (Th2) cells-is required for neuron survival. Th1 and Th2 cells secrete specific cytokines. Th1 cells secrete interferon-gamma (IFN-g), and Th2 cells secrete interleukin-4 (IL-4) and interleukin-10 (IL-10). With this in mind, it can be shown whether Th1 or Th2 cells are necessary for neuron survival by looking to see which cytokines are upregulated following nerve injury. To test this, an injury was performed on only one side of the mouse facial motor neuron (FMN); the other side was left untouched. Cervical lymph nodes from both sides of the face were removed at several time points post-operative for RNA isolation. IFN-g, IL-4, and IL-10 expression were qualified using RT-PCR followed by gel electrophoresis. These showed the levels of expression to be invariant between cut and uncut sides, suggesting that a general rather than site-specific CD4+ T cell response is necessary for FMN survival.

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## **AN ANALYSIS OF CONSUMER AND COMMERCIAL CONFIDENCE IN THE WEB DEVELOPMENT INDUSTRY FOLLOWING THE "TECH WRECK" OF 2000-2001**

### Presenters

James Holmes, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
onerib18@imsa.edu

Sravisht Iyer, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sravisht@imsa.edu

Alan Xiang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yjxiang@imsa.edu

### Advisor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5889

The "Tech Wreck" is a term for the collapse of the technological sector that occurred in late 2000 early 2001. Since that time but prior to September 11, consumer confidence as measured by the Conference Board fell more than 25%. It was our intention then to measure how receptive the private and commercial sectors were to investing in the web industry, an Internet related field. To do this, we formed a group of web site technicians and solicited business from the two sectors. By distributing questionnaires to our clients, we hoped to gain an insight into why they chose to invest in the Internet and if they didn't want our services, why they chose that. After attempting all this we were only able to convince one client, and we are currently in contact with one more, both of whom own businesses. Thus, we have deduced that people are hesitant to invest in web development, and that those who are members of the business community, where there is a potential return on investment.

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## **HISTORY IGNITED: REFURBISHMENT AND ANALYSIS OF A 19TH CENTURY LIME KILN IN MAQUOKETA, IOWA**

### Presenters

Sarah Howe, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; warpgirl@imsa.edu

Joseph Langan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
danjoe47@imsa.edu

Julie Lauffenburger, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
julz003@imsa.edu

### Mentor

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; 847-683-4188;  
dgossman@gcisolutions.com

As part of the Archaeology mentorship in Maquoketa, Iowa, we have dedicated this year to the study of a (relatively) small lime kiln on Mr. Gossman's property. The kiln is a reworked extension of a natural cave in a limestone cliff face, and was used in the production of construction mortar by 19th century American settlers in the region. Around 1870, regional industrial-scale kilns came into operation, rendering unnecessary the smaller local sites still found in the area. During the past year, we re-ignited the kiln for a full eight hours, collected the batch of limestone we placed inside the kiln for a full eight hours, collected the batch of limestone we placed inside the kiln beforehand, and chemically analyzed the rocks to see how much anhydrous lime we converted from the original limestone. This research helps to give insight into the construction methods of early American settlers, as well as the practicalities and dilemmas they may have faced.

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## **RECURRENCE QUANTIFICATION ANALYSIS OF PROTEIN SECONDARY STRUCTURE**

### Presenter

Yinin Hu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; paladin3@imsa.edu

### Mentor

Charles Webber, Jr., Ph.D., Loyola University, Chicago Stritch School of Medicine, Physiology, 2160 South First Avenue, Maywood, IL 60153; cwebber@luc.edu; 708-216-4131; 708-216-6308

After the success of the Human Genome Project, the next step is to identify the relationship between DNA coding sequence



and expressed proteins. Protein structure can be deduced by X-ray crystallography. The purpose of this study is to delineate protein secondary structures using hydrophobicity profiles of amino acid sequences within a large Group of proteins. Methods used include direct coordinate plotting and hydrophobicity recurrence quantification analysis across the entire protein set. The current approach incorporates twenty amino acids of the same protein viewed within a "window" shifting through the sequence of the protein. These twenty-base windows generate recurrence variables such as %recurrence, %determinism, and entropy which are then correlated with known secondary structures along the chain. The overall objective is to be able to use RQA variables to predict protein secondary structures without requiring protein crystallography. The project is a work in progress, and further effort will lead to advancements in methods and results.

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## **STOCKS, BROKERS, AND EXCHANGES, OH MY! : WHAT YOU NEED TO KNOW ABOUT INVESTING IN THE STOCK MARKET**

### Presenters

Kristoffer Inton, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; inton@imsa.edu  
Qing (Mary) Miao, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
kittykas@imsa.edu

### Mentor

James Meyerhoff, Chicago Stock Exchange, Inc., One Financial Place, 440 S. LaSalle St, Suite 3200; Chicago, IL 60605;  
jimpa54@aol.com; 312-663-2200

Investing plays an increasingly important role in today's world. For the issuing company, it allows for increased resources. For the investor, it offers possibilities of personal profit. Yet before entering the market, there are some basics critical to understanding and success. First, one should understand that investing is done through brokerage houses. Among these, it is important to look at and compare the leading firms in several aspects. The potential investor should also understand the role of the government, ranging from regulatory organizations and standardized training of individual brokers. The government executes these tasks with mandatory broker's tests such as the Series 7 Exam and regulatory bodies such as the SEC and the NASD. Lastly, one should understand that most trading is done through exchanges. There are regional exchanges located throughout the U.S., as well as the existence of NASDAQ, a completely automated exchange carried out on computers. At these exchanges, it is critical to understand how orders are executed, how prices are determined, and the role of people at the exchange. This mentorship does not offer view into stock analysis. Instead, its goal is to give a basic understanding of how the stock market works.

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## **PROLIFERATION AND DIFFERENTIATION OF SCHWANN CELLS STIMULATED BY AXOLEMMA-ENRICHED FRACTIONS FROM LARGE AND SMALL AXONS**

### Presenter

Sravisht Iyer, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sravisht@imsa.edu

### Mentor

George DeVries, Ph.D., Laboratory of Cellular Neurobiology, Hines VA Hospital, Fifth Ave and Roosevelt Road, Building 1, Room C423, Hines, IL 60141; 708-202-2262; gdevrie@lumc.edu

A definite relationship has been noted between axon myelination and size of the axon. Larger axons in a neuron tend to be myelinated while those smaller in size do not. Schwann Cells (SC) that come in contact with small axons proliferate but do not differentiate (create myelin). Due to the size of the smaller axons, the area of contact between the SC and the axon may be too small to allow for the passage of the differentiation response. This problem will be attacked by exposing SC to Axolemma enriched fractions (AEF) in culture because previous literature has proven that the exposure of SC to AEF in culture elicits the same response as the contact of SC with an axon in the peripheral nerve. In culture the surface area of SC that comes in contact with axolemma in culture is the same for axolemma from both large and small axons. The small axons are obtained from the bovine splenic nerve and the large ones are obtained from bovine white matter. The study will culminate by placing AEF from both of these sources in culture with SCs with one another and observing if differentiation occurs in both cultures. If differentiation occurs in the culture containing AEF from unmyelinated sources, it can be inferred that smaller axons and SC lack enough contact in the human body for the signal for differentiation to pass through.



## **WIZ KIDS ROCKIN' POWER**

### Presenters

Jillian Jacobson, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jilibean@imsa.edu

Jubilee Tan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jubyt3@imsa.edu

### Mentor

Connie Van Brunt, Community Youth Creative Learning Experience, 1111 N. Wells, Chicago, IL 60610; 312-573-8920

We conducted our learning lab at the Community Youth Creative Learning Experience (CYCLE) in order to foster within our students, called Wiz Kids, interest in the social interactive world around them, and the ability to express their insights in a newspaper. After discussions on newspaper organization and freedom of speech, each third-through-fifth-grade girl chose a topic dealing with student activities at CYCLE. With our help, the students gathered information, conducted interviews, constructed outlines, and eventually wrote and edited articles. The resulting newspaper, Words From the Wiz Kids was a success, and all involved were proud of it. After we worked with these girls for a semester though, we decided that it would be beneficial for us to create an environment for them, which developed their social skills. We called this environment the Etiquette Lab, where the girls found that etiquette is "a fancy term for getting along with others." This provided them with practice in interacting with people in a variety of school and other social situations. Judging from what the students had to say about their experiences, we seem to have achieved our objective.

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## **THE EFFECTIVENESS OF HANDS-ON LEARNING FOR MIDDLE SCHOOL STUDENTS**

### Presenters

Chandana Jasti, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
chandana@imsa.edu

Samanthi Narayanan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
doobydoo@imsa.edu

### Advisor

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987

Three science activities were designed during Intersession of this year by a group of IMSA students who would then teach the curriculum to 7th and 8th graders from the Chicago area, who visit IMSA through Project School Visit. All activities involved electrostatics. The IMSA Intersession group decided all the activities were quite engaging, reliable, and appropriate for the age group of the visiting students. Two of the activities were ones in which the students use fur-rubbed rubber rods to make tape attract and repel and to make a meter stick spin on the back of a spoon. The third required the students to get a shock from a pie pan sitting on a Styrofoam plate. After completing the activities and discussing their results, the students were given a quiz and asked to explain a similar but novel process of electrostatics. The quiz is our source of data. The results support our hypothesis made in September, that hands-on learning really does enhance the student's ability to remember and analyze what they are learning.

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## **THE EFFECT OF NAZI POLITICS ON THE GERMAN MEDICAL PROFESSION DURING WORLD WAR II**

### Presenter

David Jou, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506; dsjou@imsa.edu

### Advisors

Leon Lederman, Ph.D., Resident Scholar, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506; lederman@fnal.gov; 630-907-5046

Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506; quella@imsa.edu; 630-907-5899

Joanne Wallmuth, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora IL 60506;  
wallmuth@imsa.edu; 630-907-5046

The atrocities committed by physicians in Nazi concentration camps during World War II and the Hitler regime, exemplify



the horror and depravity that can readily take place, when professional ethics and morals are replaced with faulty political ideology and propaganda. At the end of the nineteenth century, Germany's social Darwinists emerged to power, and by the mid-1920s their rhetoric of racial hygiene had merged with Nazi ideology to create an environment patronizing acts of violence and brutality in the name of military research and "ethnic cleansing." The victims slaughtered, numbered in the hundreds of thousands, with only a handful surviving. Though, seemingly valid, their experimentations on high altitude, the effect of cold, potability of processed seawater, along with the effects of mustard gas and phosphorous burn, were only a guise to torture and exterminate the "socially unfit" on a grand scale. The German medical professions' full cooperation with the Nazi regime began with accepting an outwardly harmless government philosophy that judged people "based upon their perceived costs and benefits to the state." This distorted ideology served as justification for numerous atrocities committed in the name of scientific research.

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## **EXAMINATION OF A PURPORTED LINK BETWEEN ABORTION AND LATER DEVELOPMENT OF BREAST CANCER**

### Presenter

Catherine Kim, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ckim@imsa.edu

### Mentor

Senator Chris Lauzen, 52 West Downer Place, Aurora, IL 60506; admin@lauzen.com; 630-264-2334

The issue of a possible abortion/breast cancer link has arisen in the Illinois General Assembly as a potential matter for future legislation. Such legislation may stipulate that doctors inform patients of the possible increased risk of breast cancer after an induced abortion. However, there is much disagreement within the scientific and political community as to whether or not an abortion/breast cancer link actually exists. Some studies conducted to investigate a possible abortion/breast cancer link have shown an increased risk of approximately 10 to 40 percent. Yet, there is disagreement on whether or not the increased risk is legitimate or due to testing bias or error. Therefore, by researching the possible abortion/breast cancer link in medical literature and also through interviews with oncologists, the goal of this project is to better inform Illinois Senators and Representatives who may be required to make legislative decisions dealing with a possible abortion/breast cancer link.

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## **AN ANALYSIS ON THE REACTION OF CYTOCHROME C PEROXIDASE WITH VARIOUS REACTANTS**

### Presenter

Nicholas Kim, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kangho@imsa.edu

### Mentor

Dr. James E. Erman, Department of Chemistry, Northern Illinois University, DeKalb, IL 60115; jerman@niu.edu;  
815-753-6867

The purpose of this experiment is to further investigate the structure and function of a heme protein, Cytochrome c Peroxidase (CcP). Amino acid 146 in this protein is thought to control access of negatively charged reactants to the heme group. The hypothesis is that Aspartate 146 on a normal CcP enzyme inhibits reactions with its negative charge. To test this hypothesis, the rates of the reactions between native CcP and a reactant and a mutated, neutral CcP and a reactant will be measured. If the hypothesis is true, then the rate of reaction of para-nitroperoxybenzoate anion should be inhibited less relative to the neutral peroxybenzoic acid in the CcP (D146N) mutant compared to wild-type yeast CcP. The first set of data between the reactions with the mutated CcP and para-nitroperoxybenzoic acid (pNPBA) show less decreased reaction speeds than the reactions with a normal CcP and pNPBA for pH 6-8. These preliminary findings suggest that the hypothesis is true. Unfortunately, only a few pH values have been tested for which does not account for a complete data set.

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## **IDENTIFICATION AND CHARACTERIZATION OF MULTICOPY SUPPRESSORS OF VPR-INDUCED CELL DEATH**

### Presenter

Pyong Wha (Hannah) Koh, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ice1004@imsa.edu

### Mentor

Dr. Yuqi Zhao, Children's Institute for Education and Research, Northwestern University Medical School, 2430 North Halsted, Chicago, IL 60614; yzhao@northwestern.edu; 773-880-6608

Vpr is an auxiliary protein found in the HIV-1 virus. Vpr is responsible for two major functions: viral activation and depletion of CD4 lymphocytes. Several Vpr-induced activities were observed in vitro: nuclear localization of the pre-integration viral complex (PIC), cell cycle G2 arrest, and cell death. My research concentrated on screening for suppressors of Vpr cell killing activity by using fission yeast (*Schizosaccharomyces pombe*) as a model system. A fission yeast strain carrying an integrated copy of the vpr gene was transformed with *S. pombe* cDNA genomic library, then plated on minimal media agar plates without thiamine to induce vpr expression. After three days of incubation, the thiamine-carrying plates were used to calculate transformation efficiency and the -T plates were screened for suppressors. Cell colonies on -T plates were considered potential suppressors. The entire *S. pombe* genome has been transformed, and 48 cDNA clones were identified through the initial screening process. 30 have been confirmed to have identifiable functions. The isolated cDNA from the 30 proteins were transformed back into *S. pombe* to ensure suppression of Vpr-induced apoptosis. Six proteins displayed vpr suppression in the second transformation including ribosomal protein L27-A, rp S11, rp L39, heat shock protein 16, elongation factor 2, and protein kinase (skp +1). Identification of natural proteins that suppress Vpr effects may potentially lead to new anti-HIV therapies.

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## **WILD CANID OBSERVATIONS**

### Presenters

Bethany Kondiles, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
wolfis36@imsa.edu

Linda Pinto, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lpinto@imsa.edu

### Mentor

John Thompson, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jtt@imsa.edu; 630-907-5944

Of all the different types of canids, wolves and coyotes are the focus of this project. Coyotes in the Geneva region in Illinois have been the focus of a predicament. The coyotes are behaving in typical coyote fashion; however people who live in the subdivision in which their territory is centered are having difficulties adjusting. Fear for children and pets have caused many people to desire the coyotes removed. The government of Geneva has asked for help in determining whether the coyotes pose any sort of threat or nuisance to the people living there. Observations taken in the Geneva area and studies and surveys conducted amongst the citizens will determine whether or not the threat posed is real. The behavioral patterns of wolves during the mating season are extremely complex. The rank of the pack is shuffled as statuses are redefined as hormone levels rise. Conclusions made from observations should help the town of Geneva and the scientific community.

