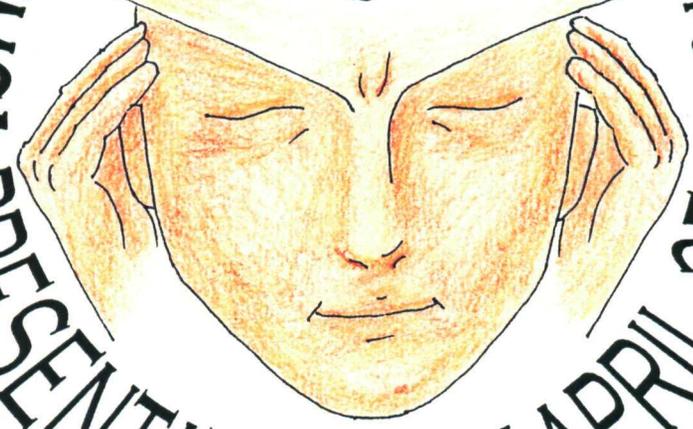


IMSA PRESENTATION DAY APRIL 25, 2001





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"

**THIRTEENTH ANNUAL IMSA PRESENTATION DAY**  
**APRIL 25, 2001**

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

**Academic Pit**

- 8:30 – 8:45 THE BIOGRAPHIES PROJECT: PORTRAITS OF GREAT AMERICAN SCIENTISTS  
Nia Dukov, Anne Halsall, Kelly S. McArdle, Erica L. Ruddy, Margaret Wat,  
Dr. Neill Clark, Dr. Leon Lederman, Dr. Judith Scheppler
- 8:55 – 9:10 ARTIFICIAL INTELLIGENCE, MEMETICS, AND COGNITIVE SCIENCE A.K.A.  
A JOLLY ROMP IN THE EVOLUTIONARY DESIGN SPACE  
Jennifer Levin, Jean Lu, Steven Quimby, Michael P. Ososky
- 9:20 – 9:35 EXPLORATIONS IN LEADERSHIP: INVESTIGATIONS INTO VARIOUS  
LEADERSHIP TECHNIQUES AND THEIR INFLUENCE ON DIFFERENT  
COMMUNITIES  
Emi Arima, Helena Knight, Matthew Knisley, Lauren Kozak, Lacey Langguth,  
Linda Lee, Kent Limson, Chailee Mann-Stadt, Kelly McArdle, Anitra Sumbry,  
Robert Hernandez
- 9:45 – 10:00 QUALITATIVE ANALYSIS BETWEEN THE TRADITIONAL CALCULUS  
METHOD AND THE MODERN FUZZY METHOD TOWARD A  
MANUFACTURING PREDICAMENT  
Grace Woo, Dr. Peng Yung Woo
- 10:10 – 10:25 THE INLAND STEEL BUILDING: THE STORIES AS AN ORGANISM  
Anupama Garla, Mark Sexton
- 10:35 – 10:50 ILLINOIS LEGISLATION FOR ROUTINE PRENATAL HIV TESTING WITH THE  
RIGHT OF REFUSAL  
Catherine Kim, Senator Chris Lauzen
- 11:00 – 11:15 FROM CLASSICAL TO CONTEMPORARY: A STUDY OF MUSICAL THEORY  
AND STYLES  
Tim Hachmeister, Dr. Christopher Kuhl

**Auditorium**

- 9:45 – 10:00 LIVE RECORDINGS OF ORIGINAL COMPOSITIONS  
Raymond Magee, Michael Wright, David Deitemeyer

**Lecture Hall**

- 8:30 – 8:45 FLIPPOVISION: EXPANSION – STUDENT PRODUCED STOP-MOTION  
ANIMATION  
Olufemi Adeyanju, Patrick Delfert, Joseph Giardino, Dmitry Goldin, Nishant Kumar,  
Daniel Reed, Thomas P. Rooney, Joel M. Schad, Sean M. Smith, David Xia,  
Chris Young, Brian T. Thornburg
- 8:55 – 9:10 EFFECTS OF PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR (PPAR)  
ON GENE EXPRESSION  
Heather FitzHenry, Vaishalee Yeldandi, Janardan K. Reddy, M.D., Chao Qi, Ph.D.,  
Songtao Yu, Ph.D.
- 9:20 – 9:35 TOPICAL VERSES PERIBULBAR ANESTHESIA FOR CATARACT SURGERY  
Michael Hanes, Dr. Gary L. Fanning
- 9:45 – 10:00 CORBA TOP FOR LINUX ON EMBEDDED BOARDS  
Jered Wierzbicki, Margaret Votava
- 10:10 – 10:25 THE REGULATION OF PHOSPHOLIPASE C DELTA-1 BY NEURONAL CALCIUM  
SENSOR-1  
Debra Yoo, Dr. Jon Lomasney

**Lecture Hall (continued)**

10:35 – 10:50

COMMUNICATION BETWEEN ELECTRONIC DEVICES

Charles Felish, Mihaela Mihalcea

11:00 – 11:15

THE DEVELOPMENT AND IMPLEMENTATION OF FUNCTIONAL MAGNETIC RESONANCE IMAGING IN THE STUDY OF NEURAL PAIN PERCEPTION

Riddhi Patel, Tom Souhlas, Dr. A.Vania Apkarian

**Maintenance Garage**

9:20 – 9:35

THE DEVELOPMENT AND DESIGN OF A GO-KART

Anthony Garcia, Joonil Kwak, Edgar Mosshamer

**A-110**

8:30 - 8:45

A STUDY OF MODERN FRENCH CULTURE AND THE INFLUENCE OF THE HOMOGENIZING EUROPEAN UNION

Marissa Fierz, Willa Shultz

8:55 - 9:10

THE ROLE OF GLUTATHIONE ON THE DIFFERENTIATION OF TH0 LYMPHOCYTES

Eric K. Szczesniak, Carl Waltenbaugh, Ph.D.

9:20 - 9:35

CONSTANT LIGHT EXPOSURE DECREASES CLOCK GENE MRNA EXPRESSION IN MOUSE EYE TISSUES

Margaret Wat, Dr. Margarita L. Dubocovich, Joseph Dudley, Dr. Monica I. Masana, Dr. Vijay Sarthy

9:45 – 10:00

LOCALIZATION OF CLOCK MRNA EXPRESSION IN THE MOUSE RETINA

Margaret Wat, Dr. Margarita L. Dubocovich, Joseph Dudley, Dr. Monica I. Masana, Dr. Vijay Sarthy

10:10 – 10:25

SURVEY OF QUALITY OF CARE IN PATIENTS UNDERGOING ENDOSCOPIC PROCEDURES AND LIVER BIOPSY

Anitra R. Sumbry, Thelma E. Wiley, M.D.

10:35 – 10:50

INQUIRY ON INQUIRY

Eric K. Szczesniak, Anupama R. Topgi, Matthew E. Traverso, Edgar Mosshamer

11:00 – 11:15

CALCIUM BINDING PROTEINS IN MOUSE RESPIRATORY NEURONS

Anupama Topgi, Dr. George F. Alheid, Dr. Donald R. McCrimmon

**A-112**

8:30 - 8:45

A JOURNEY INTO ANIMAL CONSCIOUSNESS

Tiffany White, Dr. David R. Hilbert, Dr. Marya Schechtman

8:55 – 9:10

THE ROLE OF DOMESTICATED COTTON IN THE DEVELOPMENT OF COMPLEX SOCIETY IN PERU

Julia Jennings, Dr. Winfred Creamer

9:20 – 9:35

KOREAN COSTUMES OF THE CHÔSON PERIOD

Julie Park, Dr. Bennet Bronson

9:45 – 10:00

THE POWER OF CHIEFS

Kasia Szremiski, Dr. Jonathan Haas

10:10 - 10:25

THE EFFECTS OF SUB-AQUATIC VIBRATIONS ON THE TERRITORIAL BEHAVIOR OF A MALE GREEN FROG

Katy Dieber, Vicki Burgholzer

10:35 – 10:50

ANTIBODY LABELING OF TAU POLYMERS AS PROBES FOR TAU STRUCTURE IN ALZHEIMER'S DISEASE

Christine S. Tsai, Dr. Lester Binder

11:00 – 11:15

ANALYSIS OF THE RESPONSE OF *HYDRA OLIGACTIS* TO EXTRACELLULAR ATP

Ann Hinterman, Stacia Whitaker, Vicki Burgholzer

**A-113**

- 8:30 - 8:45 UNDERSTANDING JAPANESE LANGUAGE THROUGH MANGA  
Matthew Isoda, Andre Phillips, Justin Skarha, Kenny Vogelpohl, Jonathan Besancon
- 8:55 - 9:10 INVESTIGATING THE ROLE OF DERMATAN DISULFATE (INTIMATAN) IN  
AMELIORATING PLATELET ACTIVATION RESPONSE IN HEPARIN-INDUCED  
THROMBOCYTOPENIA  
Vinaya K. Puppala, Ashwin R. Shetty, Jeanine M. Walenga, Walter P. Jeske, Ph.D.,  
M. Margaret Prechel, Ph.D.
- 9:20 - 9:35 A STUDY OF SHASHLIK SCINTILLATOR DESIGNS  
Jared Kaplan, Erik Ramberg
- 10:10 - 10:25 PERSONAL CONNECTIONS  
James Carney, Dr. Gregory Makoul
- 10:35 - 10:50 THE COLD WAR CONFLICT REFLECTED IN STAR TREK  
Meghan Bannon, James Victory, Ph.D.
- 11:00 - 11:15 ANALYSIS OF GLOBAL MARKET TRENDS  
Shaun Roach, Mark Witt, James Meyerhoff

**A-114**

- 8:30 - 8:45 THE ORIGINS OF PERSIAN SUFI POETRY  
Shannon Dobson, Dr. Robert Kiely
- 8:55 - 9:10 IDENTIFICATION AND CHARACTERIZATION OF MULTICOPY SUPPRESSORS  
OF VPR-INDUCED CELL DEATH  
Hannah Koh, Dr. Yuqi Zhao
- 9:20 - 9:35 SCIENCE EXPLORERS / REAL SCIENCE COLABORATIONS  
Roy Droste, Britta McKenna
- 9:45 - 10:00 SCIENCE EXPLORERS: IMSA TEAM MARS ONLINE  
Katie Boehm, Britta McKenna
- 10:10 - 10:25 NEONATAL MORTALITY AND MORBIDITY IN ALL APPROPRIATE  
GESTATIONAL AGE NEWBORNS ADMITTED TO THE NICU BETWEEN 1990  
AND 1999 WITH BIRTHWEIGHTS < 1000 GRAMS  
Anson T. Tang, Jonathan K. Muraskas, M.D., Marc G. Weiss, M.D.
- 10:35 - 10:50 RISK FACTORS FOR NECROTIZING ENTEROCOLITIS IN EXTREMELY LOW  
BIRTH WEIGHT INFANTS  
Kelly S. McArdle, Dr. Monika Bhola
- 11:00 - 11:15 IN-VITRO INHIBITION OF HIV-1 BY LEUKEMIA INHIBITORY FACTOR IN  
RANDOM DONOR PERIPHERAL BLOOD MONONUCLEAR CELLS  
Hanna Schitteck, Nicole Thompson, William Kabat

**A-115**

- 8:30 - 8:45 CONSTRUCTION AND RESEARCH OF A SONOLUMINESCENCE APPARATUS -  
Year 2  
Dustin Hendrickson, Dr. Donald Dosch, Michael Lindenmeyer
- 8:55 - 9:10 RHESUS BLOOD TYPE INCOMPATIBILITY AND JAUNDICE  
Erin Huffington, Dr. Donald Dosch
- 9:20 - 9:35 ILLINOIS AND THE NOBLE SAVAGE  
Lisa Kelly, Kathleen King, Dr. Robert Kiely, Dr. Claiborne Skinner
- 9:45 - 10:00 APPLYING RAPID PROTOTYPING TECHNIQUES TO THE PRODUCTION OF  
BIOCOMPATIBLE CERAMIC PRODUCTS  
Wen J. Chen, Professor Selçuk I. Güçeri
- 10:10 - 10:25 PREVENTION OF SENESCENCE BY TELOMERASE IN HUMAN DIPLOID  
FIBROBLAST CELLS  
Lisa Kelly, Dr. Kathy Rundell
- 10:35 - 10:50 DROPLET/SOLID SURFACE INTERACTIONS IN REDUCED GRAVITY  
PERTAINING TO MICROELECTRONICS MANUFACTURING: PART II  
Angela Campbell, Dr. Constantine Megaridis, Jason Hagedorn, Chui Melvin,  
Eric Moore, Julie Schaefer, Biljana Zdravevski

**A-115 (continued)**

11:00 – 11:15

THE ACCELERATION OF THE INCORPORATION OF INFORMATION  
TECHNOLOGY IN MUNICIPAL GOVERNMENT

Erin Huffington, Kathleen King, Dr. Stewart Personick

**A-116**

8:30 - 8:45

TELE-IMMERSION: TURNING VIRTUAL REALITY INTO REALITY

Tania Khanna, Kachiu Lee, Brian Park, Dr. Tom DeFanti

8:55 – 9:10

TECHNOLOGICAL ADVANCEMENTS IN THE VISUAL MEDIA INDUSTRY

Melissa Kaye, Catherine Shartzter, Mark Hislop

9:20 – 9:35

TRAPPED BETWEEN TWO WORLDS: THE PSYCHOLOGY OF CHINESE-  
AMERICAN CHILDREN

Weiran Yan, Jennie Zhao, Jonathan Besancon

9:45 - 10:00

OSMOTIC RESPONSE OF FIBROBLASTS

Gaurav Kamboj, Jens O.M. Karlsson, Ph.D., Katy F. Hsiao, Daniel Irimia

10:10 - 10:25

RESEARCH ON "FOR SALE" CLAUSE IN PATENT STATUTES

Stephanie Yeh, Barbara Greenberg

10:35 - 10:50

TERMINATION OF PARENTAL RIGHTS

Elizabeth Garrison, Barbara Greenberg

11:00 – 11:15

KIDNAPPED: THE IMPLICATIONS AND EFFECTS OF INTERNATIONAL  
PARENTAL KIDNAPPING

Judy Kang, Barbara Greenberg

**A-117**

8:30 - 8:45

SCIENCE EXPLORERS: NUTRITION AND WELLNESS

Nikhil Agarwal, Emi Arima, Anupama Garla, Lucy Guo, Britta McKenna

8:55 - 9:10

THE CREATION OF A WELL-WRITTEN SCREENPLAY

Nathan Walsh, Dr. Christopher Kuhl

9:20 - 9:35

THE INFLUENCE OF MOTHER TERESA IN AMERICA

Colleen Unger, Dr. Christopher Kuhl, Jose Palos

9:45 - 10:00

CHAMBER MINIATURIZATION TO SHORTEN ASSAY TIME AND MINIMIZE  
LIGAND AND RECEPTOR CONSUMPTION DURING PULSED  
ULTRAFILTRATION

Sri P. Vagvala, Kevin Yang, Dr. Richard B. van Breemen

10:10 - 10:25

DRAFTING A NEW LEGISLATIVE PROCESS FOR AMERICA

Danny Yagan, Kenneth Guest

10:35 - 10:50

FRANÇAIS AVEC DR. SKINNER

Lavina Jadhvani, Dr. Claiborne Skinner, Brenda Crosby

11:00 - 11:15

ESTABLISHMENT OF A PROBE SET FOR FLUORESCENCE IN SITU  
HYBRIDIZATION (FISH) DETECTION OF SILENCING MEDIATOR OF RETINOIC  
ACID AND THYROID HORMONE RECEPTOR (SMRT) GENE  
REARRANGEMENTS IN NON-HODGKIN'S LYMPHOMAS

Danny Yagan, Dr. Lionel Coignet

**A-119**

8:55 – 9:10

CREATING HABIT: THE INTERACTION OF CUSTOM AND CLOTHING

Amanda Lucek, Clay Sewell

9:20 – 9:35

REALIZING A SCULPTURE

Rosalind Yang, Clay Sewell

9:45 – 10:00

A CATALOGUE CULTURE: MODERNIZING THE FRONTIER

Belinda Chang, Rosalind Yang, Kenneth Guest

10:10 – 10:25

THE KIRBY-BAUER ASSAY IN RELATIONSHIP TO STUDENT INQUIRY

Nan Sethakorn, Dr. Judith Scheppler

10:35 – 10:50

CONTINUUM OF ASTHMA CARE: FROM OUTPATIENT EDUCATION TO  
INPATIENT CRITICAL PATHWAY EVALUATION

Helena Knight, Judith Arneson

-119 (continued)

- 11:00 – 11:15 LAKE SUPERIOR, ITS PERCEPTION, AND ITS UTILITY: A STUDY OF HUMAN INFLUENCE UPON THE NORTH WOODS, SPANNING FROM THE VOYAGEURS TO THE PRESENT  
Dan Langan, Dr. Claiborne Skinner

-121

- 8:30 - 8:45 THE NEW AND IMPROVED PROJECT SCHOOL VISIT  
Katherine Lorentzen, Britta McKenna
- 8:55 - 9:10 SCIENCE EXPLORERS: HOW CAN HIGH SCHOOL STUDENTS EXPAND A DEVELOPED PROGRAM REGIONALLY?  
Pooja Agarwal, Britta McKenna
- 9:20 - 9:35 SCIENCE EXPLORERS: I WANT MY MUMMY  
Aleata Hubbard, Lavina Jadhvani, Paul Malina, Britta McKenna
- 9:45 – 10:00 THE EFFECT OF OVEREXPOSURE OF ANTIOXIDENTS ON THE LIFESPAN OF MAMMALIAN TISSUE CULTURES  
Nikhil Agarwal, Ashwin Shetty, Dr. Donald Dosch
- 10:10 – 10:25 FREE TRADE AREAS OF THE AMERICAS (FTAA): WHAT INTERNATIONAL CONCORDS DICTATE FOR THE GLOBAL CONSUMER MARKET  
Nikhil Agarwal, Fred L. Fleischbien
- 10:35 – 10:50 PRIYA'S PIZZA PUB – BUSINESS PROPOSAL  
Priya H. Khetarpal, Fred L. Fleischbien
- 11:00 – 11:15 SCIENCE EXPLORERS- "SENSATIONAL SENSES AND PSYCHOLOGY"  
Sandra Garcia, Katherine Lorentzen, Victoria Ogunsanya, Britta McKenna

-147

- 8:30 – 8:45 FINANCIAL SPECULATION FOR MONETARY ALLOCATION IN US AND FOREIGN MARKETS  
Kent Limson, Jim Van de Ven
- 8:55 – 9:10 THE IROQUOIS THEATER FIRE: A HISTORICAL EXAMINATION OF THE TRAGEDY THAT CHANGED THE WORLD  
Brian A. Link, Michael DeHaven, David Heffernan
- 9:20 – 9:35 A COMPARATIVE ANALYSIS OF BROKERAGE FIRMS  
Alison Ruddy, Michael DeHaven
- 9:45 – 10:00 ECOMMERCE AND IMSA: SURVEYING INTERNET SHOPPING HABITS  
Kristoffer V. Inton, Fred L. Fleischbien
- 10:10 – 10:25 HOW IMPERIALISM HAS AFFECTED THE PHILIPPINES  
Jason Barnes, Dr. Christian Nokkentved
- 10:35 – 10:50 THE GOVERNMENT AND PEOPLE OF BURMA  
Vanessa Vardon, Dr. Christian Nokkentved
- 11:00 – 11:15 SOCIO-ECONOMIC IMPLICATIONS OF CHILD LABOR AND ITS EFFECTS IN THE THIRD WORLD GLOBAL PRETEXT  
Nikhil Agarwal, Kent Limson, Dr. Christian Nokkentved

-149

- 8:30 - 8:45 REAL SCIENCE: DOLPHINS, PRINCES OF THE OCEAN  
Dennis Li, Jennifer Mo, Britta McKenna
- 8:55 - 9:10 REAL SCIENCE: ROCKS ROCK!  
Annabel Fu, Linda Ly, Britta McKenna
- 9:20 - 9:35 GLOBAL COMPANIES AND CULTURAL HUMAN FACTORS  
Gautam Kumar, Professor Patrick Whitney
- 9:45 - 10:00 PREDICTING THE EFFECTS OF D-AMPHETAMINE BASED ON PERSONALITY TYPE AND CORTISOL LEVELS  
Mary Sullivan, Dr. Harriet deWit, Dr. Tara White
- 10:10 - 10:25 GENOMIC ANALYSIS OF NMDA-RECEPTORS IN ATTENTION-DEFICIT (HYPERACTIVITY) DISORDER  
Pius Wong, Roger Kroes, Ph.D.

**A-149 (continued)**

10:35 – 10:50

EFFECTS OF LOW MOLECULAR WEIGHT GLYCOSAMINOGLYCANS ON TAU PHOSPHORYLATION

Rena Shah, Dr. John Lee, Mark Walzer

11:00 – 11:15

HEPARANASE GENE EXPRESSION AND REGULATION

Marc Pan, Dr. Anthony W. Kim, Dr. Xiulong Xu

**A-150**

8:30 - 8:45

AN INVESTIGATION OF LOW-ENERGY ELECTRON CLOUD INTERACTIONS WITH HIGH-ENERGY PARTICLE STREAM

Polina Segalova, Dr. Katherine Harkay

8:55 - 9:10

WILL DISRUPTING THE S100B DIMER REDUCE GLIAL ACTIVATION AND INFLAMMATION?

Sarah Sanders, Linda Van Eldik, Ph.D., Amy Lam, Ph.D.

9:20 - 9:35

BLOOMBERG, L.P. – FIELD OPERATIONS

Keiko Miceli, Jeary Beals II, St. Ignatius College Prep, Jonathan Felger

9:45 - 10:00

DETECTION OF OVARIAN AUTOIMMUNITY

Samina Shaikh, J.L. Luborsky, Ph.D.

10:10 - 10:25

THE EFFECTS OF METHANOL ON WASTEWATER REFINERY TREATMENT

Carlo J. Ordonez, Dr. Yvette Baxter-Drayton

10:35 – 10:50

TAILLESS GENE (TLX) DIVERSITY IN SCHIZOPHRENIC PATIENTS AND CONTROLS

Connie Jung, Taiyang Liang, Dr. Pablo Gejman

11:00 – 11:15

CLONING THE GENOMIC BREAKPOINTS OF *AML1* AND *ETO* IN LEUKEMIA PATIENTS WITH t(8;21)

Jennifer S. Li, Janet D. Rowley, M.D., Yanming Zhang, M.D., Ph.D.

**A-151**

8:30 - 8:45

REAL SCIENCE: CLOUDS

Steve Bauer, Sarah Walter, Britta McKenna

8:55 - 9:10

THE NEAREST-NEIGHBOR RULE REPRESENTATION OF BOOLEAN FUNCTIONS

Zhihao Liu, Professor Gyorgy Turan

9:20 - 9:35

SCIENCE EXPLORERS: ECOLOGY

Matthew D. Hall, Sarah Walter, Britta McKenna

9:45 - 10:00

THE MANIFEST AESTHETIC

Lance Hall, Tony DiSanto

10:10 - 10:25

UNDERSTANDING THE PAST THROUGH PERSONAL PERSPECTIVES: THE AMERICAN ARMY IN WORLD WAR II EUROPE

Winn. W. Wasson, Dr. John C. Sippy

10:35 - 10:50

COMPUTABLE NUMBERS USING TURING MACHINES AND OTHER FINITE COMPUTATIONAL MODELS

Zhihao Liu, Dr. Micah Fogel

11:00 – 11:15

FUNCTIONS OF A COMPLEX VARIABLE

Jady Hsin, Dr. Micah Fogel

**A-152**

8:30 - 8:45

TEACHING AND LEARNING THROUGH ENGINEERING IN A VIRTUAL SETTING

John Addison, Thomas J. Royston

8:55 - 9:10

DEVELOPING AND CALIBRATING A LASER SCHLIEN VIDEO SYSTEM FOR IMAGING AND DETECTING AIR DENSITY GRADIENTS

Chris Chrobak, William A. Ellingson, Ph.D.

9:20 – 9:40

A CHANGE IN TRADITION: INTELLIGENT ASSIST DEVICES AND THEIR BUTTON AND LIGHT SCHEMES

Poonam Khatri, Michael Peshkin

**A-152 (continued)**

- 9:45 - 10:00 BIOCOMPATIBILITY OF CARBON COATING PRODUCED BY THE CHLORINATION OF METAL CARBIDES  
Catherine Mia Ihm, Michael McNallan
- 10:10 - 10:25 CYTOKINE MODULATION OF BETA 2 ADRENERGIC RECEPTOR ( $\beta$ 2AR) EXPRESSION IN T HELPER 2 (TH2) CELLS  
James M. Holmes, Virginia M. Sanders, Adam P. Kohm, Sam Lemeris
- 10:35 - 10:50 ENERGY INTAKES IN BROWN AND POLAR BEARS  
David Hamman, Kerri Slifka
- 11:00 - 11:15 DEVELOPING AN APPLICATION TO DISPLAY 3D-MODELS IN DIFFERENT PERSPECTIVES  
Navreet Gill, Ben Watson

**A-155**

- 8:30 - 8:45 SPECIFIC SEROTONIN RECEPTOR STIMULATION IN THE HYPOTHALAMUS  
Anuluwa Adeboje, Fatima Hatia, Dr. Thackery Gray
- 8:55 - 9:10 MAST CELL STIMULATION OF THE UROTHELIAL INFLAMMATORY RESPONSE  
Thomas Kim, Dr. David Klumpp, Robert Batler
- 9:20 - 9:35 EFFECTS OF RETINOIC ACID ON PLASMINOGEN ACTIVATOR RECEPTORS IN CANCER CELLS  
James Kinzer, Dr. Rhonna Cohen
- 9:45 - 10:00 THE EFFECT OF ADAPTATION ON SYNAPTIC INTEGRATION IN A LATERAL-PYRAMIDAL NEURON  
Stephen Trevick, Philip Ulinski, Ph.D.
- 10:10 - 10:25 MOLECULAR GENEOLGY; A STUDY OF THE THREE DOMAIN SYSTEM  
Emily Richter, Dr. Susan Styer
- 10:35 - 10:50 ARCHITECTURE BASED ON COMPUTER AIDED DESIGN (CAD)  
Jennifer Joy Peck, Richard E. Ogren
- 11:00 - 11:15 GENERATING ANTIBODIES TO A VIRAL REPLICASE ENZYME  
Zachary S. Nayak, Susan C. Baker, Ph.D.

**B-108**

- 8:30 - 8:45 ION PROPULSION  
Vladimir Krastev, Mengyao Liang, Christopher McLaughlin, Dr. David Workman
- 8:55 - 9:10 DYNAMICS OF THE MORRIS GREAT BLUE HERON ROOKERY  
Catherine Breckenridge, Rachel Cook, Emma Goodman, Anna Hang, Andrew Langan, Tori Walters, Jon Warnock, Dr. David Workman
- 9:20 - 9:35 HOOP STRESS CALCULATOR FOR LIQUID STORAGE TANKS  
Andrew Barber, David Gossman
- 9:45 - 10:00 EARLY SETTLER'S LIME KILN EFFICIENCY ANALYSIS  
Kristina Bolt, Megan Dinkelman, Laura Freund, Steven Lucy, Sue Massey, Christiana Taylor, David Gossman
- 10:10 - 10:25 ANALYSIS OF PREBIOTIC PROTEIN SYNTHESIS AND IMPLICATIONS FOR THE ORIGIN OF LIFE  
Amit Behal, Dmitry Goldin, Thomas Rooney, David Xia, Dr. Richard Dods
- 10:35 - 11:15 LEADING REAL SCIENCE STAFF MEMBERS IN THE PRODUCTION OF THE 2001 CD  
Eric Bowden, Margaret Wat, Cindy Xi, Kevin Yang, Rosalind Yang, Britta McKenna

**B-114**

- 8:30 - 8:45 REAL SCIENCE: GRAPHICS ARTIST  
Leon Wang, Eric Wilson, Britta McKenna
- 8:55 - 9:10 PAVLOVIAN EYEBLINK CONDITIONING: AN EXAMINATION OF ASSOCIATIVE LEARNING  
Rui Guan, Darrel Saldanha, Craig Weiss, Ph.D.

**B-114 (continued)**

- 9:20 - 9:35 HEART RATE VARIABILITY AND IMMUNE RESPONSE AS EARLY INDICATORS OF NEONATAL SEPSIS  
Daniel D. Reed, Dr. Charles L. Webber Jr., Dr. Linda Janusek, Dr. Herb Mathews
- 9:45 - 10:00 SCIENCE EXPLORERS: FORENSICS – INTRODUCING CRIMINAL SCIENCE TO ELEMENTARY SCHOOL STUDENTS  
Amit Behal, Rui Guan, Elizabeth Lawrence, Chris Young, Britta McKenna
- 10:10 – 10:25 PHYTOREMEDIATION OF AN INDUSTRIAL SITE  
Holly Bybee, Emma Goodman, Anna Hang, Lynn Peng, Diana Tung, Tori Walters, Yun Wu, Dr. David Workman
- 10:35 – 10:50 ANTICOAGULANT, ANTIPLATELET, AND ANTIPROTEASE EFFECTS OF A NEW ANTICOAGULANT DRUG (PI-88)  
Jessica Dy-Johnson, Pranay Patel, Jawed Fareed, Ph.D., Debra Hoppensteadt, Ph.D.
- 11:00 – 11:15 ANALYSIS OF FAIR SIGNAL SMOOTHING ALGORITHMS  
Belinda Chang, David Xia, Dr. Paul Fischer

**B-133**

- 8:30 – 8:45 MATHEMATICAL MODELING OF INTERNET FILE TRANSFERS  
Amit Behal, Brandon Gordon, Derek Swartz, Dr. Lawrence Votta, Teodoro Alonso
- 8:55 – 9:10 ROBOTICS: A STUDY IN DESIGN AND CONSTRUCTION  
Patrick R. Delfert, Nishant Kumar, Thomas P. Rooney, Joel M. Schad, Larry Bartoszek
- 9:20 – 9:35 HELIOTROPIC ROBO-BUG  
Jesse Jang, Ivan Lee, David Lu, Eric Wilson, Larry Bartoszek
- 9:45 – 10:00 WHAT CAUSED THE GEOMAGNETIC STORM OF AUGUST 12th  
Catherine Breckenridge, Dr. Robert Brazzle
- 10:10 – 10:25 VIRTUAL INTERACTIVE ONLINE CHEMISTRY LAB  
Andy Barber, Chris Brown, Yong Chen, Apurva Jantrania, Joey Lau, Eric Sutton, David Gossman
- 10:35 – 10:50 A BOTANICAL SURVEY  
Rachel Cook, Andrew Langan, Tori Walters, Chris Young, David Gossman, Dr. Elizabeth Neese
- 11:00 – 11:15 ARTIFACT IDENTIFICATION AS PART OF THE ARCHAEOLOGICAL INVESTIGATION OF JACKSON COUNTY, IOWA  
Megan Fast, Dmitry Goldin, Krysta Heaney, Amanda Raddatz, David Gossman

**B-148**

- 8:30 – 8:45 LEAD ANALYSIS OF ARCHAEOLOGICAL POTTERY SAMPLES  
William Conroy, Jessica D'Souza, David Gossman
- 8:55 – 9:10 APPLICATIONS OF JAVASCRIPT IN SCIENCE EDUCATION  
Andy Barber, Chris Brown, Yong Chen, Apurva Jantrania, Joey Lau, Eric Sutton, David Gossman
- 9:20 – 9:35 CONTROL SPECIFICATIONS FOR AN AUTOMATED MUCKHAULING VEHICLE  
Yun Wu, Craig Drennan
- 9:45 – 10:00 C.Y.C.L.E. (COMMUNITY YOUTH CREATIVE LEARNING EXPERIENCE): BROADENING THE MULTICULTURAL AWARENESS OF KINDERGARTEN-SECOND GRADE BOYS  
Brianna Arrington, Marissa Fierz, Lucy Guo, Connie Van Brunt
- 10:10 – 10:25 CREATING A STRONG FOUNDATION IN MATH WITHIN HISTORY  
Aikeisha Jones, Keisha Williams, Connie Van Brunt, George Colone
- 10:35 – 10:50 TEACHING CHINESE SPEED CALCULATION METHOD TO FIFTH AND SIXTH GRADERS AT CYCLE'S WIZ FACTORY  
Anna Hang, Annie Park, Connie Van Brunt, George C. Colone
- 11:00 – 11:15 CYCLE: GIRLS LOVE MATH TOO  
Kim Barchenger, Mia Layne, Joyce Pulphus, Connie Van Brunt, George C. Colone

## TEACHING AND LEARNING THROUGH ENGINEERING IN A VIRTUAL SETTING

### Presenter:

John Addison, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Thomas J. Royston, Associate Professor Director, Acoustics and Vibrations Laboratory, Associate Director of Graduate Studies, Dept. of Mechanical Engineering (m/c 251), University of Illinois at Chicago, 842 W. Taylor Street, Room 2043 ERF, Chicago IL 60607-7022; 312-413-7951; troyston@uic.edu

Teaching and learning has proven to be quite efficient in an interactive related environment. By using modern technology in the form of the internet, an interactive environment can be created. The "Interactive Engineer", a web tutorial, was designed for this purpose. The "Interactive Engineer" is an on-line tutorial whose goal is to teach the science of sound through engineering in a virtual setting. Users of the tutorial are presented with scientific and mathematical facts pertaining to the function of basic audible sound. These facts are then applied to the engineering of a loudspeaker enclosure. The user has the opportunity to use what they have learned about sound to build loudspeaker in a virtual setting. If the user chooses, he or she can use the tutorial as a guide to building his or her own physically working loudspeaker. Upon further investigation of the workings of a loudspeaker, the question of a material's relationship to sound can be raised. This relationship can be defined as acoustical impedance. Acoustical impedance describes how sound reacts to a specific change in a known medium. It is the factor largely considered when looking at sound control using specific damping materials. By designing and creating an impedance tube, this relationship was further explored. Through data gathered, relationships between factors such as power input, frequency and sound pressure were established. The effects of damping materials on these relationships were also concluded.

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## SPECIFIC SEROTONIN RECEPTOR STIMULATION IN THE HYPOTHALAMUS

### Presenters:

Anuluwa Adeboje, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Fatima Hatia, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Dr. Thackery Gray, Department of Cell Biology Neurobiology and Anatomy, Loyola University Medical Center, Maywood, IL 60153

Serotonin is a major brain neurotransmitter that is disrupted in patients who have depression and anxiety-related disorders. The stimulation of brain cells with a serotonin 5-HT receptor agonist can tell us whether specific receptors play a role in the release of hormones related to depression and anxiety. An approach using a combination of a 5-HT<sub>2A/C</sub> agonist, 5-HT<sub>2A</sub> antagonist and immunohistochemistry identified specific 5-HT<sub>2A</sub> serotonin receptor controlled cells in the hypothalamus. DOI (2,5,-dimethoxy-4-iodophenyl)-2-aminopropane, a 5-HT<sub>2A/C</sub> agonist, was injected into rats. DOI induces FOS, a neuronal activity marker and protein in brain cells. The DOI-induced FOS was mapped using immunohistochemistry. Fos protein was found in the following areas: suprachiasmatic, anterior hypothalamic, paraventricular (PVN), supraoptic nucleus (SON), dorsomedial, ventromedial and arcuate nuclei. MDL-100,907, a 5-HT<sub>2A</sub> antagonist, was also injected into another group of rats before the DOI to inhibit the action of DOI mediated by 5-HT<sub>2A/C</sub> receptors. The MDL 100,907 inhibited the effects of DOI, 907 in the supraoptic nucleus and paraventricular. Immunohistochemistry was used again on tissue stained for Fos to map the location of the cells containing the following: oxytocin, vasopression, and corticotropin releasing factor. Cells containing corticotropin releasing factor and oxytocin also contained Fos in the supraoptic nucleus and paraventricular respectively. Vasopressin cells did not contain fos. All these cells are important for normal responses to stress and anxiety-provoking stimuli. Corticotropin releasing factor acts on the pituitary to release ACTH. Oxytocin is a reliable marker for serotonergic function, although its function in the response is unknown. Our data demonstrates that 5-HT<sub>2A</sub> receptors control the action of these important hormones.

## **FLIPPOVISION: EXPANSION – STUDENT PRODUCED STOP-MOTION ANIMATION**

### Presenters:

Olufemi Adeyanju, Editor/Special Effect/Director of Operations for FlippoDigital, Illinois Mathematics and Science Academy, Aurora, IL 60506; dkid@imsa.edu  
Patrick Delfert, Director's Assistant/Animator, Illinois Mathematics and Science Academy, Aurora, IL 60506; blizzard@imsa.edu  
Joseph Giardino, Special Effects/Set Constructor, Illinois Mathematics and Science Academy, Aurora, IL 60506; joeg@imsa.edu  
Dmitry Goldin, Effects/Animator, Illinois Mathematics and Science Academy, Aurora, IL 60506; dgtal@imsa.edu  
Nishant Kumar, Director/Creative Consultant/Animator, Illinois Mathematics and Science Academy, Aurora, IL 60506; guesswho@imsa.edu  
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Joel M. Schad, Creative Consultant/Editor/Special Effects/Web Site Maintenance and Design, Illinois Mathematics and Science Academy, Aurora, IL 60506; agent007@imsa.edu  
Sean M. Smith, Camera Operator/Animator/Editor, Illinois Mathematics and Science Academy, Aurora, IL 60506; sean1701@imsa.edu  
David Xia, Animator, Illinois Mathematics and Science Academy, Aurora, IL 60506; dxia@imsa.edu  
Chris Young, Animator, Illinois Mathematics and Science Academy, Aurora, IL 60506; cyoung@imsa.edu

### Advisor:

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Using stop-motion animation techniques, we have created a series of visually stunning short films. Principal photography was done using a still digital camera. The still pictures were then digitally edited and spliced together to produce a moving picture. Our subject matter varied greatly but the process was refined and the products slowly improved. We will be showing our work along with commentary on technique and materials. This is a continuation of a project started and presented last year. For more information, you can find us on the Internet at <http://flippovision.cjb.net>.

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## **THE EFFECT OF OVEREXPOSURE OF ANTIOXIDANTS ON THE LIFESPAN OF MAMMALIAN TISSUE CULTURES**

### Presenters:

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Ashwin Shetty, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; ashetty@imsa.edu

### Advisor:

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Oxidants are free radicals that are destructive to organisms. Certain of the oxygen that is consumed in the body is transformed into free radicals that over time accumulates and erodes many of the inner organs. The majority of oxidants are products from the electron transport system. Antioxidants are agents that fight against oxidants. They prevent the increase of oxidants but are not fully proficient. Therefore oxidants still accumulate in organisms. We attempted to use various concentrations of Vitamin E in liquid form and create mediums into which we could introduce the mammalian tissue culture. By placing a .5 ml of cell suspension (concentration of approximately  $1 \times 10^5$  to  $2 \times 10^5$  cells per ml) in screw cap test tube, and adding .1 ml of .4% of Trypan Blue Stain, we endeavored to observe viable and non-viable strains of cells. These results would then we compared to the number of viable and non-viable cells in the control group (tissue culture without the overexposure of vitamin E) to see if the overexposure of antioxidants affected the aging process of mammalian tissue cultures.

## **FREE TRADE AREAS OF THE AMERICAS (FTAA): WHAT INTERNATIONAL CONCORDS DICTATE FOR THE GLOBAL CONSUMER MARKET**

### Presenter:

Nikhil Agarwal, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; nagarwal@imsa.edu

### Mentor:

Fred L. Fleischbien, Global Business Alliance, Inc., 445 W. Erie, Suite 109, Chicago, IL 60610; 312-280-0183

Following the signing of the North American Free Trade Agreement (NAFTA) in 1993, the American economy has grown substantially, as seen with the 4.3% increase in GDP in 1999. Unemployment has also substantially declined, as people have been able to find jobs in the new industry created by trade between NAFTA partners. With the success of NAFTA and other trade agreements in the Western Hemisphere, there is now an initiative to reach a concord that will work towards a free-trade zone encompassing the majority of the Western Hemisphere. This proposed agreement, termed Free Trade Areas of the Americas (FTAA), had talks launched in December of 1994 during the Summit of Americas. While there are some problems that must be overcome before the agreement can be signed, such as environmental and labor concerns, and the reinstating of fast-track authority for the United States, FTAA could potentially unite the economies of the Western Hemisphere with a combined GDP of \$11 trillion (U.S.) and create the largest free trade zone in the world.

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## **SCIENCE EXPLORERS: NUTRITION AND WELLNESS**

### Presenter:

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### Advisor:

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Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. The nutrition and wellness days of Science Explorers integrate hands-on activities with information about nutrition and general health to allow students to experience the topics through planned activities. A general trend has emerged that youth are spending too much time at computers or watching television; many youth overlook the importance of a healthy lifestyle. This subject is, perhaps, a common one, but the goal of this inquiry is to create an original way of conveying this information to elementary school children. Activities, such as sit and reach, flexibility/agility tests, heart rate monitoring and cardiovascular exercise are designed to keep the children engaged and learning. Resident scientist Matt Haffner will present the connections between a healthy diet, exercise, and lifestyle. A "food derby" will integrate physics with nutrition having students build a racecar using fruits and vegetables as the culminating camp activity.

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## **SOCIO-ECONOMIC IMPLICATIONS OF CHILD LABOR AND ITS EFFECTS IN THE THIRD WORLD GLOBAL PRETEXT**

### Presenters:

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### Advisor:

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Child labour is simply the most severe form of child exploitation and child abuse in the world today. The overwhelming majority of working children are found in developing countries in Africa, Asia and Latin America. Child labor also exists in many industrialized countries and is emerging in a number of East European countries that are now in transition to a free market economy. Although Bangladesh accounts for less than 2 percent of the world population, it is the home of 6.6 million

working children, accounting for more than 5 percent of the world's working child population numbering 120 million. Many of them work 48 hours a week on an average, earning less than 500 taka per month. Early involvement of children in work leads to serious health and developmental consequences. Working children suffer significant growth deficits as compared with school children. They grow up shorter and lighter, and their body size continues to be smaller even in adulthood. Many of them work under conditions that leave them alarmingly vulnerable to chemical and biological hazards. Moreover, children in certain occupations experience particular types of abuse. Child domestic workers are often found to be victims of verbal and sexual abuse, beating or punishment by starvation.

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## **SCIENCE EXPLORERS: HOW CAN HIGH SCHOOL STUDENTS EXPAND A DEVELOPED PROGRAM REGIONALLY?**

### Presenter:

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### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5073; britta@imsa.edu

Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-6. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. The Science Explorers Regional Expansion project is an effort to expand our local program to include two satellite sites for the summer of 2001, including Liberty High School in Liberty, Illinois and Walter Payton High School in Chicago, Illinois. IMSA students will be co-teaching with the local high school students for the summer camps offered. During Intersession 2001, six IMSA students facilitated preliminary training at both of the off sites. Topics discussed included classroom management techniques, disability awareness, and group dynamics. Following the training, both groups of high school students at the off sites have been revising the existing Mars Millennium curriculum and preparing it for the Science Explorers camp they will be hosting at their school during the summer.

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## **EXPLORATIONS IN LEADERSHIP: INVESTIGATIONS INTO VARIOUS LEADERSHIP TECHNIQUES AND THEIR INFLUENCE ON DIFFERENT COMMUNITIES**

### Presenters:

Emi Arima, Student/L.E.A.D. Facilitator, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; em@imsa.edu

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IMSA's mission statement includes "developing ethical leaders for the world." The Leadership Education and Development (LEAD) program embraced this vision by educating the sophomore class in a variety of leadership skills and social advocacy strategies. The charter facilitation team underwent extensive training and assessment to implement LEAD. Several members of the LEAD Team reviewed the current curriculum to determine what comprises an effective leadership curriculum, what assessment tools were needed to determine the program's effectiveness, and what needed addition, deletion, or revision from present material. Each relevant topic was revised and developed into distinct, consistent, compact, and complete sessions. The experience of current facilitators was combined with program goals, facilitation skills, and suggested activities to create a more detailed curriculum. A survey modeled after the Kellogg Foundation's Grantee Information Survey was also conducted. Facilitator, self, and peer evaluations were distributed to determine observed individual, institutional, and community-wide improvements. The results of this survey indicated which aspects of LEAD have succeeded and which need improvement. This will enhance the LEAD curriculum and ease yearly transitions. Only careful analysis of the LEAD program can allow for optimization of leadership potential in students in the IMSA community and beyond.

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### **C.Y.C.L.E. (COMMUNITY YOUTH CREATIVE LEARNING EXPERIENCE): BROADENING THE MULTICULTURAL AWARENESS OF KINDERGARTEN-SECOND GRADE BOYS**

#### Presenters:

Brianna Arrington, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; breezb@imsa.edu  
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#### Mentor:

Dr. Connie Van Brunt, C.Y.C.L.E., 1111 N. Wells, Chicago, IL 312-664-0895

In an undeserved and educationally underprivileged environment like Cabrini Green, the entire world for many children is just around the corner. The children of C.Y.C.L.E. were endowed with curiosity and imagination. To better "equip" the kindergarten through second grade boys in our learning lab, we have concentrated our teaching on multicultural awareness. In the early stages of both this teaching *and* learning experience, it became evident that humans know little about the world, a place filled with diverse cultures and traditions. Through the making of ethnic cuisine, listening to cultural music, reading and writing cultural fables, studying prominent leaders from various countries, and a special study of Egyptian pyramid building, hieroglyphics, and mummification, we have exposed the boys to a plethora of culture. Our goal of this lab is that the boys will use this cultural knowledge not only directly (in the learning lab and in sharing facts with peers or family), but also indirectly – the cultural knowledge will develop a thought process within the boys that will allow them to achieve at a newfound level. Hopefully they will raise their expectations on what they have to offer the world and what the world has to offer them.

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### **THE COLD WAR CONFLICT REFLECTED IN STAR TREK**

#### Presenter:

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

#### Advisor:

James Victory, Ph.D., History and Social Science, Illinois Mathematics and Science Academy,  
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The fear and anxiety that American people felt because of the Cold War were reflected in the popular TV show, Star Trek. Many Americans feared the atomic bomb. Along with the apprehension of atomic warfare, issues of a communist take over pushed suspicion and dismay into the minds of the Americans. The creator of Star Trek, Gene Roddenberry, created characters of diverse ethnicities and used controversial topics to make Americans reflect upon their views. From the original 79 episodes, three were chosen to help identify the key emotions. Once identified, a background analysis of the Cold War was done to help link the two together.

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## APPLICATIONS OF JAVASCRIPT IN SCIENCE EDUCATION

### Presenters:

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### Mentor:

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Over the past year, the group has expanded the functionality of an online JavaScript units converter, a project that has been going on for approximately two years now, started by Matthew Stanislowski and David Stears. The group's goal is not only to present to the public a site where the users have the ability to convert between hundreds of units but also to be able to learn about the units they use, something that the average user doesn't usually know. The group hopes to not only provide users with a useful tool, but to give the users an opportunity to expand their horizons.

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## HOOP STRESS CALCULATOR FOR LIQUID STORAGE TANKS

### Presenter:

Andrew Barber, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; abarber@imsa.edu

### Mentor:

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Liquid storage tanks are used by many companies to store water, petroleum, and a variety of chemicals. Gravity causes the fluids contained inside to put pressure on the rest of the fluid, which in turn, "pushes" on the walls at the base of the tank. This pressure is greatest at the bottom because all of the liquid is pushing there at once. This stress imparted by the liquid, causes the tank to stretch. This phenomenon, in which force is transaxially applied to a metal tank, is referred to as "hoop stress" or "girth stress". A point is reached when the tank cannot safely expand anymore. Companies need to know what this point is and, hopefully, when it will occur. The web-based calculator will allow companies to evaluate a tank's thickness and how much life it has left.

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## VIRTUAL INTERACTIVE ONLINE CHEMISTRY LAB

### Presenters:

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The purpose of this project is to show how someone could identify an unknown compound using standard techniques of organic chemistry. The student would use the techniques of nuclear magnetic resonance, infrared spectroscopy, mass spectroscopy, the melting point, and the boiling point of the unknown. This would be done using a wide range of interlinking web pages. It would be the student's job to correctly identify the virtual unknown using the information gathered. Integrated within this will be teaching aids to help the students understand how to use the different analytical techniques, along with information on the actual unknown compound once it is discovered.

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## **CYCLE: GIRLS LOVE MATH TOO**

### Presenters:

Kim Barchenger, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; yoda02@imsa.edu  
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Joyce Pulpus, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; jazzy02@imsa.edu

### Mentors:

Connie Van Brunt, Executive Director, Community Youth Creative Learning Experience, 1111 N. Wells, Suite 300, Chicago, IL 60610; 312-573-8921  
George C. Colone, Associate Executive Director, Community Youth Creative Learning Experience, 1111 N. Wells, Suite 300, Chicago, IL 60610; 312-573-8924

The purpose of our mentorship was to gain an understanding of how to interact with primary students, as well as learn and understand how primary students gain knowledge of mathematical concepts. Our particular interest, was to observe how well female students interact in a single sex math class. Could girls become confident enough to explore and show their knowledge in a variety of areas being taught in this environment? As we venture through this field we come up with more and more questions related to teaching. We sought to understand these questions by becoming "Wizards" in the Community Youth Creative Learning Experience (CYCLE) program. Over the course of the year we tried to maintain continuity by having activities that tie together. We started each lab with a warm-up game, grabbing their attention, and reviewing what had been previously covered. Following that, we began to teach a new lesson, handing out worksheets. We have found that the girls feel confident answering questions, and are willing to strive for the correct answer, even if they don't understand the questions at first. Overall we found that we succeeded in making the girls feel comfortable, and confident in expressing their knowledge of mathematical concepts.