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## **ANALYSIS OF CARBON NANOTUBE SYNTHESIS USING PLASMA ARC DISCHARGES**

### Presenter

James Koo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jk8381@imsa.edu

### Mentors

Shaun Doherty, Northwestern McCormick School of Engineering, 2145 Sheridan Road, Evanston, IL 60208;  
sdoherty@northwestern.edu; 847-491-7443

R.P.H. Chang, Northwestern McCormick School of Engineering, 2145 Sheridan Road, Evanston, IL 60208; 847-491-3598;  
r-chang@northwestern.edu

With the increase of modern day demand for new processes for techniques developing types of miniaturization, the production of nanotubes are in great demand. Applications of these structures have already been found to be able to replace



carbon fiber, construction materials, and certain aviation parts. However, even though there is a high demand for quantities of these nanotubes, the current processes to produce them are very time consuming and they can only produce a limited quantity. Carbon Nanotube structures have many semi conductive properties that can serve many different applications within our environment. The most basic carbon nanotube is a carbon atom bonded by 3 alternate hexagonal sides. These bonds not only induce high semi-conductive properties but also compose a bond that can be stronger than the carbon structure of that of a diamond. The processes in which we make nanotubes today are considered to be too time consuming and ineffective at producing high quantities. New processes involving the plasma-arc that synthesizes these tubes have many different variables that can be altered. Perhaps one of these variables will lead to a viable solution that will be a benefactor in the synthesis of carbon nanotubes.

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## **ION PROPULSION DESIGN AND EFFICIENCY**

### Presenters

Vladimir Krastev, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; deadtie@imsa.edu

Christopher McLaughlin, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; siam@imsa.edu

Robert Quimby, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bobq@imsa.edu  
Christopher Szucko, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ces@imsa.edu

### Advisors

Michael Lindenmeyer, Grainger Workshop, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; tfilm@imsa.edu; 630-907-5959

David Workman, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; workman@imsa.edu; 630-907-5915

For our inquiry, we explored the mechanics of ion propulsion, in the hopes of being able to design and build an ion engine. We conversed with faculty members and members of the staff at Argonne National Laboratories. We have designed a plan based on a simple stainless steel tube with tungsten filaments at one end, surrounded by magnets and ending with a series of plates with a hole in the center, charged at various electric currents. Gas will be injected into the end of the tube with the filaments. The filaments are heated to create an ionization arc. They will shoot off electrons, which will knock off electrons from, and thus ionize, the gas particles. The particles will then accelerate towards the plates, as they will bear an attracting charge. The ions will then move through the holes in the charged plates due to the shape of the electric fields caused by the hole and receive their final boosts of acceleration. After this stage, there will be a cathode, thus allowing the ions to regain their electric charge. The thrust gained is from the acceleration of these particles. We plan then to analyze this ion beam using a mass spectrometer.

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## **VERBAL MEMORY PERFORMANCE: ARE FEMALES REALLY SUPERIOR TO MALES?**

### Presenter

Elizabeth Lampe, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; air@imsa.edu

### Mentors

Christopher Randolph, Ph.D., Loyola University Medical Center, Department of Neurology, 2160 South First Avenue, Maywood, IL 60153; crandol@lumc.edu; 708-216-3539

Catherine Zaweski, M.A., Loyola University Medical Center, Department of Neurophysiology, 2160 South First Avenue, Maywood, IL 60153; 708-216-3539; czawesk@lumc.edu

It has been reported that females generally outperform males on measures of verbal memory. This may be due to the use of female-biased stimuli in several prior studies, however, and the purpose of this experiment was to determine whether females would continue to exhibit superior performance on a verbal memory task after the stimuli were controlled for their imagery, familiarity, and emotional value. A list of one hundred nouns was presented to high school students. Participants (N=107) were asked to rate each word according to imagery, emotional value, and familiarity. Three lists were derived from these ratings; a list of words that were rated highly on these variables by males but not females (the "male" list), a word list rated highly on these variables by females but not males (the "female" list), and a "neutral" list, composed of words rated at equal levels by males and females. The second phase of the study will consist of obtaining memory performance data on all three lists for both males and females. It is hypothesized that males will outperform females on the "male" list, that females will outperform males on the "female" list, and that the groups will perform at equivalent levels on the "neutral" list.



## WOLLSTONECRAFT: PAST AND PRESENT PERSPECTIVES

### Presenter

Elizabeth Lampe, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; air@imsa.edu

### Advisor

Julie Hipp, Ph.D., English, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jhipp@imsa.edu; 630-907-5981

Women conform to a feminine ideal even when they try not to; visible and unseen social constraints force most women into playing a feminine role. According to Mary Wollstonecraft, an eighteenth century writer, this desire for conformity is based on society's educational, political, and class systems. In *A Vindication of the Rights of Woman* (1792), Wollstonecraft argued that through proper social restructuring and education, both men and women would learn to rely on reason, rather than emotions, which would lead to greater equality between sexes and social classes. Wollstonecraft formed her critique of gender roles in reaction to prior philosophical theories presented by Rousseau, Burke, Paine, and Godwin. Some of these writers called for separate, but equal gender spheres, while others wanted everyone to be treated equally. Although two hundred years have passed since the publication of her work, Wollstonecraft's critique of social conformity by men and women is still valid, and it can be seen in more modern writing. Writers have since responded to or used Wollstonecraft's critiques in their written arguments or novels, and mediums such as commercials and magazines continue to reinforce the feminine ideal that Wollstonecraft worked to dismantle.

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## A HOUSE FOR MY PARENTS

### Presenters

Vivian Lau, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; vlau@imsa.edu  
Grace Whang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
eunhae28@imsa.edu

### Mentor

Joy Meek, Wheeler Kearns Architects, 343 S. Dearborn St., Chicago, IL 60604; joy@wkarch.com; 312-939-7784

In 1977, Anthony Tsirantonakis, along with several other aspiring architects of the Irwin S. Chanin School of Architecture, was assigned a thesis project for the intent of edifying the techniques necessary for proficiency in personal and consistent design. This particular project was a house designed for the architect's parents. With this purpose in mind, we have been able to decide on a project further extending this ready-made project. Our undertaking explores the significance of the architect's unique design; we have studied the house plans extensively, and investigated the given background of the architect and his parents. In due course, we have been able to come to a better understanding of the architect's vision and aim for this house, as well as the particularity of his design. Our expansive research has been displayed through a physical model of Tsirantonakis's design, and a power point presentation analyzing the details of his work.

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## HOW DO WE TALK? A STUDY ON DIFFERENT DIALECTS AND THEIR AFFECTS IN ILLINOIS

### Presenters

Julie Lauffenburger, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
julz003@imsa.edu  
Urvi Purohit, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; urvs9@imsa.edu

### Advisor

Dennis Czerny, Ph.D., Educational Psychology, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; dczerny@imsa.edu; 630-907-5974

Everyone speaks differently, with different accents and combining different words to make their dialects. Using three geographic sections of Illinois, northern Illinois (Chicagoland area), central Illinois (Springfield-Peoria area), and southern Illinois, we learned that that the way people speak is a part of their identity. People speak differently partially based on where they are from. One's ethnicity affects the way they speak in that their native language becomes intertwined in their English. People in different geographic locations develop their own dialects based on the original settlers of their area. Dialect discrimination is an underlying issue that many people try to avoid. People strive to correct their accents in order to



fit in with their social surroundings. The most favorable dialect across the United States is the midwestern dialect, as people with this dialect are considered to have no accent. Most people speak more than one dialect, in their homes, in their neighborhoods, with their friends, and in a professional setting. The practice of changing dialects to fit one's surroundings is called "Code Switching." Dialects affect our everyday lives, and sometimes, without even knowing it, we change our dialect to assimilate with the other people around us.

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## **SCIENCE EXPLORERS: SPACE EXPLORATION**

### Presenter

Jeanne Lee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jeanne@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

Space exploration is a topic of fascination for kids of all ages. The challenge is to create curriculum that is appealing and educational. The main goal of Science Explorers is to teach science topics through engaging materials while engaging the participants in a problem based learning environment. The "Space Exploration" topic team developed four hours of curriculum covering the following topics: astronomy, rockets, and planets. Students will launch Alka-Seltzer rockets, build a to-scale model of the solar system, learn cultural myths about the constellations, and construct a comet out of dry ice. Through hands-on activities and demonstrations, the curriculum provides opportunities for campers to learn and discover. The feasibility of these activities was tested in the Kids Institute and on a "Field Trip" with third graders. From a survey for the kids to fill out, the effectiveness of the curriculum and student teaching can be tested.

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## **EXPLORING INTERACTIONS OF THE GENE TAP**

### Presenter

Kachiu Lee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; chewie@imsa.edu

### Mentors

Dr. John Crispino, Ben-May Institute for Cancer Research, 924 East 57th St, Chicago, IL 60637; 773-834-7459; jcrispin@huggins.bsd.uchicago.edu

Erica D. Smith, Ben-May Institute for Cancer Research, 924 East 57th St., Chicago, IL 60637; 773-834-7459; edsmith@midway.uchicago.edu

Research on blood cell development has been extensive, but not exhaustive. It is of interest that SCL (stem cell leukemia), a gene essential to normal blood cell development, has been found to be over expressed in many adult leukemia patients. It has also been discovered to interact with the gene TAP. Current research on TAP suggests that it plays a large role in early embryonic development. Further research must be done to determine TAP's exact role in relation to normal embryonic development and to SCL. At present, few publications of the functions of TAP exist, as it has only been recently discovered. Although it is suspected to be a transcription agent, this has not yet been proven. In order to research the role of TAP, a new approach must be taken. Instead of focusing on the interaction between TAP and SCL, I have decided to investigate any other genes or proteins that may interact with TAP. If the role of TAP in relation to known genes can be discovered, then it would be highly probable that TAP plays a similar role with SCL. Also by finding other known genes that TAP interacts with, the next step would be to study the function of TAP in relation to the factors that these known genes control. The purpose of my research will be to discover other gene(s) with which TAP interacts.

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## CREATING AN EFFECTIVE SCIENCE CURRICULUM FOR THIRD AND FOURTH GRADE STUDENTS

### Presenter

Stephanie Lewis, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
shotdisc@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; britta@imsa.edu; 630-907-5987

Through Science Explorers, a group of students has created a science curriculum that not only teaches third and fourth grade children about explosions and reactions, but also sparks an interest in science. The "Radical Reactions" curriculum will be taught on April 3, 2002, during a Wednesday "Field Trip to IMSA" and also as a part of the weeklong Science Explorers Jr. summer camp. In order to tell whether or not the curriculum was successful, a pre/post survey was developed. The survey asks kids about their interest level in many topics that the curriculum covers. The survey also includes scientific questions to test the effectiveness of the curriculum and the teacher. Comparing the results of the survey will tell if the kids learned from the curriculum and whether or not they are more interested in science after they have completed the Field Trip. The Field Trip also allows the student developer team an opportunity to modify their curriculum before the summer camp, making the experience more valuable for the students and the educators.

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## CLONING GENOMIC BREAKPOINTS OF AML1 IN LEUKEMIA PATIENTS WITH t(3;21)

### Presenter

Jennifer Li, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mdjenny@imsa.edu

### Mentors

Janet D. Rowley, M.D., The University of Chicago Medical Center, Section of Hematology/Oncology, 5841 S. Maryland Ave., Chicago, IL 773-702-6117; jrowley@medicine.bsd.uchicago.edu;

Yanming Zhang, M.D., The University of Chicago Medical Center, Section of Hematology/Oncology, 5841 S. Maryland Ave., MC2115, Chicago, IL 60637-1470; 773-702-6788; yzhang@medicine.bsd.uchicago.edu

The t(e;21) is a recurring chromosome translocation primarily detected in patients with chronic myeloid leukemia (CMS) in the accelerated phase or in blast crisis and in patients with therapy-related MDS or AML (t-MDS/AML) after treatment for previous tumors with chemotherapeutic drugs that inhibit DNA topoisomerase II (top II). In t(e;21), the 5' portion of AML1 is involved in a complex fusion with MDS1/EV11 gene in eq26, resulting in a chimeric fusion gene that plays an important role in leukemogenesis. It is evident that specific structural elements of chromatin, including topo II cleavage sites, Dnase I hypersensitive sites, and scaffold attachment regions (SARs), at or near the breakpoints of genes have been implicated in DNA recombination of several chromosome translocations, such as t(9;11) and t(8;21). However, little is known about whether the genomic breakpoints in AML1 and MDS1/EV11 in t(e;21) patients cluster and whether these chromosome structural elements correlate with the breakpoints. Using Southern blot analysis, we have mapped genomic breakpoints in AML1 in 8 of 14 leukemia patients with t(3;21). The genomic breakpoints in AML1 in some patients correlate with the topo II DNA cleavage and Dnase I hypersensitive sites, suggesting that topo II cleavage and Dnase I sites may be implicated in chromosome recombination in t(3;21).

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## DROPLET CAPILLARY WAVES AND OSCILLATIONS

### Presenter

Casey Liang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; xixi12@imsa.edu

### Mentors

Dr. Constantine Megaridis, University of Illinois at Chicago, Department of Mechanical Engineering, 842 W. Taylor St., Chicago, IL 60607; cmm@uic.edu; 312-996-3436

Jose Car, James Knight, Julie Schaefer, Biljana Zdraverski, Undergraduate Team Members, University of Illinois at Chicago, Department of Mechanical Engineering, 842 W. Taylor St., Chicago, IL 60607

Under the right circumstances, a liquid droplet that impacts a surface may form a pyramid shape. This shape is constructed from the waves that propagate toward the top of the droplet. These waves form because the kinetic energy of the droplet



impact is transferred into surface tension energy. Using a high-speed camera, we capture still images and analyze these waves. Using this experimental data, we can then verify on existing models for capillary waves. Droplet oscillations occur when a droplet is perturbed during a free fall. Droplet oscillatory motion can be predicted by numerical models, which largely lack verification by experiments. Experiments in the laboratory are hindered by the droplets moving towards the ground, thus moving out of the field of view. With reduced-gravity, this experiment can be performed. The droplet can oscillate freely and for long periods of time allowing visualization using a high-speed camera. This experiment will be done on the NASA KC-135A, a modified 747 that flies parabolas allowing a weightless environment for 20-30 seconds at a time. The data from these experiments will test and verify the theoretical models.

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## **BIBLE VS. KORAN: THE WOMEN OF FAITH**

### Presenter

Rebecca Liu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; rebelulu@imsa.edu

### Advisor

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

What began as an exploration of Middle Eastern Ideologies and Arab/Israeli conflicts has evolved into an in depth study of the women in the Bible and the Koran. The first months of research were used to develop an understanding of the various conflicts in the Middle East. However, as the research on these topics continued, I noticed the absence of women in any text. Turning my focus to women, I found that the portrayal of women in books of faith created a foundation for the treatment of women in antiquity and modern life. The complex image of women in the Bible is comprised of strength due to fertility and their methods of manipulation, as well as weakness, because of their physical inferiority to men. The women in the Koran are also commonly illustrated in that manner. Is Western Society still affected by these notions? Are Muslim women still dominated by Mohammed's ideal female role? This inquiry explores the multi-faceted views of women in two different but related religious contexts, and the influences they have on today.