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## **HOW IMPERIALISM HAS AFFECTED THE PHILIPPINES**

### Presenter:

Jason Barnes, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; jgbarnes@imsa.edu

### Advisor:

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

Europe in the 1500's was trying to expand their borders anywhere they could. One tactic many of the countries used was going overseas and capturing land. They then set up colonies. European imperialism changed the world forever. From England's colonies in America to Spanish colonies around the world including the South Pacific, aboriginals were forced to conform and accept these other countries. By studying the history of the Philippines from when it was first subjugated in 1500 to present a full picture of how imperialism changed this country forever will be presented.

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## **REAL SCIENCE: CLOUDS**

### Presenters:

Steve Bauer, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; sbauer@imsa.edu  
Sarah Walter, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; goddes7@imsa.edu

### Advisor:

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Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. This dual platform CD-ROM targets students in grades 3-5 and is distributed free of charge to over 600 schools in Illinois and beyond. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science through the use of multimedia movies and interactive supplements developed using Adobe Premiere, Photoshop and Macromedia Director. The "Clouds" article touches on the scientific make-up of clouds and their many classifications. The 4-minute "Clouds" movie strives to teach young students to label clouds using their new found knowledge of the terms Nimbus, Stratus, Cumulus, Cirrus, Alto and their relationships with the scientific names of clouds. The multimedia presentation contains many pictures taken, or drawn on and around the IMSA campus. The Real Science goals for 2001 were

to include no copyrighted material and present our knowledge to students in grades 3-5 in an entertaining way. We used campus resources, our creativity, and amateur photography skills to meet that goal in "Clouds."

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## **ANALYSIS OF PREBIOTIC PROTEIN SYNTHESIS AND IMPLICATIONS FOR THE ORIGIN OF LIFE**

### Presenters:

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While scientists have produced many theories on the origin of life, few have produced actual proof that explains the formation of complex organisms. These theories are often ill defined and lack the experimental support to withstand the mounting questions. Recently, Dr. Gunter Wachtershauser discussed the difficult question of how chemicals in prebiotic earth may have formed to produce the necessary proteins found in an organism, and we have tried to follow his experiment to reproduce his results. He discovered that amino acids in an iron-sulfide environment would form dipeptide and even tripeptides with FeS acting as the catalyst. While the setup was relatively easy, acquiring the materials required months alone. The experiment comprises building a closed model of a hypothermic environment by deaerating a serum bottle and charging it with FeSO<sub>4</sub>. After adding Na<sub>2</sub>S, CO gas, and NaOH, the mixture was heated at 100° C. The dipeptides are so extremely small in quantity that their detection requires high pressure liquid chromatography.

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## **MATHEMATICAL MODELING OF INTERNET FILE TRANSFERS**

### Presenters:

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### Mentors:

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We are researching how fast data can transfer between two personal computers while one acts as a web server. Also, we will discover the quality of service of the IMSA Intranet. We are using two personal computers running Windows 2000 professional. We are testing the speed with a single file and we will time this from the start of each transfer. For accuracy and dependability, we are repeating this 10 times for every trial. We are running System Monitor on both machines, monitoring Processor usage, File System access, and Network use. We are modeling the performance of a Personal Web Server, plus we are modeling the effects of file transfer on the performance of the personal computer. We will then try to stress this system by making multiple connections and see how the file transfer speed is affected. Also, we are measuring the variation of the file transfer speed. We are currently in the process getting the results and this information will be divulged at the presentation. In all, this project has been a great learning experience for us and we hope to continue on in this field next year.

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## **SCIENCE EXPLORERS: FORENSICS – INTRODUCING CRIMINAL SCIENCE TO ELEMENTARY SCHOOL STUDENTS**

### Presenters:

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### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road,  
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Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. Science courses traditionally focus on isolated concepts that may or may not be complemented by laboratory work and systematic analysis. Thus, a large gap exists between the intensive analytic and lab/field work required in secondary schools and the lack of exposure to this type of learning for students in many elementary schools. Forensic science provides an engaging platform for elementary school students to become actively involved in the gathering and analysis of evidence. In addition to a general introduction to forensic science, students will be engaged in topics in DNA, bloodtyping, multifaceted fingerprinting, forensic anthropology, and forensic jurisprudence. This curriculum will be taught for one week during the summer of 2001, June 18-22, after thorough testing in IMSA's Grainger Center and with local elementary school students.

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## **SCIENCE EXPLORERS: IMSA TEAM MARS ONLINE**

### Presenter:

Katie Boehm, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; turtlez@imsa.edu

### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road,  
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In the 1999-2000 school year, Science Explorers developed the Mars Millenium Project curriculum. It was a problem-centered curriculum based on building a community on Mars. It was then taught during one week of the Science Explorers camp during the summer. Since then, it has been refined after piloting and features integrated student inquiry with lessons on science, sociology, transportation, culture, recreation, government, engineering, mathematics and technology. An introductory video was developed that the teachers can show at the start of the unit to explain the goals and outcomes of the unit to the students. Ten teachers from Aurora area elementary schools are currently teaching this curriculum in their classrooms. At the end of the sixteen units, these classrooms will have completed a presentation board and a model of their Mars community. They will then present these on May 16, 2001 at IMSA.

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## **EARLY SETTLER'S LIME KILN EFFICIENCY ANALYSIS**

### Presenter:

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### Mentor:

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Before the invention of the Portland cement seen today, homesteads in the Iowa wilderness made mortar from lime, wood ash, and water. They gathered samples of limestone from nearby and loaded them into caves used as kilns to fire the rock. One such kiln, found near Zwingle, IA, was re-fired, and samples were collected of red and white partially-burnt limestone, raw limestone, and wood ash. Through a process called "Loss on Ignition" (LOI), the efficiency of the kiln's ability to turn limestone to lime was tested. This was accomplished by evaluating the mass lost as the remaining limestone in partially-burnt samples that were converted to lime in a muffle furnace. From this procedure, the efficiency of the lime kiln can be determined. In addition, remaining lime samples were combined with the wood ash and water to create a sample mortar.

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## **LEADING REAL SCIENCE STAFF MEMBERS IN THE PRODUCTION OF THE 2001 CD**

### Presenters:

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Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. This dual platform CD-ROM targets students in grades 3-5 and is distributed free of charge to over 600 schools in Illinois and beyond. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science through the use of multimedia movies and interactive supplements developed using Adobe Premiere and Macromedia Director. Real Science Editors are the leadership group that supervise teams of IMSA students with the production of the CD-ROM. Editors are selected in late spring prior to the start of the school year. Roles of Editors include: editing writing and narration, developing multimedia tutorials, designing the CD-ROM interface, conducting Great Minds interviews, creating the Recent Science web page and supervising animation. 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 for the target audience. A major challenge for the 2001 issue is creating authentic work, including artistic images and securing permission to use included copyrighted images.

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## **WHAT CAUSED THE GEOMAGNETIC STORM OF AUGUST 12th**

### Presenter:

Catherine Breckenridge, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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### Advisor:

Robert Brazzle, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

The sun is often looked at as a distant burning body, only connected to the earth through its intangible light. In reality they make contact in billions of ways every day, hour, minute, and second. High-energy particles from solar flares and wind are always passing around, across, and into Earth. It's from these that we get magnetic storms. A magnetic storm is the name for the interaction between the earth's ionosphere and the bombardment of high-energy particles from the sun. One effect a storm can produce is the phenomenon known as the Northern Lights. These lights are shimmering veils of color in the night. They can usually be seen in the far northern, the Aurora Borealis, and the far southern latitudes, the Aurora Australis. But on the night of August 11/12 there was a storm so big you could see it from New Haven, Michigan to El Paso, Texas. It was one of the biggest storms on record. To explain why this storm was so abnormal, this inquiry looked at the constant transfer of energy between the sun and earth and its relationship with variations in the solar cycle. The aurora of other bodies in the solar system will also be considered.

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## DYNAMICS OF THE MORRIS GREAT BLUE HERON ROOKERY

### Presenters:

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We have observed a Great Blue Heron (*Ardea herodias*) rookery, since the spring of 1999. The rookery is located on private land along the Illinois river south of the town of Morris, Illinois, in Grundy county. A detailed map of the nesting sites has been prepared and a population count has been done. Special precautions have been taken to minimize disturbing the birds. We counted 85 nests in the 1999 season, but only 83 in 2000. Such fluctuations are not unusual. The majority of nests are found in three large sycamore trees, one of which is dead. All of the nests in the dead sycamore are clearly visible, and we were able to determine that the 21 adult pairs nesting in that tree raised 51 baby herons to maturity. Extrapolating that success rate to the entire rookery gives an estimate of 150-200 babies raised to maturity in the entire rookery, a highly successful breeding season. One member of the research team (Jon Warnock) is using Dermestid beetles to clean the carcass of a great blue heron found near the IMSA pond, and will mount the resulting skeleton on a wire frame.

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## PHYTOREMEDIATION OF AN INDUSTRIAL SITE

### Presenters:

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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. Phytoremediation uses plants to absorb pollutants out of ground water. In our case, poplar trees (planted in the spring of 2000) are the primary plant used because their deep root systems are able to reach the water table and absorb the pollutants. We will monitor this process to determine its effectiveness. We have completed a detailed site map and have monitored the growth of the trees for two years. The first water samples were taken from the 10 test wells at the site in March of 2001. Pollutant levels were measured using an HPLC-GC. The objective is to bring the contamination levels in the groundwater to 0.001 ppm, which is drinking water quality. We will continue to monitor the evolution of the site until it is determined to be clean and able to be used for commercial or other purposes.

## **DROPLET/SOLID SURFACE INTERACTIONS IN REDUCED GRAVITY PERTAINING TO MICROELECTRONICS MANUFACTURING: PART II**

### Presenter:

Angela Campbell, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; luvstrz@imsa.edu

### Mentor:

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### Undergraduate Team Members:

Jason Hagedorn, Chui Melvin, Eric Moore, Julie Schaefer, Biljana Zdravevski

Driven by solder jetting, a technological application in microelectronics manufacturing, this experiment, performed in  $\sim 10^{-2}g$  on the NASA KC-135 plane, seeks to provide new insight on the impact dynamics of liquid-metal droplets on plate substrates. Due to the small size of the solder droplets employed in solder jetting and the fine time scales of the relevant transport and solidification phenomena, making experimental measurements at the actual scales is nearly impossible. By using dynamic similarity principles, we demonstrate that conducting the experiment using water droplets in reduced-gravity will allow us to investigate solder jetting phenomena in normal gravity. The experiment uses a rig that consists of a droplet generator assembly, a chamber, a high-speed visualization system and a lab top/control system to run the test series. This also being the second year UIC has participated in the NASA Reduced Gravity Student Flight Opportunities program, we complete physiological training and gain even more extensive knowledge in not only how to improve our experiment for the coming years, but also what the space program has to offer.

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## **PERSONAL CONNECTIONS**

### Presenter:

James Carney, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; jc@imsa.edu

### Mentor:

Dr. Gregory Makoul, Associate Professor and Director, Program in Communication and Medicine, Northwestern University Medical School, 750 North Lake Shore Drive (ABA 625), Chicago, IL 60611; 312-503-6728; makoul@northwestern.edu

While the physician-patient relationship is a crucial aspect of medical encounters, the topic of personal connections in physician-patient interactions is a new area of investigation. This project's purpose was to content analyze videotapes of actual encounters to determine the extent to which personal connections are made, to record the range of time that is devoted to personal connections during the encounter, and to examine if personal connections vary with patient gender, patient age, and encounter length. Videotaped data included encounters of eight internal medicine doctors, four (two males / two females) of whom worked in Chicago, and four (two males / two females) of whom worked in Burlington, Vermont. Each doctor met with about 25 patients, and each patient gave consent for videotaping. Data will be analyzed with Chi-square and correlation tests.

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## **ANALYSIS OF FAIR SIGNAL SMOOTHING ALGORITHMS**

### Presenters:

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

### Mentor:

Paul Fischer, Ph.D., Chemistry Department, Argonne National Laboratories, 9700 South Cass Avenue, Argonne, IL 60439-4844; 252-6188; fischer@mcs.anl.gov

Ever since Gabriel Taubin published his landmark abstract on Fair Signal Smoothing, the field of graphical and data manipulation has seen great progress in revolutionizing physics. His relatively simple algorithm allows researchers to take series of graphical data and filter out the noise and extraneous information, allowing researchers to analyze life-like depictions of objects without distortions caused by misrepresentations in the data. While the algorithms only require a few lines of code, the hardest part of this mentorship was the study of Fourier analysis and our attempts at learning both the math and physics behind the algorithms. Our first project was to graphically represent a 3-dimensional carotid artery. After dividing the artery into slices, we took one of the slices, transformed the data into Fourier space by using Fast Fourier

Transform (FFT), and removed the high frequency waves that caused the noise. However, this technique could only be used in 2-dimensional data smoothing, which means we had to create a separate algorithm for 3-dimensions. Instead of using cubic splines, which appeared at the time to be the only way to smooth the 3-dimensional data, we used the help of our mentor to transmute the data points into a polygonal mesh and used a simple Laplacian smoothing technique.

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## **A CATALOGUE CULTURE: MODERNIZING THE FRONTIER**

### Presenters:

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### Mentor:

Kenneth Guest, (deceased) History and Social Science faculty member 1988-2001, Illinois Mathematics & Science Academy

For the rural farmer, there was only one place to purchase goods- the local general store. With the lack of competition, the merchants charged high prices. Farmers resented this reality but could do little to defend themselves. Aaron Ward first tapped into this market of disgruntled farmers in 1872 with his first general catalog. The idea of the catalog that offered such a vast selection within the same covers was revolutionary. In 1886, Richard Warren Sears founded Sears, Roebuck & Co., hoping to achieve the same success as Ward. By offering a multitude of choices, catalogues spread the culture of urban life to rural regions, allowing the nation to be more equalized than ever before. With the recent construction of more extensive railroad lines, urban life could be shipped to the frontier. Technology was allowed to penetrate into the rural areas. America was now the first in the manufacturing and could boast 163,500 miles of railroad track. More effective ways of sale were always being introduced to the market. With a little luck and hard work, Montgomery Ward and Sears changed the consumer market to resemble what we know it as today.

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## **APPLYING RAPID PROTOTYPING TECHNIQUES TO THE PRODUCTION OF BIOCOMPATIBLE CERAMIC PRODUCTS**

### Presenter:

Wen J. Chen, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; wjc@imsa.edu

### Mentor:

Prof. Selçuk I. Güçeri, Dean of Engineering, Drexel University, 3141 Chestnut Street, Philadelphia, PA 19104;  
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Rapid Prototyping (RP) describes a group of technologies created for the purpose of Solid Freeform Fabrication. Previous studies in Fused Deposition, a type of RP technique, have utilized the STRATASYS system in which filaments are fed, melted, and extruded through a nozzle to create layers of the product. This method is limited, however, by the properties of the filament used, and problems encountered have included buckling and uneven extrusion. This project aims to develop a RP machine that uses a novel extrusion feeding method. Instead of filament, pellets are used and fed through a corkscrew mechanism. This will improve the consistency of the liquid as it's being extruded and expand the variety of usable materials. Also instead of a platform with the need for the producing a support structure along with the part, the rough part produced will serve as its own support. Then the part will be milled which will create the finer details to its intended specifications. It is already possible to convert magnetic resonance imaging (MRI) data to convert to STL formats through the use of Mimics® software. The eventual goal is to produce replacement bones and other organic materials using biocompatible ceramics currently available and under research. This will allow precision FD produced parts to be used directly inside the body.

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## **DEVELOPING AND CALIBRATING A LASER SCHLIEREN VIDEO SYSTEM FOR IMAGING AND DETECTING AIR DENSITY GRADIENTS**

### Presenter:

Chris Chrobak, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

William A. Ellingson, Ph.D., Argonne National Laboratory, Energy Technology Division, 9700 South Cass Avenue, Bldg. 212, Argonne, IL 60439; 630-252-5068

A schlieren system is an arrangement of optical devices that uses the principle of refraction to detect density gradients in gases or liquids within the testing area. Density gradients can be caused by temperature differences or turbulence. The schlieren system constructed will be eventually used for the purpose of characterizing transmitted ultrasound waves through air at frequencies in excess of 400 kHz. Ultrasound waves propagating through air create small density gradients. A high level of sensitivity is required to view such small density gradients. Therefore, a large amount of testing and calibrating was required to achieve this high level of detection sensitivity. The light sources used in this project were first a laser pointer and then a 20mw helium-neon. Laser light has its benefits over traditional broad-spectrum white light, but poses certain problems such as speckling because of its coherence. A significant part of the research involved evaluating one-dimensional and two-dimensional optical stops to determine which gave the best results. The resulting image data were processed through a digital image subtraction program created in Labview. This reduced noise and generated image data that was used for quantitative analysis.

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## **LEAD ANALYSIS OF ARCHAEOLOGICAL POTTERY SAMPLES**

### Presenters:

William Conroy, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; billyc@imsa.edu  
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### Mentor:

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After discovering pieces of Native American pottery in a cave on the Gossman farm in Jackson County, Iowa, it was noted that there were many lead mines in the area north of the farm. This led to the idea that lead poisoning may have affected the population that created the ceramic pieces. In order to test this hypothesis, the pottery samples were crushed and digested in a solution of hydrochloric and nitric acids. A control solution was also created for comparison of results. An atomic absorption spectrophotometer was used to determine the amount of lead in the pottery samples. Further research assessed whether this quantity was above lead levels expected for pottery.

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## **A BOTANICAL SURVEY**

### Presenters:

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In its second year, this botanical survey has progressed through its infancy and has now advanced into a higher stage of development. The store of pressed, dried specimens grows with each gathering season. As new plants are extracted from various microclimes on the Gossman's farm in Jackson County, Iowa, they are cataloged in a new system to account for their location, special characteristics, and blooming season. The clockwork of collecting, pressing, and mounting becomes ever smoother, while the botanical vocabulary expands. Due to the growing numbers of specimens, some measures have been taken to preserve the plants for the future, such as freezing and insect-free herbarium storage. This mentorship is an ongoing process and is projected to last many more years.

## **ROBOTICS: A STUDY IN DESIGN AND CONSTRUCTION**

### Presenters:

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### Mentor:

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Our presentation will concern our construction of a three-inch, six-legged Stiquito robot. The Stiquito is an inexpensive platform for experiments dealing with various facets of robotics. We have also produced designs and sketches for the construction of potential contenders for the Battlebots competition. Our studies have included the observation of previous contenders, analysis of their strengths and weaknesses, and strategies in various robotic competitions. We will present sketches and computer models of the contenders created using various pieces of modeling software.

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## **THE EFFECTS OF SUB-AQUATIC VIBRATIONS ON THE TERRITORIAL BEHAVIOR OF A MALE GREEN FROG**

### Presenter:

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

### Mentor:

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The focus of this study is the territorial behavior of the green frog (*Rana clamitans*). During the mating season, some male frogs of this species hold a territory from which they advertise to females by producing a mating call. When an intruding male becomes too bold, the resident male will warn him off his territory, and then chase him away. It is obvious that the sound created by the advertisement call is a large component influencing mating season behavior, but the effects of vibrations through the water created both by the call and the movement of the frog, are largely unexplored. I hope to discover how the presence of vibrations underwater affects the behavior of a calling male green frog. This mating season, from May to July, I intend to find several sites at which green frogs are calling to do my research. I will play recordings of several different green frog calls and simultaneously drop a small stone into the water to create vibrations and then observe the frog's response. I will perform trials of playing only the call and others only dropping the stone.

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## **THE ORIGINS OF PERSIAN SUFI POETRY**

### Presenter:

Shannon Dobson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisor:

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

Medieval Persian literature is characterized by a fundamentally positive and optimistic attitude towards life. This literature consists for the most part of religious poetry, due to the prevailing religious influences of the time period, particularly traditional Islam and Sufism, or Islamic Mysticism. The religious aspect of their poetry represents one of the few conceptual threads that Persian poets of the period had in common. However, Persian Sufi poets differed greatly in their approaches to religion, as illustrated in the various worldviews expressed in the poems of such writers as Hafez (1320-1390) and Rumi (1207-1273). While all Persian Sufi poets seem to have agreed that unity with God is the ultimate goal, two distinct approaches towards such unity appear. The first is that of the ascetic, relinquishing worldly possessions and desires, and establishing a unity with the Islamic God through humble devotion and selflessness. The second approach is also one of selflessness, but of a different kind. This selflessness is brought about by a complete immersion and joy in the world and all of God's creation. These two methods achieve the same end, but in different ways and perhaps for different purposes.

Rumi's poems, collected in two major works (the *Masnavi-ye maKnavi* and the *Divân-e Shams*) are ascetic in principle, but are written in a very personal, impassioned way. Hafez, whose poems are not part of a collection at all, paint vivid pictures of nature as a source of joy in itself, not always as a metaphor. The poetry of medieval Persia continues to be a force in everyday Persian life, and has become recognized and appreciated throughout the modern world.

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## SCIENCE EXPLORERS / REAL SCIENCE COLABORATIONS

### Presenter:

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### Advisor:

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Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science through the use of multimedia movies and interactive supplements developed using Adobe Premiere, and Photoshop and Macromedia Director. Science Explorers has expanded in many new directions during the 2000-2001 year in its goal to inspire young learners. One new idea has been the Science Explorers/Real Science interactive lab. A team of Science Explorers created 'how-to' movies of two successful labs from our summer programs, "Recycling Paper" and "Making Homemade Ice Cream". Experiments were chosen that are easy to perform at home or in the classroom, and involve minimal costs. The team filmed, edited, and digitized the labs using the digital video editing software, Adobe Premiere. These labs will be placed on the 2001 edition of Real Science, which will be distributed free of charge to over 600 schools throughout Illinois.

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## THE BIOGRAPHIES PROJECT: PORTRAITS OF GREAT AMERICAN SCIENTISTS

### Presenters:

Nia Dukov, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Anne Halsall, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Kelly S. McArdle, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Erica L. Ruddy, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Margaret Wat, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentors:

Neill Clark, Ph.D., English, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Leon Lederman, Ph.D., Nobel Laureate, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Judith Scheppler, Ph.D., Coordinator of Student Inquiry, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

As we step into a new century, the need for scientists will be increasing as technology advances. Scientific literacy will also play an important role for the creation of ethical decision makers. As a result, there will be a greater demand for today's students to better understand science. In order to get these students motivated and inspired by science, a team of IMSA students set out to write chapters about renowned scientists. Through interviews and searches for background information, we explain the accomplishments of the scientists, explore their fields, and tell about their lives. Five of the scientists and brief outlines of their best-known works are Sally Ride, first American woman in space, Mary-Claire King, geneticist who mapped the location of the breast cancer gene, Vera Rubin, astronomer who discovered dark matter, Edward Wilson, a leader in sociobiology, and Sherwood Rowland, who first described the hole in the ozone layer. The chapters will be published later this year in a book entitled *Portraits of Great American Scientists*.

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## **ANTICOAGULANT, ANTIPLATELET, AND ANTIPROTEASE EFFECTS OF A NEW ANTICOAGULANT DRUG (PI-88)**

### Presenters:

Jessica Dy-Johnson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Pranay Patel, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentors:

Jawed Fareed, Ph.D., Department of Pathology, Loyola University Medical Center, Maywood, IL 60513

Debra Hoppensteadt, Ph.D., Department of Pathology, Loyola University Medical Center, Maywood, IL 60513

PI-88 (Progen Industries, Ltd, Brisbane, Australia) was developed as an anticoagulant and antiproliferative agent. The purpose of this study was to determine the molecular weight profile, fractionation of parent compound and the anticoagulant potency of PI-88. The gel permeation chromatography and polyacrylamide gel electrophoresis analyses were used to determine the molecular profile and separation of components of PI-88, respectively. Potentiation of antithrombin III and HC-II activity was measured by using the chromogenic substrate assay. In order to determine anticoagulant, antiplatelet, and antiprotease effects of PI-88, various global anticoagulant tests were used. Anti-Xa and anti-IIa activities were also measured by amidolytic assays. The HPLC profiles of PI-88 showed that the average molecular weight of PI-88 is approximately 2100 Da. This agent activates HC-II for inhibiting the thrombin generation but not AT III. Although PI-88 produced a concentration dependent prolongation of all of the clotting tests, ECT gave a good correlation in the dose-response curve. PI-88 exhibited marked inhibition of FIIa but not FXa. Only in thrombin induced platelet aggregation was an effect on PI-88 observed. These results suggest that PI-88 exhibited strong antithrombotic and anticoagulant activity beside the antiproliferative properties. Because of this dual nature of the pharmacologic action of PI-88, it represents an attractive pharmacologic agent for the control of thrombotic and proliferative disorders.