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## **THE NEAREST-NEIGHBOR REPRESENTATION OF BOOLEAN FUNCTIONS**

### Presenter

Zhihao Liu, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; zhliu@imsa.edu

### Mentor

Gyorgy Turan, University of Illinois at Chicago, 851 S. Morgan Street, Chicago, IL 60607-7045; gyt@uic.edu; 312-413-2151

The nearest-neighbor representation of data has many applications in medical diagnosis, pattern recognition, and artificial intelligence. We consider this representation for Boolean functions. The complexity of a function is measured by the minimum number of prototypes required in its representation. Previously we found that almost all functions have an exponential lower bound, and we proved a linear lower bound for a specific function. We also proved upper bounds. Now we extend our previous results by proving lower bounds for the k-nearest neighbor representation, and by proving a lower bound for the parity function.

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## **ACOUSTIC QUALIFICATION OF AN ANECHOIC CHAMBER**

### Presenter

Tracy Llenos, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; aceswild@imsa.edu

### Mentor

Ganesh Raman, Ph.D., Asian Anthropology, Illinois Institute of Technology, 2430 North Halsted, Chicago, IL 60616; raman@iit.edu; 312-567-3554

Anechoic chambers are built to provide a reflection free environment for sound testing. By constructing walls of large wedges of sound absorbing material, echoes that lead to miscalculations in acoustical measurements can be eliminated. We have constructed a new chamber for use in laboratories at the Illinois Institute of Technology. Before it can be used, we have performed acoustical test and measurements. This allows us to find the useful ranges in decibels for the anechoic chamber.



Both steady state (continuous sound source) and transient (varying source location and duration) measurements were taken. Through computer techniques such as Fast Fourier Transform, the useful frequency ranges for the chamber were analyzed. The chamber was further qualified by performing a series of microphone calibrations inside.

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## **SUPERCOOLING, OVERCLOCKING, AND PERFORMANCE BENCHMARKING THE INTEL® PENTIUM® 4 PROCESSOR**

### Presenter

Yousaf Malhance, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; usf1@imsa.edu

### Advisor

Christopher Colburn, Network Administrator, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cmc@imsa.edu; 630-907-5980

As computer processor frequencies scale higher, their heat output rises; traditionally, this has been managed by a relatively inefficient heatsink and fan combination. Overclocking (raising the frequency of a processor beyond its rated speed) is dependent upon temperature and lowering the core temperature typically allows higher overlocks until the processor reaches its physical limit. This inquiry explores more advanced methods of cooling using water and peltier devices (thermoelectric heat pumps that make subzero temperatures possible). Two 172 watt peltiers are placed on the processor; these, in turn, are cooled by a waterblock. Upon exiting the waterblock, the water passes through a pump and is cooled by a heater core utilizing a high speed, 120-millimeter fan. The water then flows through another waterblock that cools the hot side of the water chiller. Passing through another heater core, the water is then chilled by a custom designed waterblock (with very small passages for effective heat transfer), at which time it is circulated back to the processor. An Intel® Pentium® 4 1.8 GHz processor will be overclocked and tested at different speeds using common benchmarking applications to determine the tangible benefits of utilizing an overclocked system.

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## **EXPANDING IMSA KIDS INSTITUTE ENRICHMENT OPPORTUNITIES**

### Presenters

Paul Malina, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; malina@imsa.edu  
Christopher Young, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
cyoung@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

As a part of efforts to explore possibilities for expanding IMSA's Kid's Institute, research was conducted focusing on the feasibility and efficacy of conducting enrichment activities for elementary students. The process required producing a number of detailed surveys with the aim of collecting information regarding the interests and needs of the surrounding community. Teachers were surveyed in order to gain data about their view of the needs of students, and parents were surveyed in order to gain data about perceived demand. Conducting a focus group with parents of KI participants provided a further form of qualitative information. The initial review of the data and resources showed that parents and teachers are highly interested in IMSA Kids Institute programs in many disciplines and suggested parameters for operating these programs. These conclusions were used to plan a series of five workshops, on the topics of inventions, pottery, architecture, reading, and ecology. These workshops have been occurring on Saturdays on the IMSA campus. The initial offering was a success, and it will be used as a model for this spring's programs. Based on reactions to this year's programs including enrollment numbers and student input, offerings for the fall semester 2002 are recommended.

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## **MARTIN LUTHER AND THE RENAISSANCE TRADITION**

### Presenter

Paul Malina, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; malina@imsa.edu

### Advisor

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

The Reformation was a pivotal movement in Western culture that we can view through the writings and thought of one of its leaders, Martin Luther. This is a tall task, as the volume written about the man and the movement is massive. This inquiry centered on putting his writing in historical and intellectual perspective through the analysis of his works, tracing the many influences that affected his thought. Luther was a complicated man whose work is intensely personal, a clear product of a time when the Christian religion shaped the daily lives of Europeans more deeply than we can comprehend. Luther was concerned about far more than the corruption of the Catholic Church. He was above all concerned with maintaining a right relationship with God and the proper study and interpretation of Scripture. He gradually authored an integrated theology that advanced that cause. The political and social chaos that ensued after the start of the Reformation guided him to both reaffirm his beliefs and lay the groundwork for a new church.

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## **DEVELOPMENTAL OUTCOMES OF PRETERM INFANTS WEIGHING LESS THAN 1000 GRAMS AT BIRTH, DURING THE PERIOD OF 1997-1998**

### Presenter

Joanne Mathews, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jmathews@imsa.edu

### Mentor

Dr. Monika Bhola, Department of NeoNatology, Loyola University Medical Center, 2160 South First Ave, Maywood, IL 60153; mbhola@wpo.it.luc.edu; 708-216-6967

The proposed and conducted research was to investigate the developmental outcomes of preterm infants weighing less than 1000 grams at birth during the period of 1997-1998. The purpose of this study is to observe the outcomes, namely the physical, social, and intellectual aspects of these preterm infants. This information can better prepare parents, who are expecting premature infants with low birth weights. This research involves the records of the premature infants born less than 1000 grams at birth, during the 1997-1998 period. Studies in this field show that survival of preterm infants increases with gestational age. The lower the gestational age, the higher the incidence of complications and severity of neurologic disability. Some of the factors associated with abnormal outcomes of the preterm infants were gestational age, days on oxygen, intracranial hemorrhage, social risk factor etc. However, low birth weight was not found to be associated with abnormal outcomes.

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## **FROM THE SAVOY TO THE RAVE: A COMPARISON OF 2 DIFFERENT ERAS OF DANCE CLUB MUSIC**

### Presenters

Martin McCrory, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mlmgolf6@imsa.edu

Jennifer Poulsen, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; baobob@imsa.edu

### Advisor

David Deitemyer, Director of Bands and Orchestras, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ddlemont@imsa.edu; 630-907-5048

Offering an opportunity to escape the harsh issues of everyday life, dancing appeals to people of all backgrounds by recognizing the similarities and differences between people, and incorporating it into a few minutes of light, sound, and movement. As societies change, so does the music to which it is done. Music and dance adapt to the society in which they exist as the needs of the people change from era to era. Our inquiry focuses on two specific genres of dance music: 1940's jazz club music and 2000's dance club music. The focus of this study is not only to locate the common threads between the



two, but also to analyze the differences between these genres of music. This study is a multi-step process, involving extensive research of the technical as well as the social aspects of the music, and concludes in the creation of a piece of music that illustrates similarities and differences from both genres of music.

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## **MECHANISM OF DUCTILE REGIME MACHINING OF SILICON**

### Presenter

Michelle Meneses, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
chelle@imsa.edu

### Mentors

Dr. Yury Gogotsi, Drexel University, LeBow Buding, Philadelphia, PA 19104; gogotsi@drexel.edu; 215-895-6446  
Thomas Juliano, Drexel University, Materials Engineering, Drexel University, Lebow Buding, Philadelphia, PA 19104;  
215-895-6374; tfj22@drexel.edu

The purpose of this work is to investigate the relationship of ductile indentations on the surface of a single crystalline silicon wafer to dynamic ductile scratching conditions. The relationship between the ductile indents at different loads, ranging from 30 to 130 mN, and its correspondence to machining parameters is studied. The resulting phase transformations of the silicon in both the static and dynamic case are investigated using a Raman micro-spectrometer and a correlation is drawn between the two cases. Raman micro-spectroscopy has been found to be a very useful tool to analyze silicon and detect different phase transformations that have developed under loading conditions. It is illustrated that static models for ductile indentation can be applied to dynamic conditions. Based on the results found, parameters for ductile machining of silicon will be established, enabling new processes, such as ductile regime dicing methods.

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## **DRINK IT FOR SCIENCE: A STUDY OF DIETARY SUPPLEMENTS**

### Presenters

Jennifer Mo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jmo@imsa.edu  
Amy Winans, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amyli@imsa.edu

### Advisor

Richard Dods, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
rdods@imsa.edu; 630-907-5969

Last year, American consumers spent over 16 billion dollars on dietary supplements. Six years earlier, Congress passed the Dietary Supplement Health and Education Act, which allowed the widespread distribution of various organic additives without direct FDA approval. More specifically, a company is responsible for ensuring the safety of any product sold in the U.S. before 1994, and is not required to turn any of its documentation over to the FDA. This inquiry took the issues of validity and safety concerning these dietary supplements and applied them to the IMSA campus. A random survey sent out polled students about their use of energy drinks containing one or all of the following non-FDA approved ingredients: ginseng, taurine, and guarana. The main purposes of the survey are as follows: to establish the knowledge that the average IMSA student has concerning energy drinks, and to determine the receptiveness to an all-natural energy drink and obtain an outline as to what the energy drink should enhance. The presentation will include the results of this survey. This project attempts to address various components of certain dietary supplements, often in the form of energy drinks, including the chemistry and research (or lack thereof) behind these all-natural boosters, the politics concern, and the eventual composition of an all-natural energy drink made solely out of everyday foodstuffs.

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## BACKSCATTERED REFLECTOMETRY USING POLARIZATION MAINTAINING OPTICAL FIBERS

### Presenter

Nicholas Moryl, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amoryl@imsa.edu

### Mentor

Dr. William A. Ellingson, Argonne National Laboratory, 9700 South Cass Ave, Argonne, IL 60439; ellingson@anl.gov; 630-252-5068

In the field of Non-Destructive Evaluation (NDE), many studies have been performed on how to assess machining damage on machined ceramic components. The ceramic components of interest are for application to jet engines, diesel engines, components of satellites, or other complex machines that require low-maintenance parts. The purpose of NDE is to screen the parts for defects, in order to increase their useful life. It has been established through previous research at Argonne that by using different wavelengths of polarized laser light and special optical detectors, one can determine if there are any surface or sub-surface cracks, or defects. Due to the polarization of laser light, the detected backscattered pattern allows determination of the depth of the defect in the test sample, so it is possible to differentiate between the two types of defects. The importance of this testing is its non-destructive nature, allowing the re-testing the parts again in a real-world scenario after they have been screened to determine what defects are unacceptable. The automation of this process, using a rotational stage, would end up saving both time and money for not only the testers but the company whose parts were being tested.

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## THE IMPACT OF MACROECONOMIC DATA ON EQUITY PRICE FLUCTUATION: COMPARATIVE EVALUATIONS WITHIN AND AMONG INDICES AND EQUITY GROUPS

### Presenter

Niket Nathani, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; niket02@imsa.edu

### Mentor

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dehaven@imsa.edu; 630-907-5889

Even in what seems like a superficially fluctuating economy, markets move logically as the sum of macroeconomic data. However, the impact of each type of data varies dramatically, making an attempt at incorporating all the data in a model useless. My project examines which types of data have the greatest impact, how the data are interrelated, and the relationship of the effects of the data on equity, credit, and debt markets.

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## CHARACTERIZATION OF CELL ADHESION IN *DICTYOSTELIUM DISCOIDEUM*

### Presenter

Lina Nayak, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lnayak@imsa.edu

### Mentors

Rex Chisholm, Ph.D., Northwestern University Medical School, 303 East Chicago Avenue, Chicago, IL 60611; r-chisholm@northwestern.edu; 312-503-4151; 312-503-5994

Petra Fey, Northwestern University Medical School, Department of Cell & Molecular Biology, 303 East Chicago Avenue, Chicago, IL 60611; pfey@northwestern.edu

In certain cancers, cells remain attached to each other while they develop and divide. When tumor metastasis occurs, the cells no longer adhere, thus allowing the cancer to spread. Therefore, inquiries related to cell adhesion may provide new insights into processes involved in the spread of cancer. In this study, we used *Dictyostelium discoideum*, a single-celled eukaryotic organism, as a model for studying cell adhesion. *Dictyostelium* amoebae naturally adhere to many diverse substrates. However, *Dictyostelium* mutant cells do not attach to substrate. In each mutant, a single different gene has been targeted. By shaking mutant cells at various speeds, in various solutions, we tested the mutant cells' abilities to initiate and maintain adhesion. When tested in growth medium, all of the mutants, with the exception of two, were completely adhesion deficient. One mutant, in which the SadA gene was deleted, was subjected to shaking in buffer that contained magnesium and calcium. This mutant was more adhesive in buffer than in medium. This SadA null mutant has been rescued by reintroducing an intact SadA gene. We determined that this rescued strain exhibits adhesion properties similar to those of wild type cells.



## **MUTAGENESIS AND *E. COLI* RESISTANCE TO STREPTOMYCIN**

### Presenter

Jo Nelson, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; freakyjo@imsa.edu

### Advisor

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ddosch@imsa.edu; 630-907-5987

In recent years, many strains of bacteria have become resistant to multiple antibiotics, posing a great threat and danger to humans. A major reason for the development of antibiotic resistant strains has been the overuse and abuse of the antibiotics themselves. Improper use has effectively selected for strains of bacteria that are resistant. Compounding the issue, the presence of mutagens in the environment can create the sort of antibiotic resistant mutants that are selected for by antibiotic treatment. In my inquiry, I tested UV treatment and triclosan to induce mutations resistant to streptomycin. I also gradually increased streptomycin concentration to determine its impact on isolating streptomycin resistant mutants. I found that while UV radiation only caused minimal resistance to Streptomycin, the triclosan containing "antibacterial" soap and repeated exposure to smaller doses of Streptomycin caused a great deal of resistance.

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## **MISCONCEPTIONS THAT ULTIMATELY LEAD TO WAR: PRECURSORS TO THE BIAFRA NIGERIA WAR**

### Presenter

Ola Nwabara, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cha21@imsa.edu

### Advisor

Christian Nokkentved, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; 630-907-5961; drnok@imsa.edu

In May 1967, the eastern region of Nigeria declared itself the independent state of Biafra, and in August of that year civil war broke out. After independence from Britain, a democratic government was established in Nigeria, which was then divided into the Northern, Eastern, and Western Regions, with each region dominated by a different major ethnic group. Problems arose because leaders favored their own regions resulting in tensions between mainly the north and the east that led to a series of coups, massacres, assassinations, and disputes and ultimately to war. What was the reasoning behind the coups and who were the leaders? Were they the officials in the north and the east? The views of the people who lived in Nigeria during this time were based on emotions and a direct experience of the events. By asking people from different sides why and how each of the events occurred, it becomes clear that there are many different views and many misconceptions. These misconceptions are what lead first to unorganized outbreaks, then to a hardening of attitudes and eventually to the Biafran-Nigerian war.

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## **SYSTEMATIC APPROACHES TO ENGINEERING DESIGNS**

### Presenter

Ola Nwabara, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cha21@imsa.edu

### Mentor

Dr. Wei Chen, University of Illinois in Chicago, Department of Mechanical Engineering, 842 W. Taylor St., Chicago, IL 60607; weichen1@uic.edu; 312-996-6072; 312-413-0447

Systematic approaches are used to find a methodological way of creating engineering designs. This also involves a level of analytical thinking when a problem is received. All problems can have more than one solution. Then it is a question of, which of these solutions is the best and then which one is more beneficial in terms of multiple requirements. A simple design problem is used to answer this question. The task of this design problem is to design and build a mechanism that will relocate at least one ping-pong ball to a zone 6 feet away from the starting point and its radius being one foot. With limitations to size and weight this is done using a systematic design procedure consisting of brainstorming, defining variables, finding the various solutions, modeling designs, and selecting the best design alternative.



## THE SUB-CONSCIOUS MIND'S INVOLVEMENT IN INTERPERSONAL ATTRACTION

### Presenters

Nathaniel O'Bear, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
minion@imsa.edu

Nicholas Reinhart, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
iceman64@imsa.edu

### Advisor

John Sippy, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; sippy@imsa.edu; 630-907-5021

The human brain has one of the most sophisticated facial identification systems which not only determines who a person is but also attaches an emotional tag to that face which propels us to interact with that person. The brain, the most complex functional mass on the earth, can decipher information from external stimuli on a sub-conscious level that provides us with a very complex form of attraction. Facial identity, body size, and genetic similarity information provide the brain with a complex portrait of a person. The brain, in turn, takes in all factors and can determine mate selection. The conscious mind, on the other hand, portrays this primitive information as attraction and stimulates the body into sexual arousal. The project's research has shown that the human brain is a complex organ that identifies stimuli, processes information, manages thoughts and body chemistry, and reacts to stimuli in ways that science can predict and produces something as primitive as attraction. The brain accomplishes these processes on a level that the conscious mind is unaware of directly. The research shows that every human has a similar system of attraction even though each individual's ideas of an attractive mate are different.

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## HARDNESS OF EXTRUDED AND WELDED 6061 ALUMINUM ALLOY AFTER PROCESSING AND HEAT TREATMENT

### Presenter

Sang Oh, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; uni012@imsa.edu

### Mentor

Dr. Joseph Benedyk, Illinois Institute of Technology, Engineering 1, Room 203, 10 West 32nd St., Chicago, IL 60616;  
benedyk@iit.edu; 312-567-3048

This project used various laboratory techniques, particularly the Al-Mg-Si system, in metallurgical examination of welded samples of an age-hardened aluminum alloy supplied by the University of Wisconsin. The project focused on the common structural Al-Mg-Si alloy designated as 6061, provided in the form of samples of welded extrusions. A hardness map of the areas of base metal, heat affected zones (HAZ), and weld in the as-received, artificially aged, and solution heat treated and aged conditions was developed. Hardness test procedures employed were Rockwell microhardness and diamond pyramid microhardness. It was possible to follow hardness changes induced in base metal, HAZ, and weld zones for all test conditions. Microhardness testing proved to be more accurate over transition areas in the welded samples. The extrusions will be used in building the truck frame for the 2002 Future Truck Program at the University of Wisconsin.

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## GENOMIC ANALYSIS OF NMDA-RECEPTORS IN ATTENTION-DEFICIT HYPERACTIVITY DISORDER

### Presenter

Adebosola Oladeinde, Illinois Mathematics & Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
aoladei@imsa.edu

### Mentors

Dr. Roger A. Kroes, Department of Molecular Neuro-Oncology; Chicago Institute for Neurosurgery and Neuroresearch,  
1801 Maple Ave., Evanston, IL 60201; rkroes@hotmail.com; 847-491-4811

Donna Kersey, Department of Molecular Neuro-Oncology; Chicago Institute for Neurosurgery and Neuroresearch,  
1801 Maple Ave., Evanston, IL 60201; 847-491-4812; dsk53@hotmail.com

Nigel Otto, Department of Molecular Neuro-Oncology; Chicago Institute for Neurosurgery, Department of Molecular  
Neuro-Oncology, 1801 Maple Ave., Evanston, IL 60201, njotto@hotmail.com, 847-491-4794

Jennifer Perez, Department of Molecular Neuro-Oncology; Chicago Institute for Neurosurgery and Neuroresearch,  
Department of Molecular Neuro-Oncology, 1801 Maple Ave., Evanston, IL 60201; thespes97@aol.com;  
847-491-4794



Attention deficit hyperactivity disorder (ADHD) is a commonly diagnosed behavioral disorder found in children. The main symptoms of this disorder are lack of attention, high levels of activity, and vulnerability to being easily distracted. Researchers have concluded that ADHD is caused by neurotransmitter malfunctions in the brain and which are linked to mutations in genomic DNA encoding these genes. The N-methyl-D-aspartate (NMDA) neurotransmitter receptors are likely sources because they are involved in learning and memory, as well as in the functioning of numerous neurotransmitters. NMDA receptors are heterodimeric: they are composed of two distinct subunits, NR1 and NR2 (NR2A-NR2D). Because the NR1 subunit is common to all brain NMDA receptors, the researchers at the Chicago Institute for Neurosurgery and Neuroresearch (CINN) and myself hypothesize that there are mutations within this subunit affecting receptor function in ADHD patients. We are currently isolating, cloning and sequencing overlapping NMDA-R1 genomic fragments from normal human brain tissue. This sequence will be used as a standard to which we will compare sequences of similarly isolated fragments cloned from ADHD patients. Genomic differences will aid in the development of more accurate diagnostics for this disorder.

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## **HEADACHE: WHY, WHAT, AND HOW TO MANAGE IT**

### Presenter

Amy Orsborn, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; amy@imsa.edu

### Mentor

Dr. Fredrick G. Freitag, Diamond Headache Clinic, 476 West Demming Place, Chicago, IL 60614; Dhcdoc@aol.com;  
1-800-432-3224

Millions of people suffer from serious headaches such as episodic and chronic migraine, episodic and chronic cluster headache, and episodic and chronic tension headaches. Though much of the physical causes of these type of headaches are not fully understood, and no true cure has been found, physicians and members of the headache research field have discovered a great deal about these headaches and how to treat them. Through observational research at Diamond Headache Clinic in addition to textual research, an overall understanding of the classification system, diagnosis, physical causes, and treatments of serious headache has been achieved. Issues concerning the process of patient diagnosis, what is known about physical factors involved in the different classifications of headache, non-pharmacological headache treatment methods and their benefits, and the clinical processes of pharmacological management of headache will be addressed.

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## **THE EFFECTS OF RNA INTERFERENCE ON THE DIFFERENTIATION, TOWARD MYELOID HEMATOPOIESIS, OF MOUSE EMBRYONIC STEM CELLS**

### Presenter

Jean Park, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; genie123@imsa.edu

### Mentor

Gang M. Zou, M.D., Ph.D., University of Chicago, 5841 S. Maryland Avenue, Chicago, IL 60637;  
gzou@medicine.bsd.uchicago.edu; 773-702-6788

Mouse embryonic stem cells (ES cells) naturally differentiate into an embryonic body that contains hematopoietic stem cells (blood stem cells) characterized by the CD34+ antigen. This embryonic body later develops into a mouse fetus. However, LIF (Leukemia Inhibitory Factor) prevents the ES cells from differentiating and keeps them pluripotent (able to differentiate into many different cell types). A new technique called SAGE (Serial Analysis of Gene Expression) has resulted in the discovery of a number of unknown genes (novel genes) that may be important to cell differentiation. My mentor and I are attempting to explore the effects of RNA interference (RNAi) on cell differentiation. RNAi is a novel phenomenon that basically silences certain genes. We have been investigating whether RNAi can be used to knock down specific known gene expression during cell differentiation by means of using mouse ES cell cultures and isolating the cells with CD34+ presentation with a FACS sorter or MACS. If RNAi does, indeed, silence genes, then this will help facilitate understanding of the importance of novel genes in normal myeloid differentiation and understanding of the transformation of normal hematopoietic stem cells to leukemia.



## **THE ROLE OF HOSPICE AND PALLIATIVE CARE CENTERS IN THE TREATMENT OF TERMINALLY ILL PATIENTS AND IN THE CLINICAL STUDY OF DNR**

### Presenters

Pranjal Patel, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; pringles@imsa.edu  
Michael Saphthavee, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
mikesap@imsa.edu

### Mentor

Dr. Martha Twaddle, Palliative Care Center of the North Shore, 9701 Knox Boulevard, Skokie, IL 60076; 847-467-7423

Hospice and Palliative Care Centers offer terminally ill patients options and treatments that aren't available in traditional health-care settings. The hospice unit treat individuals physiologically, and emotionally instead of focusing solely on the treatment of disease. Do-not-resuscitate (DNR) patients are brought to these centers for special end-of-life care that focuses on alleviating their pain, unlike the typical health-care system that attempts to cure incurable diseases. We made a comprehensive examination of DNR patient health-charts to determine the influence of various factors such as sex, time of death, age, and presence of friends and family members. We made a statistical analysis of hospice patients at the Palliative Care Center of the North Shore during 2001.

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## **SOLAR DESALINATION: HUMIDIFICATION-DEHUMIDIFICATION CYCLE**

### Presenter

Anna Peralta, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; saging@imsa.edu

### Mentor

Dr. Said Al-Hallaj, Illinois Institute of Technology, 10 W 33rd St, Chicago, IL 60616; alhallaj@iit.edu; 312-567-5118

As water shortage becomes a recognized problem, solutions must be created. Besides preservation of the supplies that we already have, another good solution is desalination. There are many ways for this process, but the fundamental procedure is to supply energy to a system that will output fresh water from your feed supply. In the end, however, economics are a key issue. The manufacturing, maintenance, and energy source raise the price of each procedure dramatically. In this experiment, by designing and manufacturing a solar desalination unit that uses humidification and dehumidification, the reuse of the heat from within the system along with the renewable energy source should raise efficiency while lowering costs.

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## **WORKING TO DEVELOP AN IMSA MOBILE EDUCATION UNIT**

### Presenter

Linda Pinto, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lpinto@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

As school systems cut back their funding for field trips, new programs must be developed to reach out to children in targeted school districts. The Kids Institute is studying the feasibility of operating a mobile education unit that could travel to schools within a one-hour radius of IMSA and bring hands on enrichment to students. Surveys were mailed to over 100 schools in the community asking for input on subjects they believe would be beneficial to their current curriculum. This feedback led us to develop multiple lessons that would be offered through our program. Mobile education vehicles were contacted through email and phone surveys to explore their offerings, successes, and obstacles. Over Intersession a group of 16 IMSA students worked with the University of Illinois Physics van to create a pilot program for Excellence 2000. This pilot program with E2K+ will focus on many subjects that will be presented as a show. The "IMSA on Wheels" van will offer specialized sessions based on problem-based learning. These experiences will bring exciting hands on learning to students and act as a gateway to learning about other programs offered at IMSA.



## **PROTEASOME PRODUCTION IN HUMAN MUSCLE DURING NUTRITIONAL INHIBITION OF MYOFIBRILLAR PROTEIN DEGRADATION**

### Presenter

Sean Pitroda, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sean84@imsa.edu

### Mentors

Irwin G. Brodsky, M.D., Ph.D., Section of Endocrinology and Metabolism, Department of Medicine, University of Illinois at Chicago, 1819 West Polk Street (M/C 640), Chicago, IL 60612; igbrodsk@uic.edu; 312-996-6060

Paul Goldspink, Ph.D., Section of Cardiology, Department of Medicine, University of Illinois at Chicago, 840 South Wood Street, Chicago, IL 60612; pgold@uic.edu; 312-355-1647

Decreased protein intake inhibits muscle protein degradation via the ubiquitin-proteasome pathway. We examined the activities of the proteasome pathway in skeletal muscle of healthy humans consuming a restricted protein diet. We found that these subjects exhibited a significantly decreased excretion of 3-methylhistidine, an indicator of myofibrillar protein degradation, when compared with subjects who consumed typical America-style protein intake. To determine whether decreased myofibrillar protein degradation reflected a decrease in proteasome production and abundance, we measured proteasome subunits C2 and C3 mRNA expression, the content of C2 protein, the peptidase activity of the activated 26S and core 20S proteasome, and the rate at which isotopically-stable L-[1-13C]-leucine was integrated into proteasome proteins. We found that subjects showed no difference in any of these measurements, which suggests that, in contrast to the increase of proteasome expression in muscle wasting disorders, nutritionally-induced human myofibrillar protein conservation does not alter the quantity of proteasomes in muscle. The high fractional synthesis rate of proteasomes and its maintenance during nutritional deprivation suggests that proteasome production is an essential cellular function but unlikely to be the retraining component in breaking down muscle proteins. Furthermore, there are other mechanisms in the proteasome pathway, more relevant than the proteasome itself that regulates skeletal muscle conservation and wasting.

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## **INVESTIGATING HYPERCOAGULABLE STATE AND INFLAMMATORY RESPONSE OF VASCULAR ENDOTHELIA FOLLOWING CORONARY VESSEL REVASCULARIZATION WITH POST-PTCA BRACHYTHERAPY**

### Presenters

Vinaya Puppala, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; vpuppala@imsa.edu

Angel Qin, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; angelluv@imsa.edu

### Mentors

Jeanine M. Walenga, Ph.D., Loyola University Medical Center, Cardiovascular Institute, 2160 South First Avenue, Maywood, IL 60153; jwaleng@lumc.edu; 708-327-2838

Walter P. Jeske, Ph.D., Loyola University Medical Center, Cardiovascular Institute, 2160 South First Avenue, Maywood, IL 60153; 708-327-2842; wjeske@lumc.edu

M. Margaret Prechel, Ph.D., Loyola University Medical Center, Cardiovascular Institute, 2160 South First Avenue, Maywood, IL 60153; mprechel@lumc.edu; 708-327-2840

Amanda Drenth, B.S., Loyola University Medical Center, Cardiovascular Institute, 2160 South First Avenue, Maywood, IL 60153, adrenth@lumc.edu; 708-327-2840

Percutaneous transluminal coronary angioplasty (PTCA) is an effective treatment for coronary artery disease, but nearly half of all PTCA patients undergo coronary restenosis within six months. Brachytherapy, the localized administration of low-dose  $\beta$  or  $\gamma$  radiation, is a new treatment that prevents but does not eliminate long-term restenosis. The focus of this study was to determine the correlation between restenosis and the hypercoagulable and inflammatory states after revascularization, comparing PTCA patients to those also receiving brachytherapy. Flow cytometry was used to measure platelet P-selectin expression and platelet-leukocyte interactions in clinical samples. Inflammatory state was studied by measuring plasma cytokine levels (IL-1 $\beta$ , IL-6). Platelet-monocyte aggregates increased from 16.9 $\pm$ 3.1 to 36.1 $\pm$ 3.2% at 24-hrs in PTCA patients and from 15.9 $\pm$ 4.7 to 56.1 $\pm$ 5.9% in PTCA/ $\beta$ -radiation patients. IL-6 levels increased from 5.6 $\pm$ 1.0 to 11.1 $\pm$ 1.3 ng/mL in the PTCA group compared to an increase from 6.3 $\pm$ 2.6 to 19.6 $\pm$ 7.6 ng/mL in the PTCA/ $\beta$  group. IL-1 $\beta$  levels remained steady from 4.1 $\pm$ 1.5 to 4.1 $\pm$ 1.7 ng/mL in PTCA patients but increased in PTCA/ $\beta$  and PTCA/ $\gamma$  patients, 13.5 $\pm$ 9.2 to 20.5 $\pm$ 12.7 ng/mL and 6.5 $\pm$ 4.3 to 13.9 $\pm$ 8.8 ng/mL respectively. These preliminary findings suggest that coronary revascularization procedures result in hemostatic and inflammatory activation that may impact the outcome of the procedure.