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## **ARTIFACT IDENTIFICATION AS PART OF THE ARCHAEOLOGICAL INVESTIGATION OF JACKSON COUNTY, IOWA**

### Presenters:

Megan Fast, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Dmitry Goldin, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Krysta Heaney, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Amanda Raddatz, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

David Gossman, Gossman Consulting, Inc., 45W962 Plank Road, Hampshire, IL 60140; 847-683-4198

Digging for artifacts is only the first and the easiest step in an archaeological investigation. The most crucial step is identifying what the artifacts are, including where they come from, how they were used, who used them, and how they ended up where we found them. This presentation will begin to unravel some of the great mysteries behind Native American and pre-historic artifacts. The origins of arrowheads, pottery, and bones that were found during the archaeological investigation in Jackson County, Iowa will be examined.

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## **COMMUNICATION BETWEEN ELECTRONIC DEVICES**

### Presenter:

Charles Felish, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; chuck425@imsa.edu

### Advisor:

Mihaela Mihalcea, Science, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;

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This inquiry focused on the translation of what we as humans perceive with our five senses to electrical impulses that electrical devices can interpret, and on how those impulses can be coded and transmitted through wire or electromagnetic pulses. The inquiry turned out a well varied composite of the general details of electronic communication, including analog and digital signals, synchronous and asynchronous transmissions, and a few specific communication protocols. A few of the devices looked at in detail include regular, cellular, and digital phones, pagers, radios, and televisions. The presentation will present the findings starting with the basics and moving through more complex levels of electronic communication, but is designed so that people new to the field can follow along.

## **A STUDY OF MODERN FRENCH CULTURE AND THE INFLUENCE OF THE HOMOGENIZING EUROPEAN UNION**

### Presenter:

Marissa Fierz, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; bmwmaf@imsa.edu

### Advisor:

Willa Shultz, Foreign Language, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5024; willa@imsa.edu

*Living in the U.S., overseas from France, Americans cannot truly experience the French culture. Not only is it difficult for Americans to understand and experience French culture, but the ever-present globalization in American culture creates a roadblock for them to define "culture" in general. Thus, this inquiry focuses on the definition of "culture," in addition to an exploration of modern French culture and language via the Internet and various publications. These sources have revealed several elements of French music, fashion, cinema, cuisine, and politics that represent modern French culture. However, to fully understand French culture, the role of the French government and its citizens in promoting and protecting their culture must also be addressed. Unbeknownst to many Americans, the French government has historically fought to uphold its unique culture, along with establishing a Ministry of Culture and laws against specific threats of American customs. In light of France's fairly recent membership to the European Union, French government officials and citizens have had concerns with possible homogenizing influences of the European Union. As a solution to this potential conflict, the French will have to continue their efforts to maintain a uniqueness and unification in culture.*

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## **EFFECTS OF PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR (PPAR) ON GENE EXPRESSION**

### Presenters:

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

Janardan K. Reddy, M.D., Magerstadt Professor and Chairman, Department of Pathology, Northwestern University Medical School, 303 East Chicago Avenue, Chicago, IL 60611-3008; 312-503-8144; jkreddy@northwestern.edu  
Chao Qi, Ph.D., Research Assistant Professor, Department of Pathology, Northwestern University Medical School, 303 East Chicago Avenue, Chicago, IL 60611-3008; 312-503-1889; cqi451@northwestern.edu  
Songtao Yu, Ph.D., Research Associate, Department of Pathology, Northwestern University Medical School, 303 East Chicago Avenue, Chicago, IL 60611-3008; 312-503-1439; songtao@northwestern.edu

Peroxisome proliferators are manmade chemicals used as herbicides and components in drugs. Lately they have been shown to mimic fatty acids, which regulate gene expression in the body. Peroxisome proliferators take effect through activation of a steroid hormone receptor called peroxisome proliferator-activated receptor (PPAR) which works similar to estrogen and thyroid receptors. The main concern is the regulation of PPAR and the genes that are affected by it. There has been research suggesting that PPAR is linked to many health conditions such as breast cancer, diabetes, and inflammation. Our goal in the lab is to further test the capabilities of PPAR and its effects on human DNA (primarily through transgenic mice) using Polymerase Chain Reaction (PCR), Northern Blot, Western Blot, Immunofluorescence, plasmid vectors, and other laboratory protocols.

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## **REAL SCIENCE: ROCKS ROCK!**

### Presenters:

Annabel Fu, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; belles@imsa.edu  
Linda Ly, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; lindaly@imsa.edu

### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5073; britta@imsa.edu

Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. This dual platform CD-ROM targets students in grades 3-5 and is distributed free of charge to over 600 schools in Illinois and beyond. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science

through the use of multimedia movies and interactive supplements developed using Adobe Premiere, Photoshop and Macromedia Director. We began our project by first researching and writing an article on rocks and the rock cycle. We wrote about the way rocks are formed and how there are three different types of rocks, igneous, sedimentary, and metamorphic. Then, using resources such as the web, Field Museum, and advisors, we collected, created, and took pictures of rocks. After making the movie, we produced a few interactive games and quizzes on rocks for the kids. We hope that the students will enjoy our movie and games as much as we enjoyed making them!

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## **THE DEVELOPMENT AND DESIGN OF A GO-KART**

### Presenters:

Anthony Garcia, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; [garcia@imsa.edu](mailto:garcia@imsa.edu)  
Joonil Kwak, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; [kwak@imsa.edu](mailto:kwak@imsa.edu)

### Advisor:

Edgar Mosshamer, Computing and Network Services, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5998; [skipmoss@imsa.edu](mailto:skipmoss@imsa.edu)

A combination of practical mechanical engineering and design has led us to pursue this go-kart project. This inquiry began with the parts of an old lawnmower. The first half of this project required the dissection of the lawnmower. In taking it apart, we learned exactly what we were dealing with. This was a two-part learning process, as we learned to use the tools available to us as well as the exact parts of the machine. This in turn allowed us to evaluate our limits in terms of the final product. We were unable to disassemble the engine completely, although we learned how it worked. We did tear the transmission down and learn how power is transmitted through it. Therefore, we mainly dealt with the physics and mechanics of chassis design. The previous lawn-mower body was inadequate for our go-karting purposes. The engineering we preformed was intended to design a better chassis and to figure out how to reallocate all the parts for suitable use. We lowered the frame to the ground to give the body a better angle and to lower its center of gravity. Ultimately this gives the car better maneuverability and control. The final semester of the project was spent fitting all the parts back into the new frame and touch-ups. Our final efforts have created the wondrous go-kart that we call **THE G-MACHINE**.

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## **SCIENCE EXPLORERS- "SENSATIONAL SENSES AND PSYCHOLOGY"**

### Presenters:

Sandra Garcia, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; [sandrag@imsa.edu](mailto:sandrag@imsa.edu)  
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### Advisor:

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Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. Science Explorers is a summer day camp designed and taught by IMSA students for elementary school age children held at the IMSA campus. One of the main goals of Science Explorers is to teach science topics through original material while engaging the participants in a problem based learning environment. The entire Science Explorers team is broken up into sub-groups. Each sub-group is in charge of producing the curriculum for a specific preselected chosen science topic. The "Sensational Senses and Psychology" sub-group developed four hours of curriculum covering the following topics: the five senses, dreams, memory, and personality. Through hands-on activities that isolate senses, the curriculum provides opportunities for campers to discover and appreciate how the human brain processes sensual experiences. Other activities in this curriculum fostering discovery and discussion include: memory games, dream catcher construction, and personality quizzes.

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## **THE INLAND STEEL BUILDING: THE STORIES AS AN ORGANISM**

### Presenter:

Anupama Garla, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Mark Sexton, Krueck and Sexton Architects Principal, 221 W. Erie; Chicago, IL 60610-3125; 312-787-0056

My intention was to investigate the Inland Steel Building's relationship to the world as a reflection of the human relationship to nature at the time of the Building's conception and how the relationship has changed since its conception. My research has consisted of observing the building, drawing and taking photos of the building, studying various technical drawings of the building, constructing technical drawings of details, reading books and magazines, and an interview with its architect, Bruce Graham. I have observed the three major contributing factors to the construction of this landmark building, expressed by the building itself. I have further discovered that the Inland Steel Building is part of a language of Bruce Graham's entire work. Inland Steel is also part of a language of buildings in Chicago. Being the first building built in the Loop after World War II, it has become the forerunner of the substance of this language. As a Chicago building, it demonstrates the change from rigid uncomfortable working environments, to free open space. The structure also demonstrates the aesthetic beauty found in Louis Sullivan's historic words: *Form Follows Function*.

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## **TERMINATION OF PARENTAL RIGHTS**

### Presenter:

Elizabeth Garrison, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Barbara Greenberg, Civic Advocacy Center, 1409 Burr Oak Road, Suite 308A, Hinsdale, IL 60521; 630-323-1807;  
barbglawyr@aol.com

A termination of parental rights is a permanent ruling made by the court stating that a child can no longer reside with his or her legal guardian. All responsibility of that guardian is forfeited and the child is eligible for adoption. Once a parent loses his or her rights, they cannot be regained. Physical abuse, neglect, and drug abuse are some factors that can lead to this termination. The rights of parents are never terminated immediately. Due to the severity of a termination of parental rights, the process is slow and carefully conducted keeping the child's best interest as a priority. By studying case law, visiting courts, and talking to judges it was found that termination of parental rights rulings are decided on a case by case basis. A complete view of all circumstances in a child's life must occur before any ruling can be made. There is no rule when deciding these cases however trends do occur when studying past cases which can help in understanding what may lead to a termination of parental rights.

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## **DEVELOPING AN APPLICATION TO DISPLAY 3D-MODELS IN DIFFERENT PERSPECTIVES**

### Presenter:

Navreet Gill, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; ngill@imsa.edu

### Mentor:

Ben Watson, Assistant Professor, Dept. Computer Science, Suite 300, Room 336, 1890 Maple Ave., Evanston, IL 60201

Many researchers require the viewing of complex, detailed models to be displayed on the computer screen. To do this, it is desirable to have a program that can load model files with ease. Elodin lets someone load up a file in the specified format and then automatically generate or change the default viewing parameters. This program is able to load different models successively and use a given centering technique to automatically view the model in an appropriate manner. This will facilitate the researchers with better software thus they will increase the productivity of their sessions.

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## **PAVLOVIAN EYEBLINK CONDITIONING: AN EXAMINATION OF ASSOCIATIVE LEARNING**

### Presenters:

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Darrel Saldanha, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506; [djs85@imsa.edu](mailto:djs85@imsa.edu).

### Mentor:

Craig Weiss, Ph.D., Res. Asst. Prof.; Northwestern Univ. Dept. of Cell and Molecular Biology, 303 E. Chicago Ave,  
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A Pavlovian paradigm can be used to examine learning behavior in animals and humans. Eyeblink conditioning, one such paradigm, is a well-established model for studying learning processes in humans and animals. In this paradigm, animals of different ages learn a conditioned response at different rates. Through repeated pairing of conditioned stimulus and unconditioned stimulus, the conditioned stimulus becomes a predictor for the unconditioned stimulus so that all responses initially induced only by the unconditioned stimulus are now also produced by the conditioned stimulus. Variables in Eyeblink conditioning include age, brain lesions and drugs. In aged and hippocampally-lesioned animals, the percent of conditioned response is significantly lower than that of healthy, young animals. In aged people and Alzheimer's patients the rate of learning generally decreases and variability increases. One example of drug testing is Nimodipine with results showing an increase in associative learning abilities in rats and rabbits.

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## **FROM CLASSICAL TO CONTEMPORARY: A STUDY OF MUSICAL THEORY AND STYLES**

### Presenter:

Tim Hachmeister, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; [piguy@imsa.edu](mailto:piguy@imsa.edu)

### Advisor:

Christopher Kuhl, Ph.D., English, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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This inquiry has been a study in the works of the modern era. Beginning at a very traditional and classical style of composing the focus turned to contemporary themes and ideas. By studying different composers and then moving to compose, myself, a better understanding for the music itself was reached. I began with building different accompaniments to given melodies and arranging them into styles of different composers. Then I moved on to starting with my own melodies and trying themes and variations under these different styles. Numerous ideas were tested: Harmonic themes and progressions, meter variances, tempo effects on tone and so on. These ideas will be shown in the presentation.

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## **THE MANIFEST AESTHETIC**

### Presenter:

Lance Hall, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora IL 60506, [lance@imsa.edu](mailto:lance@imsa.edu)

### Advisor:

Tony DiSanto, Computing and Network Services, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road,  
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How are Theater and Architecture similar as manifestations of art and how can we as moderns learn new methods of expression for ourselves by learning their histories? For example, the tradition of Greek tragedy – as exemplified by such plays as Aeschylus' The Orestia and Sophocles' Theban Plays - represents the development of a very structured and solid format. The classical architecture of ancient Greece and Rome also has a very grandiose purpose and style: the Doric Parthenon on the Acropolis and the Pantheon in Rome both testify to the eternal power of the ancient world's designs. Both of these disciplines teach us something about how we express ourselves: how we connect to our surroundings - space, people, and objects - are the main foci of both architecture and theater. When looking at the two disciplines side by side, one can expect to see similarities in both the purpose and the outcomes of both. By delving into these two fields as a single combined history, the strengths of both can be used to gain a deep literary understanding of the human experience. Looking back into both, we can see how we came to express and think about ourselves the way we do, and find new methods of expression.

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## SCIENCE EXPLORERS: ECOLOGY

### Presenter:

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### Advisor:

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Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. "Ecology at IMSA" will feature several fundamental concepts of field biology, such as energy flow and dynamics, pond ecology, and behavioral ecology in four hour-long activities. These exercises will place a strong emphasis on the mastery of observation skills, basic data collection, and field techniques. The first hour of curriculum will introduce the students to the idea of carrying capacity and the food chain using an interactive game and a computer activity. During the second hour, the students will complete a hands-on activity in which they will test the health of the IMSA pond. Thirdly, campers will explore a mini-aquatic ecosystem and learn about the relationships between organisms in different habitats. Fourthly, the students will have the unique opportunity to collect insects in the field and to identify them in a lab. The day will culminate with an Ecology Scavenger Hunt.

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## ENERGY INTAKES IN BROWN AND POLAR BEARS

### Presenter:

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### Mentor:

Kerri Slifka MS, Staff Nutritionist, Chicago Zoological Society, 3300 S. Golf Road, Brookfield IL, 60513;  
keslifka@brookfieldzoo.org

The purpose of this research was to develop a standard plan to manage the Brown (*Ursus arctos*) and Polar (*Ursus maritimus*) bear diets based on seasonal body weights and energy intakes. Research was based on three years of dietary records for Brown and Polar bears. Monthly averages of food offered were calculated from 1998 to the present. Using those averages, caloric intake (kcal/day) was calculated for both brown bears and the adult male polar bear. From graphing these data we hoped to see seasonal patterns, and from these patterns develop a standard diet plan. The brown bears' caloric intake peaked consistently in September, and is lowest between January and February. Based on these observations, suggestions for seasonal dietary changes in quantity will be presented to management staff. The polar bear data was too inconsistent to determine if a pattern exists, consequently no dietary adjustments are recommended. Caloric intake per kilogram body weight was calculated for a single brown bear. Over the course of the three-year retrospective study it peaked each September, but at slightly different levels. Data points were limited due to infrequent weights.

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## TOPICAL VERSES PERIBULBAR ANESTHESIA FOR CATARACT SURGERY

### Presenter:

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

### Mentor:

Dr. Gary L. Fanning, Hauser and Ross Eye Clinic, 2240 Gateway Dr., Sycamore, IL 60178; 815-756-7351;  
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In modern cataract surgery, the lens of the eye is removed and replaced with a synthetic lens through a small incision in the cornea. It is currently one of the most common outpatient surgeries. However the optimal anesthetic management for this surgery is still being debated. In this study, two anesthetic techniques-peribulbar injection and topical anesthetic drops-are being compared for effectiveness during cataract surgery. In this prospective, non-randomized study, patients are asked to evaluate their pain and anxiety before surgery, during surgery, and approximately 30 minutes after surgery. A 10-point visual analog scale (VAS) was used to help patients measure their level of pain and anxiety, with 1 being no pain or anxiety and 10 being the greatest amount of pain or anxiety imaginable. The purpose of this study is to determine if there is a difference

between these anesthetic techniques with regard to pain and anxiety in patients during the cataract surgery experience. Early results have indicated that there is more pain with topical anesthesia.

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## **TEACHING CHINESE SPEED CALCULATION METHOD TO FIFTH AND SIXTH GRADERS AT CYCLE'S WIZ FACTORY**

### Presenters:

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### Mentors:

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George C. Colone, LaSalle Street Community Youth Creative Learning Experience's Wiz Factory, 1111 N. Wells, Suite 300, Chicago, IL 60610; 312-573-8921

LaSalle Street CYCLE (Community Youth Creative Learning Experience) Wiz Factory offers many different opportunities for kids in Cabrini Green and surrounding areas. The labs are designed so that the kids can advance at a rate faster than their schools can provide. IMSA students run their own labs entailing math or science related curriculum. Our lab focuses on the Chinese speed calculation method to solve fundamental math problems. This provides a totally new perspective on doing math than the students are used to. The materials used were sent by a math professor at the JiaoTong University in Shanghai, China. Since mathematics is a universal language, the fact that the books are written in Chinese proved not to be an obstacle to our instruction. The material is first introduced, and then reinforced through much practice. The same ideas are then approached in many different perspectives. The kids take this new knowledge into their classroom environment and into their everyday lives.

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## **CONSTRUCTION AND RESEARCH OF A SONOLUMINESCENCE APPARATUS – Year 2**

### Presenter:

Dustin Hendrickson, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisors:

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Michael Lindenmeyer, Grainger Workshop, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5959

Sonoluminescence is a miniature laboratory resting at the frontier of physical research. At the center of a quartz flask filled with degassed water, a bubble is bombarded with intense sound waves, producing equally intense pressure changes at the bubble's surface, and resulting in picosecond bursts of light. The objective in this inquiry has been primarily to build a sonoluminescence apparatus, using methods outlined in the February 1995 issue of Scientific American and elsewhere. Through research and communication with others in the field, I have found inadequacies in the Scientific American article, which led me to different sources. Through these sources I have found many other techniques and methods of analysis. Through the construction of a basic circuit board and the use of supplementary electronic devices, I have learned many principles and concepts of electrical theory that have allowed me to gain a larger understanding of what makes the apparatus work. Sonoluminescence holds great tangible potential. As a possible model for cold fusion, and as a frontier laboratory for physical study, the opportunities for study and research will, upon creation of our apparatus, be limitless.

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## ANALYSIS OF THE RESPONSE OF *HYDRA OLIGACTIS* TO EXTRACELLULAR ATP

### Presenters:

Ann Hinterman, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; annal13@imsa.edu  
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### Mentor:

Vicki Burgholzer, Biology, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; NIU,  
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In order to provide evidence for the evolution of intercellular communication systems, we have looked at the effects of ATP on the growth patterns of a relatively simple organism, *Hydra oligactis*. In the course of evolution, multi-cellular organisms were selected over single-celled organisms for their efficiency in cellular differentiation. For further adaptation, cells in such organisms developed a system of communication, which would be retained throughout evolution. Newman (1973) recognized reproducible effects in the growth pattern of hydra with the exposure to a metabolite, but did not quantify his results. By recreating his conditions, we were able to measure the subsequent growth patterns. Our data suggests that a "primitive" pathway present in may form the basis for communication between its cells. For this communication to occur, we have proposed the existence of an ATP receptor in hydra. To support this claim, we have demonstrated that the effects, brought on by the introduction of extracellular ATP, no longer take place when the receptor is blocked.

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## CYTOKINE MODULATION OF BETA 2 ADRENERGIC RECEPTOR ( $\beta$ 2AR) EXPRESSION IN T HELPER 2 (TH2) CELLS

### Presenter:

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### Mentors:

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By binding to the  $\beta$  2 adrenergic receptor ( $\beta$ 2AR), it is thought that the neurotransmitter norepinephrine may affect cytokine production by Th1 and Th2 cells. These cells originate from a common precursor cell, the naive CD4+ T cell, depending on the cytokine microenvironment. Naive CD4+ T cells express the  $\beta$ 2AR and this expression is retained on Th1 cells, but is repressed on Th2 cells. Our aim is to discover if specific cytokines cause repression. Th2 cells were grown in increasing concentrations of Interleukin (IL)-12, IL-4, and IL-2. RNA was isolated, reverse transcribed into cDNA, and amplified with both  $\beta$ 2AR and actin primers. These copies were then run on a gel along with Th1 and Th2 control groups cultured without cytokines. Activated Th1 clones grown in the presence of IL-12 showed increasing expression of the  $\beta$ 2AR, while Th2 clone expression remained repressed. In the IL-4 and IL-2 experiments, using non-activated cells, expression remained repressed with addition of IL-4 and increased with IL-2. Taken together, these findings suggest that expression of the  $\beta$ 2AR on activated Th1 cells may be up-regulated by IL-12 and that  $\beta$ 2AR expression on non-activated Th2 cells may be down-regulated by IL-4 and up-regulated by IL-2.

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## FUNCTIONS OF A COMPLEX VARIABLE

### Presenter:

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### Advisor:

Micah Fogel, Ph.D., Mathematics, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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The mathematical concept of a function is arguably the most important tool in all of mathematics. My inquiry has dealt with the study of the properties of functions of a complex variable. Though concerned with the imaginary number  $i$ , often considered by many students to have no practical applications, such functions actually have many applications as well as deep significance in pure mathematics. I came to this field through the study of prime numbers. There are deep relationships between functions of a complex variable such as the Riemann Zeta function and the structure of the prime numbers. Through this connection I became deeply interested in the study of complex analysis, and this project has expanded my knowledge of this beautiful area. I will present some of the basic tools of complex analysis and their relationship to the prime numbers.

## **SCIENCE EXPLORERS: I WANT MY MUMMY**

### Presenters:

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

### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5073; britta@imsa.edu.

Science Explorers Inquiry supports IMSA students in the development and implementation of science enrichment outreach programs for grades 3-5. Teams of students write, test and refine science enrichment curriculum to teach "On the Road" at elementary schools, during classroom "Fieldtrips to IMSA" and at the Science Explorers summer day camp to spark an interest in science in younger children. During the course of this Inquiry we developed a day long curriculum targeted to 3<sup>rd</sup> and 4<sup>th</sup> grade students. This program of study involves scientific topics related to the civilization of Ancient Egypt. Throughout the year all of the team members gained knowledge of the Egyptian culture, and learned how to work with and teach children from grades 3 to 6. Examples of the topics that have been included in this program are hieroglyphics, archaeology, the building of the pyramids, and the process of mummification. A historical and cultural background to supplement these new scientific ideas will be provided. During this presentation the teaching materials created that will be used in the Science Explorers camp this summer will be presented.

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## **THE ACCELERATION OF THE INCORPORATION OF INFORMATION TECHNOLOGY IN MUNICIPAL GOVERNMENT**

### Presenters:

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Kathleen King, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; serafina@imsa.edu

### Mentor:

Dr. Stewart Personick, Drexel University, 3141 Chestnut St. Philadelphia, PA 19104; 215-895-6208; sdp@cbis.ece.drexel.edu

This year our research was conducted in the field of information technology. The long-term objective was to accelerate the incorporation of information technology in municipal government. Our intention was to create a new and original on-line application that could be utilized by city governments in order to provide improved services for their citizens. In order to do so, we began our project by conducting an in-depth investigation of the online services that are currently available and the present on-line capabilities of local towns. We continued our project by brainstorming and exploring various possibilities for development. In the end, we created the design for a web page that would provide information about traffic within a given city. Among other services, the site, given an approximate date and time, will provide directions using the fastest available route, as well as giving predicted weather and construction problems. It would also allow users to customize the site so that they would be notified in case of problems that would affect traffic, such as inclement weather. The service would be accessible to the people through the city's homepage.

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## **RHESUS BLOOD TYPE INCOMPATIBILITY AND JAUNDICE**

### Presenter:

Erin Huffington, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisor:

Donald Dosch, Ph.D., Science, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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Blood type incompatibility between a mother and her fetus can pose a tremendous threat to the success of a pregnancy. During the first antenatal visit the mother-to-be will be tested for her and her child's rhesus status. If the blood cells of the mother lack the rhesus protein but the child has inherited it from the father, there exists a dangerous incompatibility. The mother's immune system acknowledges the protein carried by the child as an invader, and it attacks the blood cells of the fetus. This may result in serious consequences such as jaundice. This is a condition that is caused by an excess of bilirubin, which is a byproduct of hemoglobin, and it results in the yellowing of the skin. If the mother's immune system attacks the child's blood cells, then the bilirubin level is abnormally high. This can lead to extreme cases of jaundice that must be

treated. Phototherapy is the most common treatment for this condition. The sunlight helps to break down the excess bilirubin, and hence the severity of the jaundice is reduced.