## **ANALYSIS OF ARCHAEOLOGICAL ARTIFACTS FROM THE GOSSMAN FARM IN ZWINGLE, IOWA**

### Presenters

Emily Rice, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ricerice@imsa.edu  
Cecilia Westbrook, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
cecilia@imsa.edu

### Mentor

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL; 847-683-2582;  
dgossman@gcisolutions.com

Evidence from archaeological work done in the area which contains Mr. Gossman's farm supports habitation of the area dating back to the Early Archaic period in American Indian prehistory (7,500-5,500 B.C.E.). This indicates that evidence may be found on the farm for habitation from then up to the present time. Many artifacts have been found by previous mentorship students of the farm; we believe that analysis of these artifacts based on existing research can identify the artifacts as belonging to particular periods, and W. thus provide evidence for habitation during those periods. We hypothesize that the evidence will show habitation between the Early Archaic period and the present time.

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## **DISCRIMINATION IN SOUTH KOREAN POLITICS AND ECONOMY**

### Presenter

Minji Ro, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; minji@imsa.edu

### Mentor

Dr. Kiseong Park, Visiting Scholar at University of Chicago, 1126 East 59th Street, Chicago, IL 60637;  
kpark@cc.sungshin.ac.kr; 630-854-3218

Regional discrimination is present in both the South Korean economy and politics. Voting patterns from the most recent presidential election in 1997 and also statistics comparing birth regions of workers and their earnings show biases towards people from specific regions. Analyzing a pool of data gathered from 3419 workers, the project attempted to draw a correlation between these two variables by constructing an equation using factors that could possibly have impacted one's earnings. Differentiating between discrimination existing due to preference versus discrimination resulting from experiences, the project concluded that certain biases did exist in the Korean labor economy. The highly controversial presidential election in 1997 was also studied to further investigate the relationship shared by voters in varying regions and the home regions of the three main presidential candidates Kim Dae Jung, Lee Hoi Chang, and Rhee In-je.

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## **MUSIC COMPOSITION: WHAT GOES INTO THE MAKING OF A SONG?**

### Presenter

Minji Ro, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; minji@imsa.edu

### Advisor

Christopher F. Kuhl, Ph.D., Comparative Arts, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cfkuhl@imsa.edu; 630-907-5980

From the initial melody lines to the final additions made to the instrumental affects, composing music is a process that is totally up to the composer. There are an infinite number of places where notes can be added, rhythms changed, and entire phrases re-worked. Beginning with finding inspiration and working towards the final products, the focus of this inquiry was on the concept of production. Studying pop music today and how the use of computers, synthesizers, and keyboards has allowed for a wide variety of sounds, three different instrumental versions were put together. Adding specific instruments and varying the tempo and sub-melodies produced three completely different sounding songs. Although the structure of the song stayed the same, changing the background arrangement produced three very different effects.



## **COMPARING THE NEONATAL NURSE PRACTITIONER (NNP) ROLE TO THE RESIDENT ROLE IN THE NEONATAL INTENSIVE CARE UNIT (NICU)**

### Presenter

Rabeah Sabri, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; rabeah@imsa.edu

### Mentor

Jonathan K. Muraskas, M.D., Loyola University Medical Center, Pediatrics/Neonatology, 2160 South First Avenue, Maywood, IL 60153; jmurask@lumc.edu; 708-216-1067; 708-216-5602

Over the past three decades, the NNP has evolved into a very important and integral part of the NICU. Research focused on determining the difference in care administered by NNP teams and Resident teams to neonatal newborns with regards to length of stay in the NICU and mortality rate. Newborns admitted to Loyola University Medical Center's NICU were first sorted by gestational age and chi-square analysis was used to evaluate significant differences in care between the two groups. Results indicated that mortality rate was 6% higher in newborns cared for by residents than by NNPs. Differences in length of stay in the NICU also approached significance, indicating a possible difference in the quality of care provided to newborns. This difference in care provided by NNPs, in addition to the NNPs broadened technical skills, has significant implications in the future of newborn outcome in the NICU.

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## **AFFERENT AND EFFERENT CONNECTIONS OF THE CAUDAL MEDIAL PREFRONTAL CORTEX IN RABBIT: A PROPOSED CIRCUIT MEDIATING EARLY ACQUISITION OF THE TRACE EYEBLINK CONDITIONED REFLEX**

### Presenter

Darrel Saldanha, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; djs85@imsa.edu

### Mentor

Aldis Weible, Northwestern University Medical School, 303 E. Chicago Ave, M211, Chicago, IL 60611; a-weible@northwestern.edu; 312-503-1547

The caudal medial prefrontal cortex (cmPFC) is a component of the circuitry mediating forebrain-dependent trace eyeblink conditioning, a task involving the association of a conditioned stimulus (CS) with an unconditioned stimulus (US). Lesions of the cmPFC disrupt learning of the trace conditioned reflex. Robust modulation of cmPFC neuronal activity specific to trace conditioning has been reported during the first two days of training. Because these changes occurred early in conditioning, we hypothesize that the cmPFC is involved in forming the association between the CS and US. In this study, using the anterograde and retrograde neuronal tracer wheatgerm agglutinated horseradish peroxidase, we examined the afferent and efferent projections of the cmPFC so as to identify those structures directly connected with the cmPFC that may also be involved in trace eyeblink conditioning. The cmPFC may serve as a hub where information pertaining to the external environment is gathered from each of the primary sensory cortices. Furthermore, other connections provide a means to pass the newly established association on to other structures involved in eyeblink conditioning such as the hippocampal formation and lateral pontine nucleus. These structures have been shown to be involved in an assortment of associative learning paradigms, including trace eyeblink conditioning.

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## **THE ORIGIN AND TRADE ROUTES OF MAJOR SNUFF BOTTLE MINERALS IMPORTED INTO CHINA DURING THE QING DYNASTY (1644-1912)**

### Presenter

Ying Shi, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; yih852@imsa.edu

### Mentor

Bennet Bronson, Field Museum, Asian Anthropology, 1400 S. Lake Shore Dr., Chicago, IL 60605; bronson@fieldmuseum.org; 312-665-7832 x7832

Contacts between Asia and Europe resulted in the arrival of tobacco and snuff customs in eastern Asia in the late 16th century. The tradition of snuff-taking first spread to Japan via Portuguese and Spanish sailors, merchants, and missionaries by the way of the Phillipines. When the Chinese finally caught on, the early 18th century had already come to pass. Snuff-taking now became fashionable in all circles of society and was even welcomed at the Imperial Court. Unlike the Europeans who



took snuff from wooden and metal boxes, the Chinese added their own cultural flavor by fashioning special snuff containers called snuff bottles. These bottles are hand-made through a variety of methods depending on the material. A popular category for the type of snuff bottle is those forged from minerals such as jadeite, nephrite, and chalcedony. Although the origins for many of these precious stones are known, references do not always concur on the number of locations or the exact trade route. Information is also lacking on general Chinese mineral trade in the Qing dynasty. This mentorship seeks to determine the sources of these minerals by comparing different references as well as connecting Chinese trade with the political, economical, and social aspects of Asian history during that specific period.

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## **KEY FACTORS THAT CONTRIBUTE TO THE PREVALENCE OF PSEUDOSCIENTIFIC INTELLECTUAL SYSTEMS AND THE INFLUENCE OF ILLEGITIMATE SCIENTIFIC CLAIMS ON AMERICAN SOCIETY**

### Presenter

Di Shui, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; beck@imsa.edu

### Advisors

Leon Lederman, Ph.D., Resident Scholar, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lederman@fnal.gov; 630-907-5912

Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; quella@imsa.edu; 630-907-5899

Joanne Wallmuth, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; wallmuth@imsa.edu; 630-907-5912

Despite the persistent efforts of scientific disciplines to advance the realm of knowledge and push the barriers of discovery, much of society remains dominated by pseudoscientific belief systems. A recent sampling of the IMSA community demonstrates that an overwhelming majority of the population has been exposed to pseudoscience. Whether through unidentified flying objects, telepathic gurus, paranormal apparitions, or spiritual healing and alternative medicine, illegitimate "science" poses a serious threat to our intellectual development and well being. This inquiry focuses on key factors that contribute to the prevalence of this social phenomenon, concentrating specifically on the unfalsifiable nature of pseudoscience, a general lack of scientific understanding within society, and the innate vulnerability of the human species that harbor these "scientific" manipulations. Given the complex theories and deeply technical analysis, it becomes hard to determine a precise definition of science, rendering it a difficult task to identify what "science" encompasses. In addition to our inept understanding of science, many individuals possess the tendency to want to believe in supernatural forces. The efforts of some highly acclaimed scientists to approach the possibility of extraterrestrial intelligence in a scientific manner can often be misinterpreted. And the overwhelming portrayal of pseudoscience within the media also heavily nurtures the disintegration of scientific authority.

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## **WHAT IT TAKES TO CO-WRITE A NOVEL**

### Presenter

Erica Sim, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ladymute@imsa.edu

Amber Thompson, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kityhavn@imsa.edu

### Advisor

Christopher F. Kuhl, Ph.D., Comparative Arts, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cfkuhl@imsa.edu; 630-907-5980

Many authors of fiction find that there is something missing from their work. They look at their work and recognize that they are not perfect and do not do a certain part of the writing process well. This is one of the many reasons why two people often co-write a novel. There have been many ways to co-write a novel, but all of them require that the two authors sit down and decide what they are going to write about so that both authors get a sense of where the plot is going. Then they must develop the characters together so that there aren't conflicting ideas between them. Finally, they have to sit down and write the novel itself. This inquiry began with basic research into how novels are written, interpreted, and how to get around basic problems like writer's block and flat characters. Then, we proceeded to go through the aforementioned process of brainstorming a plot and characters. Together we have made two characters, Syrill and Xania, come to life in the land of Dengaul, and have begun to make our dream world turn into a reality in our readers' minds.



## WESTERN POLITICAL THEORY AND THE IDEAL STATE

### Presenter

Philip Stanton, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; palladin@imsa.edu

### Advisor

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

The ideal state has been a frequent subject of political theorists for as long as there has been political thought. Theoretical or historical models of the ideal state attempt to demonstrate a system where the greatest society could develop, with the greatest benefit to all. This Inquiry is about examining the political ideas of the past ranging from Plato's and Rousseau's notion of bringing about truth on earth to Locke's effort to justify individual rights as the basis of government. I will comment on what I think to be shortcomings of prior thinkers, such as Marx's call to eliminate private property, and I will present a basis for an ideal capitalist state. Expect to hear government institutions questioned and find out what objections past thinkers raise. The presentation will invite audience critique and discussion.

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## PROACTIVELY SEARCHING THE WEB: CAN WE AGREE ON WHAT'S RELEVANT?

### Presenters

Harrison Stein, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
harrsman@imsa.edu

Michael Ruberry, New Trier High School, 385 Winnetka Ave, Winnetka, IL 60093; mruberry@msn.com

### Mentor

Jerome Budzik, Department of Computer Science, Northwestern University, 1890 Maple Ave., Evanston, IL 60201;  
847-467-1771; budzik@infolab.northwestern.edu

We performed a study of students in two populations (at IMSA and Northwestern) using a survey. The goals of the study were: (1) to understand the participant's abilities to use the Web and attitudes toward available information access tools (2) to understand how to best design information access software we are developing at Northwestern to fit the needs of its potential users. In addition to questions regarding use of the Web and computers, we asked participants to evaluate the results of our software's automatic retrieval features, currently under development. The software works by analyzing documents its users are reading or writing (on the Internet or in MSWord) in order to automatically retrieve and deliver information from online repositories, allowing the user to avoid building complex search queries to multiple sources. Contrary to our initial expectations, we found a student's ability to predict whether or not a given query would retrieve relevant results was no better than chance. In addition, we found that users mostly agreed on the relevance of information retrieved by the software, but the results were mutable and thus not entirely conclusive. These findings have direct implications to the design of the software and future evaluation methodology.

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## CUBAN REVOLUTIONARIES: A CONTRAST OF ACTIONS AND WORDS

### Presenter

Alexandra Surasky-Ysasi, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
dude47@imsa.edu

### Advisor

Kathryn Jean Kadel, Ph.D., History and Social Science, Illinois Mathematics and Science Academy,  
1500 West Sullivan Road, Aurora, IL 60506; jkadel@imsa.edu; 630-907-5021

Jose Marti and Che Guevara desired to see a better Cuba, but they had very different methods of action. Marti was a writer in exile who rallied the emigres of Cuba around the cause of independence. In the end he would see battle because he refused to simply write. Guevara was a student who took a motorcycle trip through Latin America and saw the need for change. He wanted to see Latin America united and governed without corruption. Guevara bettered his cause on the field of battle rather than with the pen. These two men had two things in common besides their desire for a free Cuba-their upbringing in the middle class, which is rarely true for revolutionaries, and their refusal to see the US rule Latin America. Fidel Castro held the ideas of Marti at heart, but had Guevara to fight by his side. Which is greater the mind or the sword? This question faces



its ultimate test in the face of change and in the end it remains that both are needed to bring sweeping change. In two separate chapters of Cuban history two very different men influenced an entire culture through their revolutionary ideas.

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## **GLUTATHIONE LEVELS IN ANTIGEN PRESENTING CELLS POLARIZE CD4+ TH0 IMMUNE RESPONSES**

### Presenter

Eric Szczesniak, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; falcon@imsa.edu

### Mentor

Carl Waltenbaugh, Ph.D., Northwestern University Medical School, Microbiology-Immunology, 303 E. Chicago Ave., Chicago, IL 60611; waltenbaugh@nwu.edu; 312-503-8459; 312-503-1339

The immune system of vertebrates has evolved a complex defense system to fight invasion by pathogenic microorganisms. Most adaptive immune responses are regulated by thymic derived lymphocytes (T cells). T cells bearing the CD4+ marker are functionally classified on the basis of whether they regulate cell-mediated (Th1) or humoral (Th2) immunity. In healthy individuals, a balance exists between Th1 and Th2 immune function. The signals that determine whether a Th0 cell enters into the Th1 or the Th2 pathway are unknown. Among ethanol's many deleterious effects is an alteration of the Th1/Th2 balance. Ethanol-consuming mice show diminished Th1, and either an unaltered or enhanced Th2 responses. In addition, alcohol depletes intracellular glutathione (GSH). A natural tripeptide, GSH serves many chemical functions including scavenging free radicals that affect immune function. We propose that GSH may serve as a regulator of the Th1/Th2 balance. To test this hypothesis, GSH was depleted *in vivo* with diethyl maleate or buthionine sulfoximine and cytokines were determined by ELISA in supernatants of lymphocyte cultures stimulated by antigen. Data show that antigen presenting cells, but not T cells, depleted of GSH fails to support IFN- $\gamma$  production by T cells. We also show enhanced Th2-associated serum IgE levels result from chronic GSH depletion. Our data provide strong evidence for GSH-influenced polarization of the immune response.

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## **GENDER AND WITCHCRAFT**

### Presenter

Weimei Tan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; humnoegy@imsa.edu

### Advisor

Claiborne Skinner, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; skinner@imsa.edu; 630-907-5021

For more than five centuries, Western society made war on witchcraft and its practitioners. It roasted, boiled, burned, hanged, drowned, and tortured hundreds of thousands of people. Why did they hate witches so much? This inquiry used the trial of Joan of Arc, the Malleus Maleficarum, and the Salem witchcraft trials to investigate the question. The trial of Joan of Arc was an elaborate affair spanning four months. The English had to make it look legal to impeach her and her reputation. This makes the document the most detailed witchcraft trial in history. In the late fifteenth century, the Malleus Maleficarum appeared, defining a witch, how to find one, how to prosecute one, and an explanation of their powers. Then, in Salem, four girls involved in pagan rites sent the town into a panic about destroying the devilish power of nurses, mothers, and wives, who play with the life and death of others. Since all of these represent the perspective of the killers and not the killed, they can tell us the reason for fear and war. Much of this material discussed seduction and men losing their power over women. From this evidence, I have hypothesized that the war against witchcraft is due to female power challenging male domination.

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## **A STUDY OF THE DIPLOMATIC INFLUENCE OF URUGUAY ON INTERNATIONAL ISSUES DURING THE 20TH CENTURY**

### Presenter

Ana Tellez, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; ana@imsa.edu

### Mentor

Dr. Graziella Reyes, Consulate General of Uruguay in Chicago, 875 N. Michigan Ave., Chicago, IL 60611;  
conuruchi@aol.com; 312-642-3430

Throughout the 20th century, global interaction (diplomatic, political, and commercial) exponentially has produced a major effect on the worldwide evolution of human society. Uruguay is an example of a smaller nation-state which has provided the world with different perspectives on how to succeed as an autonomous state, while also contributing significantly to the development of inter-governmental organizations. Through Uruguay's diplomatic ties, it has facilitated the creation of commercial treaties to further its national and international success. This study aims to highlight the important international relations of Uruguay over the past century, as well as understand the country's diplomatic standing in the global arena.

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## **NATURAL HABITAT: ARTIFICIAL POND**

### Presenter

Sharda Thakral, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; sunray@imsa.edu

### Advisor

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
ddosch@imsa.edu; 630-907-5987

In a small section of my yard lies an 8 by 10 and 3 foot deep pond constructed in August 2001. I wanted to know: do the numbers and types of organisms change from season to season? I sought the answer to this question by observing the pond and keeping a record of the organisms that came to use the pond, as well as studying the microscopic organisms from water samples. So far I have found that an astounding diversity of organisms used the pond from August to late October, but by the beginning of November, these organisms did not visit the pond as frequently. Also, during mid to late October, the microscopic diversity was amazingly at its peak of the project. Some examples of microscopic organisms include Rotifers, Coleps, and Euglena. There was a gradual dying down of microscopic and macroscopic diversity from the end of October to mid November during which the temperature decreased and the numbers of hours of sunlight decreased. I plan to continue this project through a complete cycle of the seasons, and to determine whether temperature or sunlight is the key factor in the loss of diversity.

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## **MODULATION OF SUBJECT RESPONSE TO AMPHETAMINE BY PERSONALITY TYPES**

### Presenter

Brendan Todt, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; soccerat@imsa.edu

### Mentors

Dr. Tara White, University of Chicago Medical Center, Department of Psychiatry, 5841 S. Maryland Avenue, Chicago, IL 60637; twhite@yoda.bsd.uchicago.edu; 773-702-0084

Dr. Harriet Dewitt, University of Chicago Medical Center, Department of Psychiatry, 5841 S. Maryland Avenue, Chicago, IL 60637; hdew@midway.uchicago.edu; 773-702-3560

Extraversion has been found to be vital in personality research and is believed to indicate much about an individual. We are attempting to relate personality, specifically extraversion, as measured by the MPQ, to the magnitude or quality of subjective responses to amphetamine. Amphetamine induced mood states and personality are believed to relate to dopamine, as well as dopamine antagonists that affect the DA and 5-HT systems. Therefore, we expect to see a correlation between the DA and 5-HT systems and the traits of extraversion and impulsivity, respectively. By administering combinations of placebo, antagonist, and amphetamine capsules throughout four sessions and analyzing the resulting subjective data gathered by the ARC and DEQ subject response questionnaires, we are attempting to discover correlations between subjective responses to the drug and personality. We hypothesize that subjects scoring high on extraversion will exhibit a greater enjoyment of amphetamine and therefore exhibit a greater increase in positive mood state. We also expect to see that this increase in



positive mood state after the administration of amphetamine is related to positive emotionality, a core element of extraversion. In the future such research may be useful in identifying individuals who may be vulnerable to the use and abuse of amphetamine.

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## **IDENTIFICATION OF UNKNOWN ORGANIC COMPOUNDS THROUGH NUCLEAR MAGNETIC RESONANCE AND INFRARED SPECTROSCOPY**

### Presenters

Matthew Traverso, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
jobobs@imsa.edu

Kevin Yang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kyang@imsa.edu

### Advisor

Mary VanVerst, Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
vanverst@imsa.edu; 630-907-5047

Dr. Joseph Ray, Spectroscopy Consultant, Northwestern University, Evanston, IL 60208; ray67@msn.com

Fourier Transform Nuclear Magnetic Resonance Spectroscopy (FT-NMR) is a method for identifying the structure of organic compounds. It works by measuring the number of distinct types of hydrogen atoms being studied (integrals) and the nature of the surrounding environment (frequency of peaks) in the form of a complex spectrum generated by placing the substance in a powerful magnetic field. IMSA is the only high school in the country with a FT-NMR instrument on campus available for student use. Fourier Transform Infrared Spectroscopy (FT-IR) is a method of detecting the types of bonds that exist in a chemical because bonds vibrate at distinct frequencies. We were presented with a number of unknown substances and asked to identify them using our spectroscopy skills. The samples were dissolved in a chloroform solvent, transferred to an NMR tube, which is then placed inside the NMR instrument. Test data from the instrument is recorded on a computer where it can be analyzed. Using reference data, reference spectra, a variety of tests (FT-IR, 1D NMR, and 2D COSY NMR), and our knowledge of proton spins we have been able to identify the structure of several of the compounds such as oxyraime methyl 2-methyl propenoate and oxyraime methyl butanoate.

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## **PRIOLOSEC STUDIES: IMPROVING PATIENT CARE**

### Presenter

Vaibhav Upadhyay, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
upadhyay@imsa.edu

### Mentor

Dr. Archana Desai, Chicago College of Pharmacy (Midwestern), 555 31st Street, Downers Grove, IL 60515;  
630-515-6963; adesai@midwestern.edu

*Prilosec*®, in 1999, was the largest, selling prescription drug and with a net gross of 5.9 billion dollars. With a drug so frequently used, its patient care is of the utmost importance. *Prilosec*® is taken orally as a capsule; however, not all patients can conveniently swallow the capsule because of its size. Instead, they must have a pharmacist crush the capsule and create an oral suspension. No study has ever effectively published and determined the stability of these suspensions over time. In our study, I examined the stability and degradation of *Prilosec*® suspensions over time and at various levels of pH. I created many different suspensions at various concentrations, stored them at different temperatures, and then adjusted pH to see the effect on stability. I ran the different suspensions through High-performance liquid Chromatography (HPLC), using an Acetonitrile/Phosphate based buffer. Our findings will enable pharmacists to send pre-made suspensions home with patients. This will increase the level of patient care for *Prilosec*® users by allowing them to take the suspension at their convenience in their own home.

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## **PALEONTOLOGICAL DISCOVERIES THROUGH FOSSIL EXTRACTION, PRESERVATION, AND FAMILIARITY EXERCISES BASED ON DIG EXPERIENCES**

### Presenter

Vanessa Vardon, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
futbol02@imsa.edu

### Mentor

Kenneth Lacovara, Ph.D., Drexel University, College of Engineering, 3141 Chestnut St., Philadelphia, PA 19104;  
lacovara@drexel.edu; 215-865-6456; 215-865-6456

Dinosaurs have fascinated adults and children alike for as many as 2000 years; Greeks and Romans had legends of griffins and ogres while the Chinese made references to "dragon" bones found in writings by Chang Qu. These larger-than-life reptiles seem to inspire awe and captivate in much the same way giant beasts of today do, blue whales being an example. Paleontologists are those lucky enough to pursue this childhood dream into an adulthood profession. This mentorship afforded the opportunity to become a paleontologist for a summer. It included full participation in a paleontological dig during July of 2001 in the Big Horn Basin between the Big Horn Mountains and the Pryor Mountains in Wyoming/Montana to explore the Morrison Formation. While learning fossil preservation and extraction techniques, extensive geological research was conducted to better understand the area in which the large sauropod had existed. A weeklong internship at the Academy of Natural Sciences in Philadelphia, PA to work in a fossil preparation lab was also part of mentorship existence.

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## **CHANGES IN GLUTAMATE TRANSPORTER EXPRESSION FOLLOWING LIGHT DAMAGE TO MOUSE RETINA**

### Presenter

Neelima Vidula, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
vneelima@imsa.edu

### Mentors

Dr. Vijay Sarthy, Northwestern University Medical School, 2160 South First Avenue, Chicago, IL 60611;  
vjsarthy@northwestern.edu; 312-503-3031

V. Joseph Dudley, M.S., Northwestern University Medical School, Department of Ophthalmology, 300 East Superior St., Chicago, IL 60611; vjdudley@nwu.edu

Glutamate, a neurotransmitter, is known to play a role in numerous diseases of the central nervous system. High concentrations of glutamate can also damage the mammalian retina leading to eye disorders such as glaucoma. GLAST, a glutamate transporter, may prevent detrimental glutamate levels by controlling the uptake of excess glutamate. The purpose of this research was to elucidate the relationship between glutamate levels and retinal damage induced by long-term light exposure. After exposing BALB/c albino mice to constant light for 2 to 8 weeks, their retinas were isolated and the total RNA was extracted and reverse transcribed. PCR experiments were conducted using primers against GLAST. Cryostat sectioning was performed on frozen retinas to visualize the light damage to the photoreceptor layer of the mouse retina. Antibodies against GLAST and another glutamate transporter, GFAP, were used to detect the presence of proteins in the retina. PCR results indicated that GLAST mRNA levels decreased rapidly between 2 to 4 weeks of light damage, and by 10 weeks, there is little detectable mRNA. These data suggest that a decrease in GLAST mRNA over time may result in excess glutamate and contribute to the retinal damage.

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## THE ROLE OF SANCHO PANZA

### Presenter

Nathan Walsh, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; mrkrazy@imsa.edu  
Lisa Yung, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; lisayung@imsa.edu

### Mentors

Laura Carrillo-Barth, Editor/Publisher, El Conquistador Newspaper, 64 E. Downer Pl., Aurora, IL 630-892-9691;  
dulcinea11@juno.com

Beatriz M. Jacobo, Assistant Editor, El Conquistador Newspaper, 64 E. Downer Pl., Aurora, IL 60506; 630-892-9691;  
dulcinea11@juno.com

Over the course of ten years, *El Conquistador* newspaper has linked the Hispanic community throughout the Aurora, Elgin, and Joliet areas by printing weekly issues containing articles of interest to Mexican immigrants, aficionados of Latin entertainment, and followers of local and world events. As a bilingual newspaper, *El Conquistador* fights for dignity and better lives for minorities seeking to preserve and celebrate their native cultures. Before publication, however, this nontraditional periodical undergoes several stages, which include editing and translating articles, summarizing press releases from local organizations and Associated Press Wire Services, and reporting stories regarding insurance and welfare among other topics. *El Conquistador* newspaper seeks to help the Hispanic community to adjust in a diverse society.

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## JAPANESE FABLES

### Presenter

Sarah Walter, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; goddess7@imsa.edu

### Advisor

Jonathan Besancon, Foreign Language, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; sensei@imsa.edu; 630-907-5085

As children in Western Civilization, we are taught many lessons and morals through fables and fairy tales that we all know and love. As recipients of these stories we grow older and realize the underlying life lessons taught to us in story form. Recognizing the formality and emphasis on conformity through social behaviors of the Japanese people, one might wonder if such rigid social structure could be transmitted through fables. After due research one would find that the frequency of morals and lessons occurring in Japanese fables is much less than that of occurrences in Western fables, leading one to believe that teaching protocol is not the primary function of Japanese fables. These stories are grounded in the beliefs of Shintoism, the indigenous religion of Japan, whereas Western stories do not focus on religious beliefs. Often characters in Japanese fables come in contact with beings with supernatural powers showing the Japanese belief that the human world and the spirit world are interconnected somehow. Japanese stories are mystical and entertaining, rather than being didactic. Analysis of many Japanese fables allows one to conclude that there is a connection between story and belief, rather than a connection between story and moral as in Western culture.

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## "IMSA ON WHEELS"

### Presenter

Sarah Walter, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; goddess7@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road,  
Aurora, IL 60506; britta@imsa.edu; 630-907-5987

The findings of the "IMSA On Wheels" Senior Research project, in conjunction with the IMSA Kids Institute, indicates that the development of a mobile education unit at IMSA is feasible. After the development and mailing of the "IMSA On Wheels" survey coordinators of operating Mobile Education Units were interviewed. During Intersession the University of Illinois Physics Van, and 17 IMSA students developed a one-hour hands-on program. This experience was also a great recruiting tool. Data collected from the "IMSA On Wheels" survey, sent to Chicago area schools, demonstrated great interest from thirty-four different teachers grades two through eight. Over all 82% of the teachers surveyed demonstrated the highest level of interest in a mobile program, and 97% of all teachers surveyed showed the next highest level of interest in a mobile



program. The next step is to partner with the E2K program this spring to pilot the science presentation at select E2K sites. Finally a hands-on program with curriculum will need to be developed next year to serve the different need of teachers and students in Illinois.

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### **AN ANALYSIS OF THE PRELIMINARY HEARINGS UNIT AND RAP PROGRAM IN THE COOK COUNTY STATE'S ATTORNEY'S OFFICE, NARCOTICS PROSECUTIONS BUREAU**

Presenter

Grace Wang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; gwang@imsa.edu

Mentor

Anna Demacopoulos, Cook County State's Attorney's Office, Narcotics Prosecutions Bureau, 2650 South California, Chicago, IL 60608; 773-869-2879

The Rehabilitative Alternative Probation Program (RAP) targets first time, non-violent narcotics laws offenders who have violated their probation. Judge Lawrence Fox (the current RAP court judge) offers an intensive drug treatment education program as an alternative to sentencing. If the defendants fulfill all the program's requirements, the charges of the case will be dismissed on the next court date. Each day, in the Preliminary Hearings (PH) Unit, the numbers of cases that are narcotics-related, found with probable cause, found with no probable cause, found with no probable cause but indicted, dismissed, and nolle are also recorded. My research includes sitting in on all the different types of court calls and participating in the data collecting system in addition to helping the Assistant State's Attorneys prepare their paperwork. Through my own research and calculations, I have put together the average dismissal rates and prosecution rates in PH as far as the data would allow me to go at the Cook County State's Attorney's Office monthly from January 1998 to March 2002.

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### **ARCHITECTURAL DESIGN WITH AUTOCAD AND FENGSHUI PHILOSOPHY**

Presenter

Leon Wang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; hailiang@imsa.edu

Mentor

Andrew Wang, Architect, Wang and Associates, 5000 N. Broadway, Second Floor, Chicago, IL 60640; arwang1@yahoo.com; 773-334-3174

There are many philosophies for architectural design, but Fengshui philosophy is not one that is often used. Fengshui is the ancient Chinese philosophy used to create harmonious and balanced surroundings around us. Experts say that they can feel positive energy, called chi, in a place that has successfully incorporated Fengshui. My project tries to integrate Fengshui's lengthy and complex rules into the design of a home. The design process begins with creating adjacencies, which is a concept map that describes the connection between different spaces. It is important to compare the room areas and to configure an efficient floor plan. Then a design blueprint is digitally created using a computer program like AutoCAD. As the design is developed and modified, it is important to keep within the rules of Fengshui. For example, the philosophy says that round pillars are better than square ones, that the pathway to the road should not form a straight line, and that there should be only one door for the front entry way. After the design is complete, a Fengshui expert will be consulted to evaluate the design. The success of the design will depend on the how effectively the chi passes through the building, creating a harmonious environment for its inhabitants.