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## **BIOCOMPATIBILITY OF CARBON COATING PRODUCED BY THE CHLORINATION OF METAL CARBIDES**

### Presenter:

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### Mentor:

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When metal carbides are exposed to chlorine at high temperatures, a carbon coating is produced on the surface. Because of the low thermodynamic stability of  $\text{CCl}_4$  in comparison to metal chlorides at high temperature, the metal is selectively volatilized from the carbide as a chloride vapor, leaving carbon behind. The carbon structure formed has many beneficial properties, one being that it has a low friction coefficient and is very wear-resistant. This property can be useful for many biomedical applications, hip joint replacements in particular. Current artificial hips use materials that wear away, and the debris produced can cause inflammation and infection in that area of the body, perhaps even requiring another hip replacement. A more wear-resistant material would allow a person to utilize an artificial hip for much longer, making the carbon a desirable material to use. The biocompatibility of carbon coated SiC produced by this chlorination process was tested to see if this material is safe to put inside a human body

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## **ECOMMERCE AND IMSA: SURVEYING INTERNET SHOPPING HABITS**

### Presenter:

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### Mentor:

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A survey was conducted of students and faculty to find differences and similarities in internet shopping experience and opinions between faculty and students. The purpose of the survey was to find how the two groups have been involved with commerce in relation to the national model. "Total online revenues in 1999 accounted for a mere 0.8 percent of the total U.S. economy, but are projected to grow to 8.9 percent by 2003" (Business 2.0, 12-26-00). The internet revolutionized retail, as it gave an entirely new medium to reach customers. No longer was it necessary for a buyer to be in the store to make a purchase; instead, the customer could purchase from a retailer at home at any time. Last year alone, an estimated thirty-seven billion dollars of consumer sales was made off purchases by 63.4 million online shoppers in the U.S, with these numbers increasing yearly. An educated and technological community, IMSA has easier access to online shopping. However, the question arose of which group, faculty/staff and students, actually purchased online more.

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## **UNDERSTANDING JAPANESE LANGUAGE THROUGH MANGA**

### Presenters:

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Andre Phillips, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506; tsani@imsa.edu  
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### Advisor:

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Manga are a type of Japanese graphic novel, roughly equivalent to American comic books. Because they are written for native Japanese speakers, one wishing to understand them would need an extensive understanding of the Japanese language. We have translated the second volume of a manga, Card Captor Sakura, into English to reinforce these skills.

## FRANÇAIS AVEC DR. SKINNER

### Presenters:

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

### Advisor:

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In the past year, Dr. Skinner, a student with the fundamentals of the French language, and Lavina Jadhvani, a student who is fairly proficient in the language, have worked together to further refine his speaking, reading, and writing skills. In addition to experimenting with psycholinguistics, this pair has also tackled tasks such as translating original 17<sup>th</sup> century documents for the Illinois State Museum. To demonstrate his proficiency, Dr. Skinner will present a brief historical lecture entirely in French. The presentation will then be open to questions in both French and English. **Note:** As a good portion of this program will be presented in French, it is strongly recommended that the audience members be somewhat proficient in the language in order to fully appreciate our progress.

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## HELIOTROPIC ROBO-BUG

### Presenters:

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Ivan Lee, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; pgnwn11@imsa.edu  
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### Mentor:

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In the quest to mimic the actions of humans with machines, scientists have discovered that attempting to mirror simple insects, as opposed to programming robots with microprocessors, is the first step toward their goal. Creatures such as ants, roaches, and even lobsters have been modeled as robots, and many have now become readily available to the public. One pioneer in this field is Mark Tilden. He experimented with this type of robot, dubbed "BEAM Robots." This stands for "Biology Electronics Aesthetics Mechanics." Experiments with this type of robot to better understand the future of robotics were conducted. After ordering from Solarbotics, assembly of a Photopopper 4.2b Photovore, a small robot that seeks light and avoids obstacles was constructed. It uses only six transistors, two infrared light detectors, two motors that make it "waddle" across the ground, and a pair of long wire feelers. With the advantage of being solar-powered and not using a microprocessor, the Photovore has the qualities of a more instinctive life form. The reasons the Photovore was assembled was to become familiar with robotics, electronic engineering, and study patterns of these instinctual robots.

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## THE ROLE OF DOMESTICATED COTTON IN THE DEVELOPMENT OF COMPLEX SOCIETY IN PERU

### Presenter:

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### Mentor:

Dr. Winfred Creamer, Department of Anthropology, Northern Illinois University, DeKalb, IL 60115-2854; 815-753-7038;  
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Cotton is thought to have been domesticated in the highlands of Peru by approximately 3000-2000 b.c. Domestication developed first in the highland valleys, such as the Ayacucho Valley, later spreading to the coastal regions, such as Huaca Prieta. During the Preceramic period, cotton grown in inland valleys, like the Supe Valley, may have been traded for production of the coast, such as fish. This trade may have contributed to the accumulation of a surplus in the valley, making large construction projects, such as pyramids, possible in this early period. Identifying the source of cotton will help determine whether the Supe Valley participated in such a trade pattern. Chemical sourcing of both archaeological and modern cotton samples by inductively coupled plasma-mass spectrometry (ICP-MS) may determine whether cotton in the Supe Valley was grown locally or in an adjacent valley. An experimental procedure is proposed which involves the use of ICP-MS

to determine chemical differences among archaeological cotton samples such as textiles, as well as modern samples grown in test plots to be located in the Supe, Pativilca, Fortaleza, and Huaura valleys.

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## **CREATING A STRONG FOUNDATION IN MATH WITHIN HISTORY**

### Presenters:

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### Mentor:

Connie Van Brunt, Executive Director, C.Y.C.L.E. (Community Youth Creative Learning Experience), 111 N. Wells, Suite 300, Chicago, IL 60610; 312-573-8921  
George Colone, Associate Executive Director, C.Y.C.L.E. (Community Youth Creative Learning Experience), 1111 N. Wells, Suite 300, Chicago, IL 60610; 312-573-8921

In our mentorship, COMMUNITY YOUTH CREATIVE LEARNING EXPERIENCE (C.Y.C.L.E.), we had a specific purpose. Our goal was to teach young girls in 3<sup>rd</sup>-5<sup>th</sup> grade different math concepts in history. In teaching different math ideas, we hope to give the girls more knowledge and build a broader foundation in "Math in History". With this in mind we selected specific math concepts that are still used in schools' curriculum. These ideas are vital aspects in gaining a fulfilling education. In our lab, we only incorporate the most important facts about the idea, the creation, the methods and the importance of the specific subject matter. The lab is always started with a review of the topics learned from the previous week. Next we introduce what will be discussed for that day and ask the girls what they already know, if anything. After a brief introduction we explain the reason(s) why this subject was created and its importance, which leads to a group activity. The group activity usually consists of a matching game, question and answer sessions or re-enactment. Then we have a recap session, where we go over everything learned for that day and fill in any gaps, where needed.

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## **TAILESS GENE (TLX) DIVERSITY IN SCHIZOPHRENIC PATIENTS AND CONTROLS**

### Presenters:

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### Mentor:

Dr. Pablo Gejman, Professor of Psychiatry and Clinical Pharmacology, University of Chicago; Jules F. Knapp Research Center, 924 E. 57<sup>th</sup> Street, R-010, Chicago, IL 60637; 773-834-3060; pgejman@uchicago.edu

It has previously been reported that the tailless gene (TLX) is involved in the brain development of several species. The human TLX gene is located on chromosome 6q21, an area where genetic linkage with schizophrenia has been observed. The human TLX gene is homologous to the mouse tailless gene. Experiments in mice have showed that the TLX gene is associated with behavioral abnormalities including aggression and social withdrawal. We are testing genetic polymorphisms of the TLX gene in patients and controls by using several molecular methods, such as polymerase chain reaction and restriction fragment length polymorphism (RFLP). Using the RFLP scanning method with enzyme Hha I on 5 families selected from NIMH Genetics Initiative I, we discovered a single nucleotide polymorphism (SNP) of a change in base G to base A on intron 2. The expected digest sizes for the wildtype would be 301bp+110bp+19bp, and for the mutant would be 411bp+19bp. However, because the reported minor allele frequency was approximately 87%, this SNP doesn't appear to have significance in the development of schizophrenia in people. Other polymorphisms at the TLX gene are currently being tested.

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## **OSMOTIC RESPONSE OF FIBROBLASTS**

Presenter:

Gaurav Kamboj, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; gkamboj@imsa.edu

Mentors:

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Katy F. Hsiao, Graduate Student (College of Medicine and Department of Mechanical Engineering), 842 W. Taylor Street (M/C 251), Chicago, IL 60607-7022; 312-996-4363; khsiao1@uic.edu

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Placing cells in a hyperosmotic environment causes them to lose water through a process known as osmosis. Osmosis occurs when cooling cells below zero degrees Celsius, due to the formation of ice outside the cell, which increases the concentration of solutes. In this study, we placed fibroblasts in hyperosmotic solutions of different concentrations in order to determine the permeability of their cell membranes and their water content. If these two biophysical properties of fibroblasts can be determined, then a mathematical model can be used to predict the survival of cells after cryopreservation. Such a model would be invaluable in optimizing protocols for the cryopreservation of fibroblasts. A microscope equipped with a video camera was used to record images of fibroblasts. MetaMorph image processing software was then used to analyze these images and obtain measurements of cell volume. Lastly, by analyzing the data for changes in cell volume as a result of changes in the osmolality of the fluid surrounding the fibroblasts, the water permeability and water content of the fibroblasts can be determined. The ultimate goal of this research is the cryopreservation of simple artificially manufactured tissues such as skin grafts.

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## **KIDNAPPED: THE IMPLICATIONS AND EFFECTS OF INTERNATIONAL PARENTAL KIDNAPPING**

Presenter:

Judy Kang, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Mentor:

Barbara Greenberg, Civic Advocacy Center, 1409 Burr Oak Road, Suite 308A, Hinsdale, IL 60521; 630-323-1807; barbglawyr@aol.com

The retention or concealment of a child by a parent in derogation of the custody and visitation rights is what defines the term "parental kidnapping." The amplifications of transportation methods and the increasing ease of human mobility have further exacerbated the situation to create an international crisis. This research examines the legal aspects of international parental kidnapping, concentrating on the judicial process that leads to the determination of a child's habitual residence. Publicized cases such as the story of Elian Gonzalez, Jonathon Colombini and other important events were investigated, and domestic court judges in Cook and Dupage counties were consulted, to further understand the similarities and variances as well as the unique characteristics of each individual case.

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## **A STUDY OF SHASHLIK SCINTILLATOR DESIGNS**

Presenter:

Jared Kaplan, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Mentor:

Erik Ramberg, Scientist I, Fermi National Accelerator Laboratory

Our research focused on simulating designs for the forward veto system and testing different types of scintillator for a proposed Charged Kaon Experiment (CKM). The computer models used GEANT, a software system developed at CERN, to test particle interactions with detectors. The scintillator tests were of different liquid and solid scintillator designs, all using Shashlik fiber optic cable set-ups. The analysis of our work will add to the CKM proposal and effect the materials used in the final experiment.

## TECHNOLOGICAL ADVANCEMENTS IN THE VISUAL MEDIA INDUSTRY

### Presenter:

Melissa Kaye, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
Catherine Shartzter, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Mark Hislop, Video Impressions Aurora, IL 60504

Video Impressions is a company dedicated to making videos in numerous forms of visual media, such as training films, commercials, promotional videos, CD-ROMs, etc. While working at Video Impressions for the past two years we have become acquainted with various forms of graphical design, as well as advancements in video editing and the basic components of video production. By working with our mentor, we were able to learn how to use some of the most recent software available to do these. Using all of these acquired techniques, we set a goal to complete a short video about the life of a girl on Broadway. In order to achieve our goal we wrote a script, added storyboards and camera angles, filmed our scenes and edited our footage. Our intent is to gain knowledge about video and film making through entertainment.

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## PREVENTION OF SENESENCE BY TELOMERASE IN HUMAN DIPLOID FIBROBLAST CELLS

### Presenter:

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### Mentor:

Dr. Kathy Rundell, Department of Microbiology/Immunology, Northwestern Medical Center, Chicago, IL 60611

Telomeres are long strands of nucleotides at the ends of chromosomes. Each time a cell divides, the telomeres grow shorter. As the telomeres continue to grow shorter, cells eventually enter senescence, which normally occurs after seventy to eighty generations for human diploid fibroblast (HDF) cells. In senescence, cells are metabolically active but no longer divide. Telomerase is an enzyme that repairs telomeres and prevents cells from entering senescence, leaving them immortal. Telomerase expression is present in cancer cells. The purpose of the study was to develop immortal HDF cells. To accomplish this, the human telomerase (*hTERT*) gene was introduced into the cells through viral infection. Control cells were also maintained for comparison. Telomerase (TRAP) assays were used to determine the presence of telomerase. To test for senescence, beta-galactosidase assays were performed. Beta-galactosidase is a marker for senescent cells, and the *hTERT*-containing cells did not test positive for senescence. After seventy generations, the control cells were senescent while the experimental cells continued to grow. Cytofluorometric analysis of propidium iodide stained cells was used to show that *hTERT*-containing cells continued to go through the cell cycle normally. It was found that the *hTERT*-containing cells reacted to the combination of two Simian Virus 40 (SV40) antigens, large-T (LT) antigen and small-t antigen (ST), the same way HDF cells did. As with the normal cells, *hTERT*-containing cells formed foci when both LT and ST were introduced. Because they behave the same way normal cells do, excepting their escape from senescence, these immortal cells may be used in the future as cell-lines for laboratory work regarding SV40.

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## ILLINOIS AND THE NOBLE SAVAGE

### Presenters:

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Exploration and philosophy may seem to be two disconnected fields, but in fact they can impact each other. Such was the case throughout the exploration of North America. Specifically, the French explorers who pushed the frontiers of new territory further west also helped push the boundaries of philosophy. The people of New France were largely Jesuit missionaries, soldiers, or fur traders. The missionaries were interested in converting the Native Americans, while the fur traders wanted to make money trading with them. The soldiers were there to protect everyone, especially the lucrative fur trade. People of all sorts kept journals of expeditions, and these accounts became very popular in France. They influenced the

writing of Rousseau, who believed that nature creates men equal and they impose inequality on themselves. Rousseau idealized many different behaviors of the Americans and coined the phrase "noble savage." Rousseau and other philosophers would challenge European authority and support respect for liberty and awe of nature. The exploration of New France helped to develop these philosophical frontiers.

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## **TELE-IMMERSION: TURNING VIRTUAL REALITY INTO REALITY**

### Presenter:

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Brian Park, Illinois Mathematics and Science Academy, 1500 W. Sullivan Rd, Aurora, IL 60506; xbrianx@imsa.edu

### Mentor:

Dr. Tom DeFanti, Professor of Computer Science Division and Director of the Electronic Visualization Laboratory,  
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Developed by UIC's Electronical Visualization Lab, the CAVE, a projection-based virtual reality system, allows scientists and artists to interact and share data within a 3D audio and visual environment. It is a highly sophisticated device, where users wear stereo LCD shutter glasses and are tracked to properly view and interact with real-time 3D environments. Although many applications currently exist for this inventive technology, there are many new ones yet to be explored through thorough and innovative research. Current research involves the exploration of new applications with improved display resolution, the introduction of this groundbreaking technology into a wider audience, and the creation of more realistic 3D design for various applications. Our research at EVL currently involves the latter; we are seeking to research and create enhanced 3D designs for use within the CAVE. Using programs such as Maya, we are experimenting with and developing different models and animations to further CAVE research.

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## **A CHANGE IN TRADITION: INTELLIGENT ASSIST DEVICES AND THEIR BUTTON AND LIGHT SCHEMES**

### Presenter:

Poonam Khatri, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Michael Peshkin, Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL 60208; 847-491-4630

Robots are used in factories across the nation to help improve manufacturing productivity. Unfortunately, sometimes workers are laid off when robots replace them. This leads to an ethical dilemma. Intelligent Assist Devices (IADs) help solve this dilemma. IADs work with people, as opposed to replacing them. Because these devices are not sensitive to humans, good communication between the IAD and the operator is vital to maintaining safety. IADs have lights that are used to alert the user as to what mode it is in and buttons that allow the user to control its behavior. The scheme of these buttons and lights, however, is under debate at the moment. The purpose of this experiment is to address the issues of safety and efficiency related the button-light schemes of IADs. A program was created in Matlab which mimicked the schematic design of current intelligent devices. A user-friendly schematic design was also created in Matlab which is hypothesized to increase efficiency. These schemes were also programmed in C++ to increase programming knowledge. The C++ version was then tested on 8 random students at the Illinois Mathematics and Science Academy. The number of errors was recorded, compared, and a conclusion was reached.

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## **PRIYA'S PIZZA PUB – BUSINESS PROPOSAL**

### Presenter:

Priya H. Khetarpal, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; priya@imsa.edu

### Mentor:

Fred L. Fleischbein, President, Global Business Alliance, Inc., 445 West Erie, Suite 109, Chicago, IL 60610; 312-280-0183;  
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Priya's Pizza Pub is a potential restaurant located in Bartlett, IL. Industry analysis, products, marketing, competition, operations, management, and financial projections are included in the business proposal. Because pizza has always been, and

will continue to be, a popular choice of food for Americans, the menu will focus on the variety of pizzas available. The pizza industry analysis shows a strong growth in independent stores similar to Priya's Pizza Pub. While the industry's sales as a whole increased by 8.4%, independents' annual sales increased by 11%. By focusing on innovative marketing techniques, Priya's Pub will achieve success in the pizza world.

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## **ILLINOIS LEGISLATION FOR ROUTINE PRENATAL HIV TESTING WITH THE RIGHT OF REFUSAL**

### Presenter:

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

### Mentor:

Senator Chris Lauzen, Illinois State Senator (District 21), 52 W. Downer Place, Room 201, Aurora, IL 60506; 630-264-2334; admin@lauzen.com

The goal of this project is to establish a policy involving routine prenatal HIV-testing with the right of refusal. Studies conducted in 1994 showed that the administration of the antiretroviral drug zidovudine (AZT, a.k.a. ZDV) during pregnancy, delivery, and to the newborn could reduce HIV transmission from mother to child by two-thirds. Although most physicians are aware of this need for HIV testing, less than 75% of them will offer it. Current laws require "counseling" and written, informed consent for HIV testing. This can easily be done with routine HIV testing on pregnant women. "Counseling" would only take approximately 3 minutes and consists of information on the meaning of the test, availability of a confirmatory test, and availability of referrals and extra counseling. Written and informed consent can be obtained by integrating the HIV test into the standard battery of prenatal tests like syphilis and hepatitis. The combination of routine HIV testing on pregnant women, pre-test education and counseling, and AZT therapy will greatly reduce the number of children lost to HIV-infection and AIDS in the U.S.

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## **MAST CELL STIMULATION OF THE UROTHELIAL INFLAMMATORY RESPONSE**

### Presenter:

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### Mentor:

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Robert Batler, Urology Resident, Northwestern University Medical School, 300 E. Superior Street #11-714, Chicago, IL 60611; 312-908-1996

Mast cells are immune effector cells thought to be an important component of the innate immune response due to their presence at the host-environment interface. These cells have been studied intensely because of their ability to rapidly and completely release granules of inflammatory mediators in response to stimuli that include allergens and bacteria. Bladder tissues obtained from patients afflicted with interstitial cystitis (IC) contain elevated numbers of mast cells, and these mast cells show signs of chronic activation characterized by partial degranulation. Consistent with these observations, pro-inflammatory cytokines (e.g., IL-8) can be elevated in the urine of IC patients, suggesting chronic urothelial inflammation. Our study concerned the hypothesis that mast cells can actively stimulate urothelial inflammatory responses. A key regulator of inflammation is the transcription factor nuclear factor kappa B (NF $\kappa$ B), which stimulates the transcription of numerous pro-inflammatory genes. NF $\kappa$ B activation has been observed in urothelium cells in response to inflammatory bacterial components. Using a quantitative assay for the inflammatory response utilizing a luciferase reporter gene whose expression is dependent upon activated NF $\kappa$ B, we find that transfection of this NF $\kappa$ B-luciferase reporter construct into human urothelial cells induces luciferase activity in the presence of inflammatory stimuli. During the course of our study the capacity of mast cells to stimulate the urothelial inflammatory response was assessed.

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## EFFECTS OF RETINOIC ACID ON PLASMINOGEN ACTIVATOR RECEPTORS IN CANCER CELLS

### Presenter:

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### Mentor:

Dr. Rhonna Cohen, Associate Professor, Center for Molecular Biology of Oral Diseases, 530 E. Dent, Chicago, IL 60612; 312-413-0892; rcohen@uic.edu

The plasminogen activator (PA) system comprises enzymes and inhibitors that contribute to the growth and spread of certain types of cancer. Tissue type (tPA) and urokinase type (uPA) plasminogen activators are two such enzymes. These enzymes convert plasminogen into plasmin, which can degrade tissue (found in the extra-cellular matrix) and fibrin (found in blood clots), thus allowing the cancer to expand (metastasis). Retinoic acid (RA), a type of vitamin A, has been shown to suppress growth in both breast and prostate cancer, by inhibiting the cancer's ability to perform metastasize. Until now, the exact relationship between RA and the PA system was unclear. In this experiment, the effects of RA on uPA were tested. Proteins were first separated by weight by gel-electrophoresis. A fibrin overlay gel was then set on the protein gel. As was expected, the area of the protein gel with uPA lysed fibrin it came in contact with. When concentrations of RA ( $10^{-6}$  M,  $10^{-7}$  M,  $10^{-8}$  M) were added to the protein gel, less fibrin was lysed, but maximal lysis occurred at  $10^{-7}$  M. We conclude that RA can inhibit uPA activity.

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## CONTINUUM OF ASTHMA CARE: FROM OUTPATIENT EDUCATION TO INPATIENT CRITICAL PATHWAY EVALUATION

### Presenter:

Helena Knight, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Judith Arneson, RN, Department of Medicine, University of Chicago, 5841 South Maryland Avenue, MC 2007, B221, Chicago, IL 60637; 773-834-5983; Fax: 773-834-2238

Asthma is more accurately described as Reversible Obstructive Airway Disease. An asthmatic person's airways are inflamed and the surrounding muscles tighten, making it very difficult to breathe. Asthma is becoming much more common, especially in industrialized countries and poor areas. Based on the National Institutes for Health "Practical Guide for the Diagnosis and Management of Asthma," released in October of 1997, the University of Chicago (UC) developed a critical pathway for asthma. A critical pathway is a guideline to assist the practitioner in diagnosis and care of the patient. The inpatient critical pathway was implemented one year ago at the UC Hospitals to insure that all patients suffering from asthma exacerbations would get the best possible health care. Asthma is a serious disease, but it can be controlled. A unique part of the critical pathway at UC is the emphasis on the education of the patient. The hospital is now trying to evaluate the newly installed pathway. The most plausible way of evaluation at this point is comparing medical charts of patients admitted before the pathway and patients admitted afterwards. A significant improvement in asthma care is what the hospital hopes to see.

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

### Presenter:

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### Mentor:

Dr. Yuqi Zhao, Director of Molecular Diagnostics Laboratory, Children's Memorial Institute for Education and Research Northwestern University Medical School, 2430 Halsted St., No. 218, Chicago, IL 60614; 773-880-6608; yzhao@northwestern.edu

Vpr is an auxiliary protein found in the human immunodeficiency virus type 1. Highly conserved among HIV, Vpr is responsible for two major functions: viral activation and depletion of CD4 lymphocytes, both are major clinical manifestations of AIDS. Several Vpr-induced activities were observed during *in vitro* studies such as nuclear localization of the pre-integration viral complex, cell cycle G2 arrest, and cell death programming (apoptosis). Cells infected with a mutated *vpr* gene have been linked to long-time survival of HIV infected patients. Therefore, my research concentrated on screening for suppressors of Vpr cell killing activity by using fission yeast (*Schizosaccharomyces pombe*) as a high through put model system. Fission yeast strain 007 was transformed with *S. pombe* cDNA genomic library, then plated on minimal EMM plus

adenine plates with and without thiamine in order to control *vpr* expression. After four to five days of incubation at 30 degrees Celcius, the colonies on EMMA+T plates were used to calculate transformation efficiency and the EMMA plates were screened for suppressors. Cell colonies that thrived on EMMA plates, in spite of *vpr* expression, were considered potential suppressors. These results were confirmed by PCR and electrophoresis to ensure that the *vpr* gene was not mutated. More than 20,000 transformants have been screened and three were identified as ribosomal protein 14, ribosomal protein L11, and heat shock protein 16. These results are useful in furthering our understanding of Vpr and its role in viral pathogenesis. Identification of natural proteins that suppress Vpr effects may potentially lead to new anti-HIV therapies.