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## **CREATING GRAPHICS FOR THE REAL SCIENCE CD**

### Presenter

Leon Wang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; hailiang@imsa.edu

### Advisors

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

Clay Sewell, Fine Arts, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; clay@imsa.edu; 630-907-5054

Graphics is an essential part of the Real Science CD-ROM program because they make the science articles more exciting and visually pleasing for the readers. The Real Science CD is an interactive multimedia science program that is created by IMSA students for teaching 3-5th graders about various science topics. My goal as the graphics artist is to apply my artistic abilities in creating interesting and understandable graphics for various parts of the program. Images have been created for the various movies on the CD, the CD cover, and the Real Science web page. The procedure starts with finding out what graphics are needed by communicating with the writers, multimedia people, and editors. After understanding exactly what kinds of graphics are needed, it is necessary to research the topics or ideas for examples of professional works and techniques. Next it is important to decide what kinds of mediums and techniques would be best for creating an attention-grabbing graphic. Illustrations and cartoons turn out the best when they are outlined in ink and colored with marker or color pencil, while the logos and symbols for the CD appear the best when they are created digitally using computer software.

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## **DYNAMICS OF THE MORRIS GREAT BLUE HERON ROOKERY**

### Presenter

Jonathan Warnock, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; jonw@imsa.edu

### Advisor

David Workman, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; workman@imsa.edu; 630-907-5915

Since 1999 we have been observing a Great Blue Heron rookery that is located along the Illinois river, just south of Morris, Illinois, in Grundy county. We have been monitoring the number of nesting pairs and the number of chicks raised to adulthood in the rookery. A detailed map of the rookery has been made, and we have made a count of nests. Nests are located in three main sycamore trees, and the birds have begun to expand to surrounding trees for more nesting space. A blind has been installed to help us monitor the birds. We have found the number of chicks raised to maturity declined significantly between the 2000 and 2001 breeding seasons. We hypothesize that this may be due to road construction taking place in the area. We are also observing the heron rookery that is located at Fermi Lab. This will give us a good idea of how a rookery that is unaffected by human population operates. The heron skeleton that was begun last year will be finished and displayed by the end of the year.

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## **INVENTORY AND ANALYSIS OF HUMAN REMAINS FROM THURSTON GRAVEYARD**

### Presenter

Cecilia Westbrook, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; cecilia@imsa.edu

### Mentor

Dr. Anne Grauer, Loyola University at Chicago, Anthropology, 6525 N. Sheridan, Chicago, IL 60626; agrauer@luc.edu; 773-508-3464

On September 17, 2001, a construction company, which was grading the landscape in preparation for installing a retaining wall along Midwest Road in Oak Brook, Illinois, uncovered five sets of human skeletal remains, as well as some grave artifacts. Midwest Archaeological Research, Inc. (MARS, Inc.) was hired to excavate the area and remove the remains, pursuant to the Human Skeletal Remains Protection Act (20 ILCS 3440). Upon investigation, it was found that not only five, but as many as nineteen discrete gravesites existed, as well as a large pile of disarticulated remains. Over the course of the



past several months, these remains have been inventoried and major features noted under the guidance of Dr. Anne Grauer, who is in charge of their analysis. Ultimately, all of the possible ascertainable information about these individuals must be collected and recorded. This includes minimum number of individuals (MNI), age at death of all individuals, sex of all individuals, and any manifested pathologies.

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## **THE FABRICATION OF BIODEGRADABLE NANOSPHERES**

### Presenter

Tiffany White, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; bugeyes@imsa.edu

### Mentor

Cato Laurencin, M.D., Drexel University, Chemical Engineering, 3141 Chestnut Street, Philadelphia, PA 19104;  
215-895-6210; laurencin@drexel.edu

Nanotechnology and Tissue Engineering are rapidly emerging fields of the technological frontier, which have the potential to bring forth infinite innovation. In this study nanospheres were fabricated using the biodegradable copolymer poly lactic glycolic acid (PLAGA). These nanospheres can be used in applications such as controlled delivery systems like those described by S. Feng et al. The technique for creation of such nanospheres utilizes an altered protocol based on the single emulsion or solvent evaporation technique used in microsphere fabrication. This method employs oil-in-water emulsion using PVA (polyvinyl alcohol) as an emulsifier. Later, I intend to continue with the characterization of these nanospheres.

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## **INVESTIGATIONS INTO THE PROBLEM OF REGIOCHEMISTRY DURING PHARMACEUTICAL DESIGN OF HIV-INHIBITORS RELATED TO CONOCURVONE**

### Presenter

Keisha Williams, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; marie@imsa.edu

### Mentor

Kenneth W. Stagliano, Ph.D., Illinois Institute of Technology, Department of Chemical and Physical Sciences, 3101 South Dearborn Street, Chicago, IL 60616; stagliano@iit.edu; 312-567-3428; 312-567-3494

The seriousness of the AIDS epidemic, which afflicts more than 36 million people worldwide, led the United States National Cancer Institute (NCI) to initiate in the late 1980's a major effort to discover novel HIV inhibitory agents from natural sources. In 1993, Boyd et. Al. reported the isolation of a molecule named conocurone from the Western Australian smoke bush. By a combination of spectroscopic and semi-synthetic studies conocurone was assigned a trimeric quinone structure. Preliminary biological evaluation of conocurone was conducted by researchers at the NCI. Using a battery of interrelated assays conocurone was shown to be a potent and selective inhibitor of the HIV virus. The development of a general synthetic approach for the regiospecific synthesis of trimeric quinones was of significant interest to my research mentor because we believed it could lead to a new source of anti-HIV compounds.

In this presentation we describe the fundamental chemistry of quinones and trimeric quinones using a "pictorial approach." We then describe the field of organic synthesis and the prospect of preparing conocurone in the laboratory so we don't have to rely on the Western Australian smoke bush as a source of conocurone. With this background, the concept of regiochemistry during chemical bond formation will be introduced. The bulk of the talk will involve a discussion of my results on the use of thin-layer chromatography to separate regioisomers during trimeric quinone synthesis.

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## **FORENSICS FOR BEGINNERS: IDENTIFYING DNA USING THE PCR METHOD**

### Presenter

Brytne Winfrey, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
brytbrat@imsa.edu

### Advisors

Judith Scheppeler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; quella@imsa.edu; 630-907-5899

Susan Styer, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
sstyer@imsa.edu; 630-907-5943

The field of forensics deals with the extraction and analysis of DNA. The purpose of this inquiry is to learn how to use different DNA testing techniques and how to analyze results in order to identify the person whose DNA was sampled. DNA was collected from eight unspecified family members. The DNA was then tested using PCR and gel electrophoresis in order to determine the relationships between each of the eight samples (mother, father, sister, etc). The eight samples collected for this inquiry were tested using primers to the TPA25 and D1S80 loci. In forensic analysis, TPA25 is not nearly as helpful as D1S80. This is because TPA25 results in amplification of DNA that is 100 bp and/or 400 bp in length; this creates little room for genetic variability in a population. On the other hand, D1S80 is a VNTR region and allows for multiple allele sizes in a population. Analysis of DNA using these two loci has been started; by using the two loci together, it has been possible to derive useful genetic information about individuals. This inquiry will be continued until it is possible to extract unknown DNA from objects (stamps, clothes, etc.).

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## **ASIAN FINANCIAL STRUCTURES AND IMPLICATIONS FOR INTERNATIONAL TRADE AND CAPITAL MOVEMENT**

### Presenter

Arthur Wojtowicz, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
chochmo@imsa.edu

### Mentor

Howard J. Polk, A.G. Edwards & Sons, Inc., 222 S. Riverside Plaza, Suite 720, Chicago, IL 60606; 312-648-5274;  
howard.polk@agedwards.com

Because it comprises a significant share of the world economy, countless individuals and institutions have significant interests in the East Asian region. The business practices of East Asia are crucial to determining the future implications of austerity measures required by the International Monetary Fund and World Bank for foreign investment and capital movement globally. Consequently, the means by which financial structures and practices affect the flow of foreign investment capital into the region is of great importance. In the wake of the 1997-1998 Asian Financial Crisis issues of corporate transparency, government influence, and corporate practice have come to the forefront of economic policy and debate. International institutions, including the International Monetary Fund and the World Bank, have pressured East Asian economies to adapt Western protocol and business standards, but why? Projections for the futures of these economies are constructed by examining the reactions of Asian financial systems and economies to overhauls of many primary economic structures.

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## **A SELF-INQUIRY INTO THE PHILOSOPHICAL STUDY OF LIFE AND ITS MEANING**

### Presenter

Jennifer Wong, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dirvygrl@imsa.edu

### Advisor

Robert Kiely, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; oldstuff@imsa.edu; 630-907-5977

In this inquiry, I have explored the viewpoints of several philosophers on two great questions: the definition of truth, knowledge, and perception, and the definition of human self and its relationship to the universe. Through the examination of the rationalist philosophy of René Descartes and the conflicting views of empiricist John Locke and rationalist Baruch



Spinoza, the queries may be better understood. They wrestled with issues of body and mind, reason and sensation, and inner and outer realities. I will discuss the general strains of their thoughts as well as my own ideas on the individual, human ethics, and the existence of God, shaped by the studies of the inquiry. The individual is born without any knowledge or sense of this world, but his mind is not entirely empty--there is a general, inherent set of ethics instilled in everyone, according to Locke. Descartes maintains that the existence of God is apparent because the idea of a perfect entity is clear in his mind; however, I lean towards empiricist David Hume's argument: people have a need to believe in the supernatural--the existence of God cannot be affirmed or denied. Likewise, one's own philosophy can never be proven true.

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## **FUZZY APPROACH TO MULTI-VARIABLE OPTIMIZATION**

### Presenter

Grace R. Woo, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; gracew@imsa.edu

### Mentor

Peng-Yung Woo, Northern Illinois University, Electrical Engineering, Anne Glidden Road, DeKalb, IL 60115;  
woo@ceet.niu.edu; 815-753-0706

Although calculus has traditionally been proven effective for many single-variable optimization problems in science and engineering, the multi-constraint problem has been known to give difficulty in context of a worldly impediment. Fuzzy logic has already been proven a practical and probable approach in the single-variable situation. This paper presents further possibilities with fuzzy logic to multi-variable optimization problems that are difficult for the conventional calculus method.

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## **ANALYSIS OF MULTIGRID METHODS**

### Presenter

David Xia, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dxia@imsa.edu

### Mentor

Dr. Paul Fischer, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439-4844; fischer@mcs.anl.gov;  
630-252-6018

At the core of most physics problems there exists the need to do extensive mathematical computations, and in the last 25 years there have been major advances in the application of multigrid methods to fulfill these tasks. Today, these advances have made multigrid one of the premier tools for rapidly solving partial differential equations with N unknowns. Multigrid algorithms are small iterative functions that can closely approximate solutions to PDE's, and the accuracy of these solutions depends on the number of iterations as well as the coarseness of the grid over which the function was solved. Even though multigrid is an approximation tool, there are ways to smooth the solutions after using iterative methods. To introduce the topic, I will discuss the close relationship between finite difference approximations to two-point boundary value problems and the iterative method to solving coarse grid problems. The focus of my research has been to analyze modern algorithms as well as the origin of the first multigrid algorithm that was derived from a finite difference discretization of Poisson's equation. In the presentation, I will present my analysis of the accuracy of these solutions, the mathematical reasoning behind the process, examples of multigrid method when used to approximate random functions, and the possible uses of multigrid in research and engineering.

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## **RATIFICATION OF THE INTERNATIONAL CRIMINAL COURT: POTENTIAL WATERSHED EVENT OR FALSE PROMISE?**

### Presenter

Danny Yagan, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; dyagan@imsa.edu

### Advisor

Christian Nokkentved, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; drnok@imsa.edu; 630-907-5961

The ratification of the proposed International Criminal Court (ICC) would serve to bring war criminals and abusers of human rights to justice and thus constitute the crossing of the threshold of a new world order under enforceable international law. At



the dawn of a new century, the states of the world have codified fundamental rights of mankind and rules of war and agreed to them in principle. In order to be effective, however, such universal international law necessitates a degree of global cooperation that continues to be lacking and remains the greatest obstacle to its enforcement. The only body currently charged with handling breaches of international law is the International Court of Justice (ICJ). Designed to serve as a forum for mediation between states, the ICJ cannot hear cases against individuals, who are the typical violators of human rights and war laws, and wields no power of enforcement. By contrast, the Rome Statute for the creation of the ICC, currently eight states shy of ratification, would establish a permanent system of redress for violations of the most fundamental rights of civilians and all of mankind. The establishment of the ICC, as a decisive proposal facing the international community today, would constitute a compromise between international intervention and national sovereignty that could lead to truly effective international law.

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## **A QUANTITATIVE MODEL OF ELECTROPHORETIC MOBILITY OF OLIGOMERIC B-DNA**

### Presenter

Kevin Yang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kyang@imsa.edu

### Advisor

Dr. Udayan Mohanty, Associate Professor, Chemistry Department, Boston College, Merkert Center 214, 140 Commonwealth Ave, Chestnut Hill, MA 02467; 617-552-3610

Although gel electrophoresis has been widely used in scientific and industrial laboratories for years, the exact mechanism by which ionic oligomers migrate through gel is not yet fully understood. In an attempt to elucidate this process, the electrophoretic mobility of oligomeric B-DNA in free-solution and in polyacrylamide gel is described within the framework of a quantitative model. This model takes into account counterion condensation, the asymmetric field effect, long-range hydrodynamic interactions, screening of the charges, and the coulombic end effect. This model is then generalized to account for electrophoretic mobility in the presence of the organic solvent MPD in the buffer, a necessary compound for the crystallization of oligomeric B-DNA. In the presence of MPD, we observe a reduction in anomalous migration of B-DNA in free-solution. At 0 % MPD, a 25 bp strand of B-DNA has approximately the same mobility as a 107 bp strand, for example. At 15 % MPD, the anomaly is reduced so that a 25 bp strand of B-DNA has approximately the same mobility as a 65 bp strand. Finally, the model is shown to agree with recent experimental data concerning the gel electrophoretic mobility in the presence of MPD, elucidating MPD's effect on the mobility and conformation of B-DNA molecules. This provides new insight into a long-standing debate on the mechanism of migration of intrinsically curved B-DNA sequences containing Adenine tracts.

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## **REAL SCIENCE**

### Presenters

Kevin Yang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; kyang@imsa.edu  
Rosalind Yang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
apelaine@imsa.edu

### Advisor

Britta McKenna, Coordinator of Kids Institute, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; britta@imsa.edu; 630-907-5987

Real Science is an interactive science CD-ROM created, written, and produced by IMSA students. Real Science editors are the leadership team that supervises the IMSA student staff in the production of the CD. Roles of editors include: editing, writing and narration, developing multimedia and writing tutorials, designing the CD-ROM interface, conducting Great Minds interviews, and maintaining the Real Science web page. The process of creating movies includes topic selection, team selection, writing, narration, multimedia tutorials, and, finally, production. Movies are edited for authenticity, accuracy, and level of interest to the target audience. This year, the CD will contain some features we have not included in the past. For the first time, we are including a movie on the making of Real Science so that other schools may get an idea of how we do it, and even how they may start a similar venture. Other articles this year include "Simple Machines", "Sound", "Marine Biology", and others. We are including interviews of Homer Hickam and Paul Sereno, an "on the road" article, and plan on making an interactive "do at home" lab. We are also experimenting with making Real Science bilingual by including the article "Simple Machines" in Spanish.



## REALIZING A SCULPTURE

### Presenter

Rosalind Yang, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
apelaine@imsa.edu

### Advisor

Clay Sewell, Fine Arts, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL clay@imsa.edu

If one speaks of the interpretation of realizing a perfect aspiration, then it would be like asking the question I have asked myself all year: how can I, a single (curious) person, portray IMSA to everyone else? In the end, the solution involves more than one voice, and the work of many minds. But, the result is a sculpture--a construction of mixed material, wood, cement, chicken wire, gauze--in constant motion, constant change. This is the second year I have worked on this inquiry. Last year, I went about setting up the premises: what does IMSA mean? To find out, I conducted a series of interviews, took pictures, journaled. The process yielded many ideas that eventually produced the springboard for what the sculpture would look like. After lots of sketches and advising, I began work. And so, here I am. But why? How? And is it important? That is a story I want to share with you.

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## SHAPE EFFECTS ON MAGNETIZATION REVERSAL IN NANO-PARTICLES

### Presenter

Stephanie Yeh, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506; syeh@imsa.edu

### Mentor

Dr. Marcos Grimsditch, Argonne National Laboratory, Materials Science Division, Building 223, Argonne, IL 60439;  
grimsditch@anl.gov; 630-252-5544;

Dr. Johan Meersschaut, Argonne National Laboratory, Materials Science Division, Building 223, Argonne, IL 60439;  
630-252-5469; meersschaut@anl.gov

We have investigated the role of a particle's shape on the switching behavior and magnetic stability of sub-micron sized particles. We are attempting to show that the local dipolar fields determine the switching fields. Experimentally measured switching fields are compared with calculations based on the concept of 'dipolar instability pockets,' which are regions in which the local dipolar fields favor a spin reorientation. The experimental switching fields are extracted from hysteresis loops measured using MOKE techniques. In order to calculate the dipolar fields, the shapes of the particles were extracted from SEM images and inputted to calculate the shape-dependent dipolar fields. The comparison of experimental and theoretical data shows that the concept of dipolar instability pockets is of practical significance. It also leads to a better fundamental understanding of magnetization reversal in submicron-sized particles.

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## A STUDY OF THE EFFECTS OF PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR $\gamma$ (PPAR $\gamma$ ) AND TROGLITAZONE ON LIVER CELLS

### Presenter

Vaishalee Yeldandi, Illinois Mathematics and Science Academy, 1500 West Sullivan Road, Aurora, IL 60506;  
vvyco02@imsa.edu

### Mentor

Dr. Janardan K. Reddy, Northwestern Medical School, Pathology, 303 E. Chicago Ave., Chicago, IL 60611;  
jkreddy@northwestern.edu; 312-503-8144

Dr. Songtao Yu, Northwestern University Medical School Pathology, 303 E. Chicago Ave., Chicago, IL 60611; 312-503-1349; songtao@northwestern.edu

Peroxisome proliferators are xenobiotics that occur in a variety of substances including food, plasticizers, herbicides, pharmaceutical drugs, etc. These have been found to stimulate a gene in the family of steroid receptors, resulting in the name peroxisome proliferator-activated receptor (PPAR). Additionally, there are three main types of PPAR:  $\alpha$ ,  $\beta$ , and  $\gamma$ . Research today focuses mostly on PPAR $\alpha$ ; and PPAR $\gamma$ . Although the molecular structure of PPAR $\alpha$  and PPAR $\gamma$  are very similar, they induce different responses in the body. PPAR $\alpha$  and its ligand Wy-14,643 are mostly found to affect the liver; PPAR $\gamma$  and its ligand troglitazone, an antidiabetes drug, are usually found to affect adipocytes (fat cells). In order to understand more about the full effects of the two types of PPARs, PPAR $\gamma$  was introduced into the liver to see what kind of genes (e.g. adipocyte P2 (aP2) and lipid  $\beta$ -oxidation) could be induced there. As of yet, there have been inconclusive results in these experiments.



<u>Name</u>	<u>Time / Room</u>	<u>Time / Room</u>	<u>Time / Room</u>
Abdullah Abdussalam	8:30 / A155		
Joe Abruscato	9:45 / Garage		
Dan Adamo	9:20 / Lecture Hall		
Mary Adekoya	9:20 / A148		
Henry Andoh	8:55 / A115		
Rebecca Arundale	11:00 / 152 / A154		
Sarah Baker	9:45 / A121		
Meghan Bannon	8:30 / A114	11:00 / A152-A154	
Amit Behal	9:20 / Lecture Hall	11:00 / A115	
Yao Bian	8:55 / A150	10:35 / B133	
Justin Blanchard	11:00 / A119		
Jalila Bouchareb	8:30 / A155		
Eric Bowden	9:20 / E115	11:00 / A119	
Catherine Breckenridge	10:35 / A114		
Richard Buchman	9:20 / A152-A154		
Holly Bybee	8:30 / B112		
Reginald Champagne	9:20 / Lecture Hall		
Alicia Chan	9:45 / A110		
Samantha Chan	8:30 / A121	10:35 / A117	
Alice Chang	9:20 / A147		
Jason Chang	11:00 / B133		
Yong Chen	8:30 / A152-A154	8:55 / A152-A154	9:45 / A147
Zheyang (Jenny) Chen	8:30 / B112	9:45 / A147	10:35 / A149
Puni Chennamaneni	8:30 / B133	9:45 / A115	
Brian Choi	8:30 / A117		
Mallory Chua	11:00 / A119		
Chrystal Colbert	10:10 / A117		
Bernadette Contreras	8:55 / A117	10:35 / B148	
Rebecca Cooper	8:55 / A114		
Shaun Currier	9:45 / Garage		
Emilie Dahod	8:30 / B148	9:20 / A113	10:10 / A113
Sharon David	11:00 / A119		
Katy Dieber	8:30 / A112		
Annie Dlugokecki	8:55 / A117		
Justin Doran	10:35 / A116		
Aaron Doukas	11:00 / A114		
Jessica D'Souza	9:20 / A152-A154		
Nia Dukov	11:00 / A110		
Jessica Dy-Johnson	11:25 / A110		
Margalit Faden	10:35 / A113		
Christopher Fanning	9:45 / B108		
Heather FitzHenry	10:10 / A150	11:00 / A152-A154	
Patricia Fonseca	8:30 / A116		
L. Tracy Foote	10:10 / B108		
Andrew Friedl	9:45 / A147		
Sandra Garcia	8:55 / E115	10:35 / A150	
Dhaval Garg	10:10 / A147		
Anupama Garla	9:20 / A113		
Anna Gembis	11:00 / A152-A154		
Matthew Getz	9:20 / Lecture Hall	10:35 / A115	
Dmitry Goldin	8:30 / A150	9:20 / Lecture Hall	
Yuan Gong	8:30 / B148	9:45 / B148	
Emma Goodman	8:30 / B112		
Kristina Govorovska	11:00 / A117		



<u>Name</u>	<u>Time / Room</u>	<u>Time / Room</u>	<u>Time / Room</u>
Heidi Grothaus	11:25 / A147		
Rui Guan	10:35 / B108		
Daniel Gulotta	8:30 / B108	9:20 / B112	
Lucy Guo	11:00 / B108		
David Hamman	8:55 / A121		
Tom Han	9:20 / Lecture Hall		
Michael Hanes	9:20 / A121		
Anna Hang	8:30 / B112	9:20 / A114	
Caleb Harper	8:30 / A152-A154	8:55 / A152-A154	11:00 / B133
Kevin He	10:35 / A110		
Mark Hoadley	8:55 / A147	10:10 / A148	
James Holmes	8:30 / A147	9:20 / A149	10:10 / A149
Sarah Howe	10:10 / A152-A154		
Yinin Hu	8:55 / A155		
Jennifer Huang	10:35 / A116		
Joyce Hwu	8:55 / A150		
Kristoffer Inton	11:00 / A113		
Sravisht Iyer	8:30 / A147	9:45 / A148	
Jillian Jacobson	9:20 / A117		
Chandana Jasti	9:20 / B133		
Tim Johnson	9:45 / Garage		
David Jou	8:55 / A147	9:45 / A149	
Min Jung (Jenny) Jun	10:35 / B133		
Matthew Katz	8:30 / A117		
Kathleen Kelly	11:00 / A152-A154		
Elaine Khoong	10:35 / A116		
Catherine Kim	9:20 / A155		
Nicholas Kim	9:45 / B112		
Pyong (Hannah) Koh	11:25 / A155		
Bethany Kondiles	8:55 / A110		
James Koo	11:25 / B108		
Vladimir Krastev	10:10 / B112		
Jieun Kwak	10:10 / A117	10:35 / B133	
Elizabeth Lampe	8:30 / B148	10:10 / B148	11:00 / B148
Andrew Langan	11:00 / A152-A154		
Joseph Langan	10:10 / A152-A154		
Vivian Lau	11:25 / B133		
Julie Lauffenburger	9:45 / A150	10:10 / A152-A154	
Jeanne Lee	9:20 / Lecture Hall	11:00 / E115	
Kachiu Lee	11:25 / A113		
Erin Leindecker	9:20 / A152-A154		
Stephanie Lewis	9:45 / E115		
Jennifer Li	11:25 / A119		
Casey Liang	11:25 / A149		
Mengyao Liang	9:20 / Lecture Hall	10:35 / A115	
Rebecca Liu	8:55 / A117	9:45 / A117	
Zhihao Liu	10:10 / A116		
Tracy Llenos	9:20 / A150		
Natalie Look	9:45 / A121		
Heidi Lu	8:55 / A150		
David Lu	9:20 / Lecture Hall		
Jared (Zouyan) Lu	9:20 / Lecture Hall		
Steven Lucy	11:00 / A119		
Alex Lyle	8:30 / A152-A154	8:55 / A152-A154	



<u>Name</u>	<u>Time / Room</u>	<u>Time / Room</u>	<u>Time / Room</u>
Chelsea Lynn	9:20 / A152-A154		
Yousaf Malhance	10:10 / A121		
Paul Malina	8:30 / A113	11:25 / E115	
Joanne Mathews	11:25 / A116		
Emily McCord	8:30 / B133		
Martin McCrory	10:10 / Auditorium		
Christopher McLaughlin	10:10 / B112		
Michelle Meneses	11:00 / A150		
Qing Miao(Mary)	8:55 / A150	11:00 / A113	
Jennifer Mo	8:55A114	9:45 / A113	
Nicholas Moryl	10:35 / B112		
Amanda Murphy	11:00 / A152-A154		
Samanthi Narayanan	9:20 / B133		
Niket Nathani	10:35 / A147		
Lina Nayak	11:00 / B112		
Jo Nelson	9:45 / B133		
Sydney Null	11:00 / A152-A154		
Ola Nwabara	8:55 / A112	9:45 / A112	
Nathaniel O'Bear	10:10 / A110		
Sang Oh	8:55 / B148		
Adebosola Oladeinde	8:55 / B108		
Amy Orsborn	9:20 / B108		
Annie Park	9:20 / A152-A154		
Jean Park	9:20 / A151	10:35 / B133	
Shravani Pasupneti	10:10 / A113		
Pranay Patel	11:25 / A110		
Pranjal Patel	10:35 / A148		
Lynn Peng	8:30 / B112		
Anna Peralta	9:45 / A119		
Linda Pinto	8:55 / A110	10:10 / E115	
Sean Pitroda	10:10 / A155		
Jennifer Poulsen	9:20 / A152 / 154	10:10 / Auditorium	
Molly Punke	8:30 / A112	9:20 / A152-A154	
Vinaya Puppala	9:45 / A155		
Urvi Purohit	8:30 / B133	9:45 / A150	
Angel Qin	9:45 / A155		
Robert Quimby	8:55 / A114	10:10 / B112	11:00 / A114
Mark Quinn	8:30 / A152-A154	8:55 / A152-A154	
Manu Raam	8:30 / A117		
Kavita Ramakrishnan	9:45 / A115		
Nicholas Reinhart	10:10 / A110		
Emily Rice	9:45 / A152-A154		
Minji Ro	9:20 / A119	10:10 / A119	
Tim Roderick	9:45 / Garage		
Rabeah Sabri	11:00 / A148		
Darrel Saldanha	8:55 / A148		
James Sanders	11:00 / B133		
Michael Saphthavee	10:35 / A148		
Kevin Schlee	11:00 / A152-A154		
Donald Schmit	11:00 / A114		
Ying Shi	8:55 / A149	9:45 / A147	
Di Shui	8:30 / A149		
Erica Sim	10:35 / A119	11:00 / A119	
Joseph Sloan	8:55 / A115		



<u>Name</u>	<u>Time / Room</u>	<u>Time / Room</u>	<u>Time / Room</u>
Philip Stanton	8:55 / A116		
Harrison Stein	10:35 / A155		
Jennifer Stynoski	8:55 / A121		
Daniel Sun	11:00 / B133		
Alexandra Surasky-Ysasi	8:55 / A113		
Eric Szczesniak	9:20 / A115		
Christopher Szucko	10:10 / B112		
Jubilee Tan	9:20 / A117		
Weiwei Tan	9:45 / A116		
Ana Tellez	11:00 / A155		
Sharda Thakral	8:55 / B133		
Amber Thompson	10:35 / A119		
Brendan Todt	8:30 / A115		
Matt Traverso	8:30 / A152-A154	8:55 / A152-A154	9:20 / B148
Diana Tung	8:30 / B112		
Vaibhav Upadhyay	10:10 / A115		
Vanessa Vardon	11:00 / A147		
Soumya Venkiteswaran	9:20 / A152-A154		
Neelima Vidula	8:55 / A119		
Erik Volkman	11:00 / A119		
Nathan Walsh	11:00 / A116		
Sarah Walter	8:30 / A110	10:35 / E115	
Tori Walters	8:30 / B112	11:00 / A152-A154	
Grace Wang	10:35 / A112		
Leon Wang	10:10 / A112	11:00 / A112	
Qing Wang	8:55 / A150	10:35 / A113	
Jonathan Warnock	8:55 / B112	11:00 / A152-A154	
Cecilia Westbrook	9:45 / A152-A154	10:35 / A152-A154	
Grace Whang	11:25 / B133		
Tiffany White	8:30 / A148	9:20 / A148	
Jered Wierzbicki	11:00 / A119		
Keisha Williams	9:45 / A151	10:35 / A150	
Amy Winans	9:45 / A113		
Brytne Winfrey	11:00 / A149		
Arthur Wojtowicz	11:25 / A112		
Jennifer Wong	9:20 / A116		
Grace Woo	9:45 / A114		
Yun Wu	8:30 / B112		
David Xia	8:30 / A119	9:20 / Lecture Hall	
Alan Xiang	8:30 / A147		
Danny Yagan	9:20 / A112		
Kevin Yang	8:30 / E115	9:20 / B148	10:10 / B133
Rosalind Yang	8:30 / E115	9:20 / E117	
Stephanie Yeh	10:10 / A114		
Vaishalee Yeldandi	10:35 / A121		
Chris Young	9:20 / Lecture Hall	11:25 / E115	
Lisa Yung	11:00 / A116		