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## **ION PROPULSION**

### Presenters:

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Mengyao Liang, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

Christopher McLaughlin, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

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The goal of this inquiry is to develop an efficient, working ion propulsion system. We will try to improve on previous designs. This year, we gathered materials and developed designs for our upcoming construction of the ion propulsion unit. At this point we have several designs and are deciding which one to construct. We will most likely use the standard design, which utilizes an ionization chamber to ionize molecules of a gaseous propellant (most likely Xenon). The acceleration can be achieved through several means; the most commonly used method is acceleration through the use of an electric gradient. Since we have most of the materials, our goal is to have a working model by the end of the next school year.

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## **GLOBAL COMPANIES AND CULTURAL HUMAN FACTORS**

### Presenter:

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### Mentor:

Professor Patrick Whitney, Director, Institute of Design, Illinois Institute of Technology, 350 N. LaSalle Street,  
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Some of today's multi-national companies, mostly based in the US, envision users of their products in other countries as having similar values, needs, or sense of time and space as American users. Subsequently, they design the same products for all countries with good intentions, but those products do not sell because of cultural misfits. In reality, cultural differences play a major role in the design of products and services. Our goal is to inform global companies on how to do research projects so that they can get a better understanding of cultural differences. We would create a standard research technique that could be used by different teams around the world in order to discover how culture affects daily activities and how companies can design products and services suitable for each culture's needs.

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## **LAKE SUPERIOR, ITS PERCEPTION, AND ITS UTILITY: A STUDY OF HUMAN INFLUENCE UPON THE NORTH WOODS, SPANNING FROM THE VOYAGEURS TO THE PRESENT**

### Presenter:

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### Advisor:

Claiborne Skinner, Ph.D., History and Social Science, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road,  
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The Great Lakes, the largest collection of fresh water in the world, throughout the last four centuries have seen remarkable changes. The appearance of Europeans, trade and commerce, wide spread industrialization, and heavy pollution count among these. While this invasion of humans, at least in modern times, has been detrimental to the condition and spirit of the lower lakes, Lake Superior and the surrounding area has emerged remarkably unscathed by centuries of harmful presence. The purpose of this Inquiry was to examine this phenomenon, and, by examining the human perceptions of Lake Superior during

this time span, to perhaps gain an insight as to how this shining jewel of North America survived the age of Exploration and Industrialization.

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## **ARTIFICIAL INTELLIGENCE, MEMETICS, AND COGNITIVE SCIENCE A.K.A A JOLLY ROMP IN THE EVOLUTIONARY DESIGN SPACE**

### Presenters:

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### Mentor:

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Humans are descendants of genetics and memetics, two evolutionary systems that have intertwined to produce today's culture and technology. Memetics is the evolution of ideas and culture that began as a result of changes induced by genetic evolution. These two processes have been contained in the human body but, as artificial intelligence develops, the memetics will decouple from genetics when it is transferred onto an independent substrate. This year, we investigated our criteria for intelligence, which includes an inextricable feedback loop between dynamic perception and problem solving. Technological developments based on the research into intelligence and evolutionary systems will alter people's ideas of the definition of humanity, life, and existence, along with revolutionizing the standard of living.

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## **REAL SCIENCE: DOLPHINS, PRINCES OF THE OCEAN**

### Presenters:

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Jennifer Mo, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisor:

Britta McKenna, Coordinator of Kid's Institute, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5073; britta@imsa.edu

Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. This dual platform CD-ROM targets students in grades 3-5 and is distributed free of charge to over 600 schools in Illinois and beyond. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science through the use of multimedia movies and interactive supplements developed using Adobe Premiere, Photoshop and Macromedia Director. For ages, dolphins have amused children and adults alike with their high-jumping, ball-bumping antics. Over the course of this year, we have captured the essence of the dolphin and infused it into an education, but enjoyable experience for third to fifth graders. Our article acquaints students with basic information about the dolphins, such as their respiratory physiology, natural adaptations for survival in their environment, diet, communication, commonly seen dolphin "tricks," and the different species of dolphins. Our interactive game will provide both an entertaining yet challenging assessment of their newfound knowledge.

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## **CLONING THE GENOMIC BREAKPOINTS OF *AML1* AND *ETO* IN LEUKEMIA PATIENTS WITH t(8;21)**

### Presenter:

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### Mentors:

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One of the most frequent chromosome translocations in *de novo* acute myeloid leukemia (AML), myelodysplastic syndrome (MDS), and therapy-related AML/MDS is t(8;21). *AML1* at 21q22 is fused to *ETO* at 8q22 in t(8;21), resulting in a fusion gene that plays an important role in leukemogenesis. To clone the genomic breakpoints in *AML1* and *ETO*, the Kasumi 1 cell

line and 31 leukemia patients all with t(8;21) were studied using Southern blot analysis. Rearranged bands were detected in intron 5 of *AML1* and introns 1a and 1b of *ETO* in 29 patients. These bands were found to be clustered in several regions around topoisomerase II cleavage sites. Long-distance PCR with *AML1* and *ETO* primers amplified the genomic *AML1-ETO* and *ETO-AML1* fusions in the cell line and 27 patients. Direct sequencing of these fusions in Kasumi 1 showed a deletion of 518bp in intron 5 of *AML1* and a deletion of 18098bp in intron 1a of *ETO*, while in three other patients, an insertion of 1 to 9 bp was detected at the break junctions. This study indicates a possible clustering of genomic breakpoints in *AML1* and *ETO* in t(8;21) and will help to clarify mechanisms of chromosome recombination in t(8;21).

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## **FINANCIAL SPECULATION FOR MONETARY ALLOCATION IN US AND FOREIGN MARKETS**

### Presenter:

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### Mentor:

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Morgan Stanley Dean Witter & co. (NYSE:MSWD) is a preeminent global financial service firm with well recognized brand names including Morgan Stanley Dean Witter and Discover Card, among others. MSDW combines the strength of innovative financial products and services with a powerful distribution capability to individual and institutional clients. MSDW's products and services include underwritten public offerings of securities, mergers and acquisitions and other financial advisory services, securities sales and trading, research, consumer credit and investment, and asset management services. MSDW's services and products are provided to a large and diversified group of clients and customers, including corporations, governments, financial institutions and individuals around the world. MSDW maintains leading market positions in each of its three businesses – Securities, Asset Management and Credit Services. I have in essence, worked with MSDW to learn how speculation and market analysis is carried out, along with maintaining client relationship as well as building new ones.

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## **THE IROQUOIS THEATER FIRE: A HISTORICAL EXAMINATION OF THE TRAGEDY THAT CHANGED THE WORLD**

### Presenter:

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### Advisor:

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The Iroquois Theater fire is one of the deadliest tragedies in world history, and it occurred right here in Chicago on December 30, 1903. By examining Chicago at that time, as well as construction of the theater and the origin of the fire, we can determine what exactly went wrong that cost the lives of 602 people, mostly women and children. By determining what went wrong, I hope to demonstrate the consequences of the fire, specifically how fire codes changed immediately afterwards, and how Chicago became a frontier city in building codes and fire safety. I arrived at these goals using a variety of sources, from personal stories to court room testimony to interviews with modern day experts on fire safety. Furthermore, by investigating what went wrong and how codes adapted to these changes, we can see the significance of this event as it relates to modern day entertainment, the economy, and even international relations and business.

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## COMPUTABLE NUMBERS USING TURING MACHINES AND OTHER FINITE COMPUTATIONAL MODELS

### Presenter:

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### Advisor:

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A number is computable if and only if a Turing machine can sequentially generate its digits. A Turing machine consists of a read/write head moving along an infinite tape. It reads symbols, and writes corresponding symbols based on a program. Rational numbers are clearly computable since they either terminate or become periodic. In 1936, Alan Turing showed that the computable real numbers are not countable using Cantor's diagonal process. However, most irrational numbers are still not computable. The study of computability is not limited to Turing machines. It has been shown that there are computationally equivalent models such as random access machines and Boolean circuits. Therefore, computability can be determined by proving it for any one of the types of machines. Using techniques such as Newton's method and Taylor polynomials, it was found that most of the common real numbers occurring in real life are computable.

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## THE NEAREST-NEIGHBOR RULE REPRESENTATION OF BOOLEAN FUNCTIONS

### Presenter:

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### Mentor:

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A Boolean function takes on inputs that are  $n$ -dimensional vectors with components 0 or 1, and outputs either 0 or 1. A nearest-neighbor rule representation of a Boolean function consists of two sets of points in  $\mathbb{R}^n$  called prototypes. Given such a representation, the function value for a vertex of the  $n$ -dimensional unit cube is determined by the set to which its nearest prototype belongs. This representation has many uses in pattern recognition and artificial intelligence. Currently, we are interested in minimizing the number of prototypes needed to represent any Boolean function.

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## THE NEW AND IMPROVED PROJECT SCHOOL VISIT

### Presenter:

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### Advisor:

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Serving approximately 600 students at 12 public and parochial junior high schools, Project School Visit, an admissions office initiative, sought to expand the 2001 program by partnering with Science Explorers. The resulting science curriculum, "What's for Breakfast?" serves as a "teaser" to spark an interest in IMSA among visiting eighth graders. Developed by 20 IMSA students during the 2001 intersession, the "What's for Breakfast?" curriculum offers visiting students an interactive laboratory experience in addition to the traditional admissions tour. This hour-long curriculum encourages sixth, seventh, and eighth grade students to consider various substances in food and introduces the concept of controls in an experiment. Students conduct tests for starch, glucose, and protein in traditional breakfast foods. Depending on the educational background of the students, these activities either reinforce previous knowledge or serve as a hands-on introduction to chemistry and basic laboratory procedures. The inconsistency in educational backgrounds among program participants provides a challenge for all the IMSA students involved in the program. Serving as teachers in the program, the IMSA student participants gain a greater appreciation for educators and curriculum developers as well as a clearer personal understanding of food science and experimental procedures.

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## **CREATING HABIT: THE INTERACTION OF CUSTOM AND CLOTHING**

### Presenter:

Amanda Lucek, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Advisor:

Clay Sewell, Fine Arts, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506;  
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Symbolism exists in the unconscious mind. The mind will take one's emotions, opinions, and sense of self, and attempt to make them into real, tangible objects for everyone else to see. It is through these symbolic objects that personal and cultural values manifest themselves in clothing. This project has been an attempt to interpret this symbolism. It has been a look into the Why of fashion that goes beyond, and sometimes even inhibits, practical needs. In addition to reading and researching, I tried to understand metaphorical self-expression by bringing it to a conscious level in myself. I used specific values that I have as the inspiration for creating several garments from scratch. I then examined my own representational choices of color, line, cut, style, and other elements of adornment in order to find connections between the realm of the emotional and the realm of the visual.

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## **LIVE RECORDINGS OF ORIGINAL COMPOSITIONS**

### Presenters:

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### Advisor:

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Music is the language of the soul. It's the rhythm inside you as you wake up in the morning ready to face the world. Music soothes the savage beast. Well, two young men love music so much they had to record it. Most record companies use big soundproof rooms and have fancy synthesizers. They get famous recording artists and use expensive instruments. Well, we didn't have all that. In fact, we had very little of that. During our inquiry, we raised questions on the best way to record. What's your base track? What do you do when the beat constantly gets off? What kind of sound quality do you want for different tracks? Is the rhythm smooth or mellow? Does this beat work with this song? These are just a few of the questions that were raised during our studies. In trying to solve these questions, we came up with a lot more problems and even more questions. However, this was okay because we were doing something we enjoyed and it was extremely fun. We recorded original music using a 4-track open wheel, keyboard, 5-stringed bass, and a drum set. Through the limited amount of equipment and our ingenuity we were able to produce beautiful music. Since this is something we both wish to pursue further we enjoyed getting a head start on it.

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## **RISK FACTORS FOR NECROTIZING ENTEROCOLITIS IN EXTREMELY LOW BIRTH WEIGHT INFANTS**

### Presenter:

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### Mentor:

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Technological advances have decreased mortality rates of high-risk newborns. As a result, data on these infants has become more available. Necrotizing enterocolitis (NEC) is the leading cause of emergency surgical treatment in neonates. The objective was to evaluate the risk factors that increase an extremely low-birth weight newborn's chance of developing NEC. We gathered charts on infants born between 1998-1999, with birth weights less than 1000 grams. Data was collected regarding the following maternal information: age, race, parity, prenatal care, medication, drugs used, and doses of betamethasone. Infant data was collected for APGARs, gestational age, birth weight, doses of surfactant, presence of NEC, presence of patent ductus arteriosus (PDA), use of pressors, use of steroids, use of indomethacin, presence of intraventricular hemorrhage (IVH), and number of days on ventilator. Of the 217 newborns meeting the inclusion criteria, 15.7% were diagnosed with NEC (N=30). The mean birth weight for infants with and without NEC, respectively, was 770 grams and 757 grams. Of the neonates with NEC, 50.0% also had IVH. In comparison, 30.5% of the neonates without NEC developed

IVH. PDA occurred in 56.7% of the infants with NEC and in 33.2% of the neonates without NEC. Using statistical analysis, we found no significant differences in risk factors between the group with NEC and the group without NEC.

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## **BLOOMBERG, L.P. – FIELD OPERATIONS**

### Presenters:

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Jearly Beals, II, St. Ignatius College Prep, 1076 W. Roosevelt Rd, Chicago, IL 60608; 773-769-3549; jbeals@imsa.edu

### Mentor:

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Information technology and support is vitally important to the financial services industry. Information flow is mission-critical to any firm; efficiency and dependability are required to ensure the needs of consumers are met. The role of information technology grows increasingly important with today's market volatility. One of the keys to the success of Bloomberg is the ability to adapt and more importantly respond to growing demands for technology support. In our study, we examined the various aspects of Bloomberg Field Operations, workload, coverage zones and productivity in the area of technology support. As a result of our research, we provided insight into the daily assignments of the Bloomberg Field Operations employees and vendors. The information is compiled from raw data, which is then synthesized into a weekly executive report. This report is distributed worldwide to help regional managers better determine the efficiency of field operations as compared to historical data. The value and importance of historical data is that it shows trending and seasonal anomalies. In conclusion, the information from this report is used as a determining factor in the number and geographic locations of Bloomberg vendors and employees.

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## **GENERATING ANTIBODIES TO A VIRAL REPLICASE ENZYME**

### Presenter:

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### Mentor:

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Mouse Hepatitis Virus (MHV) is a RNA virus that utilizes RNA dependent polymerase (replicase) to make copies of its genetic information. The purpose of this project was to make antibodies to a specific region and to use the antibodies to identify the protein with virus infected cells. To produce an antibody, we replicated the region of interest using a RT-PCR reaction. This region was the D-3 region colony. Next we had to induce that protein; into a GST-fusion protein cells and replicated those cells. Then we induced them in bacteria, then purified our protein of interest. Next we purified the protein from the bacteria and injected it into test rabbits. We bled the rabbits every two weeks and performed an ELISA assay to see if the antibody was present. We then performed Immunoprecipitation to see if our protein was present in virus infected cells. We are now in the process of doing these processes with the D-24 region to produce another antibody. We successfully generated a specific anti-sera that recognizes a replicase protein in virus-infected cells.

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## **THE EFFECTS OF METHANOL ON WASTEWATER REFINERY TREATMENT**

### Presenter:

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### Mentor:

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Wastewater treatment plants are created to remove many impurities from the water. These treatment plants can only handle certain limitations of pollutants in the wastewater. For example, many plants are designed to handle only a specific level of COD (Chemical Oxygen Demand) or BOD (Biological Oxygen Demand). BOD and COD are interrelated. If either of the levels are exceeded, complications may occur, ranging from a lowering of plant efficiency up to the shutting down of a plant. Methanol is a compound known to increase the COD of wastewater. Using a respirometer and wastewater and activated

sludge from the BP Whiting refinery, the effects of different amounts of methanol on the water's BOD were tested. From the analysis of results, it appears that methanol does increase the BOD of wastewater, but starts to have toxic results at around a 40% (120 mg/l) increase in COD. Further testing will be undergone to investigate the different mechanisms by which activated sludge can biodegrade higher concentrations of methanol.

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## HEPARANASE GENE EXPRESSION AND REGULATION

### Presenter:

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### Mentor:

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The study focuses on the metastasis of cancer cells and its relation with the protein and enzyme known as heparanase(HPR). This enzyme seems to be degradative element which destroys the extracellular matrix, allowing infiltration of the cancer cells into the lymphatic channel and the blood stream. We examined 93 samples of thyroid cancer for the expression of heparanase using *in situ* hybridization. The 93 samples contained cancers of different metastatic potential. Out of the samples, 49 of 62 papillary carcinomas, 3 of 4 medullary carcinomas, and 3 of 3 follicular carcinomas showed positive expression of heparanase. However, only 4 of 19 follicular adenomas, and 2 of 5 Hurthle cell adenomas expressed HPR positive. Clinicopathological analyses shows that thyroid tumors which have already migrated to distance sites and infiltrated the lymph nodes have a higher rate of expressing the heparanase enzyme than benign tumors which show non-metastatic tendencies. To confirm the above results, we performed Reverse transcriptase (RT)-PCR analysis of 10 thyroid tumor cell lines. The cell lines that showed metastatic potential such as papillary, follicular, and anaplastic carcinoma cell lines showed HPR expression. These results together show that the expression of HPR is expressed differently in different types of thyroid neoplasms, and that HPR expression is associated with the metastatic potential of thyroid carcinomas.

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## KOREAN COSTUMES OF THE CHÔSON PERIOD

### Presenter:

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### Mentor:

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The Field Museum of Natural History is home to a collection of Korean costumes from the Chôson period (1392-1920 AD). Included in this collection are three royal bridal robes, or *hwarrot*, which were brought to Chicago for display at the 1893 World's Columbian Exposition. With the exposition's end, the robes were given to the Field Museum, which had been incorporated that same year. As part of an official presentation organized by the Korean government, the costumes brought Korean culture to the United States during the brief window of time, roughly between 1880 and 1905, in which Korea, the so called Hermit Kingdom, was open to the outside world. Korea was closed again in 1905 when it became a colony of Japan. Due to the museum's scant early records, little else is known about the *hwarrot* collection, except that the robes are estimated to be from the later part of the 19<sup>th</sup> century and most likely belonged to princesses of the royal house. It cannot be denied, however, that the articles possess immense historical value, especially in light of the fact that most royal costumes were destroyed during the Japanese occupation and the Korean War (1950-53). Along with this historical significance, the *hwarrot* collection is also of cultural and artistic merit. The costumes bring us back to a period during which the *hwarrot* with its intricate embroidery and design conveyed symbolic meaning both to the wearer and to the wedding party. Therefore, in examining the collection, it is necessary to place the *hwarrot* in relation to the historical, cultural, and artistic climate of Korea during that very important period.

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## **THE DEVELOPMENT AND IMPLEMENTATION OF FUNCTIONAL MAGNETIC RESONANCE IMAGING IN THE STUDY OF NEURAL PAIN PERCEPTION**

### Presenters:

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### Mentor:

Dr. A.Vania Apkarian, Department of Physiology, Northwestern University Medical School, Chicago, IL 60611

Despite modern technology in the various fields of medical research, not much is known about chronic pain. Where in the brain is this perceived? What can be done to avoid it? What are some possible cures? In our study, we are striving to better understand pain through neuroscience. Functional magnetic resonance imaging (fMRI) is used to understand the complexity of brain networks involved in pain. By inflicting painful stimuli, such as a stretching of the sciatic nerve in chronic back pain patients, we will work to identify the cortical regions that may be involved in chronic pain. Along with the brain images, an extensive graph depicting the pain endured by the patient is needed to match brain activity with physical sensation. Also, outside of the fMRI, chronic pain patients are asked to rate their pain. A perceptometer, with which the patient uses the space between the thumb and index finger to represent experienced pain, recorded the patient's pain over a given interval and was stored as data to demonstrate the fluctuation of pain over time. A lack of commonality existed among the patients using the perceptometer, hence, we have created a training program, with the use of a transient line, that will test the accuracy of each patients finger mobility prior to their rating.

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## **ARCHITECTURE BASED ON COMPUTER AIDED DESIGN (CAD)**

### Presenter:

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### Mentor:

Richard E. Ogren, Downers Grove North High School, Downers Grove, IL 60126

The aim of this mentorship was to focus on residential drawing and design. I was given the opportunity to develop a preliminary drawing of a house design. Emphasis was placed on the development of architectural drafting skills with the use of professional tools, equipment and materials like those of an architectural draftsman. The plans were made using the Computer Aided Design (CAD) Program. Floor plans, left, right, front, and rear elevations were all part of the design process. After the plans were finalized a model was created out of foam board.

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## **INVESTIGATING THE ROLE OF DERMATAN DISULFATE (INTIMATAN) IN AMELIORATING PLATELET ACTIVATION RESPONSE IN HEPARIN-INDUCED THROMBOCYTOPENIA**

### Presenters:

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Heparin-induced thrombocytopenia (HIT), an abnormal platelet activation response that can lead to severe thrombotic complications, is caused by antibodies to the heparin-platelet factor 4 complex. A promising new possibility to ameliorate the HIT response and prevent progression to overt thrombosis is the antithrombotic agent intimatan, derived from dermatan sulfate. The focus of this study was to determine the extent to which intimatan inhibits heparin-mediated platelet activation to ameliorate the HIT response. Whole blood was combined with clinically diagnosed HIT serum and varying concentrations of heparin as the HIT-response activator in combination with intimatan as a HIT-response inhibitor. Dermatan sulfate was used as a control. Samples were analyzed using flow cytometry to measure markers of platelet activation (platelet microparticle

formation, P-Selectin expression). Intimatan and dermatan sulfate were capable of blunting the platelet activation induced by HIT antibodies. However, intimatan and dermatan sulfate were inhibitory only at low (<1 mg/ml) concentrations. At higher concentrations, both caused platelet activation on their own. No noticeable differences were observed in the inhibitory effects of intimatan versus those of dermatan sulfate. These data suggest that low doses of intimatan may be useful to reduce the risk of clinical complications in patients with antibody to heparin.

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## **HEART RATE VARIABILITY AND IMMUNE RESPONSE AS EARLY INDICATORS OF NEONATAL SEPSIS**

### Presenter:

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### Mentor:

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Neonatal sepsis is the clinical term applied to any potentially fatal bacterial infection in the premature infant. In proven cases of sepsis, morbidity and mortality rates are alarmingly high. If it were possible to detect septic processes earlier, however, it would give the physician a time advantage for proper intervention. It is known that compared with normal infants, septic neonates display cardiac instability as well as differential spectra of cytokines. The purpose of this study is to investigate these factors using more sensitive measuring tools in order to detect sepsis earlier. For cardiac instability, we implemented Recurrence Quantification Analysis (RQA) to examine subtle changes in the ECG and RR intervals. ECG signals will be recorded in ten-minute segments from non-septic, suspected septic, and septic infants over a period of one week. At the same time, the infants will also be tested for levels of leptin, IL-6, and C-reactive protein. There is prior evidence suggesting that these blood-borne agents might constitute early warning markers of stressed immune system activity.

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## **MOLECULAR GENEEOLOGY; A STUDY OF THE THREE DOMAIN SYSTEM**

### Presenter:

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### Advisor:

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In this inquiry, I wanted to examine the three domain hypothesis, which groups organisms into bacteria, archaeobacteria, and eukaryotes by the relatedness of their small subunit rRNA (SSUrRNA). To look at these differences in molecular geneology, I isolated the sequence for ribosomal RNA from several organisms. There is very little difference in rRNA between closely related organisms, as ribosomes perform crucial functions. However, over the long periods of time necessary for evolution to take place, there have been gradual shifts in the crucial areas of the code for rRNA. After isolating the various DNAs, I used SSU primers to isolate the sequences for rRNA, and then ran PCR on the samples so that they could be seen after electrophoresis. Archaeobacteria are unavailable to me, but I found that all eukaryotes were more related to each other than to the bacterial sample, which is in accordance with the three domain hypothesis.

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## **ANALYSIS OF GLOBAL MARKET TRENDS**

### Presenters:

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### Mentor:

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In the financial world, investors spend much time and money looking for stock tips that will make them successful traders. Many times, the most successful stocks and markets cannot be found within the United States. Emerging markets throughout

the world grow on average three times as fast as the established ones. For this reason, more and more investors are turning overseas to spend their money. Although these lively markets can flourish overnight, they can also crash just as quickly leading to disaster. These global markets provide for a fast-paced, high-risk investment atmosphere where some get rich while others fall. A look at the top 5 performing global markets as well as those that have struggled will prove that international trading is truly a precarious business

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## **A COMPARATIVE ANALYSIS OF BROKERAGE FIRMS**

### Presenter:

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### Mentor:

Michael DeHaven, History and Social Science, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; 630-907-5000; dehaven@imsa.edu

The internet has dramatically increased the capability of the individual investor to directly control his own portfolio. Analysts from the Wall Street Journal estimate that 25% of all trades completed by individual investors are executed by web based brokerage firms. Several market consultants contend that the current volatility in the market is due in part to the increase in the number of investors, many of which trade primary through online brokerage firms. This research project focused on the advantages and drawbacks of traditional and online methods of trading. It was found that while online brokers generally offer discounted rates, a wider range of service hours, and a lower minimum balance, traditional brokers provide more reliable service and better customer service. Due to the limited amount of time online firms have been executing trades, little government regulation has been passed to protect the individual entrepreneur. Online methods of investing, therefore, leave American capitalist more susceptible to offshore frauds and computer glitches. Despite the various risks associated with this new industry, internet trading has become valuable tool to many educated investors. This technology has changed how individuals choose to invest in today's markets.

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## **WILL DISRUPTING THE S100B DIMER REDUCE GLIAL ACTIVATION AND INFLAMMATION?**

### Presenter:

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### Mentors:

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Amy Lam, Ph.D., Postdoctoral Fello, Department of Cell and Molecular Biology, Northwestern University Medical School, Chicago, IL 60611-3008

The astrocytic, calcium binding protein S100B stimulates neurite outgrowth at nM concentrations, suggesting that S100B aids in the regulation of neuronal survival and differentiation during development. However, at higher concentrations S100B can stimulate excessive production of inducible nitric oxide by glia (astrocytes, microglia), which can be harmful to neurons and can cause neuronal death. This is supported by the finding that S100B is over expressed in Alzheimer's disease, epilepsy and other chronic neurodegenerative diseases. S100B exists as a dimer forming both covalent and non-covalent interactions. The nourishing properties of S100B on neurons require disulfide covalent bonds. When these bonds are disrupted, S100B can no longer support neurons, but can still activate glia to produce harmful inflammatory molecules. We hypothesize that the disruption of non-covalent interactions in the dimer will reduce glial activation. In this study, we mutated the S100B protein lacking the cysteine residues (S100B-C68V84S), which cannot form covalent interactions, using site directed mutagenesis. We tested S100B proteins in which amino acid residues 6, 74, and 75 were mutated (dcysS100B—C68V84S-[74,75]K) and (dcysS100B—C68V84S-[6,74,75]K), for activation in cultures of rat brain astrocytes. Our results show that no significant glial activation reduction occurred upon mutation of these residues.

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## **IN-VITRO INHIBITION OF HIV-1 BY LEUKEMIA INHIBITORY FACTOR IN RANDOM DONOR PERIPHERAL BLOOD MONONUCLEAR CELLS**

### Presenters:

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### Mentor:

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Previous studies have shown that Leukemia Inhibitory Factor (LIF), has an effect on the vertical transmission of viral diseases from mother to infant. More specifically, increased LIF expression in placental tissue has been shown to decrease the likelihood of HIV-1 transmission to infants. Comparable studies done on thymus tissue have also shown inhibitory activity of LIF. We decided to study the effects of LIF in-vitro in continuous lymphoid cells lines and random donor Peripheral Blood Mononuclear Cells (PBMC's) infected with three different strains of the HIV-1 virus. The strains of virus used were HIV-1<sub>ME46</sub> (lymphocyte and monocyte tropic), HIV-1<sub>Bal</sub> (monocyte tropic), and HIV-1<sub>Lai</sub> (lymphocyte tropic). Continuous cell lines did not show LIF activity due to lack of CD130 expression. The random donor PBMC's expressed varying levels of cellular gp130-LIF $\beta$  receptor (range<1% to 85%). The bioactivity of LIF is dependent on the presence of the gp130-LIF $\beta$  receptor. Depending on the HIV-1 isolate used and degree of CD130 expression in PBMC's, LIF inhibited the HIV-1 virus in a tropism-independent manner with IC<sub>50</sub> values between 0.1 pg/ml and 0.7 pg/ml. In-vitro results support previous in-situ studies showing LIF bioactivity against HIV-1. Future mechanistic studies will require the establishment of a more reliable in-vitro cell system.

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## **AN INVESTIGATION OF LOW-ENERGY ELECTRON CLOUD INTERACTIONS WITH HIGH-ENERGY PARTICLE STREAM**

### Presenter:

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### Mentor:

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I have studied the physics of the Advanced Photon Source (APS), a high-energy particle accelerator, located at Argonne National Laboratory, Illinois. Particles are first accelerated up to an energy of 7 GeV, with velocities nearing the speed of light. They are then injected into the storage ring where they emit synchrotron radiation in the form of x-rays. Some of the x-rays collide with the interior casing of the storage ring and produce electrons through the photoelectric effect. This interaction produces a chain reaction and causes a low energy electron cloud to fill the interior casing of the storage ring. A number of planar retarding field analyzers were used to examine the cloud and its properties. By collecting data from the analyzers and using an appropriate computer model, my objective was to find the pattern these low-energy electrons were traveling in, so as to better understand the chain reaction. The data from the analyzers were used to determine the configuration of the electron cloud in the z-direction while software developed at Berkeley Laboratory was utilized to describe composition in the x-y plane. It is hoped that in the future, this research can be used to build better accelerators and improve existing ones.

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## **THE KIRBY-BAUER ASSAY IN RELATIONSHIP TO STUDENT INQUIRY**

### Presenter:

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### Advisor:

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Various natural substances were tested using a modification of the Kirby Bauer assay to determine whether they inhibit bacterial growth. The procedure involves plating an overnight culture of *E. coli* HB101, or other bacteria, on Luria-Bertani agar and then placing filter disks soaked in a solution of the test product onto the agar surface. After incubating the plates overnight, they are observed for zones of growth inhibition around the disks. From this project, garlic, cloves, madras curry

powder, tea tree oil, and Sunbreeze oil (a manufactured oil containing cassia, eucalyptus, and peppermint oils) were found to inhibit bacterial growth. This inquiry also involves writing an article on how this modified Kirby Bauer assay can be used to promote student inquiry. For example, students can choose which bacteria and which substances to test, thereby designing their own experiments. Test substances can include but are not limited to spices, essential oils, citrus fruit extracts, other plant extracts, and cleaning products. The goal is to spark student interest in science, to promote scientific thinking, to increase comfort in experimentation, and to enhance laboratory skills. This project will culminate in an article that will be submitted to a science teaching journal for publication.

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## **EFFECTS OF LOW MOLECULAR WEIGHT GLYCOSAMINOGLYCANS ON TAU PHOSPHORYLATION**

### Presenter:

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### Mentors:

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Alzheimer's disease (AD) is pathologically defined by neurofibrillary tangles (NFTs), senile plaques, and neuronal degeneration. Through protein aggregation, these plaques and tangles are thought to lead to neurodegeneration. Proteoglycans (PGs) and high-molecular weight (HMW) glycosaminoglycans (GAGs) are both colocalized with the Beta amyloid ( $A\beta$ ) peptide in senile plaques and hyperphosphorylated Tau in NFTs of AD, and are thought to play a significant role in the formation of both senile plaques and NFTs. Previous research has shown low-molecular weight (LMW) GAGs can block  $A\beta$  induced tau conformational changes in an animal model of AD-like neuropathology. To identify the mechanism of action of these LMW GAGs, we tested whether LMW GAGs can block  $A\beta$  induced tau conformational (measured by the tau-2 monoclonal antibody) and/or phosphorylated changes (measured by PHF-1 and Alz-50 monoclonal antibodies) in a human neuroblastoma cell line (SH SY-5Y). We also studied whether LMW GAGs can block the tau phosphorylation induced by Okadaic acid (a phosphatase inhibitor) in this cell line. These studies will help us begin to delineate the usefulness of LMW GAGs as a possible treatment for AD.

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## **DETECTION OF OVARIAN AUTOIMMUNITY**

### Presenter:

Samina Shaikh, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

J.L. Luborsky, Ph.D., Department of Obstetrics and Gynecology, Rush Medical College, 1653 W. Congress Parkway, Chicago, IL 60612

Autoimmunity is a common disorder. One out of thirty-one individuals has an autoimmune disorder. Different autoimmune diseases attack different targets of the body. A recently discovered disorder of the ovary results in infertility or premature menopause. Identification of individuals with Ovarian Autoimmunity involves testing of immune system products called autoantibodies, proteins that attack self. The need for an antibody test, to test for Ovarian Autoimmunity started ten years ago, and many of the procedures are still utilized by us. One method still uses tests for cellular components in the ovary and another procedure tests for components in the eggs. Researchers show that immune cells misrecognize foreign protein, making the recognition mechanism defective. The object of our study was to determine if assessments of protein recognition and antibody test correlate.

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## **PREDICTING THE EFFECTS OF D-AMPHETAMINE BASED ON PERSONALITY TYPE AND CORTISOL LEVELS**

### Presenter:

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### Mentors:

Dr. Harriet deWit, Associate Professor, University of Chicago, Department of Psychiatry, 5841 S. Maryland Ave., Chicago, IL 60637; 773-702-1537

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Clinical studies have shown the effects on d-amphetamine on the body, both psychologically and physiologically. The effects of d-amphetamine, in relation to personality type and initial cortisol levels in the body, were investigated using two previously collected samples of subject data. Subjects participated in a multi-session, placebo-controlled survey in which either a placebo or a dose of cortisol was taken. Additionally, a dose of either placebo or d-amphetamine was administered to each subject. After each time period following dosage, subjects completed a computer evaluation based on the effects perceived during the time period. Subjects rated different description words (i.e.: elation, anger, fatigue, arousal, etc.). Data taken from the Placebo-Amphetamine session were analyzed using baseline cortisol levels and the categorized results of a personality type indicator taken by each subject prior to the study.

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## **SURVEY OF QUALITY OF CARE IN PATIENTS UNDERGOING ENDOSCOPIC PROCEDURES AND LIVER BIOPSY**

### Presenter:

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### Mentor

Thelma E. Wiley, M.D., Medical Director & Liver Transplant, Digestive Diseases and Liver Center (MC 787), University of Illinois at Chicago Medical Center, 840 South Wood Center, Chicago, IL 60612; 312-996-3800; twiley@uic.edu

Patients with chronic liver disease often need to undergo procedures such as liver biopsy and other endoscopic procedures such as Upper Endoscopy (EDG), Colonoscopy, and Flexible Sigmoidoscopy. As healthcare professionals we think that a patient's anxiety level or knowledge of procedure may affect the quality of care. When a patient is scheduled for any procedure he or she is given a packet by the doctor or nurse as well as verbal instruction regarding the procedure. Through survey the patients were evaluated regarding their perception of these procedures, to assess anxiety and quality of care. A two-part survey was constructed which consisted of demographic information and 14 questions regarding knowledge and anxiety related to the procedure. The survey was orally administered to each patient before the proposed procedure and after recovery from the procedure. In general, most patients have been willing to participate in the study. I was unable to include several patients in the study due to language barrier, patient refusal, or other medical conditions, which precluded their participation (dementia, tracheostomy).

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## **INQUIRY ON INQUIRY**

### Presenters:

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### Advisor:

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The purpose of this inquiry is to investigate the nature of inquiry-based learning as well as look into the feasibility of using inquiry as a primary form of teaching in school. We expect to see many advantages in the use of inquiry over traditional methods used in schools now. We think that inquiry-based learning will increase the possibility for creative thinking and potential for students at all levels. This year, we prepared a survey to go out among members of the IMSA community. We

plan to have this survey distributed and analyzed by Presentation Day. We will also be examining the changed roles students and teachers will play, and what personality traits might lead to success in this type of environment. We will be conducting considerable research in the areas of educational psychology, brain mechanics, cognitive thought, and many more. All bibliographical information on the researchers, along with our project questions and research/conclusions, will be available to anyone who wishes to view them at <http://www.imsa.edu/project/ioni>.

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## **THE ROLE OF GLUTATHIONE ON THE DIFFERENTIATION OF TH0 LYMPHOCYTES**

### Presenter:

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### Mentor:

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Glutathione (GSH), a natural tri-peptide, is found in most organisms. Although the primary role of GSH is the control of intercellular oxidative states, it also has many secondary functions. In mammals, GSH depletion has a profound effect upon the regulation of T-cell mediated immune responses. Ethanol-consumption in mice diminishes GSH levels; and consequentially the Th1 response is down regulated while the Th2 response is up regulated. To test the responses of T-cells to glutathione depletion, GSH is depleted in BALB/c mice through the use of buthionine sulfoximine (BSO) or diethyl maleate (DEM). GSH levels of the spleen tissues in the mice are then measured through the use of the Tietze Assay. The spleen cells are also co-cultured with naive antigen specific T-cells from T cell receptor transgenic DO11.10 mice. Interferon gamma (IFN $\gamma$ ) and interleukin 2 (IL-2) levels are measured through the ELISA. It has been found that GSH depletion down regulates IFN $\gamma$  levels with no effect on IL-2 levels. By testing the role of GSH depletion on the production of Th1- and Th2-associated cytokines, we hope to determine whether GSH alone modulates the mechanism for the differentiation of Th0 lymphocytes, or if it is part of a larger mechanism.

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## **THE POWER OF CHIEFS**

### Presenter:

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### Mentor:

Dr. Jonathan Haas, MacArthur Curator North American Anthropology, Anthropology Department, The Field Museum of Natural History, Chicago, IL 60605

The size of monumental and other public structures can lend insight into the power that a leader is able to exert over his people. In Peru a series of very early sites have been discovered, all with monumental architecture. The largest, Caral, located in the Supe Valley 150 km north of Lima has six large platform mounds, the largest of which is 200 meters in length and 20 meters tall. Questions have arisen as to whether or not the culture responsible for these mounds can be classified as a chiefdom. A survey was done of structures in known chiefdom sites in Hawaii, Panama, and Costa Rica. The results show that the architectural capabilities of chiefdom cultures are quite limited. In Hawaii, the average length is 30.7 meters and the average height is 1.9 meters high. The largest heiau (temple) in volume (25,046.8 meters cubed) measures 98.7 meters in length and 3.0 meters in height. In Panama and Costa Rica the average length is 18.8 meters in length and the average height is 1.1 meters, with the largest structure measuring 137 meters in length and 3 meters high. Structures built by chiefdom cultures do not approach the size of the mounds in Peru. This implicates that the culture that constructed the sites in the Supe Valley did not belong to a society that could be classified as a chiefdom. Further research will be done to determine the classification of this culture.

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## **NEONATAL MORTALITY AND MORBIDITY IN ALL APPROPRIATE GESTATIONAL AGE NEWBORNS ADMITTED TO THE NICU BETWEEN 1990 AND 1999 WITH BIRTHWEIGHTS < 1000 GRAMS**

### Presenter:

Anson T. Tang, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506; anson@imsa.edu

### Mentors:

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We retrospectively evaluated 395 newborns <1000 grams admitted to the Loyola University Medical Center Neonatal Intensive Care Unit (NICU) between 1990 and 1993 (Group 1), as well as 663 newborns <1000 grams admitted between 1994 and 1999 (Group 2). These two groups (N=1058) were evaluated on the basis of morbidity and mortality for length of stay (LOS) until death, intraventricular hemorrhage (IVH), hyperkalemia, use of antenatal steroids, necrotizing enterocolitis [NEC (medical and surgical)], retinopathy of prematurity (ROP), bronchopulmonary dysplasia (BPD), and patent ductus arteriosus (PDA). Five birthweight groups (500-600g, 601-700g, 701-800g, 801-900g, 901-1000g) were analyzed. There was no significant difference in survival, with the only negative trend being a drop in survival of the 601-700g range: Group 1-74%(63/85) compared to Group 2-63%(90/144). The prolonged length of stay in Group 2 suggests technology could be prolonging death in newborns. The drop in survival in the 601-700g group (Group 2) may be contributed to a higher incidence of pneumothoraces as well as postnatal steroid regimens in a non-uniform manner. The increased use of antenatal steroids appears to have had a positive impact on the decreased incidence of IVH, NEC, hyperkalemia, ROP and PDA in Group 2 newborns.

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## **CALCIUM BINDING PROTEINS IN MOUSE RESPIRATORY NEURONS**

### Presenter:

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### Mentors:

Dr. Donald R. McCrimmon and Dr. George F. Alheid, Department of Neurophysiology, Northwestern University Medical School, 303 East Chicago Avenue, Chicago, IL 60611

The ability to anatomically correlate the presence of particular neurochemical markers within functionally identifiable neuronal cell groups will allow future research to apply molecular biochemistry, and biophysical models to understand the basis for the intrinsic firing properties of these neurons with the ultimate goal of developing system-wide models neuronal control systems. The distribution of proteins found in the respiratory control system in the ventrolateral medulla was examined. Parvalbumin, calretinin and calbindin, known as calcium-binding proteins (CBPs) found in neurons, are rarely co-localized and demonstrate an uneven distribution in the central nervous system. This project examined the differential expression of CBPs in subsets of respiratory neurons in the ventrolateral medulla (i.e. the ventral respiratory group; VRG) of mice. We have immuno-stained mouse parasagittal brain sections for parvalbumin, calretinin and calbindin and compared their rostro-caudal topography with the expected topography of VRG compartments.

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## **THE EFFECT OF ADAPTATION ON SYNAPTIC INTEGRATION IN A LATERAL-PYRAMIDAL NEURON**

### Presenter:

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### Mentor:

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When a neuron is excited, it fires action potentials. Some neurons decrease their firing frequency, or adapt if the stimulus is sustained. An action potential is caused by sodium ions flooding into the cell. In cells that exhibit adaptation, this causes the opening of calcium channels. When enough calcium has entered the cell, AHP channels activate, hyperpolarizing the cell, halting action potential propagation. Although the mechanisms underlying adaptation are well understood, there have been few studies into how adaptation affects the outgoing signal. Thus, a lateral pyramidal cell from a turtle's visual cortex was modeled using the NODUS software package. The neuron was tested with and without calcium and AHP channels. When

modeled without adaptation, the neuron fired at a constant frequency. When modeled with adaptation, the frequency increased during the first few hundred milliseconds of the simulations. This was because the calcium channels are a depolarizing force, causing the action potentials to propagate more frequently. After enough calcium had accumulated, the AHP lowered the frequency until the neuron ceased to fire. As opposed to lowering the frequency of action potentials, adaptation stretched out the frequency of firing to greater and lesser values than the neuron exhibited without adaptation.

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### **ANTIBODY LABELING OF TAU POLYMERS AS PROBES FOR TAU STRUCTURE IN ALZHEIMER'S DISEASE**

Presenter:

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Mentor:

Dr. Lester Binder, Department of Cell and Molecular Biology, Northwestern University Medical School, 303 East Chicago Ave., Tarry Building 8-733, 60611; 312-503-0823; l-binder@nwu.edu

Alzheimer's disease (AD) is a neurodegenerative disease, which is partially characterized by the intracellular accumulation of filaments in specific regions of the brain. These filaments are formed by tau, a microtubule-associated protein that is normally found as a monomer in cells. How and why these filaments of tau form in AD remains unanswered. In this study, the tau filaments were examined using antibody labeling. These antibodies, which attach to specific epitopes on tau, can help describe the structure of the molecule in both its monomeric and polymeric states. This research investigates the Tau-9 antibody and its epitope by measuring the binding affinity of Tau-9 to different constructs of tau through an enzyme-linked immunoabsorbant assay (ELISA). The results from these experiments were compared to those employing a control antibody, Tau-5, whose epitope is well characterized. By analyzing the binding affinity of tau antibodies to tau monomers and polymers, the location of the antibody binding sites and the structure of the protein will be better understood. Our findings may further our knowledge of how tau monomers form polymers and perhaps will help in the design of drugs that prevent tau filament formation in Alzheimer's disease.

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### **THE INFLUENCE OF MOTHER TERESA IN AMERICA**

Presenter:

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Advisors:

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Mother Teresa undoubtedly has held fame in America from the late 1970s through the present. She has spoken at countless engagements in the United States, including the National Prayer breakfast, and has enraptured thousands to millions in this nation through her spoken word, written language, and courageous actions. It is curious that her name, a synonym for anything or anyone charitable and religious, has spread rapidly within a popular culture that regularly dismisses and even looks down upon religion. To discover the reasons for her popularity, the culture that so readily accepted Mother Teresa was studied: a variety of commentaries on her life, work, and beliefs including magazine and newspaper articles, biographies, and television segments; her books and speeches; public response to her visits to America; similar spiritual figures accepted by the American public; the impressions of those who worked alongside Mother's Sisters of Charity; and the numerous "saint cards" of recent years. While many causes attributed to her American fame, her intense religious convictions and extreme spiritual dependence were the traits that created her into a unique celebrity for American popular culture, made her a role model for the politically incorrect, and changed the fashion of living for many Americans.

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## **CHAMBER MINIATURIZATION TO SHORTEN ASSAY TIME AND MINIMIZE LIGAND AND RECEPTOR CONSUMPTION DURING PULSED ULTRAFILTRATION**

### Presenters:

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### Mentor:

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Since its development, pulsed ultrafiltration has been used as a method for both drug screening and protein-ligand binding analysis. The distinguishing feature of pulsed ultrafiltration compared to traditional dialysis is the coupling of the ultrafiltration chamber to a spectrophotometer or mass spectrometer that allows elution profiles to be recorded. The main advantage of this method is the ability to study the interaction of ligand mixtures with macromolecular receptors. Applications of pulsed ultrafiltration address the bottlenecks in the process of drug discovery and development. Our project has been to miniaturize the ultrafiltration chamber in order to shorten assay time and minimize ligand and receptor consumption. One of the limitations of the chamber has been the need to contain a magnetic stir bar which ensures homogeneity throughout the chamber. However, our chamber is built in the shape of a torus so that mixing will occur automatically as liquids flow in a circle through a ring driven by the tangential flow. Furthermore, ultrafiltration chambers have traditionally been made by machine shops, which is both extremely costly and time consuming. In contrast, our chamber was made through the molding of silicone elastomer in a hand-crafted aluminum cast. In short, we have developed a new kind of chamber that is easily manufactured with comparable or augmented efficiency.

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## **THE GOVERNMENT AND PEOPLE OF BURMA**

### Presenter:

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### Advisor:

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Burma or Myanmar? Behind this simple question surrounding the name of a little known southeastern country lies 39 years of greed, struggle, oppression, violence, sadness, and devastation. This question is only the tip of an iceberg of questions surrounding the fate of a country and its people in southeastern Asia. The research in this inquiry sought to answer some of those questions. The situation in the country of Burma is a little known little heard travesty of human life. Tourists breeze through the land of "a thousand pagodas" on a cushion of comfort and falseness. Travelers convince themselves that they have participated in the exotic rural culture for the duration of their short stays by visiting ancient Buddhist temples and breathtaking landmarks. "Ninety percent of tourists are rich people who don't even know there's a military regime here. They think it is so nice: everyone smiles, it's sunny, it's pretty." Said one diplomat centered in Rangoon. Through interviews with first generation Burmese immigrants and even current residents of the military controlled nation this inquiry seeks to answer those questions in an objective honest way and to inform others of the situation.

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## **THE CREATION OF A WELL-WRITTEN SCREENPLAY**

### Presenter:

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### Advisor:

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Being an avid fan of both good and bad movies, I was curious about the process that led to the creation of films, from conception to realization. I asked myself what elements separate the good film from the bad, eventually leading me to delve into the world of screenplays. After watching and analyzing both critical successes and blockbuster hits, I began to ascertain the traits of a truly good script, including clever, realistic dialogue, choosing innovative ways to express complex and abstract ideas, and of course, developing good ideas themselves. My research completed, I began work on a screenplay of my own. I began by trying to adapt short stories and real life incidents into full length scripts. This allowed me a great deal of

creativity, deciding how unmentioned ideas and images would be shown to the audience. Now, after a great deal of revision and practice, it has become easier to put down my own ideas and make them understandable to others, not just making me a better playwright, but a better writer altogether. Currently, I hope to begin work on a full feature film length script.

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## **REAL SCIENCE: GRAPHICS ARTIST**

### Presenters:

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Real Science is an interactive science CD-ROM created, written and produced by teams of IMSA students. This dual platform CD-ROM targets students in grades 3-5 and is distributed free of charge to over 600 schools in Illinois and beyond. The goal of Real Science is to bring engaging science enrichment to classrooms to excite young children about science through the use of multimedia movies and interactive supplements developed using Adobe Premiere, Photoshop and Macromedia Director. In order for the Real Science articles to have their own original artwork, the graphics artists create images for the multimedia articles. Artwork is created via computer and hand sketching. Software used to create images was Adobe Photoshop, Adobe PhotoDeluxe, Microsoft Paint, and Universe. Media used for sketching were primarily non-colored and colored pencils. Computer drawn images would obviously look smoother and more aesthetically pleasing when inserted into movies; however, free-hand drawing lends more freedom and flexibility as to what can be drawn. To achieve better quality sketches, hand-drawn images could be edited with a computer. All pictures were done so they could be more easily understood by third, fourth, and fifth graders.

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## **UNDERSTANDING THE PAST THROUGH PERSONAL PERSPECTIVES: THE AMERICAN ARMY IN WORLD WAR II EUROPE**

### Presenter:

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Perhaps the most fascinating source for understanding the events of the past can be found in one's own home and family; adding a personal perspective to history can make the past come to life. By examining one's family history and genealogy, one can view how history affected one's family and vice versa. Building upon the background knowledge gained from one previous year of related exploration, research focused on the lives of Milton W. Witt and May N. Prestwood Witt during the Second World War and culminated in the compilation of a manuscript containing several informative vignettes. In 1942, May Prestwood decided to expand her horizons beyond North Carolina and join the Women's Auxiliary Army Corps; after undergoing basic training, May journeyed overseas and served in headquarters in England, Belgium, and France. During the same time period, Milton Witt prepared the plan for the U.S. Army's printing office in Great Britain and acted as Inspector General of the ports of Liverpool and Cherbourg, where Prestwood, his future wife, served as his secretary. Many important events and everyday commonalities were witnessed by the Witts, giving an enlightening, subtle perspective to the contemporary politics, economics, geography, and people of North America and Europe.

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## CONSTANT LIGHT EXPOSURE DECREASES CLOCK GENE MRNA EXPRESSION IN MOUSE EYE TISSUES

### Presenter:

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### Mentor:

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The Clock gene in mice, mClock, is essential in regulating circadian rhythms. Constant light exposure alters mammalian circadian rhythm, however, the effect of this treatment on the transcription of the Clock gene had not been previously studied. Using the reverse transcription polymerase chain reaction methodology, it was discovered that there is a decline in Clock mRNA expression in the eyeballs of mice, due to exposure to constant light for a period of five weeks or more. Expansion of the data is in progress; the same methodology is applied using only the retinal tissue. The Clock mRNA level has been measured for mice exposed to four and eight weeks of constant light. This is the first research on the effects of long-term light on the expression of the important circadian clock genes. Future studies include the effects of constant light exposure on Per genes, to better understand the intermolecular workings between the genes, and this knowledge can be applied to human circadian rhythms.

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## LOCALIZATION OF CLOCK MRNA EXPRESSION IN THE MOUSE RETINA

### Presenter:

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### Mentor:

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Exposure to constant light for five weeks or more decreases the Clock mRNA level in the mouse eyeball, and also causes degeneration of photoreceptors in mouse retina. Since the photoreceptors are important circadian clocks, the specific aim is to provide additional evidence that the photoreceptors express Clock mRNA. Mice were placed in constant light of 970 lux for two week intervals between two and eight weeks. Two experimental techniques were used: 1) histology of the retina at each time interval and 2) reverse transcription polymerase chain reaction using only retinal tissue of the mouse eye. Data collection is in progress to make a correlation between photoreceptor degeneration and the decrease in Clock mRNA level in the mouse retina. This correlation would substantiate previous research that Clock gene expression occurs in the photoreceptors, using a different methodology. This research suggests new avenues of research in human circadian rhythms: people who are susceptible to retinal damage not only suffer photoreceptor loss, but may also risk a change in the expression of a circadian clock gene.

## **A JOURNEY INTO ANIMAL CONSCIOUSNESS**

### Presenter:

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### Mentors:

Dr. David R. Hilbert, Department of Philosophy, University of Illinois at Chicago, 1410 University Hall, 601 S. Morgan Street, Chicago, IL 60607-7114; 312-996-5490, [hilbert@uic.edu](mailto:hilbert@uic.edu)

Dr. Marya Schechtman, Department of Philosophy, University of Illinois at Chicago, 1421 University Hall, 601 S. Morgan Street, Chicago, IL 60607-7114; 312-355-7665, [marya@uic.edu](mailto:marya@uic.edu)

Have you ever wondered if your pet has consciousness? My mentorship this year has focused on what can be said scientifically and philosophically about animal consciousness. The inner life of animals has long been a mystery to philosophers. The question to focus on is whether animals have consciousness. The problem that results from this is how you can tell what exhibits consciousness. The behavior of these animals was compared to humans. Using this method, I will consider the question of consciousness in dolphins, chimpanzees, elephants, bats, termites, and dogs. I find that in each case there are important behavioral differences and similarities. This leads to the conclusion that there are different levels of consciousness. It becomes difficult for me to fully comprehend or understand any animal other than myself. Their lives and communication are not like that of humans. As a result, I lack the expectation that their consciousness is like that of humans. These findings raise many interesting questions about free will, what animal consciousness is like, and the role of language in consciousness.

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## **CORBA TOP FOR LINUX ON EMBEDDED BOARDS**

### Presenter:

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### Mentor:

Margaret Votava, Computing Division/Experiment Online Support, Fermi National Accelerator Laboratory, PO Box 500, Batavia, IL 60510; 630-840-2625; [votava@fnal.gov](mailto:votava@fnal.gov)

The elegance, versatility, and familiarity of an open-source Unix kernel and software are perfectly suited to the development constraints of real-time research applications. Fermi National Accelerator Laboratory asked me to create a scalable remote process monitoring facility for Linux on embedded boards as part of an effort to evaluate its viability for use in data collection. This was trivial to realize in the form of a CORBA interface which published the contents of the proc file system and a hacked up version of top that queried the interface.

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

### Presenter:

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### Mentor:

Dr. Roger Kroes, Ph.D., Chief, Molecular Neuro-Oncology, Chicago Institute of Neurosurgery and Neuroresearch, 2515 N. Clark St., Suite 800, Chicago, IL 60614; 773-388-7880

Modern medical research suggests that mutations in the human genome influence the onset and severity of neuroaffective disorders, a significant problem in human populations. In particular, mutations in the genes encoding various neurotransmitter receptors in brain cells have been associated with Attention-Deficit (Hyperactivity) Disorder (ADD/ADHD). One of these neurotransmitter receptors, the NMDA-receptor, was chosen for detailed study. As the NMDA-receptor is a multi-subunit protein, the key component protein (NR1) was chosen for initial analysis. In order to determine whether mutations in the NR1 gene are linked with ADD, the NR1 gene sequence in ADD patients must be compared with the NR1 gene sequence in non-ADD (normal) patients for discrepancies. However, the published sequence of the normal NR1 gene is not fully verified. As a prelude to large scale mapping of genomic mutations in NR1, the normal NR1 primary gene structure was mapped through multiplex genomic PCR amplification and direct sequencing of the resulting gene fragments. The sequence obtained will be directly utilized in future studies to manufacture microarrays used in determining the sequence of the NR1 gene in DNA isolated from ADD patients.

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## **QUALITATIVE ANALYSIS BETWEEN THE TRADITIONAL CALCULUS METHOD AND THE MODERN FUZZY METHOD TOWARD A MANUFACTURING PREDICAMENT**

### Presenter:

Grace Woo, Illinois Mathematics and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506

### Mentor:

Dr. Peng Yung Woo, Professor of Electrical Engineering, EB 308, Northern Illinois University, DeKalb, IL 60115;  
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Traditional Calculus has emerged as the most effective way to solve the optimization problem in science. Whether that be in context of complex manufacturing systems, aeronautics, hydraulics or others, researchers have always turned to calculus. This article proposes an alternate approach to these predicaments using fuzzy logic, which was first proposed by Professor Zadeh in 1965. Specifically, this new approach offers simpler feasible results to multi-variable applicable issues. Throughout the approach, a hypothetical manufacturing system is used to demonstrate the effects of this new method. A comparison is made between the conventional calculus approach and the fuzzy approach for the specified manufacturing system discussed in this article.

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## **CONTROL SPECIFICATIONS FOR AN AUTOMATED MUCKHAULING VEHICLE**

### Presenter:

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

### Mentor:

Craig Drennan, Engineering and Technical Teams Department, Particle Physics Division, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510; 630-840-2160; cdrennan@fnal.gov

Control specifications are being developed for an automated muck-hauling vehicle to be used in future accelerator tunneling projects at Fermilab. The vehicle is intended to support the Tunnel Boring Machine (TBM) and replace costly mucking shaft infrastructure. A simple mathematical model simulating the lateral motion of the vehicle versus time has been created with Microsoft Excel. The model is capable of exploring different control schemes for regulating the vehicle's distance from the tunnel wall by controlling the angle of the front and rear wheels of the vehicle. The simulations have provided information necessary to specifying feasible control schemes and the controls hardware for the vehicle. Input and output sampling rates and controller processor requirements such as word size and instruction execution speeds are estimated

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## **DRAFTING A NEW LEGISLATIVE PROCESS FOR AMERICA**

### Presenter:

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### Advisor:

Kenneth Guest, (deceased) History and Social Science faculty member 1988-2001, Illinois Mathematics & Science Academy

When the Founding Fathers drafted the Constitution of the United States, they crafted a government that would protect the fledgling nation of thirteen newly independent states. The Constitutional Congress deemed stability a primary goal, and the government maintains the status quo in part through a gruelingly complex legislative process. Established over two centuries ago when America was a small and isolated agricultural society, a deliberately lengthy legislative process was acceptable. Currently, however, the United States of America commands the greatest economic and military influence in the world. It is now time to make thorough revisions to Article I of the Constitution, specifically the legislative process. Drawing from our evaluations of political philosophy, historical models of legislative inefficiency and foreign governments, we have drafted a new law-making process that allows for quicker change that more accurately reflects the will of twenty-first century America.

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## **ESTABLISHMENT OF A PROBE SET FOR FLUORESCENCE IN SITU HYBRIDIZATION (FISH) DETECTION OF SILENCING MEDIATOR OF RETINOIC ACID AND THYROID HORMONE RECEPTOR (SMRT) GENE REARRANGEMENTS IN NON-HODGKIN'S LYMPHOMAS**

### Presenter:

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### Mentor:

Dr. Lionel Coignet, Assistant Professor, Departments of Medicine and Pathology, Loyola University Medical Center, Maywood, IL 60153; 708-327-3298; lcoigne@lume.edu

Non-Hodgkin's lymphomas (NHL's) are characterized by a prolonged low-grade indolent phase that may be followed by a clinical progression to high-grade disease. This progression is usually associated with an aggressive clinical course and shorter survival. We recently established that loss of the silencing mediator of retinoic acid and thyroid hormone receptor (SMRT) transcriptional repression seems to drive the progression of the disease. According to Knudson theory, the two SMRT alleles have to be disrupted sequentially. In order to be able to i) detect such genomic alterations ii) to predict the transformation into high-grade disease in low-grade NHL samples, and iii) to characterize the molecular events occurring in SMRT, we have developed a set of genomic probes to be used in double color fluorescence *in situ* hybridization (FISH) experiments. Using SMRT specific primers in PCR experiments, we generated three different genomic clones for both the 5' end and 3' end of the gene, each pool representing 25 kb of genomic DNA. These probes were characterized on a series of high-grade NHL model cell lines. This established probe set will be tested by FISH in a large series of NHL samples to assess the validity of such an approach to predict NHL transformation and thus predict the progression of the disease.

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## **TRAPPED BETWEEN TWO WORLDS: THE PSYCHOLOGY OF CHINESE-AMERICAN CHILDREN**

### Presenters:

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### Advisor:

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

As two children of Chinese heritage living in the United States, we recognize that bi-culturalism can oftentimes lead to much confusion and a great deal of pain. This Inquiry explores a few aspects that makes living life as a Chinese-American youth so difficult. One of the most prominent causes for this emotional conflict is the rift caused by generational gaps between the youth and their parents. This causes miscommunication and a general lack of understanding for one another. With members separated by their differing stages in acculturation, it becomes difficult for families to connect. In our research, we have looked at works by many Chinese-American authors examining their respective youths. We have also taken note of various studies that dealt with associated topics such as cultural identity, generational gaps, and differences in levels of cultural assimilation. Our inquiry was established with the hopes of understanding the causes of our problems. After all, as Norvin McGranahan once said, "When a man begins to understand himself he begins to live."

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## **REALIZING A SCULPTURE**

### Presenter:

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### Advisor:

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To share my inquiry with you, I would have to show you my room, describe my friends, ask about your day, tell you about my world at IMSA. When I submitted my proposal at the beginning of the year, I outlined my steps to be: 1) define IMSA, and 2) create a sculpture that portrays this definition. Since then, I have conducted several interviews that have given me insight as to what is IMSA. I have recordings of very IMSA-ish experiences: blackouts and late night study sessions, for example. I have taken many rolls of pictures and written journals about the interviews and photos; it is a sort of analytical process. I have also examined different types of sculpture to get ideas of how I can conceptualize the ideas and words I have been told. Starting in January, I began some very simple sketches. I believe I could suggest IMSA is a fiction being realized.

Perhaps, it is the person we will be twenty years from now. The fiction is like my sculpture; it is in the process of realization. But for now, to share my inquiry, I would need to share with you a great story.

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## **RESEARCH ON "FOR SALE" CLAUSE IN PATENT STATUTES**

Presenter:

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Mentor:

Barbara Greenberg, Civic Advocacy Center, 1409 Burr Oak Road, Suite 308A, Hinsdale, IL 60521; 630-323-1807, barbglawyr@aol.com

Title 35 Section 102 Part (b) of the United States Code, the "for sale" clause pertaining to the eligibility of a patent describes the conditions that allow an invention to be patented, and when the loss of the right to a patent will occur. Part (b) of this section states that, "A person shall be entitled to a patent unless...the invention was...in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States." Throughout the course of this country's history the meaning of this "for sale" clause has been challenged many times. The meaning of this clause is ambiguous and has gone through many different interpretations throughout the years by judges, lawyers, and legislators. This research examines the differences among these opinions and analyzes numerous cases to determine the current interpretation of this clause, and how it is applied to patent applications and patent cases.

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## **THE REGULATION OF PHOSPHOLIPASE C DELTA-1 BY NEURONAL CALCIUM SENSOR-1**

Presenter:

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Mentor:

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Phospholipase C enzymes hydrolyze phosphatidylinositol 4,5-bisphosphate (PIP<sub>2</sub>), yielding diacylglycerol (DAG) and 1,4,5-trisphosphate (IP<sub>3</sub>). The formation of these second messengers leads to the release of Ca<sup>2+</sup> ions within a cell, which in turn can induce hypertension and cardiac hypertrophy. It is known that when polyphosphoinositides bind to the PH domain of PLC delta-1, the rate of PIP<sub>2</sub> hydrolysis is effected at the active site. Neuronal calcium sensor 1 (NCS-1) is a Ca<sup>2+</sup> sensor mainly found in neurons. We hypothesized that NCS-1 might regulate PLC delta-1, since in yeast NCS-1 regulates the formation of polyphosphoinositides. TSA201 cells were transfected with pcDNA3, pcDNA3 and PLC delta-1, pcDNA3 and NCS-1, and PLC delta-1 and NCS-1. The percent hydrolysis in cells transfected with pcDNA and PLC delta-1 doubled, while cells transfected with pcDNA3, pcDNA3 and NCS-1, and PLC delta-1 and NCS-1 showed similar levels of basal activity. These results demonstrate that NCS-1 may play an important role in the regulation of PLC delta-1 by inhibiting hydrolysis of substrate.

Name	Time/Room	Time/Room	Time/Room	Time/Room
John Addison	8:30/A152			
Anuoluwa Adeboje	8:30/A155			
Olufemi Adeyanju	8:30/LECTURE HALL			
Nikhil Agarwal	8:30/A117	9:45/A121	10:10/A121	11:00/A147
Pooja Agarwal	8:55/A121	9:20/A121		
Emi Arima	8:30/A117	9:20/AC PIT		
Brianna Arrington	9:45/B148			
Meghan Bannon	10:35/A113			
Andrew Barber	8:55/B148	9:20/B108	10:10/B133	
Kim Barchenger	11:00/B148			
Jason Barnes	10:10/A147			
Steve Bauer	8:30/A151			
Jeary Beals	9:20/A150			
Amit Behal	8:30/B133	9:45/B114	10:10/B108	
Katie Boehm	9:45/A114			
Kristina Bolt	9:45/B108			
Eric Bowden	10:35/B108			
Catherine Breckenridge	8:55/B108	9:45/B133		
Chris Brown	8:55/B148	10:10/B133		
Holly Bybee	10:10/B114			
Angela Campbell	10:35/A115			
James Carney	10:10/A113			
Belinda Chang	9:45/A119	11:00/B114		
Wen Chen	9:45/A115			
Yong Chen	8:55/B148	10:10/B133		
Chris Chrobak	8:55/A152			
William Conroy	8:30/B148			
Rachel Cook	8:55/B108	10:35/B133		
Jessica D'Souza	8:30/B148			
Patrick Delfert	8:30/LECTURE HALL	8:55/B133		
Katy Dieber	10:10/A112			
Megan Dinkelman	9:45/B108			
Shannon Dobson	8:30/A114			
Roy Droste	9:20/A114			
Nia Dukov	8:30/AC PIT			
Jessica Dy-Johnson	10:35/B114			
Megan Fast	11:00/B133			
Charles Felish	10:35/LECTURE HALL			
Marissa Fierz	8:30/A110	9:45/B148		
Heather FitzHenry	8:55/LECTURE HALL			
Laura Freund	9:45/B108			
Annabel Fu	8:55/A149			
Anthony Garcia	9:20/GARAGE			
Sandra Garcia	11:00/A121			
Anupama Garla	8:30/A117	10:10/AC PIT		
Elizabeth Garrison	10:35/A116			
Joseph Giardino	8:30/LECTURE HALL			
Navreet Gill	11:00/A152			
Dmitry Goldin	8:30/LECTURE HALL	10:10/B108	11:00/B133	
Emma Goodman	8:55/B108	10:10/B114		
Brandon Gordon	8:30/B133			
Rui Guan	8:55/B114	9:45/B114		
Lucy Guo	8:30/A117	9:45/B148		
Tim Hachmeister	11:00/AC PIT			
Lance Hall	9:45/A151			

Name	Time/Room	Time/Room	Time/Room	Time/Room
Matthew Hall	9:20/A151			
Anne Halsall	8:30/AC PIT			
David Hamman	10:35/A152			
Mike Hanes	9:20/LECTURE HALL			
Anna Hang	8:55/B108	10:10/B114		10:35/B148
Fatima Hatia	8:30/A155			
Krysta Heaney	11:00/B133			
Dustin Hendrickson	8:30/A115			
Ann Hinterman	11:00/A112			
James Holmes	10:10/A152			
Jady Hsin	11:00/A151			
Aleata Hubbard	9:20/A121			
Erin Huffington	8:55/A115	11:00/A115		
Catherine Ihm	9:45/A152			
Kristoffer Inton	9:45/A147			
Matthew Isoda	8:30/A113			
Lavina Jadhvani	9:20/A121	10:35/A117		
Jesse Jang	9:20/B133			
Apurva Jantrania	8:55/B148	10:10/B133		
Julia Jennings	8:55/A112			
Aikeisha Jones	10:10/B148			
Connie Jung	10:35/A150			
Gaurav Kamboj	9:45/A116			
Judy Kang	11:00/A116			
Jared Kaplan	9:20/A113			
Melissa Kaye	8:55/A116			
Lisa Kelly	9:20/A115	10:10/A115		
Tania Khanna	8:30/A116			
Poonam Khatri	9:20/A152			
Priya Khetarpal	10:35/A121			
Catherine Kim	10:35/AC PIT			
Thomas Kim	8:55/A155			
Kathleen King	9:20/A115	10:10/A115		
James Kinzer	9:20/A155			
Helena Knight	9:20/AC PIT	10:35/A119		
Matthew Knisley	9:20/AC PIT			
Hannah Koh	8:55/A114			
Lauren Kozak	9:20/AC PIT			
Vladimir Krastev	8:30/B108			
Gautam Kumar	9:20/A149			
Nishant Kumar	8:30/LECTURE HALL	8:55/B133		
Joonil Kwak	9:20/GARAGE			
Dan Langan	8:55/B108	10:35/B133*		11:00/A119
Lacey Langguth	9:20/AC PIT			
Joey Lau	8:55/B148	10:10/B133		
Elizabeth Lawrence	9:45/B114			
Mia Layne	11:00/B148			
Ivan Lee	9:20/B133			
Kachiu Lee	8:30/A116			
Linda Lee	9:20/AC PIT			
Jennifer Levin	8:55/AC PIT			
Dennis Li	8:30/A149			
Jennifer Li	11:00/A150			
Mengyao Liang	8:30/B108			
Taiyang Liang	10:35/A150			

Name	Time/Room	Time/Room	Time/Room	Time/Room
Kent Limson	8:30/A147	9:20/AC PIT	11:00/A147	
Brian Link	8:55/A147			
Zhihao Liu	8:55/A151	10:35/A151		
Katherine Lorentzen	8:30/A121	11:00/A121		
David Lu	9:20/B133			
Jean Lu	8:55/AC PIT			
Amanda Lucek	8:55/A119			
Steven Lucy	9:45/B108			
Linda Ly	8:55/A149			
Raymond Magee	9:45/AUDITORIUM			
Paul Malina	9:20/A121			
Chailee Mann-Stadt	9:20/AC PIT			
Sue Massey	9:45/B108			
Kelly McArdle	8:30/AC PIT	9:20/AC PIT	10:35/A114	
Christopher McLaughlin	8:30/B108			
Keiko Miceli	9:20/A150			
Jennifer Mo	8:30/A149			
Zachary Nayak	11:00/A155			
Victoria Ogunsanya	11:00/A121			
Carlo Ordonez	10:10/A150			
Marc Pan	11:00/A149			
Annie Park	10:35/B148			
Brian Park	8:30/A116			
Julie Park	9:20/A112			
Pranay Patel	10:35/B114			
Riddhi Patel	11:00/LECTURE HALL			
Jennifer Peck	10:35/A155			
Lynn Peng	10:10/B114			
Andre Phillips	8:30/A113			
Joyce Pulphus	11:00/B148			
Vinaya Puppala	8:55/A113			
Steven Quimby	8:55/AC PIT			
Amanda Raddatz	11:00/B133			
Daniel Reed	8:30/LECTURE HALL	9:20/B114		
Emily Richter	10:10/A155			
Shaun Roach	11:00/A113			
Thomas Rooney	8:30/LECTURE HALL	8:55/B133	10:10/B108	
Alison Ruddy	9:20/A147			
Erica Ruddy	8:30/AC PIT			
Darrel Saldanha	8:55/B114			
Sarah Sanders	8:55/A150			
Joel Schad	8:30/LECTURE HALL	8:55/B133		
Hanna Schitteck	11:00/A114			
Polina Segalova	8:30/A150			
Nan Sethakorn	10:10/A119			
Rena Shah	10:35/A149			
Samina Shaikh	9:45/A150			
Catherine Shartzter	8:55/A116			
Ashwin Shetty	8:55/A113	9:45/A121		
Justin Skarha	8:30/A113			
Sean Smith	8:30/LECTURE HALL			
Tom Souhlas	11:00/LECTURE HALL			
Mary Sullivan	9:45/A149			
Anitra Sumbry	9:20/AC PIT	10:10/A110		
Eric Sutton	8:55/B148	10:10/B133		

Name	Time/Room	Time/Room	Time/Room	Time/Room
Derek Swartz	8:30/B133			
Eric Szczesniak	8:55/A110	10:35/A110		
Kasia Szremski	9:45/A112			
Anson Tang	10:10/A114			
Christiana Taylor	9:45/B108			
Nicole Thompson	11:00/A114			
Anupama Topgi	10:35/A110	11:00/A110		
Matthew Traverso	10:35/A110			
Stephen Trevick	9:45/A155			
Christine Tsai	10:35/A112			
Diana Tung	10:10/B114			
Colleen Unger	9:20/A117			
Sri Vagvala	9:45/A117			
Vanessa Vardon	10:35/A147			
Kenny Vogelpohl	8:30/A113			
Nathan Walsh	8:55/A117			
Sarah Walter	8:30/A151	9:20/A151		
Tori Walters	8:55/B108	10:10/B114	10:35/B133	
Leon Wang	8:30/B114			
Jon Warnock	8:55/B108			
Winn Wasson	10:10/A151			
Margaret Wat	8:30/AC PIT	9:20/A110	9:45/A110	10:35/B108
Stacia Whitaker	11:00/A112			
Tiffany White	8:30/A112			
Jered Wierzbicki	9:45/LECTURE HALL			
Keisha Williams	10:10/B148			
Eric Wilson	8:30/B114	9:20/B133		
Mark Witt	11:00/A113			
Pius Wong	10:10/A149			
Grace Woo	9:45/AC PIT			
Michael Wright	9:45/AUDITORIUM			
Yun Wu	9:20/B148	10:10/B114		
Cindy Xi	10:35/B108			
David Xia	8:30/LECTURE HALL	10:10/B108	11:00/B114	
Danny Yagan	10:10/A117	11:00/A117		
Weiran Yan	9:20/A116			
Kevin Yang	9:45/A117	10:35/B108		
Rosalind Yang	9:20/A119	9:45/A119	10:35/B108	
Stephanie Yeh	10:10/A116			
Vaishalee Yeldandi	8:55/LECTURE HALL			
Debra Yoo	10:10/LECTURE HALL			
Chris Young	8:30/LECTURE HALL	9:45/B114	10:35/B133	
Jennie Zhao	9:20/A116			

